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ROLE OF COGNITIVE ABSORPTION AND TRUST FOR COLLABORATION IN VIRTUAL WORLD

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Abstract

Virtual worlds (VWs) have paved a new and important channel for user collaboration and information sharing. Businesses are now considering using VWs as innovative means for collaboration and information sharing among its organizational members. Despite the huge potential of VWs for harnessing and increasing the flow of ideas among organizations, research on the subject is rather sparse. Drawing on the social cognitive theory, we re-specify the concept of cognitive absorption (CA) in the context of VWs by theorizing environmental factors in addition to the individual factors as antecedents of CA. Further, by integrating CA with 'trust' we develop a VW usage model. We test the specified model with data collected from 197 VW users in Singapore. Results display the important roles that both CA and 'trust' play in the usage of VW. Further, through a post-hoc analysis we demonstrate the imperative need for considering both CA and 'trust', together in the proposed VW usage model. The study also delineates a set of implications for research and practice.

Keywords: Cognitive absorption, virtual worlds, trust, behavioral intention, Singapore

1. INTRODUCTION

User collaboration and information sharing through Virtual Worlds (VW) is the next step in information dissemination and communication. In VWs, three-dimensional graphic characters, or avatars, can stand in for actual users and conduct meetings (Kharif, 2007). Businesses are considering using VWs as a nouveau channel of collaboration and learning among virtual team members. It will be especially useful for companies to facilitate close interaction among geographically dispersed individuals. This emergent technology of 3D platforms permits users to immerse in the VWs where learning and collaboration happens 'hand in hand' with fun and play.

Companies contemplating investment in VWs are still unsure about the effective usage and utilization by the intended organizational members. Value for investment in VWs will be realized only when company employees and intended users utilize this virtual platform in the most effective manner (Agarwal and Karahanna, 2000). Researchers have been intrigued by the question of adoption and usage of emerging technologies. In response to these concerns, several studies have been conducted to explain the adoption and use of new technologies (e.g. Agarwal and Karahanna, 2000; Gefen, 2003;

Pavlou, 2003; Teo et al., 2009, Venkatesh, 2000). Despite the differences in the studies with respect to the constructs and the posited relationships, there is convergence in findings that individual's beliefs for using the technology significantly influence the usage behavior (Agarwal and Karahanna, 2000). Similar to other technological contexts, researchers and practitioners are now interested in examining the issues which influence the usage intentions of VW users.

Cognitive absorption (CA) has been found to be an important factor influencing behavioral intention of use of information technologies (IT) which are stimulating and absorbing for the user (Agarwal and Karahanna, 2000). In the context of information systems (IS), CA can be defined as the state of deep involvement or holistic experience with the underlying technology (Agarwal and Karahanna, 2000). VWs offer a technological platform that can be very engaging and involving for the users, in as much that it can be equated to being a simulation of a real environment. VWs generally have immersive environments with visual and aural cues and rich graphical interface which are the prerequisites for the cognitive absorption of the users (Agarwal and Karahanna, 2000). Hence in the context of VWs, CA appears to be having an important role in its usage.

User trust is a belief that has been empirically tested and verified for information systems usage behavior in several contexts (Pavlou, 2003; Awad and Ragowsky, 2008). Further, studies on online environments have shown 'user trust' to be an important factor not only for its adoption (Pavlou, 2003; Gefen, 2000; Gefen et al., 2003) but also continued use (Teo et al., 2009). As in online environments there are inherent uncertainties and risks involved in the usage of virtual environments, hence developing user trust in VWs appears to be the key for its usage (Pavlou, 2003; Gefen, 2000; Gefen et al., 2003). Hence an understanding from the trust perspective can provide insights for the adoption and usage of this new rich medium of communication. Such an understanding would assist businesses and also VW operators and designers in creating virtual platforms which will be utilized by the intended users. Hence, it is important to examine the production of trusting beliefs in VWs and their subsequent impact on behavioral intention to use VW for information sharing. In the current research scenario, there is limited understanding about the role of trust in the adoption and usage of VWs for business activities like information sharing and collaborative tasks.

We address this research gap by integrating CA and 'trust' and posit CA as a key factor in building user trust in VWs. In addition, we explore the determinants of CA as per the Bandura's (1977; 1986) theory of triadic reciprocity, which identifies human behavior as an interaction of personal factors (individual), situational factors (the environment), and behavior. Agarwal and Karahanna (2000) had identified the individual factors of perceived playfulness and perceived innovativeness in their study, but they did not explore the situational factors or the environmental factors. Environmental factors need special attention in the context of VWs as the individuals interact in the virtual environments for different purposes like social networking and information dissemination or collaboration, for gaming, business or even educational purposes. Motivated by the need to conceptualize the factors that determine CA and thus play a role in building user trust in VWs and further intention to use VWs for business activities like information sharing, in this paper we investigate the intrinsic motivation related variable of cognitive absorption and its impact in developing user trust to study the behavioral intention to use VWs for collaboration and sharing of ideas. The specific research questions that we examine in this study are:

- What are the individual and environmental determinants of CA in the context of VWs?
- Is CA a significant determining factor for user trust and also behavioral intention to use VWs for collaborative tasks?
- Is user trust a significant determining factor for behavioral intention to use VWs for collaborative tasks?

There are four primary contributions of this study. First, the study integrates CA and trust in VWs context and investigates the role of CA in building user trust in VWs. Second, we extend the literature on CA by explicitly dividing the antecedents of CA into two broad dimensions of *environment* and *individual* and further identifying the environmental and individual factors to study the relationships of both these dimensions with CA in VWs. By doing this, the study identifies environmental factors along with individual factors proposed by Agarwal and Karahanna (2000) as significant antecedents of CA. Third, the study emphasizes the role of CA and trust in developing the behavioral intention to

use VW for information sharing and collaborative tasks. Fourth, from the practical point of view, this study exhorts the developers and designers of VWs to pay more attention to environmental factors along with individual traits which influence the user behavior towards the usage of VWs.

2. THEORETICAL FRAMEWORK AND RESEARCH MODEL

Intention to use VW is imperative for its acceptance and eventual success. In the context of adoption and use of new technologies, many researchers have asked the fundamental question as to “what factors make the users adopt and use the new technology?” Various researchers have explored this basic research question from different perspectives such as technology characteristics (Heijden et al., 2003; Sarker and Wells, 2003), demographics (Sarker and Wells, 2003), and trust (Gefen, 2000; Jarvenpaa and Tractinsky, 1999).

The proposed “VW usage model” presented in Figure 1 theorizes CA and user trust as the two key factors influencing behavioral intention to use VWs for collaboration and information sharing. The study hypothesizes that CA develops user trust in VW which is posited as a salient factor influencing behavioral intentions to use VWs for collaboration and information sharing. The research model also examines the determinants of CA in VWs.

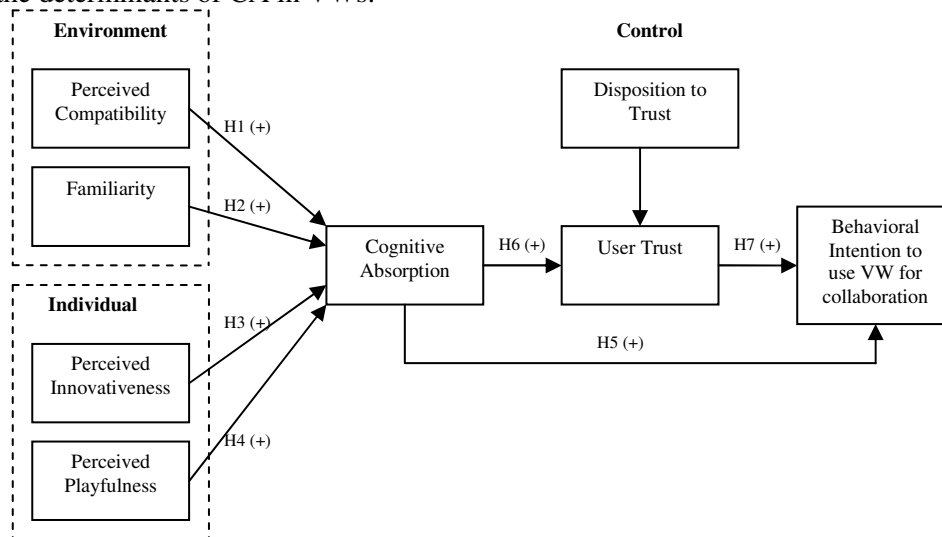


Figure 1. Virtual World Usage Research Model

We use ‘behavioral intention to use VW for collaborations’ as the key dependent variable in our study (Gefen et al., 2003; Pavlou, 2003). ‘Disposition to trust’, is included as a control variable, 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).

2.1 Cognitive Absorption

Cognitive absorption (CA) is a state of deep involvement or a holistic experience an individual has with an IT such as Internet and video games, is rooted in psychology and built on three closely inter-related the *concepts of flow* (Csikszentmihalyi, 1990) *trait of absorption* (Tellegen and Atkinson, 1974) and *cognitive engagement* (Webster and Ho, 1997). The ‘theory of flow’ describes the state whereby people are so involved in an activity that nothing else matters, ‘trait of absorption’ defines an individual’s state of deep attention; and the concept of ‘cognitive engagement’ refers to playfulness and intrinsic interest (Saade and Bahli, 2005). Previous studies suggested positive attitudes towards usage behavior emerging from such a holistic experience resulting from cognitive absorption (Ghani and Deshpande, 1994; Saade and Bahli, 2005). Various studies have explained the individual’s behavior towards new technology by taking the holistic experiences with technology as external variable (Agarwal and Karahanna, 2000; Hartwick and Barki, 1994; Saade and Bahli, 2005). Motivated by the interest in understanding the influence of holistic experiences on behavioral intention to use VWs for collaboration and information sharing, we posit CA as a significant determinant of the trusting beliefs.

The five dimensions of CA as suggested by Agarwal and Karahanna (2000) and used in this study are temporal dissociation, focused immersion, heightened enjoyment, control and curiosity. *Temporal dissociation* is the state of inability to understand the passage of time while engaged in the interaction. *Focused immersion* is a state of complete engagement with the task whereby distractions go unheeded. *Heightened enjoyment* refers to the pleasure and enjoyment users get from the interaction. *Control* is the sense of being in charge of the interaction. *Curiosity* refers to the aroused sensory and cognitive curiosity of the user during interaction (Agarwal and Karahanna, 2000). These five dimensions together constitute the intrinsic motivational variable of CA.

2.2 Determinants of Cognitive Absorption

Prior research provides some insights into the determinants of CA (e.g. Agarwal and Karahanna, 2000; Roche and McConkey, 1990). Agarwal and Karahanna (2000) discussed CA pertaining to Internet usage behavior. VWs provide an even more immersive experience than Internet browsing. Moreover, unlike Internet where an individual interacts with technology alone, VW is a social platform, where individuals interact with technology as well as other members. Thus, as suggested by Agarwal and Karahanna (2000), an individual's traits are likely to have an effect on experiential state. Previous studies have shown the significance of individual factors like personal innovativeness and perceived playfulness for determining CA (Agarwal and Karahanna, 2000). However, in accordance to Bandura's (1986) notion of triadic reciprocity where individual factors (the person), situational factors (the environment), and individual behaviors interact and are reciprocally determined, the influence of environmental factors in determining the CA of a user appears vital. The importance of environmental factors is even more accentuated in the case of VWs where members socialize and interact with each other. Hence, this study proposes the environment or situational factors as significant determinants of CA. Among environmental factors in the context of CA two variables appear to be especially important from past research are perceived compatibility of the VW users (with the VW technology) and familiarity of the VW users (with VW community and environment). If these two attributes are favorable for users, their experience with the VW will definitely be more engaging and hence there will be a higher CA.

2.2.1 Perceived Compatibility

An important factor determining the extent of CA of the VW users in the VW is the perceived compatibility of the VW platform with the user needs, beliefs and ideas about the new technology. Rogers (1995) in his seminal study on diffusion of innovations found perceived compatibility to be a significant factor explaining the use of an innovative technology. Compatibility was evaluated by examining the innovative technology's compatibility with existing values and beliefs, previously introduced ideas, and potential users' needs (Rogers, 1995). In summary, the prospective users of the innovative technology should be comfortable with the innovation and there should be minimum dissonance with their existing belief system.

In this research we theorize perceived compatibility (PC) construct in a manner similar to the information diffusion theory and posit it to be an antecedent of CA as perceived compatibility construct in our research model is able to address the technology's role in satisfying the user's belief systems about VWs. If users perceive technology used in VW to be compatible with their needs and ideas, the users are likely to have an immersive experience with VW and get totally absorbed in their task. On the contrary, perceived incompatibility or low compatibility with the user needs and beliefs will lead to distractions and disruptions leading to low CA. Hence we hypothesize:

Hypothesis 1: Perceived compatibility between the user's beliefs and the virtual world platform is positively associated with the user's cognitive absorption in the virtual world.

2.2.2 Familiarity

The interacting members are the basic building blocks for VW. Familiarity with the VW community and its members helps reduce the underlying uncertainties and simplifies the relationships amongst

members (Gefen, 2000). Familiarity is an understanding of the current actions of individuals (Luhmann, 1979). Researchers have distinguished familiarity from trust by stating that familiarity is the knowledge about the present whereas as trust is the belief about the future actions of the users. Familiarity reduces uncertainty in the present by setting a structure while trust mitigates uncertainty in the future by letting users hold “reliable expectations” (Gulati, 1995; Luhmann, 1979). Familiarity between individuals is an ongoing process and grows from previous interactions, experiences, and learning about the other members’ actions (Luhmann, 1979). In contrast the familiarity of present actions may lead to the development of trust. Thus, familiarity and trust are related but different concepts and complement each other as complexity-reduction methods (Gefen, 2000; Luhmann, 1979). Familiarity in the context of VW is the cognizance of the VW community based on the users’ past accumulated experiences (online or offline). A high level of familiarity with the VW members and community will reduce cognitive overload on the users, thereby facilitating CA in VWs. We posit an influence of familiarity with members as well as virtual platform for increased CA in VWs.

The interacting members and their reliability are of prime concern for VWs. If the members are familiar, users are more likely to get deeply involved and experience the immersive environment of VW. On the contrary, if members are unfamiliar, s/he will tend to doubt the reliability of the members. VW operations involve constant interaction among the members. Hence users with low levels of familiarity with other members would constantly worry about the efficiency and reliability of VWs. This would discourage the users from getting into the state of deep involvement and absorption with the VWs. Hence it follows,

Hypothesis 2: Familiarity of the user with the virtual world community is positively associated with the user’s cognitive absorption in virtual world.

In addition to environmental factors the two individual factors of perceived playfulness and personal innovativeness will affect the extent of cognitive absorption of the user with the virtual world. Agarwal and Karahana (2000) have demonstrated that the individual traits of perceived playfulness and personal innovativeness are salient predictors of CA. Drawing from their findings we extend their contention to the VWs where individuals definitely need to be innovative and playful in trying virtual platforms to experience the state of CA. Hence, we hypothesize:

Hypothesis 3: Personal innovativeness of the user is positively associated with the user’s cognitive absorption in the virtual world.

Hypothesis 4: Perceived playfulness of the user is positively associated with the user’s cognitive absorption in the virtual world.

2.3 Consequences of Cognitive Absorption (CA)

2.3.1 CA and User Trust

CA is expected to influence the users’ trusting beliefs through all its five dimensions. When the user experiences temporal dissociation focused immersion, heightened enjoyment and amplified curiosity along with a sense of control over the activities in VWs, the cognitive overload of using the new technology is reduced (Agarwal and Karahanna, 2000). Reduced cognitive overload results in a state of deep involvement of users in their interaction with VWs. In addition, they perceive a better sense of control over the activities in VW when they are totally immersed in the environment. This enhanced cognitive absorption helps the users perceive VWs to be useful and easy to use resulting in increased user trust (Gefen et al., 2003). Hence we hypothesize:

Hypothesis 5: Cognitive absorption of the user in the virtual world is positively associated with the user’s trust in the virtual world.

2.3.2 CA and Behavioural Intention

Cognitive absorption of the user in the VW is a state of deep involvement which influences the behavioural intention to perform congruent actions. Agarwal and Karahanna (2000) in their study demonstrated the effect of CA on the beliefs of perceived usefulness and perceived ease of use which in turn affects the adoption intention. Drawing from this discussion we posit that CA will have an effect on the behavioural intention for using an innovative technology. Hence we hypothesize,

Hypothesis 6: Cognitive absorption of the user in the virtual world is positively associated with the user's behavioural intention to use the virtual world for collaboration and information sharing.

2.4 User Trust and Collaboration and Information Sharing Intention

Trust has a silent presence in all social interactions (Misztal, 1996) be it online or otherwise. Three-dimensional VWs are the next frontier for social networks, the usage of which depends to a large measure on trust among the members. Hence studies on VWs should emphasize on the perceptions of user trust rather than technology alone.

The online/virtual interactions induce risk and uncertainty and online/virtual communities provide no guarantees on the behavior of the other members. VWs involve several risks and uncertainties and hence user trust is a salient belief for developing positive attitudes and behavioral intention to use among the users. Lack of user trust would prevent users from performing online/virtual activities mainly because the users are concerned about the uncertainties involved in the Internet/virtual infrastructure (Hoffman et al., 1999). Following theory of reasoned action, which posits that beliefs lead to attitudes which in turn lead to behavioral intentions, trust is an important behavioral belief which creates positive attitudes and which finally affects behavioral intention to use the technology. Several researchers have empirically tested the positive relationship of trust with attitudes (Jarvenpaa et al., 2000; Jarvenpaa and Tractinsky, 1999) which leads to create behavioral intention to use information systems. Hence, user trust generated in VWs would play an important role in the intention to use this virtual platform for team collaboration. Hence, we hypothesize

Hypothesis 7: User trust in virtual worlds is positively associated with the user's behavioral intention to use the virtual worlds for collaboration and information sharing.

3. RESEARCH METHODOLOGY AND ANALYSIS

3.1 Measures and Data

We used the survey method to test the proposed research model. A survey instrument was developed by identifying appropriate measurements from a comprehensive literature review. For our research, we adapted validated scales from existing literature where psychometric properties have already been established. In order to ensure content validity, the items were modified to make them relevant to the context of VWs. The demographic variables such as gender, age and educational level, were also asked for in the survey instrument. We used a 7-point Likert scale for measuring the items. The designed questionnaire was pilot tested with three research students who were VW users for recreational activities. Their comments about the readability of the survey items were incorporated in the final instrument.

The sampling frame for this study comprised of the 'VW users who use VW for recreational activities' like fun, gaming and socializing rather than for serious task-oriented activities. For conducting the survey, the first step was to pre-screened users of VWs who had prior experience of VWs for fun, gaming, socializing or other recreational activities but not any serious task-oriented activities like fulfilling the business needs. This was indicated as the qualifying criteria for the respondents of this survey. In addition to informing the potential respondents about the qualifying criteria, we had a check question in the survey to verify this aspect. Further, we asked these respondents if they were willing to use this virtual medium of communication for more serious tasks such as collaboration and information sharing tasks in their organizations. Using these criteria we

distributed paper-based survey questionnaires to nearly 300 Singapore residents with the help of a few research students. In the instructions given to the respondents, we asked them to respond to the questions by visualizing their preferred virtual world website and also asked them to state their preferred virtual world in the questionnaire. Subsequently, we had responses from 226 respondents out of which we considered only 197 for data analysis. Incomplete questionnaires and questionnaires that did not fulfil the qualifying criteria for potential users were not included in the analyses.

The study was conducted in Singapore. One reason for choosing Singapore is the fact that it has a large number of VW users, so much so, that Second Life's (an example of VW) California-based creator Linden Lab is planning to locate its servers in Singapore so that growing number of Singapore users can experience faster loading of images and search requests and have a 'hyper' experience in 3-D virtual social worlds (Tham, 2008). Also, over the next three years, Linden Lab expects to invest between US \$5 million and US \$10 million in new staff and training in Singapore as the user base grows further (Tham, 2008). Moreover, the firm, whose software is used by Fortune 500 companies like IBM and Cisco Systems to host virtual conferences, has an office in Singapore which is its only one office in Asia (Tham, 2008). Further, Singaporeans are known to be tech-savvy and were well aware of the concepts of various e-commerce applications and latest web applications. Adding to this, Singapore has a literacy rate of over 95 per cent among residents aged 15 years and older (Singapore Department of Statistics, 2007) and thus are more likely to be exposed to the usage of latest and emerging technologies. Due to these reasons, Singapore provides an excellent context for testing our research problem.

3.2 Analysis Method

Partial Least Squares (PLS) was used to analyze the data as it makes minimal demands in terms of sample size, measurement scales and residual distributions as compared to other structured modeling techniques (such as LISREL, EQS, or AMOS) (Chin 1998; Srivastava and Teo, 2007). PLS analysis has added advantages of being more robust against other data structural problems such as skew distributions and omissions of regressors (Cassel et al., 1999). Various information systems (IS) studies have used PLS effectively for data analysis (e.g. Teo et al. 2009; Srivastava and Teo, 2007). For data analysis, we used SmartPLS 2.0 which is also a component-based path modeling software application similar to other PLS softwares (Ringle et al., 2005).

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Among the 197 respondents, 42.6 percent were males and 57.4 percent were females. The average age of the respondents was 29.3 with a standard deviation of 5.8. Further, all the respondents were highly educated with more than 70 percent respondents having post graduate university education. Most of the respondents had over 10 years of Internet experience.

4.2 Measurement Model

Following the recommended two-stage analytical procedure (Anderson and Gerbing, 1988; Hair et al., 1998), the first stage of data analysis is the evaluation of the measurement properties of the instruments followed by an examination of the structural relationships. In order to assess our measurement model, three types of validity were tested: content validity, convergent validity, and discriminant validity. Content validity was examined by checking for consistency between the measurement items and the existing literature followed by pilot-testing the instrument (Srivastava and Teo, 2007).

Convergent validity was tested by examining the composite reliability (CR) and average variance extracted (AVE: the ratio of the construct variance to the total variance among indicators) for the measures (Hair et al., 1998). 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). As seen in

Table 1, the CR values ranged from 0.92 to 0.97. For the AVE a score of 0.5 is the recommended threshold (Fornell and Larcker, 1981). Table 1 show that AVE ranged from 0.69 to 0.90, which are all above the acceptable values.

Finally, we verified the discriminant validity of the various by checking the square root of the average variance extracted as recommended by Fornell and Larcker (1981). The values of the square root of the AVE (reported on the diagonal in Table 1) are all greater than the inter-construct correlations (the off-diagonal entries in Table 1) exhibiting satisfactory discriminant validity.

Further, from Table 1 we observe that none of the correlations between the latent constructs are above 0.8, which indicates that there is no significant problem of multicollinearity (Gujarati, 2003). Although, we aggregated the items of the five dimensions of CA to arrive at the indicators of CA, we checked the items of the five dimensions of CA for discriminant validity by examining their cross loadings.

Variable	Nos. Items	Mean	SD	AVE	CR	AI	CA	COM	DTR	FAM	PIN	PLY	UTR
BI	4	4.22	1.34	0.80	0.94	0.89							
CA	5	4.55	1.03	0.69	0.92	0.58	0.83						
COM	3	3.55	1.58	0.90	0.96	0.57	0.6	0.95					
DTR	5	4.45	1.31	0.77	0.94	0.41	0.37	0.22	0.88				
FAM	5	3.19	1.59	0.85	0.97	0.4	0.48	0.6	0.06	0.92			
PIN	4	4.42	1.47	0.80	0.94	0.41	0.43	0.45	0.26	0.41	0.90		
PLY	7	4.63	1.44	0.82	0.97	0.54	0.55	0.47	0.41	0.48	0.51	0.90	
UTR	5	3.48	1.38	0.88	0.97	0.66	0.49	0.48	0.51	0.39	0.44	0.43	0.93

Key: AVE: Average Variance Extracted, CR: Composite Reliability, BI: Behavioral Intention, CA: Cognitive Absorption, COM: Perceived Compatibility, DTR: Disposition to Trust, FAM: Familiarity, PIN: Personal Innovativeness, PLY: Perceived Playfulness, UTR: User Trust. **Note:** The shaded numbers in the diagonal row are the square roots of the average variance extracted.

Table 1 Results of Confirmatory Factor Analysis, Descriptives and Correlations

4.3 Structural Model

After validating the measurement model the proposed hypotheses were tested using PLS. The results of the analysis are depicted in Table 2 (Results).

Paths	Results			Post hoc Analyses					
	Hypothesized Model			No direct link from CA to BI			No direct link from UTR to BI		
	β	t	R ²	β	t	R ²	β	t	R ²
COM → CA	0.37***	4.83	0.456	0.37***	4.91	0.456	0.37***	5.04	0.456
FAM → CA	0.08	1.41	0.456	0.08	1.46	0.456	0.08	1.49	0.456
PIN → CA	0.07	1.13	0.456	0.07	1.12	0.456	0.07	1.16	0.456
PLY → CA	0.30***	3.62	0.456	0.30***	3.48	0.456	0.30***	3.62	0.456
CA → BI	0.34***	5.66	0.521				0.58***	11.16	0.521
CA → UTR	0.34***	5.03	0.366	0.34***	4.98	0.365	0.34***	5.09	0.366
UTR → BI	0.49***	9.26	0.521	0.66***	17.12	0.435			
DTR → UTR	0.39***	6.45	0.366	0.39***	6.41	0.365	0.39***	6.25	0.366

*p < 0.1; **p < 0.05; ***p < 0.01; R² values of the paths are for the target variables
Key: BI: Behavioral Intention, CA: Cognitive Absorption, COM: Perceived Compatibility, DTR: Disposition to Trust, FAM: Familiarity, PIN: Personal Innovativeness, PLY: Perceived Playfulness, UTR: User Trust.

Table 2 Results of the Hypothesized Model and Post-hoc Analyses with Two Competing Models

Assessing the two determinants of CA in the category of environment, we find perceived compatibility has a significant relationship with CA (path=0.37, t=4.84, p<0.01), thus supporting H1. This research identifies 'perceived compatibility' to be an important factor to develop CA in the

context of VWs. The relationship between ‘familiarity’ with VW and CA was found to be insignificant (path=0.08, $t=1.41$, $p>0.1$), thereby not supporting H2. We believe that familiarity will be an important determinant of CA for regular users especially in the context of more serious tasks. In the context of this study many respondents were not regular users, rather they were using VW for fun and experience. It will be interesting to examine if the seriousness of the task (or the personal risk involved) influences the importance of familiarity for cognitive absorption. This can be an avenue for future research. The results from this study suggest that perceived compatibility is important among the two antecedents of CA under the ‘environment’ dimension in the context of VWs.

Next, we discuss the results for the other two CA antecedents identified and grouped in the category of the ‘individual’. The relationship of the first antecedent of CA in the category of ‘individual’, viz ‘personal innovativeness’ with CA was not significant (path=0.07, $t=1.13$, $p>0.1$) thus H3 was not supported. The individual trait of personal innovativeness i.e. the willingness to try out new technologies has been shown to have a significant relationship with CA by Agarwal and Karahanna (2000) in the context of Internet usage. However, in the context of VWs, personal innovativeness is not a significant determinant of CA. We believe that this result is mainly due to the respondent characteristics. The subjects in our study are all young, well-educated and knowledgeable about the Internet and VWs, and therefore, personal innovativeness may not necessarily be a significant determining factor for CA in VWs. The relationship of the other CA antecedent in the ‘individual’ category viz ‘perceived playfulness’, has a significant relationship with CA (path=-0.30, $t=3.62$, $p<0.01$) thereby, supporting H4. This result is consistent with and supports past research on the subject by Agarwal and Karahanna (2000) which had identified perceived playfulness as a significant determinant of CA in the context of Internet usage. The results suggest that perceived playfulness is important among the two antecedents of CA under the ‘individual’ dimension in context of VWs. We also observe that the four antecedents of CA divided into two categories of environmental characteristics and individual characteristics, identified in the study, explain a significant amount of variance in CA ($R^2=0.456$). This exhibits the high explanatory power of the theorized determinants of CA. Next, we observe that CA in VWs has a significant relationship with ‘user trust’ (path=0.34, $t=5.03$, $p<0.01$), thereby rendering strong support to H5. We also find that CA alone explains a fairly big proportion of variance in ‘user trust’ ($R^2=0.366$), thereby exhibiting the importance of CA in increasing trusting belief of the users.

From the results in the ‘consequences’ part of the research model, we find that CA has a strong significant relationship with the ‘behavioral intention to use VWs for collaboration and information sharing’ (BI) (path=0.34, $t=5.66$, $p<0.01$), thereby rendering strong support to H6. Past studies (e.g. Agarwal and Karahanna, 2000) have empirically demonstrated this result in context Internet usage. This result validates the importance of CA for the behavioral intention to use technology for collaborative and information sharing tasks even in the context of VWs. In addition, we find that ‘user trust’ is positively associated with BI (path=0.49, $t=9.26$, $p<0.01$), thereby rendering a strong support for H7. We also observe that ‘user trust’ and CA together explain most of the variance in BI ($R^2=0.521$), providing strong support to our proposed research model. All the causal relationships between the constructs postulated by our model are well-supported.

4.4 Robustness Check: Effect Size of Competing Models

Further to test the robustness of the hypothesized model and to see if the proposed configuration does explain the maximum variance in the final dependent variable, we tested theoretically competing models. For example, as presented in Table 2 (post hoc analyses), we tested a revised model in which the direct path from CA to BI is dropped so as to study the direct effect of user trust alone on behavioral intention, as several authors suggest that ‘user trust’ may have direct effects on BI (Gefen et al., 2003). Thus, we study the effect of user trust alone on BI. The results indicate that user trust has a strong significant relationship with BI (path=0.66, $t=17.12$, $p<0.01$) but the R^2 value of BI drops from 0.521 (in the original model) to 0.435 which is a significant drop in the explanatory power of the model.

Next, we tested another revised model in which the direct path from ‘user trust’ to ‘BI’ is dropped so as to study the direct effect of CA alone on behavioral intention, because previous studies discussed the plausibility of the intrinsically motivated state of CA having direct effects on behavioral intentions (Agarwal and Karahanna, 2000). We observe that in the revised model, the path from CA to BI is significant (path=0.58, t=11.16, p<0.01) but the R² value of BI drops from 0.521 (in the original model) to 0.337. Thus, in the absence of the direct path from ‘user trust’ to BI the variance explained in the model drops significantly. This analysis gives a unique insight to VWs that user trust is directly and strongly related to the BI.

It was predicted in our original model that both the independent variables ‘user trust’ and CA are significant for the BI of users to use VWs as compared to the modified models (Post hoc models Table 2) where one independent variable is dropped. To test this, we calculate the R² change for the final dependent variable, BI, as per Chin (1998) who discusses that the effect size of independent variables on a dependent variable can be determined by comparing the R² of the dependent variable with and without the presence of each independent variable (Cyr, 1998).

We also compared the two modified models (post hoc analyses) with the original model (hypothesised model) (Table 2) in terms of R² change for the final dependent variable BI. For R² comparison, we used Cohen’s (1988) formula for calculating effect size f² as

$$f^2 = (R^2_{\text{included}} - R^2_{\text{excluded}}) / (1 - R^2_{\text{included}}).$$

Cohen (1988) provides the following criteria for interpreting effect size: (1) for small effect size, $0.02 < f^2 \leq 0.15$; (2) for medium effect size, $0.15 < f^2 \leq 0.35$; and (3) for large effect size, $f^2 > 0.35$ (Cyr, 1998). For the modified models (Table 2), R² reduced from 0.521 to 0.435 (small effect size $f^2 = 0.11$) and for the second modified model, R² reduced from 0.521 to 0.337 (medium effect size $f^2 = 0.22$). The f² value suggests that the effect of both the independent variables ‘user trust’ and CA are substantive and thus it empirically validates the proposed model. Results indicate CA as a significant determining factor of the trusting belief. In addition, results suggest the significance of both CA and user trust for motivating the users to use the VWs for the purpose of collaboration.

5. LIMITATIONS AND FUTURE DIRECTIONS

Before discussing the implications of this study, it is important to highlight the limitations. *First*, exploring the determinants and consequents of CA for VWs usage is a relatively new area in IS research. The findings and their implications were obtained from one single study that targeted a specific set of users. Thus, more research is needed in this new field of VWs so as to generalize our findings. *Second*, though we have identified a few variables that are related to the behavioral intention to use VWs. Additional variables may be explored so as to improve the robustness of the model for more accurate predictions on behavioral intentions. *Third*, we study the effect of the intrinsic motivational construct of CA and the trusting belief on behavioral intention of VWs for collaboration and information sharing. However, this research model does not consider many other beliefs which may have a significant relationship. For example, it might be reasonable to add the cost factor involved in using VWs to our model for VWs usage behavior in future research. *Fourth*, our research model is cross-sectional; that is, it measures perceptions and intentions at a single point in time. However, perceptions change with time and experience of users (Mathieson et al., 2001). These changes are significant for researchers and practitioners interested studying the acceptance and usage of VWs over time. A dynamic model that would predict behavioral intention of users over time would be more appropriate to study the usage of VWs. Future research can address the above mentioned issues so as to extend research on the adoption and usage of VWs.

6. IMPLICATIONS

The current study is one of the first that empirically examines the role of ‘cognitive absorption’ and ‘user trust’ in the context of VWs. In addition to addressing this research gap, our study offers some important implications for research and practice.

6.1 Implications for Research

The results emerging from this study have several important implications for research. *First*, a model for VW usage is proposed in which theorized antecedents of CA (consisting of environmental and individual factors) explain a significantly high percentage of variance (45.6%) in CA thus highlighting the importance of the identified factors. The model also demonstrates the integrated role of user trust with CA and provides a basis for understanding VW usage intentions. *Second*, we extend the literature on CA by innovatively dividing its antecedents into two dimensions of environment characteristics and individual characteristics. Future research can study these characteristics in greater detail to expand the list of factors affecting CA. *Third*, the findings demonstrate the significance of CA for influencing the user trust and consequently behavioural intention to use VWs. Future research can explore under what conditions user trust is more important and does CA influence user trust under all conditions.

6.2 Implications for Practice

In addition to having implications for research, our study has several important implications for practitioners. *First*, this study exhorts the VW designers to be emphatic in aesthetically pleasing, appealing, expressive and affective interfaces in their design so as to elicit positive responses from the user and ensure that there is sufficient cognitive absorption of the user in VW. The VWs should be so designed that users get holistic experiences which would affect the CA and trust of users in VW thereby motivating them to use VWs for information sharing and collaboration. *Second*, the significance of user trust exhibits its imperative role in the behavioral intention to use VWs for information sharing and thus cannot be ignored by system designers who attempt to design VWs. This study reiterates that the sharing of information on virtual networks is not motivated through technology alone and argues against the myth of extra emphasis given to technology alone for its use (Dixon, 2000). Thus, designers and managers of VWs should give emphatic attention to trust rather than technology alone. *Third*, the significant relationship of CA with the trusting belief affirms the value of CA in increasing user trust. Managers and designers of VWs need to be cognizant of this significant relationship and strive to increase the pleasurable aspect in their design of VWs so as to improve user trust in VW. Fourth, our study directs the VW designers and practitioners on the means to develop CA for its successful usage. Results reiterate the need to develop 'game-based' environment so as to give a playful experience to the users. It is extremely important to merge learning with the motivation of games, and this trend is lately becoming quite widespread so as to retain, rather than lose, the learner's interest and attention (Prensky, 2003). In addition, the technology used in VW should be compatible to the user ideas and expectations. This can be done by understanding the user needs and expectations and aligning the VW design to satisfy these needs and expectations.

7. REFERENCES

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