Journal of the Association for Information Systems
JAIS

Special Issue

Cognitive Absorption and Trust for Workplace Collaboration in Virtual Worlds: An Information Processing Decision Making Perspective

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Abstract

Virtual worlds (VWs) are media-rich cognitively engaging technologies that geographically dispersed organizations can use as a cost effective workplace collaboration tool. Using an information processing decision making perspective and building on unique characteristics of VWs, this paper proposes a nomological net for adaptive use intention (AUI) of VWs for workplace collaborations. AUI implies intention to use a technology in a setting different from the one for which it was initially designed. We study the AUI of VWs as a workplace collaboration tool which were originally conceived as recreational gaming platforms. Decision-making literature directs us to reduction of perceived cognitive burden and minimization of risk as the two key motivations for VWs' AUI. Building on these motivations, the paper identifies cognitive absorption and user trust in VWs as the mechanisms leading to individual-level AUI decision. Drawing on social cognitive theory and literature on trust, the proposed model not only re-specifies the concept of cognitive absorption in the context of VWs but also relates it to the level of trust and usage intention for VWs. We empirically tested the proposed model via data collected from 197 VW users in Singapore. Results demonstrate the significant roles that cognitive absorption' and user trust play in VW's usage as a collaboration tool. Further, through a series of post-hoc analyses, we demonstrate the imperative need for considering both cognitive absorption and user trust together in the proposed research model for theoretical parsimony. We also discuss implications for research and practice emerging out of this study.

Keywords: *Cognitive Absorption, Virtual World, Trust, Adaptive Use Intention, Singapore.*

* Gert Jan de Vreede was the accepting senior editor. This article was submitted on 15th December 2010 and went through two revisions.

Volume 13, Special Issue, pp. 797-835, October 2012

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1. Introduction

In the last two decades, work and customers have significanty dispersed across the world. Consequently, organizations are continuously searching for innovative collaborative technologies that can overcome temporal and geographical barriers. The literature suggests that effective collaboration among globally distributed employees, customers, and business partners would be instrumental in creating value for organizations (Church, 2008; Koplowitz, Brown, & Burnes, 2009). Organizational collaboration has largely been studied in face-to-face settings. However, because virtual teams and virtual work environments are becoming dominant for (inter)organizational tasks, there is a growing need for examining emerging options for collaborating virtually (Vreede, Briggs. & Massey, 2009). Our paper addresses this need by examining the use of virtual worlds (VW) for collaborative organizational tasks.

Virtual worlds (VWs) such as Second Life and Kaneva are three-dimensional (3D), media-rich computer-based simulated environments where individuals assume pseudo identities (avatars) and interact among themselves via the Internet through computer-based text and voice chat. Though originally conceived as boundary-less gaming environments, VWs offer a platform that organizations could use for interaction and collaboration across the world. Collaboration has been an important aspect of virtual online multiplayer games, where interactions are structured in a way that encourages players to work with other online players to achieve common goals. In their 2007 report, IBM Global Business Services note several similarities between virtual game worlds and virtual work environments (DeMarco, Lesser, & O'Driscoll, 2007). They found that, in both game worlds and work environments, individuals come together in large, complex virtual spaces to self-organize and take on a variety of roles as problems arise. They also found that both environments require users to take risks, iteratively strategize, and accept failures. Following these findings, the IBM report recommended virtual worlds as possible workplace collaboration tools. Since then, several major corporations such as IBM, Intel, Xerox, and Unilever have started experimenting with VWs. However, they soon realized that using VWs in an organizational setting is fraught with various challenges. Undoubtedly, there have been some VW implementation success stories, yet leading companies such as Sears, Sun Microsystems, Dell, Coca Cola, Reebok, Coldwell Banker, and Calvin Klein are still struggling with their VW presence (Wagner, 2007). Gartner reports that nine out of 10 business experiments in VWs fail within 18 months (Greene, 2008). Hence, despite the high collaborative potential and the low cost [1] involved in VW implementations, not many firms have been able to adopt VWs for workplace applications.

From a theoretical standpoint, key concerns about using VWs for organizational tasks revolve around the decision to adapt their use from a fun-filled, recreational, social-networking setting to a workplace-related context. To a large extent, this depends on individual employees' willingness to accept VWs as a viable workplace application tool, which, in turn, depends on employees' inherent requirements and motivations (Gonsalves, 2008). Although substantial research has examined both recreational and workplace adoption of new technologies, there is a perceptible disconnect between the two because the two streams are generally compartmentalized into distinct groups. Situations that describe the adaptation of recreational technologies for workplace use has clearly not been the focus of research on technology adoption. Thus, we see a theoretical gap between recreational and workplace technology-use literatures. For example, while we somewhat understand the drivers of users' intention to use VWs for recreation, the literature provides little guidance about what motivates those same users to adapt their use of such technology for work purposes. The current study addresses this theoretical gap by developing a model that explains what motivates current recreational users to adapt their VW use for workplace applications.

Because we study individual-level decisions for adapting VWs for workplace collaborations, our research is anchored in the information-processing decision-making perspective, which seeks to explain the mechanisms through which such decisions are made. The workplace use of VWs is clearly different from the recreational-social networking context for which VWs were originally created.

[1] Gartner reports that companies can experiment in VWs for as little as $5000 (Gonsalves, 2008).

We term using a technology in a setting different from the one for which it was initially designed as "adaptive use intention" (AUI). The information-processing decision-making perspective argues that individuals make decisions based on the amount of information available to them and the effort they expend to arrive at their decisions. Generally, individual decision-making strategies vary on a continuum from being completely rational normative to purely heuristic (Bettman, 1979). In situations where all the necessary information and resources are available, an individual makes a rational-normative decision for arriving at an accurate optimal decision. On the contrary, in situations where the context is novel and the information available is limited, individuals resort to a heuristic decision-making style, through which they draws generalizations and projections to arriving at an appropriate decision, which minimizes perceived cognitive burden and risk (Bettman, Luce, & Payne, 1998). In the context of decision making, cognitive burden denotes the load (effort) experienced by the decision maker during the decision making process, whereas risk specifies the vulnerability of the decision that turns out to be unfavorable *post facto*.

Recreational VW users have no prior experience using VWs for workplace-related tasks. Hence, examining their adaptive intentions for extending VW usage from recreational to workplace-related tasks creates a heuristic context. Thus, projections of such individuals about intended workplace use of VWs are based on individuals' experiences using VWs in recreational settings. From the information-processing decision-making perspective, in such a decision-making context, minimizing perceptions of cognitive burden and risk will be the key. Moreover, these two theoretical decision requirements also correspond well with the two unique characteristics of VWs; namely, a "high degree of experienced cognitive involvement" and "multifarious perceived risks", which we explain below.

First, VWs offer media-rich 3D platforms that can be leveraged to simulate the circumstances and the associated context of a life-like situation. For example, VWs can capture elements such as "airflow" and "temperature" that are often hard to depict in a 2D media platform (Dern, 2008). Moreover, VWs, with their multitude of visual and aural cues, provides an immersive enjoyable experience for their users, which creates a high degree of enjoyable cognitive involvement. This high degree of cognitive absorption experienced during VW usage is not necessarily associated with other collaborative technologies and may significantly influence usage intention. Second, since their, inception, VWs have been largely pigeonholed as a technology for social networking and recreation, something like a more anonymous and multidimensional version of Facebook or MySpace (King, 2009). They are often referred to as "fun" and "cool" things. Hence, in contrast to other collaborative technologies that were primarily designed for organizational requirements, VWs were created for non-organizational "recreational" reasons. As such, VW avatars may not necessarily portray users' real identity attributes. Instead, they may portray unrealistic and often aspirational alter-egos. Moreover, the VW technological platform is new and evolving. This poses identity, security, privacy, and technological risks, which are likely to influence employees' trust in VWs. This in turn may influence individual's adaptive use intention (AUI) of VWs. Thus, the key question that we study in this research is:

> ***RQ:*** *What factors are associated with an individual's decision to adapt VW use from a recreational context to a workplace context?*

To answer this research question, we draw on the information-processing decision-making perspective and integrate it with social cognitive theory and the literature on trust. We propose a nomological network that elaborates the intention to adapt the use of VWs from recreational to workplace applications. Our research model for examining this question not only identifies the antecedents of cognitive involvement but also relates them to the level of trust and adaptive use intention for VWs, which we empirically tested via a survey of VW users. Our work makes several important theoretical contributions. First, we contribute to the literature on individual level adoption decision for an emergent technology in a setting different from the one for which it was originally designed – that is, its adaptive use intention, which thus moves beyond the initial technology adoption and continuance intentions. Second, prior research on technology adoption and continuance has used multiple theoretical lenses such as the theory of diffusion of innovations (Moore & Benbasat, 1991), the theory of reasoned action (Fishbein & Azjen, 1975), the technology acceptance model (Davis, 1989; Davis, Bagozzi. & Warshaw, 1989), the theory of planned behavior (Azjen, 1985; Azjen & Madden, 1986), institutional theory (Liang, Saraf, Hu, & Xue, 2007; Teo, Wei, & Benbasat, 2003), and expectation-confirmation theory (Oliver, 1993; Bhattacherjee, 2001). In contrast, we anchor this study in the information-processing decision-making perspective, which we believe offers an alternate view and helps to delineate the nomological network explaining the AUI for VWs. Third, we offer a granular understanding of the relationships associated with VW use, especially those related to a user's enjoyable cognitive involvement in media-rich VW platforms, and highlight the need for fostering user trust.

The paper is organized as follows. Section 2 presents the theoretical background leading to the development of research hypotheses. Sections 3, 4, and 5 presents the research methodology, data analyses ,and the emerging results, respectively. Section 6 presents our study's limitations and future research directions. Section 7 discusses the implications of this study for research and practice, and Section 8 concludes the paper.

2. Theoretical Background

2.1 Decision Making for Using VWs in the Workplace

Using VWs for workplace applications entails two potential decision-making scenarios that are closely related to each other. First, managers must decide if they wish to implement VW environments for workplace collaborations. Second, individual employees must decide if they prefer to adopt and use VW as a collaboration tool. Managerial-level organizational decisions often depend on employees' perceptions about the introduction of new collaboration tools. Hence, we focus on individual-level decision making for adopting VWs as workplace collaboration tool in this research.

From the information-processing perspective, we can describe decision making as a set of cognitive mental processes that result in an outcome that leads to the selection of a course of action. Prior research describes two divergent perspectives for decision making; namely, the rational choice perspective and the bounded rationality perspectives (Bettman et al., 1998). The rational choice perspective for decision making assumes that accurate and complete information is available to the decision maker for making a normative decision. The underlying assumption is the mechanistic nature of the decision-making process where preferences are well articulated and clear. On the other hand, the bounded rationality argument posits limitations on the information and resources available to the decision maker, which requires the individual to make a heuristic decision. The underlying assumption is the constructivist nature of the decision-making process because options are constructed during the process of decision-making and not merely revealed (Bettman, 1979; Bettman & Park, 1980; Payne, Bettman, & Johnson, 1992). Normative decision-making strategies are generally systematic and rely on the careful application of compensatory decision rules, whereas heuristic decision-making is based on less-intense information processing and has a lesser associated cognitive burden.

Depending on the completeness of available information and the extent of cognitive effort the decision maker is prepared to expend on information processing, decision-making strategies vary on a continuum from "completely normative" to "completely heuristic" (Bettman, 1979). As noted previously, in uncertain, complex, and novel situations where cognitive resources are unavailable, the decision maker often constructs preferences for decision-making options based on certain heuristics (Bettman 1979). In a heuristic decision-making scenario, individuals construct their options because 1) they may not have sufficient information on the subject, 2) they lack cognitive resources to generate well-defined preferences, and 3) they may often have multiple goals to a single decision problem (Bettman et al., 1998; March, 1978). The constructed preferences are highly context-dependent and sensitive to the local problem structure. Bettman et al. (1998) has proposed that, in heuristic decision-making scenarios, decision makers try to minimize perceived cognitive burden and associated negative emotions (risk) while simultaneously attempting to maximize the ease of justifying the decision.

In bounded-rationality scenarios, the two key heuristic constructive-choice processes described by Payne (1982) are the accuracy-effort approach and the perceptual approach. The accuracy-effort approach is based on the basic assumption that each decision strategy is characterized by its accuracy and the effort required in decision-making. Decision makers select strategies that make some compromise between the desire to make an accurate decision and the desire to minimize cognitive burden. The perceptual approach is associated with the human perception of the decision outcome in terms of gains or losses. Integrating the two approaches, Bettman et al. (1998) has suggested that the goals considered in accuracy-effort approach be supplemented with goals for minimizing the negative emotion experienced during the process and for maximizing the ease of justifying the decision.

Recreational VW users often have no prior experience using VWs for workplace applications, so examining their adaptive intentions for extending VW usage from recreational to workplace-related tasks clearly creates a bounded rationality context in which individuals do not have complete information for making an accurate decision. Moreover, users who wish to minimize their perceived decision-making cognitive burden can resort to the heuristic decision-making approach. Building on the accuracy-effort heuristic approach, we notice that enjoyable cognitive involvement of the individual in VW presents a situation of a reduced perceived decision-making cognitive burden (Agarwal & Karrahanna, 2000). Hence, despite a high degree of cognitive involvement/engagement (and effort expended) while using VWs, a VW user's perceived cognitive burden would be relatively lower because the VW is an "enjoyable" cognitively absorbing context. Thus, enjoyable cognitive absorption is associated with perceptions of comparatively lesser cognitive burden. Likewise, building on the perceptual approach for minimizing loses and risks, individuals contemplating using VWs for workplace applications need to reduce their risks associated with using VWs. Trust has served as a useful mechanism for mitigating risks in multiple contexts (Mayer, Davis, & Shoorman, 1995). In the current research scenario, we posit "user trust in VW" to be a significant risk-mitigator. Thus, following the information-processing decision-making perspective and taking into account the unique characteristics of VWs (cognitive engageability and riskiness), in this research, we focus on cognitive absorption and user trust as key variables that facilitate adaptive use intention of VWs, which Figure 1 summarizes.

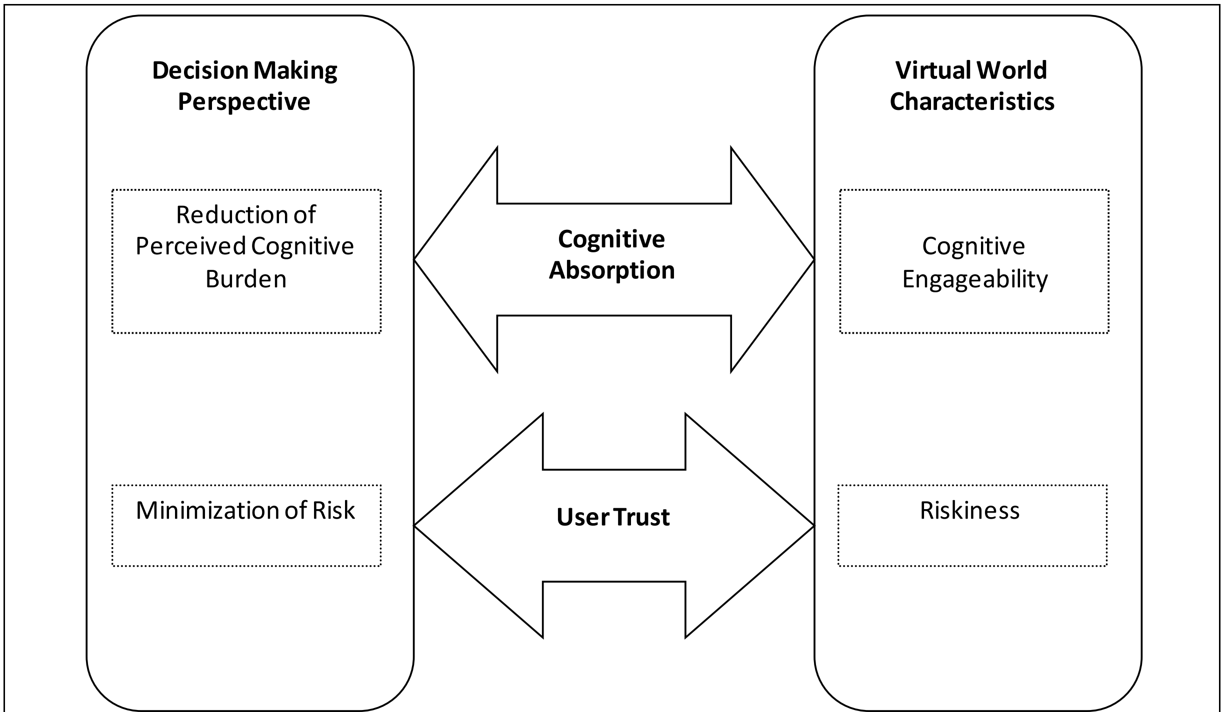

Figure 1. Identification of Key Research Variables for VW Context

2.2. Virtual Worlds and Adaptive Use Intention

Many researchers believe that the effects of advanced technologies are less a function of technologies themselves than the manner in which they are used by people (DeSanctis & Poole, 1994). People adapt information systems (IS) in their workplace, resist using them, or even shift the usage of these systems from originally designed uses to new uses. Prior research has made impressive strides in explaining the initial adoption of IS (e.g., Davis, 1989; Davis et al., 1989, Venkatesh & Davis, 2000). Likewise, prior technology acceptance research has made significant progress in understanding the continued usage of IS (e.g., Bhattacherjee, 2001; Teo, Srivastava, &

Jiang, 2009). Yet, research related to using existing technologies in new and unrelated areas has been limited (Po-An Hsieh & Wang, 2007). Realizing this limitation, some researchers have called for expanding the scope of research from sheer usage behaviors to deeper and broader-level investigations (Chin & Marcolin, 2001). Burton-Jones and Gallivan (2007) realized the need to re-conceptualize system usage, and they have contributed to a deeper understanding of system usage in organizations by examining its multilevel nature, yet the broader applications of IS for new uses that emerge as people interact with these technologies has received relatively lesser attention in IS research to date. While the acceptance and continued usage of IS is important for realizing the initial success, the eventual long-term success of an IS depends on adapting its uses to new areas for fresh applications. Burton-Jones and Straub (2006) have noted the lack of theoretical scrutiny of the system use construct and suggest the need to broaden the concept. According to Burton-Jones and Straub (2006), the structure of system use is tripartite (i.e., user, system, and task); researchers should clearly justify the elements of use most relevant for their study to make the system use construct richer with a broadened meaning. This broader-level concept of adaptive use by users represents a valuable perspective for understanding the full potential of any complex system (Po-An Hsieh & Wang, 2007). Responding to this call, in this research, we posit users' adaption of technology structures as the key factor in causing any change (DeSanctis & Poole, 1994), which we term adaptive use intention (AUI). Thus, AUI implies the intention for using the same technology in a setting different from the one for which it was initially designed. We study AUI of VWs as workplace collaboration tool from their originally designed intent of serving as recreational social-networking platforms.

2.3. Cognitive Absorption in Virtual Worlds

We can define cognitive absorption (CA) as the state of deep involvement or holistic experience an individual has with cognitively engaging information technologies (ITs) such as the Internet and video games (Agarwal & Karahanna, 2000). CA influences the usage intention of ITs that are stimulating and absorbing for the user. Because of the immersive and cognitively engaging nature of VW platforms, VW users also experience a significant degree of CA. Note that, in addition to VWs, other hedonic systems (e.g., van der Heijden, 2004) and game-based interventions for facilitating technology (e.g., Venkatesh, 1999), creating an immersive environment may essentially be creating a state of CA for the user. Hence, CA could play a significant role for the adaptive use intention of VWs for workplace applications.

CA is rooted in ideas from psychology and is built on three closely inter-related concepts of trait of absorption (Tellegen & Atkinson, 1974), the state of flow (Csikszentmihalyi, 1990) and the notion of cognitive engagement (Webster & Ho, 1997). Absorption defines an individual's state of deep attention, the theory of flow describes the state whereby people are so involved in an activity that nothing else matters, and the concept of cognitive engagement refers to playfulness and intrinsic interest (Agarwal & Karahanna, 2000; Saade & Bahli, 2005). Concepts of absorption, flow, and cognitive engagement are conceptually similar and together describe the behavioral state of CA. Thus, cognitive absorption is defined as a state of deep involvement with software and is exhibited through the five dimensions that describe the states of absorption, flow, and cognitive engagement; that is, temporal dissociation, focused immersion, heightened enjoyment, control, and curiosity (Agarwal & Karahanna, 2000). Temporal dissociation is the state of inability to register 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 represents the sense of being in charge of the interaction. And curiosity refers to the aroused sensory and cognitive curiosity of the user during interaction. These five dimensions describe the state of CA.

Although CA helps us to understand the usage intentions for cognitively involving technologies, relatively few research studies have explicitly used the CA concept. Table 1 provides a list of key studies that use CA for explaining user behavior. In their recent study, Burton-Jones and Straub (2006) considered CA as a way to measure a user's engagement with an information system during use, whereas Agarwal and Karahanna (2000) introduced CA to the IS literature as a state of deep involvement with cognitively engaging information technologies. In the context of this research, we conceptualize CA in a way similar to Agarwal and Karahanna (2000) and propose a nomological net for AUI of VWs. Note that different conceptualizations of CA may affect the research outcomes; thus, it is essential to specify the assumptions upfront.

Table 1. Key Research Using the Concept of "Cognitive Absorption"

Author	Methodology/sample	Results
Agarwal and Karahanna (2000)	Survey methodology for data collection	Cognitive absorption has a significant relationship with the salient beliefs of perceived usefulness and perceived ease of use.
Burton-Jones and Gallivan (2007)	Conceptual paper	System usage presented as a multilevel construct.
Burton-Jones and Straub (2006)	Empirical investigation	Results suggest new directions for research into the nature of system usage, its antecedents, and its consequences.
Park, Nah, DeWester, & Eschenbrenner (2008)	Conceptual paper	The study proposes a model linking environment-induced and business-enabled affordances to enhance the flow state, which in turn increases customers' perceived brand equity.
Lin (2009)	Survey of 172 community members	Cognitive absorption significantly affects behavioral intention through perceived usefulness and perceived ease of use of the virtual community.
Saade and Bahli (2005)	Survey methodology	Results show the significance of cognitive absorption for acceptance of online learning systems.
Shang, Chen, & Shen (2009)	Web-based survey from on-line consumers and also paper-based survey from student sample	Results show that fashion and a cognitive absorption experiences on the web were more important than their extrinsic factors in explaining online consuming behavior.
Wakefield and Whitten (2006)	Survey-based study	Cognitive absorption and user playfulness impact beliefs.

2.4. User Trust in Virtual Worlds

Trust has been the focus of IS research in various contexts such as technology adoption (Pavlou, 2003), e-commerce (Ba & Pavlou, 2002; Bhattacherjee, 2002; Gefen, Karahanna, & Straub, 2003; Pavlou, Liang, & Xue, 2007), e-government (Teo et al., 2009) ,and virtual collaborations (Jarvenpaa, Knoll, & Leidner, 1998; Jarvenpaa & Leidner, 1999). Lack of user trust has been identified as the most significant long-term barrier to the success of any technology (Keen, 1997; Gefen, 2000; Gefen et al., 2003).

Mayer et al. (1995) describes trust as the belief that the trustor will trust the trustee to fulfill thetrustor's expectations without taking advantage of trustor's vulnerabilities. Trust is a way to "manage people whom you do not see" (Handy, 1995, p. 41) and is particularly important in virtual collaborative tasks (McKnight, Cummings, & Chervany, 1998). Trust is an expectation that alleviates the fear that one's exchange partner will act opportunistically (Bradach & Eccles, 1989). It is believed that the trusted party will behave in a responsible manner to meet the expectations of the trusting party (Gefen, 2000; Mayer et al., 1995). Although these definitions of trust describe situations where interacting partners are individuals or groups, the concept of trust has wider implications. For example, it could refer to an object such as technology. Sitkin and Roth (1993) define trust as a set of expectations that tasks will be accomplished reliably. Likewise, this research conceptualizes "trust in VWs" as the belief that VWs will accomplish an individual's tasks reliably. Further, note that "trust in VWs" signifies the composite trust engendered (which is a combination of trust in VW technology and trust in VW community).

Trust has a silent presence in all social interactions (Misztal, 1996) be they online or otherwise. Clearly, it is a key concern for accomplishing collaborative tasks (Mayer et al., 1995; McAllister, 1995). Moreover, in the context of virtual interactions (e.g., VWs), trust is particularly significant because collaborative users need to cooperate by sharing relevant information across a technological platform (Jarvenpaa et al., 1998). Prior research has demonstrated a direct link between user trust and collaborative task performance (Paul & McDaniel, 2004). Similar to the real world, social interactions are an integral part of VWs. This poses several risks and uncertainties for VW users that can be both technological and social. Hence, the usage of VWs would depend to a large measure on the extent of trust that interacting members have in the VW platform. Further, as the seriousness of tasks accomplished through VW platform increases, the role of trust becomes more important (Teo et al., 2009). Hence, as compared to recreational social-networking scenario, user trust assumes greater salience for workplace collaborations.

A review of key papers on trust in virtual environments (Table 2) reveals that, though the concept of trust has been widely used to examine virtual collaborations, none of the studies focus on understanding AUI of VWs. Further, to the best of our knowledge, there are no studies theorizing the relationship between user trust and CA, which assumes importance especially in the context of cognitively engaging technologies such as VWs. The current research attempts to address these theoretical gaps in the trust literature on virtual environments.

Table 2. Key Research on Trust in Virtual Environments

Author(s)	Methodology/sample	Results
Brown, Poole, & Rodgers (2004)	Conceptual.	The study develops propositions positing that individual's interpersonal traits affects the individual's disposition to trust, perceived trustworthiness, communication, and thereby affects willingness to collaborate in virtual environment.
Gallivan (2001)	Case studies.	Effective performance within open source software (OSS) projects relies on control rather than trust.
Gefen et al. (2003)	Field study technique. Data collected from experienced repeat online shoppers who were asked to assess the last online book or CD vendor from whom they had purchased.	Results shows that consumer trust is as important to online commerce as the TAM use-antecedents, perceived usefulness and perceived ease of use. Results also show that online trust is built through calculative-based beliefs, structural assurance, situational normality and easy to use interface.
Jarvenpaa et al. (1998)	Survey followed by qualitative analysis.	In the early phases of teamwork, team trust was predicted strongest by perceptions of other team members' integrity, and weakest by perceptions of their benevolence. The effect of other members' perceived ability on trust decreased over time. Introduced the strategy of “swift trust”.
Jarvenpaa, Shaw, & Staples (2004)	Empirical work by conducting two studies.	The two studies find that trust affects virtual teams differently in different situations.
Kanawattanachai and Yoo (2007)	A project-based study that involved 38 virtual teams of MBA students performing a complex web-based business simulation game over an 8-week period.	The study shows that the three behavioural dimensions associated with transactive memory systems (TMS) in virtual teams – expertise location, knowledge coordination, and cognition-based trust – and their impacts on team performance changes over time.
Leimeister, Ebner, & Krcmar (2005)	Online surveys and archive analyses, log file analyses, and observations.	Perceived goodwill and perceived competence support the process of creating and sustaining trust between members as well as between members and the operators of the virtual community and important for the successful implementation and maintenance of the community.

Table 2. Key Research on Trust in Virtual Environments (cont.)		
Author(s)	**Methodology/sample**	**Results**
McKnight, Choudhury, & Kacmar (2002)	Online study with data collected through questionnaires administered in the context of an experiment. The specific setting was a created artifact of a legal advice site.	Results show that trust is a multidimensional concept with four high-level constructs—disposition to trust, institution-based trust, trusting beliefs, and trusting intentions—which are further delineated into 16 sub-constructs.
Paul and McDaniel (2004)	Study of 10 operational telemedicine projects in health care delivery systems.	Results show an association between calculative, competence, and relational interpersonal trust and performance.
Pauleen (2004)	Quantitative methodology with data collection and analysis based on grounded theory approaches.	The leaders considered it essential to build some level of personal relationship with their virtual team members before commencing a virtual working relationship. The study identifies steps a virtual team leader undertakes when building relationships with virtual team members.
Piccoli and Ives (2003)	A longitudinal study with an experiment involving 51 temporary virtual teams.	Behavior control mechanisms have a significant negative effect on trust in virtual teams.
Scott (2000)	Semi-structured interviews to develop a conceptual model.	Results show the role of information technology in lower and higher levels of interorganizational leaming, cognitive and affective trust, and virtual and humanistic interorganizational collaboration.
Staples and Webster (2008)	Questionnaire-based data.	A strong positive relationship between trust and knowledge sharing was found in virtual teams.
Mathwick, Wiertz, & Ruyter (2008)	Online survey and observational data using netnography.	Results support the conceptualization that social capital composed of the normative influences of voluntarism, reciprocity, and social trust in virtual communities.

2.5. Determinants of Cognitive Absorption: Social Cognitive Theory

Social cognitive theory (SCT) is a robust and empirically validated model of individual behavior that acknowledges reciprocity and interaction among an individual's cognitive, environmental, and behavioral influences (Money, 1995). Further, SCT specifies that, for a holistic understanding of any phenomenon related to an individual's behavior, it is imperative to consider the triadic reciprocal causation among an individual's environment, personal characteristics, and behavior (Wood & Bandura, 1989). By introducing personal cognitive beliefs into the social behavioral model, Bandura (1977; 1982; 1986) has suggested that an individual's behavior is not merely determined by their personal characteristics but also by the environment in which they operate. The "absolute environment" in which the individual functions could be the same for different individuals, but the "constructed environment" experienced by each individual is unique and based on the individual's distinctive "familiarity" and "compatibility" with the absolute environment. Although the original conceptualization of SCT by Bandura (1977) includes an individual's environment personal characteristics, a review of prior IS research using SCT (Table 3) highlights the lesser emphasis given to individuals' environments as compared to their personal characteristics (e.g., Agarwal, Sambamurthy, & Stair, 2000; Compeau & Higgins, 1995; Fuller, Hardin, & Davison, 2007; Johnson & Marakas, 2000; Yi & Davis, 2003). Acknowledging this gap, our paper conceptualizes both an individual's personal characteristics and the environmental variables for explaining VW users' CA determinants.

CA is a useful construct for explaining the cognitive experience that individuals have when using immersive information technologies. Prior research provides valuable insights into the determinants of CA (e.g., Agarwal & Karahanna, 2000; Roche & McConkey, 1990; Wild, Kuiken, & Schopflocher, 1995). Using SCT and Bandura's (1986) notion of triadic reciprocity, Agarwal and Karahanna (2000) have demonstrated the significance of individual characteristics such as personal innovativeness and perceived playfulness for determining CA. But they studied CA in the context of individual Internet-browsing behavior. Contrary to the individual Internet-browsing scenario, VW is a social platform where individuals interact with technology and other VW community members. Furthermore, VWs appear to provide a deeper immersive experience because of their visual and aural cues. Hence, in accordance with Bandura's (1986) notion of triadic reciprocity, in addition to individual's personal characteristics, the influence of environment (i.e., the characteristics of the VW environment in relation to the individual) appears to be vital for determining CA. Webster and Martochhio (1992) have also noted that the relationship of the environment with the individual needs to be considered separately for a richer understanding of technology use.

Building on the work of Agarwal and Karahanna (2000), our research conceptualizes the influence of an individual's environment (familiarity and compatibility) and an individual's personal characteristics (perceived playfulness and perceived innovativeness) as determinants of CA. Hence, extending the concept of CA, we identify the key determinants of the behavioral state of CA in VWs as comprising personal (individual) and environmental (situational) variables. After controlling for the two personal characteristics (perceived playfulness and perceived innovativeness), previously studied by Agarwal and Karahanna (2000), we examine the influence of the two VW environmental variables in relation to the individual; that is, "compatibility" and "familiarity" of the individual with the VW environment.

Table 3. Key Research Using the Concept of "Social Cognitive Theory"

Author(s)	Methodology/sample	Results
Agarwal and Karahanna (2000)	Data collected from student subjects enrolled at a large state university with World Wide Web as the target innovation.	Results demonstrate the individual traits of playfulness and personal innovativeness as important determinants of cognitive absorption using triadic reciprocity.
Bolt, Killough, & Koh (2001)	Laboratory experiment with a sample of students from a large university.	Behaviour modeling outperforms lecture-based training for measuring final performance when task-complexity is high. When task complexity is high, computer self-efficacy has a greater effect on performance.
Compeau and Higgins (1995)	Survey of Canadian managers and professionals.	Self-efficacy is an important individual trait that moderates organizational influences on an individual's decision to use computers.
Fuller et al. (2007)	Field study data from multiple samples of information systems project teams.	Results show that computer collective efficacy is antecedent to virtual team efficacy, and virtual team efficacy is a predictive measure of performance.
Klein (2007)	Survey of 294 patients.	The study incorporates computer self efficacy and personal innovativeness in the domain of information technology, with perceived usefulness and perceived ease of use. The analysis finds that usefulness and innovativeness positively influence behavioral intention to use.
Lam and Lee (2006)	Longitudinal study through both survey and lab experiments.	The study validates the affects of Internet self-efficacy and outcome expectations on usage intention by older adults.
Looney, Akbulut, Poston (2008)	Survey-based study.	The results suggest that task specific self-efficacy beliefs entice consumers to favour a particular service channel. Thus, individuals with higher self-efficacy prefer online approach.
Looney, Valacich, Todd, & Morris (2006)	Survey-based study.	The results suggest that perceptions about what an individual can accomplish through online investing technologies can lead investors to exaggerate their capabilities. This, in turn, produces higher expectancies of financial payoffs and non-monetary rewards.

Table 3. Key Research Using the Concept of "Social Cognitive Theory" (cont.)

Author(s)	Methodology/sample	Results
Money (1995)	Experimental describing a classroom experience to prototype.	The results show that in the learning process people learn from a variety of experiences and from the observation of the actions of others as per reciprocal determinism.
Santhanam, Sasidharan, & Webster (2008)	Experimental with participants trained through e-learning to design a website.	The results show that instructional strategies need to persuade learners to follow self-regulated learning strategies.

Figure 2 summarizes the research agenda and the key background theoretical concepts used in this study. An individual's decision to adapt the use of VW technology from a recreational to a workplace scenario creates a situation of bounded rationality that is apt for heuristic decision-making. The two key heuristics used in such a situation are minimization of associated perceptions of "risk" and "cognitive burden". User trust in VWs could be instrumental in mitigating perceived risk; likewise, CA in VWs could help in minimizing perceived cognitive burden. Further, social cognitive theory directs us to the important role of individual and situational variables in determining CA.

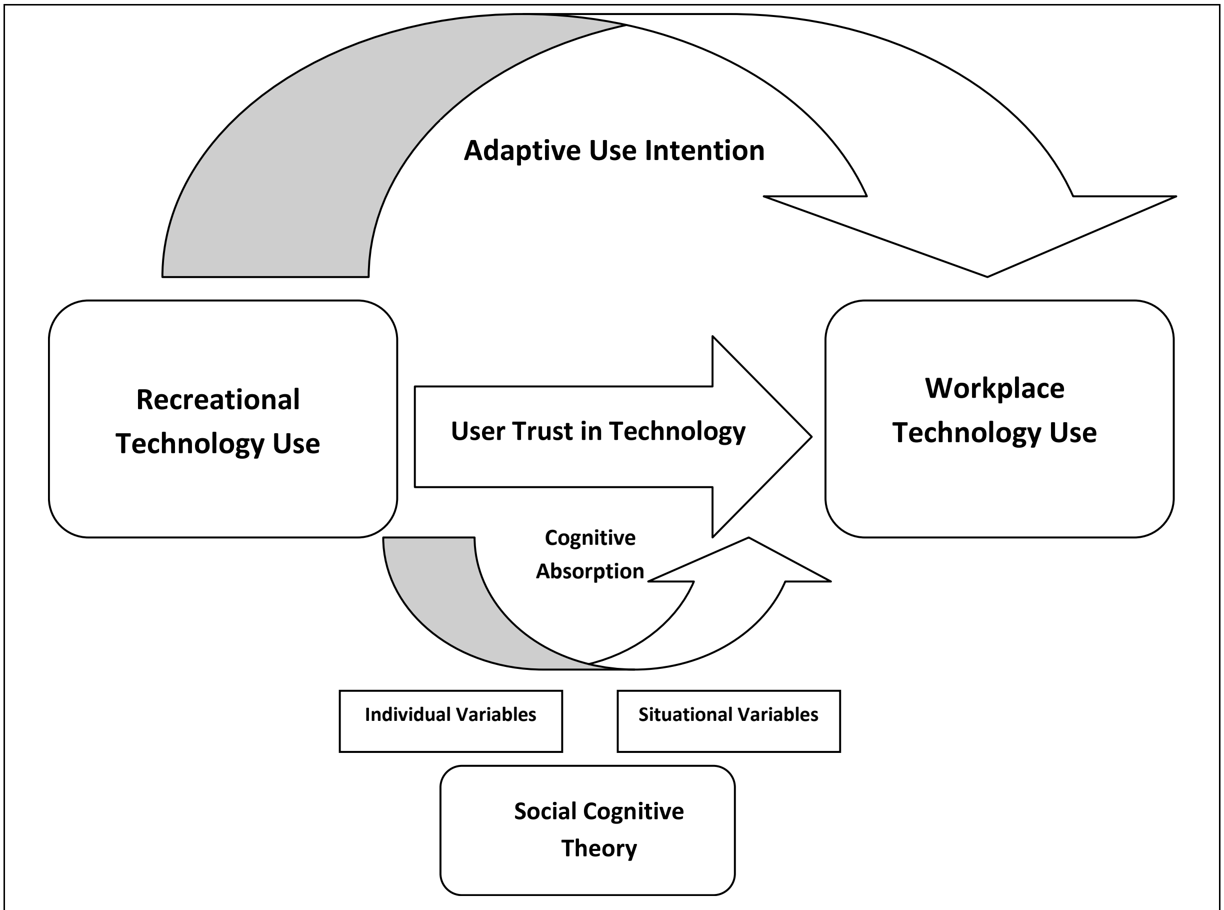

Figure 2. Conceptual Diagram for Adaptive Usage of Cognitively Engaging Technologies: From Recreational to Workplace Technology Usage

3. Research Model And Hypotheses Development

The information-processing decision-making perspective coupled with unique characteristics of VWs highlight the importance of considering CA and user trust as key variables associated with AUI of VWs (Figures 1 and 2). The proposed research model in Figure 3 integrates CA and user trust to delineate a nomological net for the adaptive use of VWs for workplace applications. In addition, we also re-specify the determinants of CA. Although past CA research has largely focused on the individual characteristics as determinants of CA, which draws from Bandura's (1977, 1986) conceptualization of triadic reciprocity (in social cognitive theory), we incorporate environmental variables in addition to individual characteristics. In summary, our paper theoretically develops and empirically validates a model examining the proximal antecedents of CA and its consequence as user trust to predict the AUI of VWs for workplace collaborations. We posit that CA and user trust are especially important for understanding the VW context. The enjoyable cognitive involvement associated with VWs makes CA a relevant construct in the nomological net for AUI. Similarly, trust serves to reduce the risks associated with VW usage for AUI.

It is possible that other studies might propose alternative nomological nets for understanding the network of relationships for AUI. But similar to the study by Agarwal and Karahanna (2000), the goal of this research is not theory testing; instead, we seek to examine a possible nomological net that incorporates CA and user trust in explaining the AUI for using VWs for workplace collaboration. In the following sections, we theorize for the proposed paths in the research model (Figure 3) and subsequently test the theorized relationships.

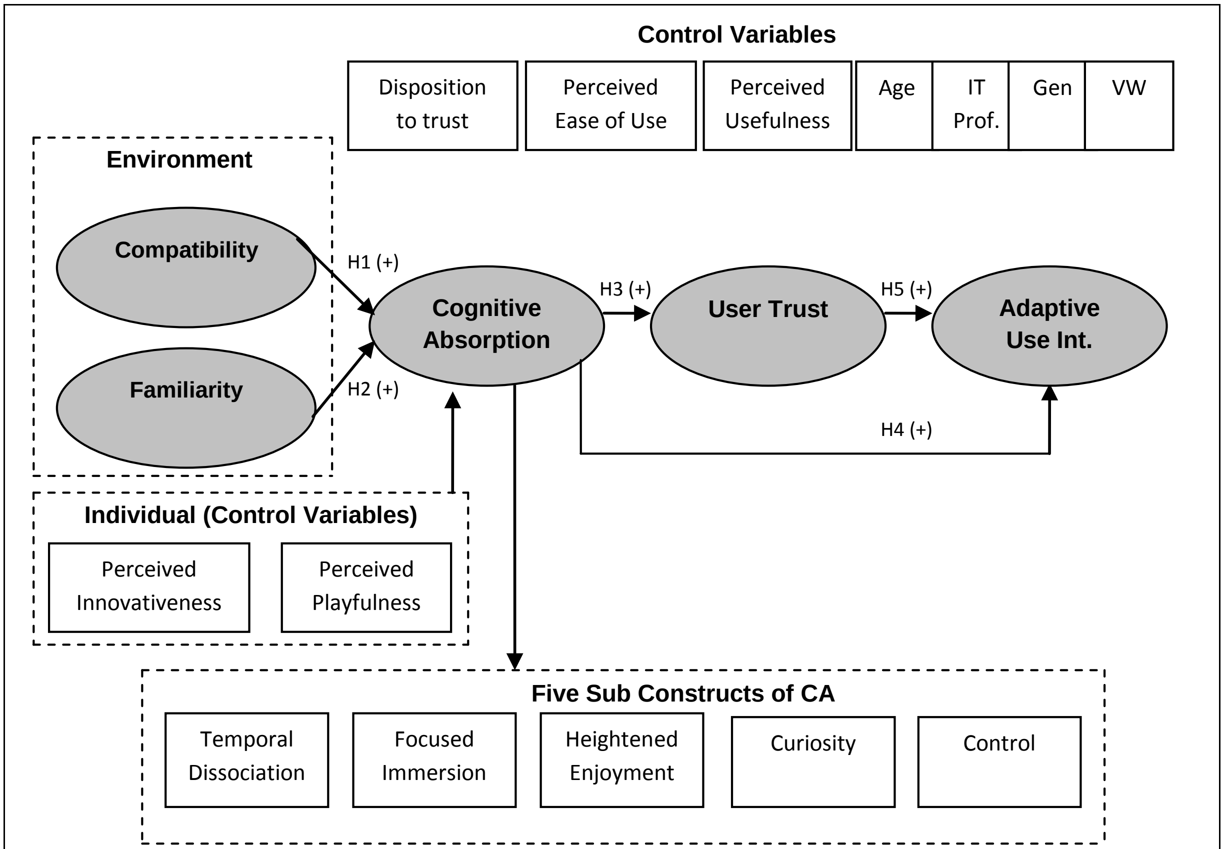

Figure 3. Research Model

3.1. Determinants of Cognitive Absorption

Because the roles of the two individual characteristics of personal innovativeness and perceived playfulness in determining CA have already been examined by Agarwal and Karahanna (2000), we focus on the environmental variables; that is, the relationship of the individual with the VW environment. The two environmental variables that we theorize in this research are "compatibility with VW environment" and "familiarity with VW environment", which we believe are particularly important in the context of new innovative technologies.

3.1.1. Compatibility with VW Environment

The two basic elements that make up VWs are (1) the VW technological platform and (2) the members of the VW community. Through these two basic elements, different VW users aim to achieve divergent objectives. For example, some users are motivated to collaborate and connect with people across the globe, some find using 3D animated computer graphics a pleasurable experience, and others like to project and live their aspirational alter-egos through avatars. Whatever the underlying user objectives, if the VW environment fulfills the individual's broad overall goals, they will be motivated to use the platform more extensively and deeply. This deeper VW use would involve expending more of user's cognitive resources while using the technology. Owing to the importance of tasks, we expect this cognitive involvement to be even more pronounced for adapting technology use from recreational to work-related tasks. Thus, the compatibility of an individual's objectives with those achievable by the technology serves as a major reason for the individual being actively involved in using the technology. This, in turn, would lead to deeper cognitive involvement while using the technology.

Prior studies have also highlighted the need for a better understanding of the requirements and needs of virtual-community participants for deeper participation (Lee, Vogel, & Limayem, 2003). Past research on the diffusion of technology found compatibility with existing values and beliefs, previously introduced ideas, and potential users' needs as significant factors that explain the involvement with an innovative technology (Rogers, 1995). There should be be minimal dissonance between innovative technology and the prospective user's existing belief system, and the technology should clearly support the individual's beliefs and requirements. Agarwal and Prasad (1998) demonstrated the significant role that compatibility with environment plays in the context of Internet usage. Thus, if users perceive VWs to be compatible with their needs, ideas, and objectives, they are more likely to have a greater interest in them. Consequently, they will engage with VWs more deeply and hence have an immersive experience while using them. On the contrary, perceived low compatibility with the user needs and beliefs will lead to distractions and disruptions leading to low CA in the VW. Therefore, we hypothesize that:

> ***H1:*** *Compatibility between a user and a virtual world environment is positively associated with the user's cognitive absorption in the virtual world*.

3.1.2. Familiarity with VW Environment

Familiarity is described as a combination of knowledge, understanding, and the amount of time that an individual has spent gaining experience with something (Brown, Fuller, & Vician, 2004). In the context of VWs, this would imply gaining an understanding of the two VW elements; that is,VW technology and VW community. Cognizance of VW technology, community, and the underlying processes is generally based on past accumulated experiences, which serve to reduce individual's apprehensions and anxieties about using the technology. This facilitates the development of positive attitudes towards the technology, more so for workplace adaptive use than for recreational use . Further, familiarity reduces the perceived cognitive burden that may otherwise be expended in navigating through non-familiar technological environments, thereby facilitating heuristic decision-making. Thus, bfamiliarity with the VW environment would motivate VW users to use VWs freely and extensively. This wide use of VWs is expected to result in the user experiencing a deeper engagement with VWs, thereby increasing their cognitive involvement with VWs. Moreover, familiarity also reduces uncertainty by setting a structure of what to expect (Gulati, 1995; Luhmann, 1979). This would also contribute to the cognitive engagement of the user in the VW platform. Hence, if VW users are familiar with the underlying technology, community members, and processes comprising the VW environment, they are more likely to get immersed while using VWs. On the contrary, if the users are unfamiliar with the VW environment, they would constantly worry about the unexpected and unanticipated challenges they might face while using VWs. This could prevent them from getting into the state of deep involvement and absorption with VWs. Therefore, we hypothesize that:

> ***H2:*** *A user's familiarity with a virtual world environment is positively associated with the user's cognitive absorption in the virtual world.*

3.2. Consequences of Cognitive Absorption (CA)

3.2.1. Cognitive Absorption and User Trust in VW

CA is a state of deep involvement of the user with information technology. In the context of VWs, the rich environment coupled with the enjoyment experienced during use contributes to user's deep cognitive involvement with the VW platform, which in turn may influence user trust in VW. Trust is an expectation that alleviates the fear that one's exchange partner will act opportunistically (Bradach & Eccles, 1989). The exchange partner can be an individual, group ,or even an object of use - such as technology (Sitkin & Roth, 1993; Srivastava & Teo, 2009). In the context of this research, the construct trust in VW measures the extent to which a VW accomplishes tasks reliably for the user, and is conceptualized as a composite measure incorporating total trust engendered (which is a combination of trust in VW technology and trust in VW community).

For explaining the mechanism through which CA impacts trust, we take recourse in research that explains the influence of individual's affective states on their judgments and behaviors. This deduction is consistent with the heuristic decision-making style where a pleasurable experience serves as a heuristic for trustworthy judgments. Prior research has shown that affect laden information infuses into an individual's cognitive processes, which thereby colores their judgments in a mood-congruent direction (Forgas, 1995; Forgas & George, 2001). Thus, people in positive affective states will make positive heuristic judgments, whereas people in negative affective states will make negative judgments. This happens because affective states are closely associated to the information we store and recall. Positive affective states are more likely to access and recall positive information from the memory, whereas negative affective state facilitates the recall of negative information. This recall of positive or negative information will in turn influence judgments and behaviors. Note that the impact of negative affect is relatively stronger than positive affect (Venkatesh & Morris, 2000). But this research focuses only on the positive affect of CA that is a pleasurable state for the user. Thus, CA is expected to influence the users' trusting judgments[2] through all its five dimensions of temporal dissociation, focused immersion, heightened enjoyment, amplified curiosity, and a sense of control over the activities in VWs.

In addition, there is considerable empirical evidence that shows affective states influence trust judgments (e.g., Anderson & Kumar, 2005; Dunn & Schweitzer, 2005; Kumar, 1997). The idea that affect shapes perceptions of trustworthiness is also consistent with a wide body of research suggesting that individuals frequently use their feelings as informational heuristics for making judgments (e.g., Forgas, 1992; Schwarz & Clore, 1983). Hence, we posit that enhanced cognitive absorption (which is an enjoyable positive experience) helps users perceive VWs as being trustworthy. Therefore, we hypothesize that:

> ***H3:*** *Cognitive absorption of a user in a virtual world is positively associated with the user's trust in the virtual world.*

3.2.2. Cognitive Absorption and Adaptive Use Intention

In the context of present research, the individual has to make a decision for adapting the use of VWs from a recreational social-networking setting to a workplace scenario. A recreational VW user contemplating to use the technology in workplace scenario is generally unaware of the performance and applicability of the technology in the new context. Clearly, the user will have limited incomplete information for making this decision. Hence, in a bounded rationality scenario, the individual will tend to have a heuristic decision-making style.

CA can be described as an enjoyable state of deep involvement with the VW platform. AUI, on the other hand, is the intention for using a technology in a setting different from the one for which it was initially designed. In the context of this research, AUI is the intention to adapt the use of VWs as a workplace collaboration tool from its originally designed use as a recreational social-networking tool. As already discussed, CA influences the AUI for using VW as a workplace collaboration tool through mechanisms based on the assumptions of a heuristic decision-making style.

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[2] It must be noted that distrust may well disrupt cognitive absorption. But lack of trust and distrust are two different concepts and in this study we focus on fostering of user trust rather than the impact of distrust on CA, which is beyond the scope of this research.

Owing to its unique characteristics, we expect VWs to be associated with a high degree of CA, which implies an enjoyable positive affective state. A positive affective state will serve to reduce the perceived cognitive burden during VW use. Although users have a deep cognitive involvement with VWs, the enjoyment (CA) experienced during VW use results in a reduction of “perceived cognitive burden. Individuals who have experienced such a reduced cognitive burden in recreational VW settings project and perceive a similar reduced cognitive burden in their VW workplace scenario. This decision heuristic facilitates AUI for VWs. Prior research has also shown that individuals are more likely to use new technologies if they perceive lesser cognitive burden during their interaction with the technology (Adams, Nelson, & Todd, 1992). Drawing from this discussion, we posit that CA will influence the AUI for VWs positively. Therefore, we hypothesize that:

H4: *Cognitive absorption of a user in a virtual world is positively associated with the user’s adaptive intention to use the virtual world for workplace collaboration.*

3.3. User Trust and Adaptive Use Intention

Virtual online interactions have inherent risks and uncertainties, not only in terms of underlying technologies but also because in terms of the unpredictability of members using the technologies (Pavlou et al., 2007; Ridings, Gefen, & Arinze, 2002; Teo et al., 2009). In a similar vein, VWs also involve several risks and uncertainties (possibly more than traditional online settings) because of identity issues associated with the persona of avatars. Because the research respondents have used VWs only in recreational settings, they have to make projections about its use in their workplace scenarios. As discussed earlier, in a bounded rationality context, individuals resort to heuristics for making decisions. Trust is an important heuristic about the future expectations from interactions in a relationship (Srivastava & Teo, 2009), in this case with the VWs. In fact, the heuristic of trust is so important that lack of user trust could prevent users from performing online/virtual activities mainly because users are concerned about uncertainties involved in the Internet/virtual infrastructure (Hoffman, Novak, & Peralta, 1999). Hence, user trust could serve as a salient mechanism for developing positive attitudes and favorable intention to use VW technology in workplace settings. If users trust VWs in recreational settings, they will project this trust to their AUI of VWs in workplace-related tasks. The manifestation of sufficient user trust would mitigate their risk perceptions in VWs and thereby facilitate AUI of VWs. Moreover, past research provides empirical evidence for the positive relationship of trust with positive attitudes which eventually affects technology use intentions (Gefen, 1997; Jarvenpaa & Tractinsky, 1999; Jarvenpaa, Tractinsky, & Vitale, 2000). Therefore, grounding our argument in heuristic decision making perspective, we hypothesize that:

H5: *User trust in a virtual world is positively associated with the user’s adaptive intention to use the virtual world for workplace collaboration.*

4. Research Method, Data, And Analyses

We tested the proposed research model with a survey method. We first developed a survey instrument (on a 7-point Likert scale) by identifying and adapting appropriate measures from existing literature where psychometric properties have already been established (Appendix A). We pilot tested the designed questionnaire with three research students familiar with VWs for recreational social-networking. We incorporated their comments about the readability of survey items in the final instrument. We measured the only conceptually new construct introduced in this research, namely adaptive use intention (AUI), in a fashion similar to behavioral intention to adopt a new technology. However, we asked questions for AUI with reference to adapting the use of VWs for workplace collaboration, rather than for new technology adoption. The sampling frame for the study comprised “VW users who currently use VW only for recreational social-networking activities”. In accordance with the research agenda, it would be meaningful to examine AUI for individuals who have no previous experience of using VWs for workplace collaborations. Nonetheless, respondents should have experienced VWs for recreational social-networking activities. Hence, the first step was to pre-screen VW users fulfilling this criterion. In addition to informing potential respondents about the qualifying criterion, we had a check question in the survey to verify this aspect. We asked the respondents about their willingness to adapt the use VWs for workplace collaboration. With the help of several research students, we distributed the paper-based survey questionnaires to nearly 300

Singapore students from two large university campuses, of which all were part-time students with work-experience. We asked respondents to visualize their “preferred VW” web site while responding to the survey questions. Subsequently, we had 226 responses, out of which we included only 197 complete questionnaires in the data analyses.

To be confident about the research results, we incorporated suitable controls from prior studies along with the focal research constructs. This would help us to explain the variance in the dependent variable(s) that weren’t already explained by the control variables. We classified control variables as demographic and non-demographic variables. Demographic control variables included gender (sex), age, and profession (IT or non-IT). Past research has found that demographic variables significantly affect technology adoption intentions (e.g., Venkatesh, Morris, Davis, & Davis, 2003). Further, in order to see if the choice of VW makes a difference in the adaptation decision, we controlled for the preferred VW in the research model. Currently, users have the option of choosing from several VW platforms such as Second Life, World of Warcraft, Kaneva, There, Maid Marian, and Active Worlds. In our sample, Second Life emerged as the dominant “preferred VW” (78.7 percent users preferred Second Life); therefore, we controlled for the “preferred VW” by adding a dummy variable for Second Life users. We found that neither the demographic variables nor the choice of VWs was significantly associated with the AUI. Hence, we did not report them in the final analysis and results.

In addition to the above mentioned demographic control variables, we also controlled the final dependent variable (AUI) and the intermediate variables user trust and CA for relevant non-demographic variables. Given that traditional technology acceptance model (TAM) constructs of perceived usefulness (PU) and perceived ease of use (PEOU) have well-established relationships with IT adoption, we controlled AUI for these variables to understand the significant effects of CA and user trust on AUI beyond what PU and PEOU provide (Davis, 1989; Davis et al., 1989, Venkatesh & Davis, 2000). Further, disposition to trust was included as a control variable for user trust because previous studies have highlighted that individuals who have a higher propensity to trust will in general be more trusting (e.g., McKnight et al., 2002). Furthermore, as discussed in the previous section, we included the individual personal characteristics variables “personal innovativeness” and “perceived playfulness” as controls for CA because their significance has already been established by Agarwal and Karahanna (2000). This helps us to understand the effects of the two environmental variables; that is, “compatibility with VW environment” and “familiarity with VW environment” beyond what the individual personal characteristics variables provide.

We used partial least squares (PLS), specifically SmartPLS 2.0, which is a component-based path modeling software application, to analyze the data (Ringle, Wende, & Will, 2005; Vance, Elie-Dit-Cosaque, & Straub, 2008). We used PLS for analysis because it is useful in situations where the research context is relatively new and the model is not essentially testing well-established theories. Virtual worlds are an emerging area of research, and the aim of this research is to suggest a possible nomological net explaining the AUI of VWs for workplace collaboration. For a research scenario that is not purely confirmatory in nature, it is suggested to use component-based structure equation modeling techniques (such as PLS) rather than covariance-based structure equation modeling techniques (such as AMOS, LISREL) which are more suitable for confirmatory theory testing research (Gefen, Straub, & Bourdreau, 2000; Hair, Anderson, Tatham, & Black, 1998). Further, PLS facilitates easy handling of the second-order constructs, which is an important consideration in the present study where CA is modeled as a second-order reflective construct (comprising five dimensions: temporal dissociation, focused immersion, heightened enjoyment, control, and curiosity). In addition, PLS makes minimal demands in terms of sample size, measurement scales, and residual distributions (Chin, 1998; Srivastava & Teo, 2007). It also has the added advantages of being more robust against other data structural problems such as skew distributions and omissions of regressors (Cassel, Westlund, & Hackl, 1999).

5. Results

5.1. Demographics

Table 4 provides the demographics of the survey respondents.

Table 4. Demographic Profile of Respondents

Demographic variable	Category	Frequency (N=197)	Percent
Gender	Male	84	42.6
	Female	113	57.4
Age	21- below 30 yrs	113	57.4
	30- below 40 yrs	72	36.6
	Over 40 yrs	12	6.1
Education level	Secondary	0	0
	Undergraduate	51	25.9
	Graduate	146	74.1
IT professional	Yes	28	14.2
	No	169	85.8
Preferred VW	Second Life	155	78.7
	Others	42	21.3

Among the 197 respondents, 42.6 percent were males and 57.4 percent were females. The average age of respondents was 29.3 with a standard deviation of 5.8. Further, all respondents were highly educated with more than 70 percent respondents having graduated from university education. Most respondents had over 10 years of Internet experience. Because there are several VWs with significant differences, we asked the respondents to visualize and report their preferred VW while responding to survey questions. Most respondents (78.7 percent) reported Second Life as their preferred VW, while the remainder (21.3 percent) reported using other VWs such as Kaneva and World of Warcraft.

5.2. Measurement Model

Following the recommended two-stage analytical procedure (Anderson & 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.

CA is multi-dimensional concept that comprises five dimensions. While measuring and analyzing multidimensional constructs, it is a common practice to collapse items for each dimensional sub-construct into uni-indicator sub-constructs. Thus, the prime second-order construct is evaluated as a first-order construct where each sub-construct is indicated by a single collapsed indicator (reflective construct). However, collapsing higher-order multi-dimensional construct into a single construct can cause measurement problems and compromise validity (Petter, Straub, & Rai, 2007). Hence, for this study, the multi-dimensional construct CA is modeled as a second-order reflective construct. Therefore, it is important to assess the psychometric properties for each of the five dimensions of CA. We checked the psychometric properties for each of the dimensions of CA and confirmed its validity by factor analyzing the items grouped under each dimension of the latent construct, CA, which Appendix B shows. One of the items (CAC3) of the dimension “control” didn’t load well and was thus excluded from the study. To further examine the pattern of association among indicators of latent construct CA, we checked the internal consistency of the five dimensions using Cronbach’s alpha and

Fornell and Larcker's (1981) measure of composite reliability. As Appendix B shows, all scores are above 0.70 and thus satisfy Nunnally's (1978) guidelines for determining internal consistency.

After assessing the measurement properties of the first order sub-constructs for CA, we assessed the measurement properties of the measurement model with the second order construct. Three types of validity were assessed; that is, content validity, convergent validity, and discriminant validity. Content validity assesses whether the measures chosen appropriately capture the full domain of the construct (Straub, Boudreau, & Gefen, 2004). In this research, we examined content by checking for consistency between the measurement items and the existing literature followed by pilot-testing the instrument (Srivastava & Teo, 2007).

Convergent validity detects if the measures for a construct are more correlated with one another than with the measures of another construct (Petter et al., 2007). Factor loadings measure the strength of the correlation between and among each item and the research constructs. As Appendix C shows, factor loading values (bolded) indicate strong correlation between each item and their corresponding construct. This demonstrates convergent validity. We further tested convergent validity 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), which Table 5 shows.

Many studies using PLS have taken 0.50 as the threshold for CR of the measures; however, 0.7 is the suggested threshold for reliable measurement (Chin, 1998). As Appendix D shows, the CR values ranged from 0.92 to 0.96. For the AVE, a score of 0.50 is the recommended threshold (Fornell & Larcker, 1981). Appendix D show that AVE ranged from 0.60 to 0.90, which are all above the acceptable values. In addition, as Appendix A shows, the high values of Cronbach Alpha, which range from 0.90 to 0.96, highlight the reliability of the measures of the various constructs used in the study.

Table 5. Correlations

	CA	COM	DTR	AUI	FAM	PEOU	PIN	PLY	PU	UTR
CA	**0.82**									
COM	0.59*	**0.95**								
DTR	0.37*	0.22*	**0.88**							
AUI	0.58*	0.57*	0.41*	**0.89**						
FAM	0.47*	0.60*	0.06	0.40*	**0.92**					
PEOU	0.57*	0.57*	0.36*	0.60*	0.47*	**0.88**				
PIN	0.42*	0.45*	0.26*	0.41*	0.41*	0.60*	**0.90**			
PLY	0.55*	0.47*	0.41*	0.54*	0.48*	0.55*	0.51*	**0.90**		
PU	0.59*	0.59*	0.30*	0.71*	0.34*	0.61*	0.33*	0.40*	**0.93**	
UTR	0.48	0.48*	0.51*	0.66*	0.39*	0.47*	0.44*	0.43*	0.61*	**0.93**

* Correlation is significant at the 0.01 level (2-tailed).
Note: The bold numbers in the diagonal row are the square roots of the average variance extracted.
Key: CA: Cognitive absorption, COM: Perceived compatibility, DTR: Disposition to trust, AUI: Adaptive use intention, FAM: Familiarity, PEOU: Perceived ease of use, PIN: Personal innovativeness, PLY: Perceived playfulness, UTR: User Trust, PU: Perceived usefulness, UTR: User trust.

We verified the discriminant validity of the various constructs 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 5) are all greater than the inter-construct correlations (the off-diagonal entries in Table 5), which thus exhibites satisfactory discriminant validity. Further, the cross-loadings of items on other constructs (Appendix B) are quite low, which indicates appropriate discriminant validity. Finally, as Table 5 shows, we observe that none of the correlations among the independent and control variables are above 0.80. Therefore, we conclude that there are no serious problems of multicollinearity confounding the results (Gujarati, 2003).

Note that all research variables are modeled as reflective constructs with multiple indicators. CA is modeled as a second-order multi-dimensional reflective construct. Appendic C shows the outer model loadings for items on their respective constructs, C and the significant loadings for all the five dimensions (sub-constructs) of CA are reported with the structural model results.

5.3. Common Method Bias

Because the data on all the variables for this study is self-reported and collected through the same questionnaire during the same period of time with cross sectional research design, there is a potential for common method bias. Variance occurring due to the measurement method rather than the constructs of interest may result in systematic measurement error and further bias the true relationship among the theoretical constructs. We performed statistical analysis to assess the severity of common method bias in the data. First, we performed Harman's one factor test (Podsakoff & Organ, 1986). We loaded all the variables in the study into exploratory factor analysis and examined the factor solution to determine the number of factors essential to account for the variance in the variables (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). The test indicated the presence of seven factors accounting for a total of 82.4 percent of the variance, of which the first factor accounted for merely 17.9 percent of the variance. Because a single factor did not emerge and one general factor did not account for most of the variance, we conclude that common method bias is not a significant problem with the data (Podsakoff et al., 2003). Second, we adopted the technique recommended by Liang et al. (2007) using PLS to assess the magnitude of common method bias in the data. We did this by introducing a common method factor whose indicators included all the principal constructs' indicators and calculated each indicator's variances substantively explained by the corresponding principal construct and also the common method factor. As Appendix E shows, the average substantively explained variance of the indicators is 0.813, whereas the average method based variance is only 0.009. The ratio of substantive construct variance to common method variance is about 90:1. Further, most method factor loadings are not significant, which indicates that common method is not a serious concern for this research (Liang et al., 2007). These tests helped us preclude the possibility of common method bias contaminating the results from this research.

5.4. Structural Model

After establishing an adequate measurement model, we used a bootstrapping procedure with 500 subsamples to estimate the statistical significance of the hypothesized relationships using PLS. Figure 4 depicts the results of the analysis.

Assessing the two determinants of CA in the category of environmental characteristics, we found that, after controlling for individual characteristics, "compatibility of VW users with VW environment" has a significant relationship with CA (path=0.36, t=4.76, $p<0.01$), which supports H1. However, we found the relationship between "familiarity of VW users with VW environment" and CA to be non-significant (path=0.09, t=1.60, $p>0.05$); thus,H2 is not supported. Additionally, the proposed antecedents of CA explained a significant amount of variance in CA (R2=0.45). This exhibits the high explanatory power of the theorized antecedents of CA.

From the results in the consequences part of the proposed nomological net, we found that, even after controlling for disposition to trust, CA had a significant relationship with user trust (UTR) (path=0.31, t=4.39, $p<0.01$), which supports H3. Further, we found that CA had a significant relationship with adaptive use intention (AUI) (path=0.11, t=1.80, $p<0.05$), which supports H4. Moreover, user trust in VW had a significant positive relationship with AUI (path=0.10, t=5.64, $p<0.01$), which supports H5. Note that the relationships of CA and user trust with AUI were significant even after controlling for the traditional TAM variables of PU and PEOU. This justifies our theoretical argument from the information-processing decision-making perspective for incorporating CA and user trust in the proposed nomological net. Among the control variables, the relationships of perceived playfulness of VW user with CA (path=0.30, t=3.53, $p<0.01$), disposition to trust with user trust (path=0.41, t=6.86, $p<0.01$), PU with AUI (path=0.35, t=5.15, $p<0.01$), and PEOU with AUI (path=0.17, t=2.67, $p<0.01$) were all significant. But, in the VW research context, the relationship between personal innovativeness and CA was not significant (path=0.07, t=1.08, $p>0.05$). This result is different from that of Agarwal and Karahanna (2000), who found an appreciable influence of personal innovativeness on CA in the context of individual Internet browsing behavior. Further, from the results in Figure 4, we can see that CA had a direct and mediated relationship through trust with AUI.

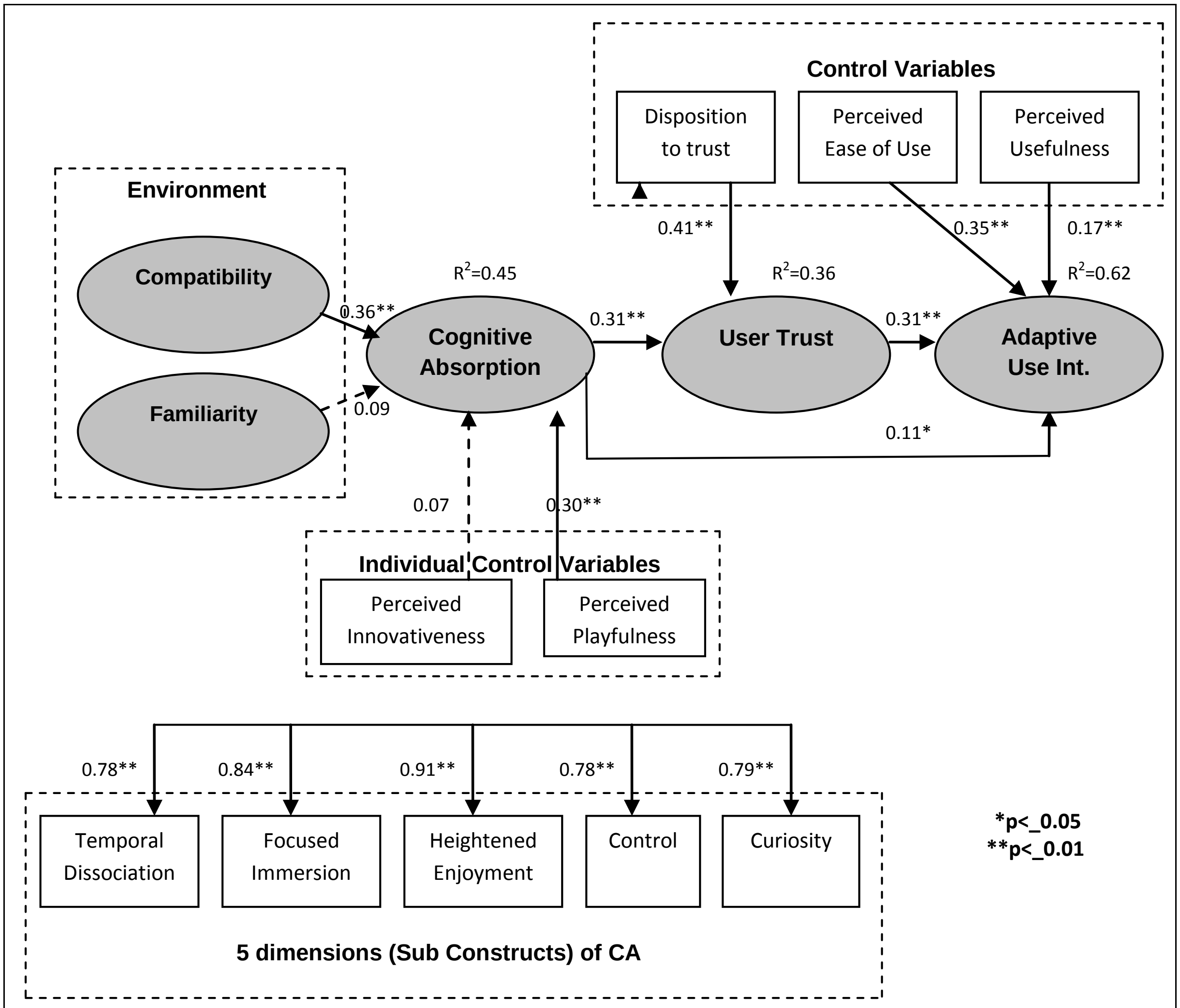

Figure 4. Structural Model Results

5.5. Post Hoc Analysis: Robustness Checks for the Research Model

5.5.1. Environmental Variables as Antecedents of Cognitive Absorption

In contrast to past research that included only individual characteristics as antecedents of CA (Agarwal & Karahanna, 2000; Saade & Bahli, 2005), this study proposed environmental variables andindividual characteristics as determinants of CA, especially in the context of VWs. It will be interesting to examine if adding environmental characteristics (as per SCT) enhances the explanatory power of CA significantly in the VW context. To examine this, we compared the hypothesized model with the modified model (without environmental variables) in terms of R^2 change for the dependent variable – cognitive absorption. Adopting a procedure similar to Teo et al. (2009) for R^2 comparison, we used Cohen's (1988) formula for calculating effect size f^2 as:

$$f^2 = (R^2_{hypothesized} - R^2_{modified}) / (1 - R^2_{hypothesized}).$$

The value of f^2 captures whether the impact of a particular independent construct on a dependent construct is substantive. 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, $f^2 > 0.35$. We see that, for the modified model (without environmental variables), the decrease in R^2 of cognitive absorption from 0.45 to 0.33 (f^2=0.22) is a medium effect size, which is a significant drop in the explanatory power of CA antecedents.

Hence, we conclude that specifying environmental variables as antecedents of CA in addition to individual characteristics does improve the explained variance in CA significantly. Thus, in the context of VWs, the suggested conceptualization of CA with additional environmental characteristics (as proposed in the research model) offers an improved explanation of the phenomenon.

5.5.2. Competing Models for Explained Variance in Adaptive Use Intention

To further test the robustness of the proposed model and examine if proposed configuration does explain the maximum variance in the final dependent variable, we tested theoretically competing models. As Table 6 presents, we tested two competing models with the originally hypothesized model.

Table 6. Results – Hypothesized Model and Two Competing Models

	Results			Results: Competing models					
Paths	Hypothesized model			No direct link from UTR to AUI			No direct link from CA to AUI		
	β	t	R^2	β	t	R^2	β	t	R^2
COM→CA	0.36**	4.73	0.45	0.37**	4.90	0.45	0.37**	4.88	0.45
FAM→CA	0.09	1.53	0.45	0.08	1.52	0.45	0.08	1.46	0.45
PIN→CA	0.07	1.04	0.45	0.07	1.02	0.45	0.07	1.00	0.45
PLY→CA	0.30**	3.35	0.45	0.30**	3.58	0.45	0.30**	3.47	0.45
CA→UTR	0.31**	4.87	0.36	0.34**	4.85	0.36	0.34**	4.93	0.36
CA→AUI	0.11*	2.26	0.62	0.18**	2.89	0.57			
UTR→AUI	0.31**	5.49	0.62				0.32**	5.95	0.61

*p < 0.05; **p < 0.01; R^2 values of the paths are for the target variables
Key: COM: Perceived compatibility, FAM: Familiarity, PIN: Personal innovativeness, PLY: Perceived playfulness, CA: Cognitive absorption, UTR: User trust, AUI: Adaptive use intention.

First, we tested a competing model in which the direct path from user trust to AUI is dropped so that we only examined the direct effect of CA on AUI. The results in Table 6 indicate that, in the modified model, the path from CA to AUI was significant (path=0.15, t=2.18, p<0.01), but that the R2 value of AUI dropped from 0.62 (in the hypothesized model) to 0.57 (in the competing model). Adopting a procedure similar to the previous section, we found that f2 = 0.16, which indicaties a significant drop in the explanatory power of the model (Subramani, 2004; Teo et al., 2009). Thus, we conclude that user trust has to be considered together with CA in the research model.

Next, in the modified model, the direct path from CA to AUI is dropped so there is only one direct path from user trust to AUI. The results in Table 6 indicate that user trust had a significant relationship with AUI (path=0.32, t=5.75, p<0.01) and that the R2 value of AUI dropped nominally from 0.62 (in the hypothesized model) to 0.61 (in the competing model). Adopting a procedure similar to the previous section, we found that f2= 0.02, which indicates a small drop in the explanatory power of the model (Subramani, 2004; Teo et al., 2009). A plausible explanation for this small effect size is the possibility of the relationship between CA and AUI being mediated through user trust. In the following section, we present the results of a conduct mediation analysis that we performed to further explore this important question in order to have a better understanding of AUI of VWs for workplace collaborations.

5.5.3. Mediation Analysis of User Trust

As highlighted in the previous section, a plausible reason for the relatively small decrease in the explanatory power of the modified model when the direct path from CA to AUI is dropped can be attributed to the fact that "user trust" mediates the relationship between CA and AUI. In this section, we test this mediation possibility.

For testing the mediation effect, we employed a causal steps approach (Baron & Kenny, 1986; Judd & Kenny, 1981) because it works best with PLS as an analysis tool (Bontis, Booker, & Serenko, 2007; Mackinnon, Chondra, & Hoffman, 2002). In the causal steps approach, the path coefficients generated by PLS can be used in a way similar to the traditional regression coefficients as described below (Bontis et al., 2007; Gefen et al., 2000). In the first step, we established a direct link between the independent and the dependent variable. Results indicate that there was a significant relationship between CA and AUI (path=0.14, t= 2.17, p<0.01), which fulfills the first condition for mediation. In the second step, we ascertained whether there was a direct relationship between the independent and mediator variable. On testing, we found that there was a significant relationship between CA and user trust (path=0.31, t= 4.43, p<0.01), which satisfies the second condition. In the third step, the mediator variable must be shown to be significantly related to the dependent variable. We found that there was a significant direct relationship of user trust with AUI (path=0.31, t= 5.70, p<0.01), which satisfies the third condition for mediation. Further, to confirm the mediation effect, the strength of relationship between the independent and dependent variables should be significantly reduced upon adding the mediator variable. But it is inadvisable to compute the effect from independent to dependent variable in a model without the mediator and compare it with the effect in the model which incorporates the mediator. The factor structures and weights for the two models will be different so the two coefficients are not comparable. Hence, for mediation analysis, we rather computed the total effect and compared it with the coefficient for the direct path[3] (Figure 5). For this analysis we computed the total effect as follows:

Total effect c = c' + ab, where,
c' is the path coefficient of CA→AUI,
a is the path coefficient of CA→UTR, and
b is the path coefficient of UTR→AUI.

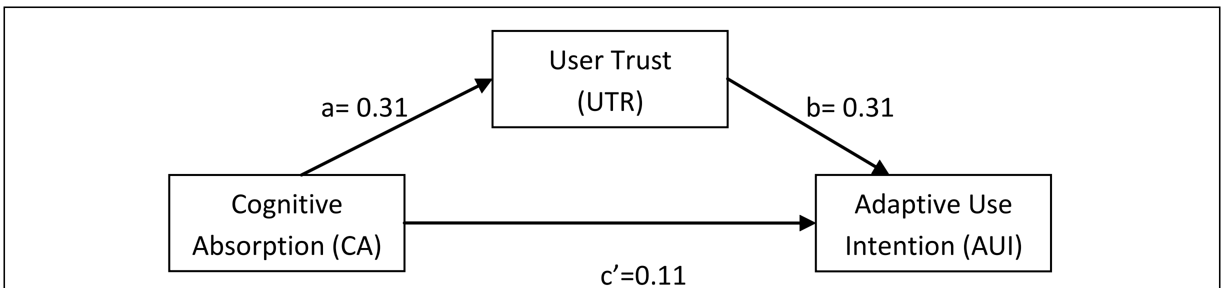

Figure 5. Total Effects Model

From the total effects model, we note that, after incorporating the mediator variable UTR, the direct effect of CA on AUI was significant, though at a reduced level of significance (at p<0.05 instead of p<0.01), and that the path coefficient (β) reduced from 0.21 to 0.11, which suggess partial mediation. To ascertain if the reduction in relationship between the independent and dependent variables was significant on adding the mediator variable, we employed Sobel test and found the z-value to be 3.52, which is significant at p<0.01. This confirms user trust as a partial mediator of the relationship between CA on AUI. Furthermore, this analysis provides methodological validity for considering both CA and user trust together in the research model, thereby establishing the theoretical parsimony of the hypothesized nomological net for VWs.

5.6. Discussion

Among the two environmental variables modeled as antecedents of CA in VWs, the results indicate that compatibility with VW environment is a significant determinant of CA, which emphasizes the consistency of a target technology with a user's overall ideas and beliefs as a pre-requisite for cognitive involvement of the user with the technology. Thus, for being deeply involved with VWs while using them, VWs should be perceived as a channel fulfilling user's personal objectives and goals. Deeper cognitive engagement with VWs is thus dependent on the compatibility of VWs with the broad

[3] We thank one of the reviewers for suggesting this analysis.

overall goals and aspirations of users. In contrast, the other environmental variable, familiarity with VW environment, is not significantly related to CA. Familiarity with VW environment may just create a necessary condition for initial interaction with VWs but may not influence deep cognitive engagement with VWs. It is possible that, at lower levels of familiarity, the interaction may not take place at all. But at higher levels of familiarity the interaction takes place involuntarily (without deep cognitive involvement of the user). The situation is somewhat similar to driving a car where higher familiarity with roads, cars, or the environment may lead to a person driving the car without much conscious cognitive involvement. Thus, in the current research context, familiarity with VWs is not a significant determinant of CA.

Next, among the two individual characteristics modeled as antecedents (and also controls) of CA, the results indicate that, although perceived playfulness is a significant determinant of CA, the individual characteristic of personal innovativeness (i.e., the willingness to try out new technologies) has a non-significant relationship with CA. In the context of individual Internet browsing behavior, Agarwal and Karahanna (2000) found both playfulness and personal innovativeness as significant predictors of CA, yet, in this study, CA was influenced by playfulness but not by personal innovativeness. Although non-significant relationship of personal innovativeness with CA is surprising, it is plausible that there was a substantial amount of fascination and mystery attached to the use of Internet at the time when the Agarwal and Karahanna (2000) study was conducted. In contrast, a decade after the Internet boom, the respondents in our study (from generation Y) have grown up using Internet-based technologies such as Blogs, Wikis, media websites (e.g., YouTube), and gaming consoles (Goel & Mousavidin, 2007), so that personal innovativeness or one’s willingness to try out new technologies would not have an impact on the level of one’s involvement with the technology (VWs in this context). These findings are consistent with some recent studies that also found playfulness and spontaneity rather than innovativeness as significant factors influencing technology use (e.g., Leonard & Riemenschneider, 2008). Hence, in the present day VW context, individuals become absorbed in the technology because of the enjoyment they derive in interacting with 3D animated avatars rather than their personal innovativeness. Future VW research can further investigate the playfulness dimension. This study, to the best of our knowledge, is one of the first to include environmental variables as predictors of CA in addition to individual characteristics. Although past studies have shown individual characteristics to be significant antecedents of CA (e.g., Agarwal & Karahanna, 2000; Saade & Bahli, 2005), through our robustness check analysis we demonstrate that including environmental characteristics significantly improves the predictive capability of the model in the VW context.

Results from the “consequences” part of the research model indicate significant relationships of both CA and user trust with AUI. This indicates that, based on the information-processing decision-making perspective and the unique features of VWs, it is important to consider both CA and user trust to better understand AUI of VWs for workplace collaborations. Past studies in the context of technology adoption have empirically demonstrated strong relationships of CA (e.g., Agarwal & Karahanna, 2000; Saade & Bahli, 2005) and user trust (e.g., Gefen, 1997; Jarvenpaa & Tractinsky, 1999; Jarvenpaa et al., 2000) with intention to use the focal technology. Our study extends these results to the context of AUI. The heuristic decision-making perspective serves as a useful theoretical lens for explaining the strong relationship between CA and user trust, and could be used to analyze other similar situations with cognitively engaging technologies. Through a series of post-hoc analyses, by comparing competing models with the hypothesized model, we demonstrate the importance of considering both CA and user trust together in the proposed nomological net. The hypothesized model provides a theoretically driven parsimonious network of relationships among the research variables and could be considered as a point of reference for future research. Another important finding of this research is that the relationship between CA and AUI is partially mediated through user trust. Thus, the proposed model provides a plausible relationship structure explaining the mechanisms through which trust mediates the relationship between CA and AUI.

6. Limitations And Future Directions

Though this study makes significant contributions, there are a few limitations. First, exploring the determinants and consequences of CA for the adaptive use of VWs (for workplace collaboration) is a relatively new area of research. We obtained the findings and their implications from one single study that targeted a specific set of users in Singapore. Thus, more research is needed in this new field of

VWs to generalize the findings. Second, though we have identify some of the important variables that are related to the AUI of VWs for collaborations in workplace, additional variables could be explored to improve the robustness of the model for more accurate predictions. Third, we study the relationships of CA and user trust with intention to use VWs for workplace collaboration. However, this research model does not consider many other factors that may be important for intention to use VW; for example, co-worker influence, organizational policies, organizational requirements, implementation costs, and top-management championship. Examining such factors can be an avenue for future research in VWs. Fourth, this study does not take into account the kind of workplace collaborations and the significance of these collaborations for the users. Research on decision making has shown that the valence of the expected outcome could significantly impact the decision-making process (Bettman et al., 1998). Future research could further segregate the use of VWs for different kinds of workplace collaborations. Fifth, the trust in VW construct as conceptualized in this research is a composite measure of the total trust engendered (a combination of trust in technology and trust in the VW community). In certain contexts, trust in community members is more salient thantrust in the technology; however, this study does not examine these details. Moreover, trust has not been conceptualized as consisting of its four components; that is, reliability, benevolence, competence, and integrity. This again precludes the possibility of a more granular understanding of the user trust construct, and is an important avenue for future research. Sixth, the research model in this study 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, Peacock, & Chin, 2001). These changes are significant for researchers and practitioners interested in studying the acceptance and usage of VWs over time. A dynamic model that would predict the intention of users over time could be an agenda for future research. Seventh, rather than proposing the three-stage model (as is the case in this study), it is possible to theorize alternative models (e.g., familiarity and compatibility affecting both CA and trust, which in turn affects AUI). But due to the cross-sectional nature of our study, questions relating to mediation and inversion of causality cannot be answered reliably (Stone-Romero & Rosopa, 2004, 2008). Future research using a longitudinal research design could better examine these questions.

7. Implications

With increasing work dispersion across the world, organizations are on the lookout for innovative, cost-effective, virtual collaborative tools. VWs offer one such technological opportunity, yet their proliferation in organizational workplaces is rather limited, possibly because VWs were originally designed for gaming and recreational purposes. Hence, from a theoretical and practical standpoint, there is a need to examine the factors associated with workplace implementation of VWs. Using the information-processing decision-making perspective, our study is one of the first that empirically examines the role of cognitive absorption and user trust in influencing individual's VW workplace adaptive use decision. In addition to addressing this research gap, the paper has important implications for research and practice.

7.1. Implications for Research

First, we contribute to the literature on individual-level adoption decision for an emergent technology by examining the user's adaptive use intention; that is, the intention to use the technology in a setting different from the one for which it was originally designed. Hence, in contrast to prior research on technology adoption and use, which has examined user's intentions for adopting and/or continuing using technologies, we study issues related to adapting the use of an available technology to a fresh context. The concept of AUI as discussed in the paper provides a useful backdrop for analyzing the effectiveness of emerging technologies. It will be interesting to examine how useful technology usage can be translated from one context to the other.

Second, in this study, we use the information-processing decision-making perspective, which we believe offers an alternate perspective for viewing the technology adoption and use phenomenon. In general, past research has used several theories for explaining technology adoption; for example, the theory of diffusion of innovations (Moore & Benbasat, 1991), theory of reasoned action (Fishbein and Azjen, 1975), the technology acceptance model (Davis, 1989; Davis et al., 1989), the theory of planned behavior (Azjen, 1985; Azjen & Madden, 1986), and institutional theory (Liang et al., 2007;

Teo et al., 2003). Likewise, expectation-confirmation theory adapted from consumer behavior literature has been used to understand the IS continuance usage intentions (Bhattacherjee, 2001). On the contrary, our research uses the information-processing decision-making perspective to examine the shift in the use of technologies to new areas (adaptive use intention), which extends the technology adoption research using a novel theoretical lens.

Third, drawing from theories on heuristic decision-making, this research proposes a model focused on minimizing cognitive burden and risk for individuals contemplating to extend the use of VWs for workplace collaborations from their typical recreational social-networking use. The proposed nomological net, based on the unique characteristics of VWs, suggests a theoretically parsimonious relationship structure linking cognitive absorption (and its antecedents) and user trust with adaptive use intention. This network of relationships could be used as a reference model for future research on the subject.

Fourth, using social cognitive theory, we propose the importance of considering environmental variables in addition to individual variables as antecedents of CA. Together, both groups of theorized antecedents explain a significantly high percentage of variance (45 percent) in CA. Through this research (including post hoc analysis), we build on and extend the antecedents of CA proposed by Agarwal and Karahanna (2000) for the VW context in particular. Among the environmental variables, the non-significant relationship of familiarity with CA calls for deeper investigation. Though the level of familiarity with the VW platform is not significantly related to CA, it is plausible that a threshold amount of familiarity is required for initial interaction of the user with VW. Also, it is possible that, at higher levels of familiarity, the user's CA may come down. Future research could examine the possibility of theorizing and testing a U-shaped relationship between familiarity and CA. Another interesting avenue for future research would be to explore the possibility of an interaction between the individual and environmental variables; for example, familiarity and perceived playfulness could interact, such that, at lower levels of familiarity, playfulness can have a far greater impact on CA.

Fifth, results from post-hoc analysis show the importance of considering both CA and user trust together in the proposed nomological net for theoretical parsimony. Further, mediation analysis shows that CA impacts AUI directly and through user trust. This explains the mechanisms through which CA is related to AUI. Hence, in contrast to prior studies on technology adoption that have shown the important direct role of trust in influencing usage decision, our study, in the context of VWs, highlights the mediating role of trust between CA and AUI. Future research could examine how trust impacts technology related decisions in other cognitively engaging contexts.

7.2. Implications for Practice

VWs offer an inexpensive life-like collaborative platform that can help organizations connect to globally distributed employees. The results from our research offer some actionable directions for implementing VWs for workplace tasks.

First, the study highlights CA and user trust as key drivers for the adaptive use intention of VWs for workplace collaboration. The results from our research exhort VW designers and managers to seriously consider the role of CA for developing user trust, which would assist in adapting the use of VWs for collaborative workplace tasks.

Second, managers need to focus on the salient role that perceived playfulness plays in enhancing CA of users in VWs. The results from our research reiterate the need to develop game-based playful environments where work and play go together. This trend is lately becoming quite popular in other contexts for retaining the interest and attention of users (Prensky, 2003). Playfulness would definitely help in riveting the attention of users to VW platforms.

Third, in addition to enhancing perceived playfulness, practitioners and managers who are considering using VWs for business purposes should focus on enhancing the compatibility of VWs with the user's objectives. The results from our research indicate that the technology used in VW should be compatible with the user's ideas, expectations and goals. This can be implemented by understanding the user needs and expectations and aligning VW design to satisfy these needs and expectations.

8. Conclusion

The key managerial concern in implementing VW as a workplace collaboration tool relates to how employees perceive the introduction of VW in their organization as the new interactive technology. In this research, we focus on individual-level decision making for adapting the use of VWs from a recreational social-networking setting to a collaborative workplace context. Building on the unique aspects of VWs and using an information processing decision making perspective, we propose and test a nomological network linking cognitive absorption, its antecedents, and user trust to VW workplace adaptive use intention.

Further, situating the discussion in social cognitive theory (Bandura, 1977, 1986), this research extends the original conceptualization of cognitive absorption (Agrawal & Karahanna, 2000) by adding environmental variables in addition to individual variables as antecedents of CA in the VW context. Playfulness and compatibility emerge as key determinants of CA. Further, this paper examines the role of CA and user trust for adapting the use of VWs for workplace collaboration. Results confirm CA as a strong correlate of user trust. Likewise, both CA and user trust have significant positive association with the AUI of VWs for workplace collaboration. Results also show that user trust mediates the relationship between CA and AUI. The study is one of the first to propose and test a model integrating CA and user trust, and could serve as reference model for future research.

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Appendices

Appendix A. Scales and Items

Compatibility

Cronbach's alpha = 0.94 (Moore & Benbasat, 1991)

1. I believe that using virtual world would be compatible with my collaborative tasks.
2. I believe that using virtual world would fit my lifestyle.
3. I believe that using virtual world would fit well with the way I like to collaborate or share information.

Familiarity

Cronbach's alpha = 0.96 (Gefen, 2000)

1. I am familiar with virtual world.
2. I am familiar with the process of interacting with members on virtual world.
3. I am familiar with the members on virtual world.
4. I am familiar with the process of collaborating on virtual world.
5. I am familiar with the process of inquiring about the members on virtual world.

Personal Innovativeness

Cronbach's alpha = 0.92 (Agarwal & Karahanna, 2000)

1. If I hear about a new information technology, I look for ways to experiment with it.
2. Among my peers, I am usually the first to try out new information technologies.
3. I like to experiment with new information technologies.
4. In general, I am not hesitant to try out new technologies.

Perceived Playfulness

Cronbach's alpha = 0.96 (Agarwal & Karahanna, 2000)

1. When using the virtual world I perceive to be spontaneous.
2. When using the virtual world I perceive to be imaginative.
3. When using the virtual world I perceive to be flexible.
4. When using the virtual world I perceive to be creative.
5. When using the virtual world I perceive to be playful.
6. When using the virtual world I perceive to be original.
7. When using the virtual world I perceive to be inventive.

Cognitive Absorption

Cronbach's alpha = 0.96 (Agarwal & Karahanna, 2000)

Temporal Dissociation

1. I feel time appears to go by very quickly when I am using the virtual world.
2. I feel sometimes I lose track of time when I am using the virtual world.
3. I feel time flies when I am using the virtual world.
4. Most times when I get on to the virtual world, I end up spending more time that I had planned.
5. I often spend more time on the virtual world than I had intended.

Focused Immersion

1. I feel while using the virtual world I am able to block out most other distractions.
2. I feel while using the virtual world, I am absorbed in what I am doing.
3. I feel while on the virtual world, I am immersed in the task I am performing.
4. I feel while on the virtual world, I do not get diverted very easily.

Heightened Enjoyment

1. I feel that when using virtual world, I have fun interacting.
2. I feel that when using virtual world, I have a lot of enjoyment.
3. I enjoy using the virtual world.
4. I do not get bored using the virtual world.

Control
1. When using virtual world I feel in control.
2. I feel that I have control over my interaction with members on virtual world.
3. The virtual world allows me to control my computer interaction.

Curiosity
1. Using the virtual world excites my curiosity .
2. Interacting with the virtual world makes me curious.
3. Using the virtual world arouses my imagination.

User Trust
Cronbach's alpha = 0.96 (Gefen, 2000; Jarvenpaa & Tractinsky, 1999)
1. I trust virtual world to be reliable.
2. I trust virtual world to be secure.
3. I believe the virtual world to be trustworthy.
4. I trust the virtual world.
5. Even if the virtual world is not monitored, I'd trust them to do the job correctly.

Adaptive Use Intention
Cronbach's alpha = 0.91 (Davis, 1989; Davis et al., 1989; Venkatesh & Davis, 2000)
1. Given a chance, I intend to use virtual world for collaborative tasks in my workplace in the future.
2. Given a chance, I predict that I will frequently use virtual world in the future for collaborative tasks in my workplace.
3. I will strongly recommend others in my workplace to use virtual world for collaborative tasks.
4. I foresee the use of virtual world for collaborations and information sharing in my workplace in the near future.

Disposition to Trust
Cronbach's alpha = 0.96 (Gefen, 2000)
1. I generally trust other people.
2. I generally count on other people.
3. I generally have faith in humanity.
4. I generally feel that people are generally reliable.
5. I generally trust other people unless they give me reason not to.

Perceived Usefulness
Cronbach's alpha = 0.95 (Davis, 1989)
1. Using virtual world would enable me to accomplish collaboration tasks more quickly.
2. Using virtual world for collaboration tasks would improve my performance.
3. Using virtual world for collaboration tasks would enhance my effectiveness.
4. Using virtual world would make it easier for me to carry out collaboration tasks.
5. Overall, I find that virtual world is useful for collaboration tasks.

Perceived Ease of Use
Cronbach's alpha = 0.90 (Davis, 1989)
1. Learning to use virtual world would be easy for me.
2. It would be easy to get virtual world to do what I want it to do.
3. My interaction with virtual world would be clear and understandable.
4. It would be easy for me to become skilful at using virtual world.
5. Overall, I would find virtual world easy to use.

Appendix B

Table B-1. Summary Analysis of the Sub-Constructs of CA: Mean, SD, Factor Structure, Cronbach's Alpha (Alpha), Composite Reliability (CR) and Average Variance Extracted (AVE)

	Mean	SD	CAT	CAF	CAH	CAC	CAU
CAT1	4.94	1.52	**0.81**	0.08	0.28	0.12	0.27
CAT2	4.94	1.42	**0.91**	0.15	0.16	0.09	0.15
CAT3	4.99	1.42	**0.88**	0.18	0.15	0.18	0.21
CAT4	5.10	1.34	**0.83**	0.23	0.23	0.14	0.12
CAT5	5.02	1.46	**0.83**	0.28	0.17	0.07	0.04
CAF1	4.21	1.32	0.16	**0.75**	0.17	0.26	0.25
CAF2	4.51	1.30	0.30	**0.82**	0.24	0.00	0.17
CAF3	4.43	1.37	0.35	**0.76**	0.23	0.13	0.30
CAF4	4.30	1.27	0.15	**0.59**	0.30	0.53	0.16
CAH1	4.57	1.40	0.34	0.34	**0.74**	0.16	0.27
CAH2	4.60	1.36	0.31	0.26	**0.77**	0.24	0.32
CAH3	4.61	1.42	0.33	0.26	**0.75**	0.26	0.33
CAH4	4.36	1.42	0.23	0.19	**0.69**	0.37	0.24
CAC1	4.23	1.36	0.18	0.16	0.34	**0.73**	0.34
CAC2	4.50	1.38	0.21	0.18	0.27	**0.78**	0.39
CAU1	4.42	1.26	0.19	0.24	0.27	0.16	**0.85**
CAU2	4.56	1.38	0.14	0.21	0.15	0.23	**0.88**
CAU3	4.61	1.31	0.22	0.22	0.25	0.15	**0.81**
Alpha			0.95	0.89	0.95	0.90	0.95
CR			0.96	0.92	0.96	0.95	0.97
AVE			0.84	0.75	0.86	0.91	0.90

Key: CAT: Temporal dissociation, CAF: Focused immersion, CAH: Heightened enjoyment, CAC: Control, CAU: Curiosity.

Appendix C

Table C-1. Item Loadings and Cross Loadings

	COM	FAM	PIN	PLY	CA	DTR	UTR	PU	PEOU	AUI
COM1	**0.73**	0.39	0.09	0.16	0.17	0.01	0.23	0.21	0.18	0.13
COM2	**0.75**	0.34	0.18	0.20	0.20	0.08	0.12	0.28	0.14	0.15
COM3	**0.71**	0.23	0.19	0.21	0.25	0.07	0.10	0.35	0.20	0.10
FAM1	0.21	**0.70**	0.13	0.24	0.26	0.04	0.04	0.10	0.15	0.11
FAM2	0.10	**0.87**	0.13	0.22	0.17	-0.03	0.12	0.08	0.18	0.07
FAM3	0.09	**0.87**	0.09	0.21	0.12	-0.12	0.18	0.02	0.13	0.05
FAM4	0.13	**0.89**	0.14	0.17	0.09	-0.05	0.14	0.16	0.09	0.01
FAM5	0.12	**0.90**	0.12	0.16	0.05	-0.02	0.15	0.08	0.08	0.10
PIN1	0.07	0.14	**0.82**	0.21	0.19	0.11	0.11	0.00	0.19	0.13
PIN2	0.03	0.19	**0.80**	0.18	0.13	0.05	0.20	-0.03	0.10	0.09
PIN3	0.15	0.12	**0.78**	0.20	0.10	0.05	0.15	0.18	0.30	0.01
PIN4	0.10	0.11	**0.79**	0.31	-0.02	0.09	0.10	0.16	0.20	-0.01
PLY1	0.04	0.16	0.18	**0.75**	0.16	0.16	0.11	0.20	0.20	0.08
PLY2	0.08	0.15	0.17	**0.85**	0.15	0.24	0.12	0.06	0.09	0.07
PLY3	0.11	0.15	0.11	**0.84**	0.14	0.21	0.09	0.07	0.12	0.12
PLY4	0.08	0.15	0.17	**0.85**	0.14	0.15	0.06	0.10	0.06	0.13
PLY5	0.02	0.25	0.09	**0.82**	0.19	0.14	0.11	0.13	0.22	0.02
PLY6	0.14	0.14	0.11	**0.79**	0.15	0.05	0.16	0.09	0.16	0.07
PLY7	0.06	0.16	0.22	**0.81**	0.06	0.08	0.10	0.11	0.12	0.18
CAT	0.05	0.16	0.09	0.19	**0.70**	0.06	-0.05	0.11	0.34	-0.13
CAF	0.14	0.13	0.03	0.21	**0.69**	0.09	0.27	0.29	0.14	0.04
CAH	0.19	0.19	0.09	0.25	**0.71**	0.18	0.12	0.29	0.15	0.10
CAU	0.10	0.18	0.21	0.28	**0.64**	0.18	0.09	0.22	-0.07	0.21
CAC	0.11	0.14	0.11	0.14	**0.71**	0.10	0.16	0.16	0.11	0.33
DTR1	0.11	-0.03	-0.01	0.07	0.07	**0.85**	0.19	0.09	0.10	0.11
DTR2	-0.01	0.08	0.05	0.17	0.08	**0.83**	0.21	-0.04	0.04	0.13
DTR3	0.08	-0.11	0.05	0.29	0.16	**0.77**	0.11	0.17	0.17	0.08
DTR4	0.05	-0.01	0.09	0.18	0.04	**0.82**	0.26	0.05	0.08	0.01
DTR5	-0.09	-0.13	0.11	0.12	0.10	**0.82**	0.12	0.12	0.05	0.02
UTR1	0.15	0.18	0.26	0.17	0.13	0.28	**0.73**	0.27	-0.02	0.10
UTR2	0.11	0.14	0.19	0.15	0.11	0.24	**0.81**	0.21	0.11	0.15
UTR3	0.09	0.17	0.19	0.14	0.09	0.25	**0.83**	0.23	0.07	0.17
UTR4	0.09	0.12	0.09	0.14	0.09	0.26	**0.81**	0.27	0.15	0.18
UTR5	0.00	0.17	0.02	0.13	0.09	0.21	**0.75**	0.29	0.12	0.10
PU1	0.13	0.07	0.09	0.14	0.21	0.24	0.19	**0.76**	0.19	0.23
PU2	0.11	0.08	0.12	0.09	0.14	0.04	0.28	**0.87**	0.15	0.10
PU3	0.17	0.03	0.10	0.12	0.19	0.01	0.31	**0.80**	0.21	0.16
PU4	0.16	0.15	0.08	0.19	0.21	0.08	0.24	**0.80**	0.17	0.16
PU5	0.11	0.12	-0.05	0.09	0.18	0.08	0.18	**0.81**	0.21	0.19
PEOU1	0.07	0.15	0.31	0.21	0.11	0.08	0.07	0.34	**0.71**	0.06
PEOU2	0.21	0.18	0.17	0.24	0.10	0.11	0.08	0.14	**0.74**	0.26
PEOU3	0.08	0.18	0.18	0.20	0.18	0.13	0.19	0.18	**0.75**	0.14
PEOU4	0.09	0.17	0.22	0.24	0.12	0.18	0.06	0.27	**0.76**	0.01
PEOU5	0.06	0.18	0.29	0.14	0.36	0.16	0.14	0.35	**0.53**	0.15
AUI1	0.08	0.07	0.05	0.31	0.16	0.09	0.20	0.38	0.30	**0.64**
AUI2	0.14	0.11	0.12	0.20	0.09	0.12	0.33	0.39	0.21	**0.62**
AUI3	0.03	0.19	0.16	0.26	0.17	0.21	0.34	0.34	0.08	**0.63**
AUI4	0.24	0.13	0.05	0.18	0.17	0.20	0.23	0.34	0.11	**0.63**

Key: COM: Perceived compatibility, FAM: Familiarity, PIN: Personal innovativeness, PLY: Perceived playfulness, CAT: Temporal dissociation, CAF: Focused immersion, CAH: Heightened enjoyment, CAC: Control, CAU: Curiosity, DTR: Disposition to trust, UTR: User trust, PU: Perceived usefulness, PEOU: Perceived ease of use, AUI: Adaptive use intention.

Appendix D

Table D-1. Loadings of the Indicator Variables (CR) (AVE)

Construct	Indicator	Mean	SD	Loading	T-value
Perceived compatibility (0.94) (0.90)	COM1	3.51	1.62	0.93	58.31
	COM2	3.55	1.67	0.97	174.29
	COM3	3.59	1.72	0.95	112.81
Familiarity (0.96) (0.85)	FAM1	3.70	1.82	0.86	43.58
	FAM2	3.25	1.72	0.96	128.54
	FAM3	3.04	1.74	0.92	45.26
	FAM4	2.97	1.67	0.94	99.66
	FAM5	2.99	1.69	0.92	64.01
Perceived innovativeness (0.92) (0.80)	PIN1	4.53	1.72	0.92	76.73
	PIN2	3.89	1.58	0.87	35.33
	PIN3	4.57	1.69	0.91	56.42
	PIN4	4.68	1.58	0.88	38.14
Perceived playfulness (0.96) (0.82)	PLY1	4.46	1.66	0.87	29.56
	PLY2	4.70	1.61	0.94	91.15
	PLY3	4.66	1.61	0.92	72.67
	PLY4	4.84	1.64	0.92	57.88
	PLY5	4.78	1.59	0.92	64.62
	PLY6	4.40	1.55	0.86	30.83
	PLY7	4.57	1.52	0.89	37.41
Cognitive absorption (0.96) (0.60)	CAT	5.00	1.31	0.78	11.32
	CAF	4.36	1.14	0.84	27.40
	CAH	4.54	1.30	0.91	58.74
	CAC	4.53	1.25	0.78	30.13
	CAU	4.37	1.31	0.79	25.18
Disposition to trust (0.92) (0.77)	DTR1	4.45	1.54	0.89	38.82
	DTR2	4.24	1.49	0.87	40.77
	DTR3	4.62	1.46	0.87	39.11
	DTR4	4.39	1.43	0.90	50.11
	DTR5	4.57	1.51	0.85	29.88
User trust (0.96) (0.88)	UTR1	3.65	1.52	0.91	68.76
	UTR2	3.49	1.50	0.95	92.29
	UTR3	3.46	1.49	0.97	248.15
	UTR4	3.45	1.43	0.95	98.22
	UTR5	3.37	1.51	0.85	30.30
Perceived usefulness (0.96) (0.87)	PU1	4.19	1.42	0.91	59.48
	PU2	4.04	1.45	0.95	110.75
	PU3	3.99	1.39	0.94	95.94
	PU4	4.17	1.45	0.95	77.01
	PU5	4.35	1.45	0.90	51.40
Perceived ease Of use (0.93) (0.77)	PEOU1	4.57	1.41	0.88	48.66
	PEOU2	4.31	1.31	0.88	47.52
	PEOU3	4.15	1.42	0.89	44.26
	PEOU4	4.44	1.41	0.90	45.11
	PEOU5	4.38	1.44	0.84	21.96
Adaptive use intention (0.92) (0.80)	AUI1	4.27	1.47	0.90	52.18
	AUI2	4.21	1.48	0.91	65.79
	AUI3	4.18	1.43	0.91	50.37
	AUI4	4.21	1.61	0.86	32.21

Appendix E

Table E-1. Common Method Bias Analysis

Construct	Indicator	Substantive factor loading (R1)	R12	Method factor loading (R2)	R22
Compatibility	COM1	0.938***	0.876	-0.008	0.000
	COM2	0.964***	0.929	0.005	0.000
	COM3	0.940***	0.882	0.003	0.000
Familiarity	FAM1	0.706***	0.510	0.181**	0.033
	FAM2	0.942***	0.891	0.024	0.001
	FAM3	0.987***	0.968	-0.077	0.006
	FAM4	0.984***	0.964	-0.047	0.002
	FAM5	0.980***	0.949	-0.066	0.004
Perceived innovativeness	PIN1	0.920***	0.845	-0.001	0.000
	PIN2	0.887***	0.783	-0.033	0.001
	PIN3	0.891***	0.790	0.031	0.001
	PIN4	0.889***	0.797	0.001	0.000
Playfulness	PLY1	0.767***	0.596	0.121*	0.015
	PLY2	0.988***	0.966	-0.058	0.003
	PLY3	0.976***	0.941	-0.063	0.004
	PLY4	0.979***	0.953	-0.069	0.005
	PLY5	0.883***	0.792	0.046	0.002
	PLY6	0.842***	0.711	0.023	0.001
	PLY7	0.884***	0.787	0.008	0.000
Cognitive absorption	CAT	0.734***	0.573	0.168*	0.028
	CAF	0.836***	0.729	0.028	0.001
	CAH	0.899***	0.781	0.178**	0.032
	CAC	0.832***	0.753	-0.024	0.001
	CAU	0.815***	0.610	0.138	0.019
User trust	UTR1	0.914***	0.717	0.163*	0.027
	UTR2	0.946***	0.901	0.114	0.013
	UTR3	0.974***	0.970	0.114	0.013
	UTR4	0.944***	0.937	-0.139*	0.019
	UTR5	0.845***	0.767	0.086	0.007
Adaptive use intention	AUI1	0.895***	0.843	0.147	0.022
	AUI2	0.907***	0.861	0.055	0.003
	AUI3	0.907***	0.701	0.156*	0.024
	AUI4	0.862***	0.794	0.031	0.001
Average		0.899	0.813	0.037	0.009

Note: *p < .1; **p < .05; ***p < .01

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