Technology Acceptance As a Trigger for Successful Virtual Project Management

A Study of Business Use of Virtual Worlds

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Place, Date *Signature*

To my family

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1 Introduction

The rise of the Internet and evolving collaborative software has opened completely new dimensions in project management. In this highly connected world of the 21st century projects are not bound to geographical and organizational boundaries any more. Dispersed teams all over the world work with members from different regions, cultures and time zones. However, even under best conditions, project management itself is a challenging task. Due to the globalization and the desire to maximize the outcomes of projects and additionally be as cost and time efficient as possible, virtual project teams are getting more and more popular. The steady increase of travel costs, a new awareness of being a sustainable “green” company and this, already mentioned, basically loss of time by travelling itself has also supported this trend towards the use of virtual collaboration tools. Thereby, this new trend is mainly rested on the fact that enhancements in technologies over the past twenty years enabled completely new ways of collaboration and thereby this new field of virtual project management (VPM) emerged. According to Cantu (1997) VPM could also be seen as simple projects and teams connected to each other over a reduced set of communication channels using information and communication technologies (ICT). This very basic definition is a very good starting point and shows that consequently a high grade of technology support – on the software and hardware side – is necessary to achieve sustainable benefits of VPM. But not only technology as a basic prerequisite is from importance in this context. Considerably more counts the ability of the project members to adequately use the available ICT. At this point lays the crux of VPM, because the technology acceptance of the project members and thereby the end-users of the technology comes into play.

Technology acceptance, or also called technology adoption, is one of the most investigated research areas in the field of information systems (IS). Since the first models were introduced in the 1970ies (see Fishbein & Ajzen, 1975) to try and understand why people use technology and to investigate why believes drive intentions and those intentions drive behavior, some really good progress was made. One of the most common models nowadays is the so-called technology acceptance model (TAM) and was introduced by Fred Davis in 1986. Since then a lot of research was conducted and made the original papers that introduced TAM to the most cited in the whole field of IS (see Venkatesh, Davis, & Morris, 2007). But especially those, at the beginning mentioned, new evolving and very interactive and collaborative technologies bring up the question if those traditional approaches can still describe and explain adoption.

However, beside those basic problems the main goal of this diploma thesis is to focus on this link between virtual project management and technology acceptance. Furthermore, the goal is to take a snapshot of the current knowledge about these two areas and thereby use the existent literature to evaluate the current state of research. During the literature review several interesting and important questions evolved and enriched these basic goals. Especially one of the newest technologies, virtual worlds became of interest and thereby enriched the mentioned goals by possible business uses of virtual world project management.

Based on the basic problems and the goals mentioned before, the research question of this diploma thesis is: How and why is technology acceptance triggering the success of virtual project management, and what are possible business uses of virtual worlds in this context? Thereby not only a literature review as the foundation is the centre of attention. Furthermore, to investigate several questions that evolved during the literature review, an empirical approach was chosen to give insights into those main differences of new technologies, like virtual worlds, and how they have an impact on technology adoption. Figure 1 gives an overview of the used methods and also helps to see the connections and the logical structure behind this diploma thesis. This topic is also addressed in more detail in the research methodology section.

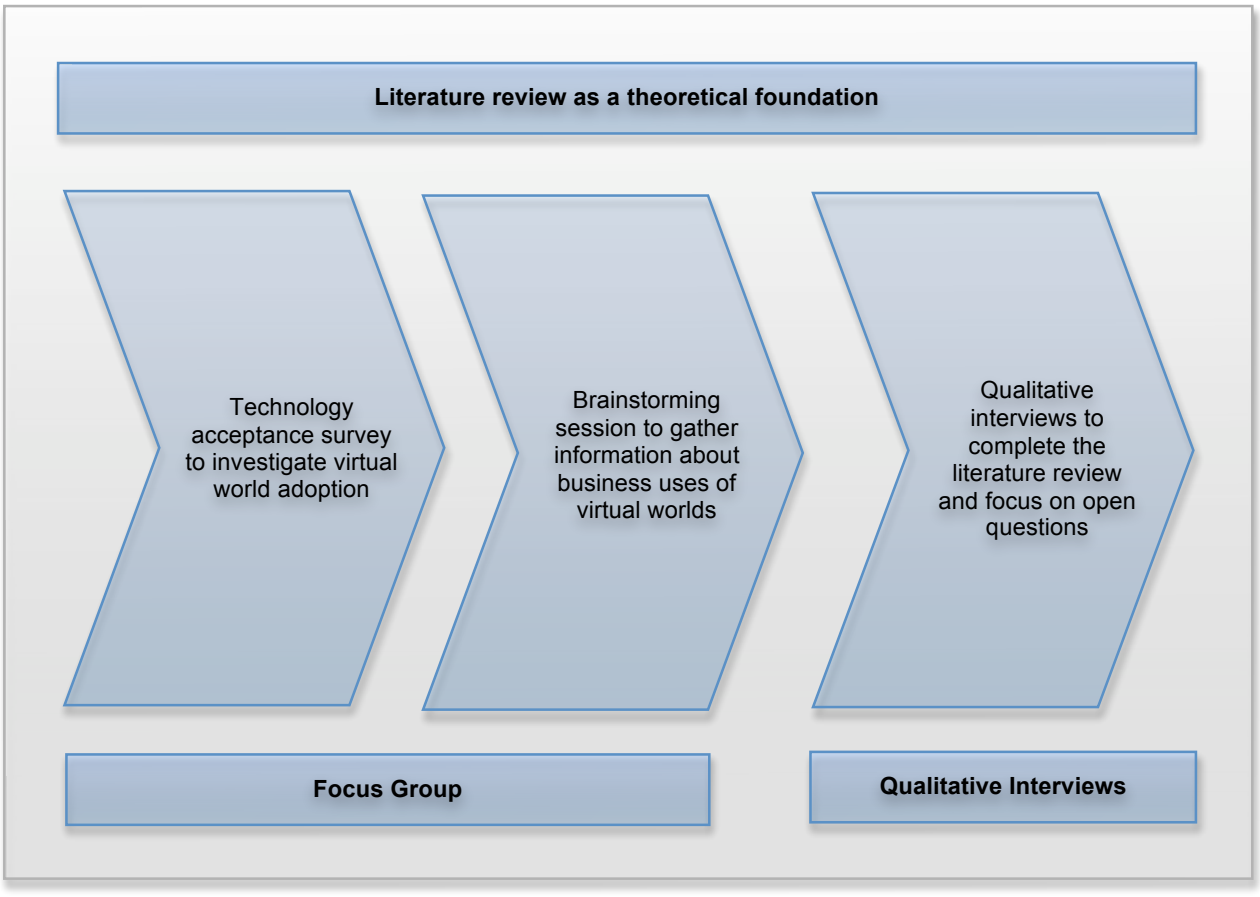

Figure 1. Diploma Thesis Overview

Due to the fact that this diploma thesis evolved from a cooperation between the University of Nebraska at Omaha and the Management Center Innsbruck and both universities have a focus on the respective research areas the preconditions were ideal. Furthermore, it was possible to actually do some research in Omaha and participate in the metaverse project group, which opened some great opportunities regarding the empirical part of this diploma thesis. As a result and in addition to the basic literature review, which builds the theoretical foundation of this diploma thesis, it was possible to conduct a focus group to cover technology acceptance and virtual world topics. Furthermore, several qualitative interviews with leading IS researchers were conducted to further investigate some areas not covered that well in the current literature.

To give a very quick guide through this diploma thesis, the following section provides the theoretical foundation and handles both, technology acceptance and virtual world project management. Furthermore, the literature review is concluded with the newest research on technology acceptance of virtual worlds, which tops this section off. The research methodology is then described, including the conducted focus group, the qualitative interviews and a description of the integrated research approach, which was used to compare and evaluate all the findings. The results and discussion section follows and thereby combines all the findings in an integrated approach. Last but not least, the diploma thesis ends with limitations, conclusions, and some directions for future research.

2 Literature Review

2.1 Technology Acceptance

2.1.1 Introduction

The adoption of technology has been studied for decades, but first gained a great deal of attention with the introduction of the technology acceptance model (TAM) by Fred D. Davis in 1989. While earlier research mainly focused on individual-level technology adoption examining user satisfaction and attitudes, Davis integrated “diverse theoretical perspectives and built on social psychology research and presented a parsimonious model of adoption and use“ (Venkatesh, et al., 2007, Progression of technology acceptance research, para. 1). TAM was originally introduced by two papers (F. D. Davis, 1989; F. D. Davis, Bagozzi, & Warshaw, 1989), which are frequently cited in research of information systems (IS) and other fields, with well over 1,000 citations (Venkatesh, et al., 2007). Based on the theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), TAM is thereby “considered the most influential and commonly employed theory for describing an individual‘s acceptance of information systems“ (Y. Lee, Kozar, & Larsen, 2003, p. 752).

2.1.2 Theory of Reasoned Action

Fishbein and Ajzen (1975) provide an overall approach to predict and describe intended user behavior. By definition, the theory of reasoned action (TRA) describes a person's behavioral intention as the attitude about the behavior and subjective norms. Basically it says that if a person intends to follow a behavior, this person will most likely do so. In the course of this, behavioral intention is measured as the strength of one's intention to perform a specified behavior. TRA describes attitude as an individual's positive or negative feelings about performing the target behavior (Fishbein & Ajzen, 1975). Subjective norm refers to „the person's perception that most people who are important to him/her think he/she should or should not perform the behavior in question" (Fishbein & Ajzen, 1975, p. 302).

TRA is a general model, and, as such, it does not specify the beliefs that are operative for a particular behavior (F. D. Davis, et al., 1989). Figure 2 illustrates the research model of TRA.

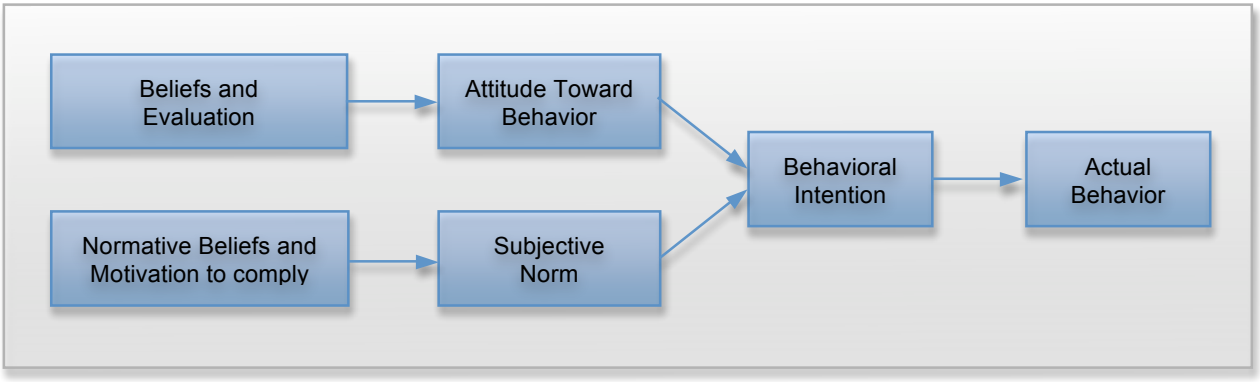

Figure 2. Theory of Reasoned Action (TRA), adapted from Davis et al. (1989)

2.1.3 Technology Acceptance Model and Theory of Reasoned Action

Davis (1989) describes TAM as an adaptation of TRA specifically tailored for modeling user acceptance of IS.

> *"The goal of TAM is to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behavior across a broad range ofend-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified" (F. D. Davis, et al., 1989, p. 985).*

TAM, originally proposed by Davis (1989), assumes that an individual's information systems acceptance is determined by two major variables: (1) perceived usefulness and (2) perceived ease of use. Perceived usefulness "is defined as the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context" (F. D. Davis, et al., 1989, p. 985). Perceived ease of use "refers to the degree to which the prospective user expects the target system to be free of effort" (F. D. Davis, et al., 1989, p. 985).

Similar to TRA, TAM postulates that computer usage is determined by behavioral intention, but differs in that behavioral intention is viewed as being jointly determined by the person's attitude toward using the system and perceived usefulness (F. D. Davis, et al., 1989).

The relationship between attitude and behavioral intention is fundamental in TRA and also represented in TAM. This "implies that, all else being equal, people form intentions to perform behaviors toward which they have positive affect" (F. D. Davis, et al., 1989, p. 986). Although the direct effect of a belief on behavioral intention runs counter to TRA, alternative intention models provide theoretical justification and empirical evidence of direct belief-intention links (Bagozzi, 1982). Figure 3 illustrates the research model of TAM.

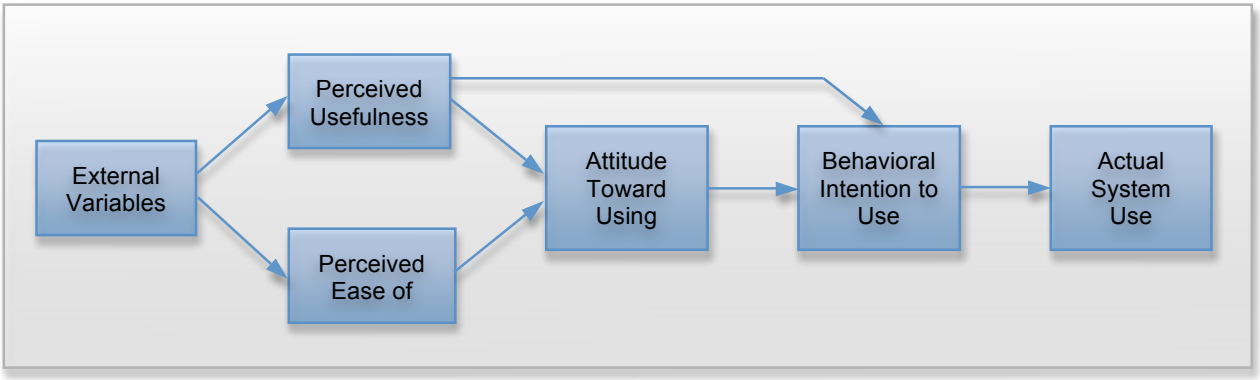

Figure 3. Technology Acceptance Model (TAM), e.g. Davis et al. (1989)

Figure 3 also shows that TAM does not include TRA's subjective norm as a determinant of behavioral intention. Davis et al. (1989) argue that it is difficult to disentangle direct effects of subjective norm on behavioral intention from indirect effects via attitude toward using. Those assumptions are also confirmed by other studies (DeSanctis, 1983). However, Davis et al. (1989) also show in their study, where they measured subjective norm in order to examine TRA, that the influence of subjective norm on attitude toward using is negligible. Taylor and Todd (1995) came to similar results by comparing TAM with the theory of planned behavior (TPB). TPB (Ajzen, 1991) is an extension of TRA, which introduces the concept of perceived behavioral control as another factor to behavioral intention. Their study showed that both subjective norm and perceived behavioral control have no substantial influence on the variance of attitude toward using beyond that which could already be described with TAM (Mathieson, 1991; Venkatesh, 1999).

Overall, TAM was shown to be empirically superior to the more general TRA (F. D. Davis, et al., 1989; Venkatesh, et al., 2007). This fact was the starting point for a huge increase in the relevance and importance of TAM. This increase, including the most recent research, will be discussed in the following section.

2.1.4 Further development of the Technology Acceptance Model

Lee et al. (2003) separated the chronological progress of TAM research into four different periods: (1) introduction, (2) validation, (3) extension, and (4) elaboration. Figure 4 provides an overview of these four periods.

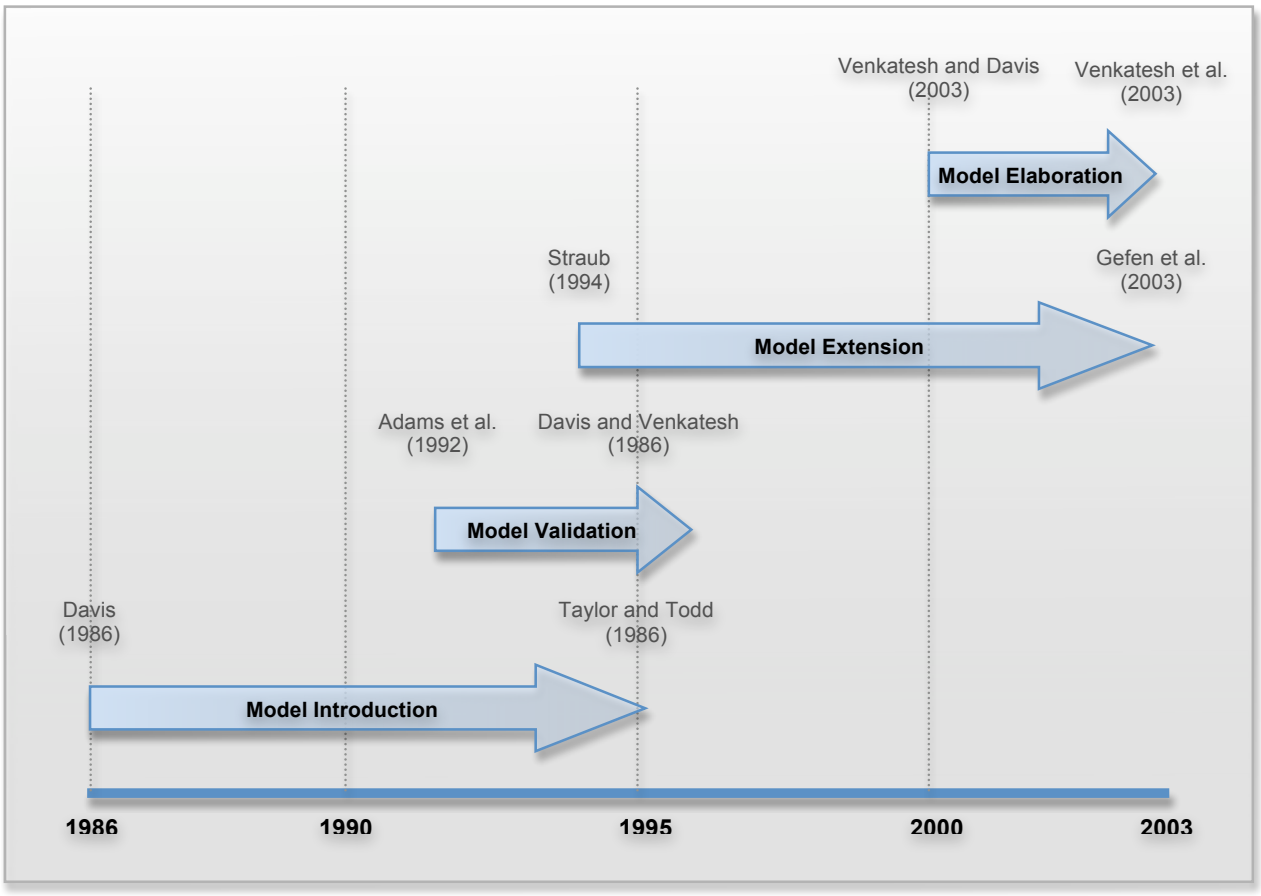

Figure 4. Chronological Progress of TAM Research, e.g. Lee et al. (2003)

Venkatesh et al. (2007) also provided an overview of the progress of TAM research. In this study a broader approach to examine the evolution of the technology adoption research as a whole is used. Furthermore, the progress of technology adoption is compared with two prominent areas of research, namely psychology and organizational behavior. As a result a catalog of major milestones in the evolution of technology adoption, including several different models and comparisons to TPB and job satisfaction, was developed.

Even though this approach (Venkatesh, et al., 2007) is more up to date than the chronological progress of TAM (Y. Lee, et al., 2003), the latter will be used to outline the further development of TAM. The latter was chosen for the simple reason that Lee et al. (2003) focus on TAM and the extensions and improvements based on this model. The broader approach from Venkatesh et al. (2007) includes several other models and is thereby not as relevant as the TAM focus for this thesis. However, in the end there are several overlaps in both approaches. One example is the focus of Venkatesh et al. (2007) on the replication and generalization period on TAM only, which provides generally the same information as Lee et al. (2003).

2.1.4.1 Model Introduction Period

After the introduction of TAM (F. D. Davis, 1989; F. D. Davis, et al., 1989), researchers mainly focused on two different streams: (1) replication studies and (2) relation of TAM and TRA (Y. Lee, et al., 2003).

There were several early attempts to test TAM in new settings and with new technologies. Overall the model and the scales were robust and the predicted relationships were found to hold in various tests, e.g., Adams, Nelson, and Todd (1992); Hendrickson, Massey, and Cronan (1993); Mathieson (1991); and Venkatesh and Davis (2000). TAM was tested using various types of information systems, including email, groupware, expert systems, CASE tools, voice mail, calculator, digital libraries, spreadsheets, and e-health systems (Venkatesh, et al., 2007). Furthermore TAM has also been tested in several different countries, including the U.S., Japan, and Saudi Arabia (Venkatesh, et al., 2007). In general, studies of this early period found that "TAM maintained its consistency and validity in explaining users' IS acceptance behavior" (Y. Lee, et al., 2003, p. 755).

The second stream of research was trying to differentiate TAM from TRA. Davis et al. (1989) for example compared TRA and TAM in how they measure an MBA student's relative facility with a word processor across two time periods. Hubona and Cheney (1994) compared TAM with TPB and found that TAM offered a slight empirical advantage. Above all TAM "is a much simpler, easier to use, and a more powerful model to explain users' technology acceptance" (Y. Lee, et al., 2003, p. 755).

In sum, Lee et al. (2003) conclude that through the studies in this period TAM could successfully predict information system acceptance behavior under different technologies and different situations. Igbaria, Zinatelli, Cragg, and Cavaye (1997) came to the same conclusion and found that "TAM was a much simpler, easier to use, and more powerful model of the determinant of user acceptance of computer technology than TRA" (as cited in Y. Lee, et al., 2003, p. 756).

2.1.4.2 Model Validation Period

The next step in the evolution of TAM is suggested by Bejar (1980), who noted that "robust instruments greatly enhance the value of research" (Y. Lee, et al., 2003, p. 756). Venkatesh et al. (2007) also suggests that the next logical step is to establish the predictive validity of TAM. Supported by these suggestions "researchers wanted to confirm that TAM truly uses an accurate measurement of the user's acceptance behavior under different technologies, situations, and tasks" (Y. Lee, et al., 2003, p. 756).

Lee et al. (2003) list several different studies and papers that have proven the validity and reliability of TAM. Amongst others, Adams et al. (1992) replicated and extended the original study of Davis (1989) across different settings and different information systems. Hendrickson et al. (1993; 1996) found that the test-retest reliability of perceived usefulness and perceived ease of use is reliable and valid. Szajna (1994) also found good predictive validity for perceived usefulness and perceived ease of use in a discriminate analysis of database management systems selection behavior of 47 MBA students.

To summarize this period of validation, research has shown that TAM is powerful, consistent, reliable, and valid (Y. Lee, et al., 2003).

2.1.4.3 Model Extension Period

After validation had confirmed the reliability of the measurement instruments, efforts began “to introduce new variables postulating diversified relationships between constructs and the search of antecedents (or external) variables of the major TAM constructs perceived usefulness and perceived ease of use“ (Y. Lee, et al., 2003, p. 756). This attempt to introduce new external variables was one of the two streams in this period. An example was the investigation of effects of organizational factors by Igbaria and Iivari (1995). This study showed that user training, computing support, and managerial support significantly affect perceived usefulness and perceived ease of use, and microcomputer usage.

The second stream in this period represented the need to identify the boundaries of TAM. Lee et al. (2003) mention the suggestion of Adams et al. (1992) that “the moderating effects for TAM variables such as culture, gender, task, user type, and information systems type needed to be examined“ (p. 757). For example, researchers found that culture plays an important role in attitude toward and choice of communication media (see Straub, 1994).

Both Lee et al. (2003) and Venkatesh et al. (2007) conclude that this period helped to deepen the understanding of the phenomenon. Furthermore studies made strides to develop a “greater understanding [that] may be garnered in explicating the causal relationships among beliefs and their antecedent factors“ (Chin & Gopal, 1995, p. 46).

2.1.4.4 Model Elaboration Period

Lee et al. (2003) characterize this period as “the elaboration of TAM in two key ways: to develop the next generation TAM that synthesizes the previous effects and to resolve the limitations

raised by previous studies“ (p. 757). Table 1 shows a summary of the major limitations that Lee et al. (2003) discovered by investigating 101 TAM studies.

Limitations	Explanation
Self-reported Usage	Did not measure actual usage
Single IS	Used only a single information system for the research
Student Samples (or University Environment)	Inappropriate reflection of a real working environment
Single Subject (or Restricted subjects)	Only one organization, one department, or MBA students
One Time Cross Sectional Study	Mainly performed based on cross sectional study
Measurement Problems	Low validity of newly developed measure, used single item scales
Single Task	Did not granulize the tasks, and tested them with the target IS
Low Variance Scores	Did not adequately explain the causation of the model
Mandatory Situations	Did not classify mandatory and voluntary situations, or assumed voluntary situation
Others	Small sample size, short exposure time to the new IS, few considerations of cultural difference, self-selection bias

Table 1. Summary of Limitations in TAM Studies, adapted from Lee et al. (2003)

We now return to the synthesis of previous effects, which Lee et al. (2003) defined as being done in one of two key ways. Several different new models and extensions of the original TAM were developed in this period. In 2000 Venkatesh and Davis (2000) and Venkatesh (2000) introduced TAM II, which “synthesizes the previous efforts, and reflected the previous request for the model‘s elaboration“ (Y. Lee, et al., 2003, p. 757). Most important, key constructs were identified in TAM II, such as determinants of perceived usefulness and determinants of perceived ease of use. In addition, several studies were introduced to resolve previous problems with TAM. Venkatesh (2000) performed a study that included subjective norm, which had been excluded by Davis (1989), and that measured actual usage instead of self-reported

usage. Another study investigated psychological origins of perceived usefulness and perceived ease of use (see Karahanna & Straub, 1999).

Venkatesh et al. (2007) state that the major findings of this period „helped deepen our understanding of the cognitive underpinnings of the key predictors of technology adoption and use“ (Antecedents and Interventions, para. 1). But on the other hand it also seems that “this domain of research has reached a level of maturity that calls for an assessment of what is known and a need to identify fruitful directions for future research“ (Venkatesh, et al., 2007, Synthesis, para. 1).

To address the issue of assessing the current state of knowledge about technology acceptance, Venkatesh, Morris, G. B. Davis, and F. D. Davis (2003) synthesized well over a decade of research and introduced a unified theory of acceptance and use of technology (UTAUT).

2.1.5 Unified Theory of Acceptance and Use of Technology

Introduced by Venkatesh et al. (2003), UTAUT is based on a detailed literature review that assessed “the current state of knowledge with respect to understanding individual acceptance of new information technologies“ (Venkatesh, et al., 2003, p. 426). In their study Venkatesh et al. (2003) presented (1) a review of eight different models of technology adoption including a summary of prior model comparison studies, (2) a conceptual and empirical synthesis of the different models to describe UTAUT, and (3) directions for future research (Venkatesh, et al., 2007). The following section goes through the development of UTAUT step by step, based on the paper by Venkatesh et al. (2003).

2.1.5.1 Review of Extant User Acceptance Models

Venkatesh et al. (2003) did a detailed review of competing theoretical models in the area of information technology acceptance research. Several different streams of research were discovered and categorized. One stream of research, for example, is using intention or usage as a dependent variable (Compeau & Higgins, 1995; F. D. Davis, et al., 1989). Other streams are focusing on implementation success at the organizational level (Leonard-Barton & Deschamps, 1988) or on task-technology fit (Goodhue, 1995), just to mention two more. Regarding those streams, Venkatesh et al. (2003) defined the main goal of the UTAUT paper in understanding usage as the dependent variable, because the role of intention as a predictor of behavior has already been well-established in information systems.

In the end, the eight identified models were the theory of reasoned action (TRA), the technology acceptance model (TAM), the motivational model (MM), the theory of planned behavior (TPB), a

model combining the technology acceptance model and the theory of planned behavior (C-TAM-TPB), the model of PC utilization (MPCU), the innovation diffusion theory (IDT), and the social cognitive theory (SCT).

One of the results of this review was that all eight models were already tested fairly well in several studies and research projects, but just four of those studies were found providing empirically based comparisons of two or more of the eight models (Venkatesh, et al., 2003). Davis et al. (1989) did a comparison of TRA and TAM, Mathieson (1991) did a comparison of TAM and TPB, Taylor and Todd (1995) did a comparison of TAM and TPB/DTPB, and finally Plouffe, Hulland, and Vandenbosch (2001) did a comparison of TAM and IDT. Furthermore, Table 2 shows five limitations of these prior model comparisons, which have been identified by Venkatesh et al. (2003).

Limitations	Explanation
Technology studied	Only relatively easy and individual-oriented information technologies were studied
Participants	Three of the four model comparison studies were based on student participants
Timing of measurement	Except for Davis et al. (1989), the model comparisons examined technologies that were already familiar to the individuals
Nature of measurement	Only one organization, one department, or MBA students
Voluntary vs. mandatory	All four model comparisons were conducted in voluntary usage contexts, which is typically not the case in working environments

Table 2. Limitations of TAM Comparison Studies, adapted from Venkatesh et al. (2003)

Those five limitations basically match the previously described findings of Lee et al. (2003) and thereby also show the development of technology acceptance research in the elaboration period. Venkatesh et al. (2003) addressed those limitations in the empirical comparison of the eight models.

Another important finding of this model comparison was the identification of four key moderating variables (experience, voluntariness, gender, and age) in conjunction with these eight models.

2.1.5.2 Synthesis and Formulation of UTAUT

Based on the detailed literature review, the four model comparisons and the consequent findings, Venkatesh et al. (2003) identified seven constructs “to be significant direct determinants of intention or usage in one or more of the individual models“ (p. 446). Four of those seven constructs were theorized to play “a significant role as direct determinants of user acceptance and usage behavior: performance expectancy, effort expectancy, social influence, and facilitating conditions“ (Venkatesh, et al., 2003, p. 447). The other three constructs - attitude toward using technology, self-efficacy, and anxiety - were theorized not to be direct determinants of intention (Venkatesh, et al., 2003). Figure 5 shows the research model of UTAUT including the previously mentioned four key moderators of gender, age, voluntariness, and experience.

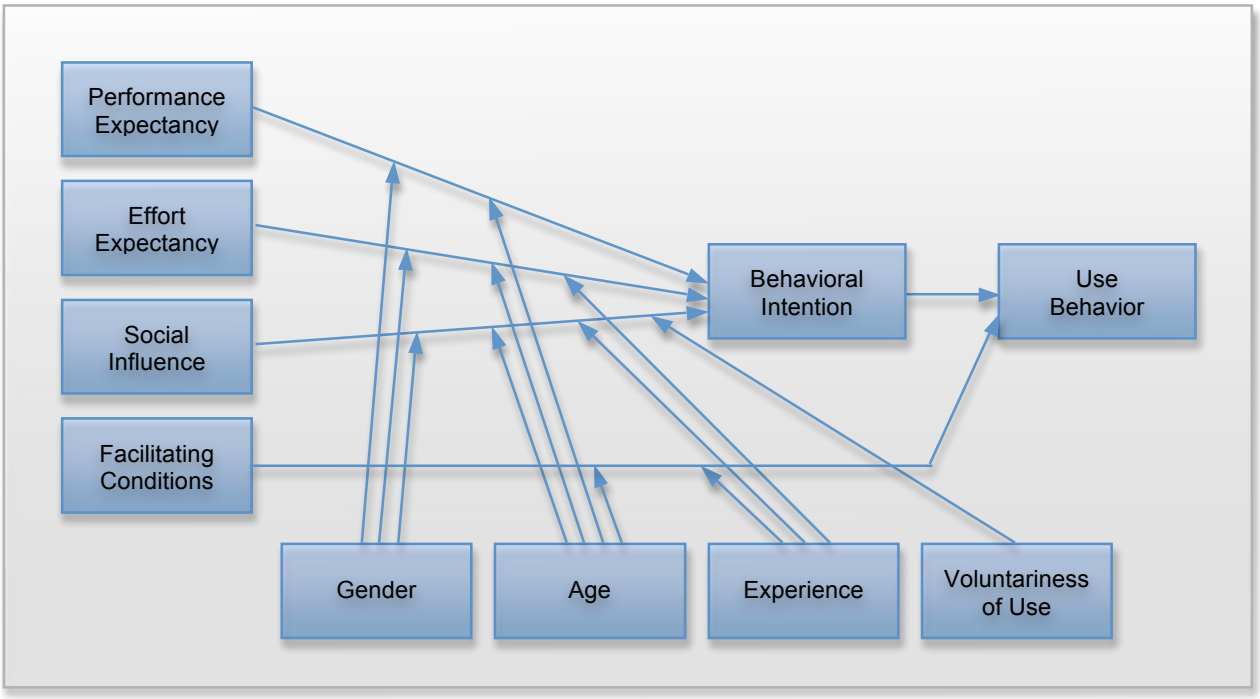

Figure 5. Research Model of UTAUT, adapted from Venkatesh et al. (2003)

2.1.5.3 Performance Expectancy

Venkatesh et al. (2003) describe performance expectancy (PE) “as the degree to which an individual believes that using the system will help him or her to attain gains in job performance“ (p. 447). PE is based on five constructs of the eight models, namely perceived usefulness (TAM/TAM2 and C-TAM-TPB), extrinsic motivation (MM), job-fit (MPCU), relative advantage (IDT), and outcome expectations (SCT). Previous model tests have also shown that PE is one of the strongest predictors of intention (Compeau & Higgins, 1995; F. D. Davis, et al., 1989; Taylor & Todd, 1995).

As shown in Figure 4, the relationship between PE and behavioral intention (BI) is moderated by gender and age. Regarding Venkatesh et al. (2003), research has shown that differences stem from gender roles and socialization processes reinforced from birth rather than biological gender per se (Bem, 1981; Kirchmeyer, 1997; Lynott & McCandless, 2000). Furthermore, research outside the IT context (e.g. Kirchmeyer, 2002) has also shown that those gender roles have “a strong psychological basis and are relatively enduring, yet open to change over time“ (Venkatesh, et al., 2003, p. 450). On the other hand, age is also playing a moderating role. Previous studies have shown that gender and age differences exist in technology adoption (Morris & Venkatesh, 2000). Venkatesh et al. (2003) especially highlight that Levy (1988) suggests that “studies of gender differences can be misleading without reference to age“ (p. 450).

2.1.5.4 Effort Expectancy

Venkatesh et al. (2003) describe effort expectancy (EE) “as the degree of ease associated with the use of the system“ (p. 450). EE is based on three constructs from the investigated eight models, namely perceived ease of use (TAM/TAM2), complexity (MPCU), and ease of use (IDT). Those similarities between the three constructs have also been mentioned in research by Davis et al. (1989), Plouffe et al. (2001), and Thompson, Higgins, and Howell (1991).

Very interesting is the fact that the relationship between EE and BI, besides gender and age, is also moderated by experience. The empirical studies of Venkatesh et al. (2003) have shown that “each one is significant only during the first time period, becoming nonsignificant over periods of extended and sustained usage“ (Venkatesh, et al., 2003, p. 450). These findings also correspond with prior research (F. D. Davis, et al., 1989; Thompson, et al., 1991).

2.1.5.5 Social Influence

Venkatesh et al. (2003) describe social influence (SI) “as the degree to which an individual perceives that important others believe he or she should use the new system“ (p. 451). This definition of SI is based on similarities of the three constructs: subjective norm (TRA, TAM2, TPB/DTPB, and C-TAM-TPB), social factors (MPCU), and image (IDT). Thompson et al. (1991) first used the term social norms and “acknowledged its similarity to subjective norm within TRA“ (Venkatesh, et al., 2003, p. 451).

An important fact is that “none of the social influence constructs are significant in voluntary contexts; however, each becomes significant when use is mandated“ (Venkatesh, et al., 2003, p. 451). This moderating role is also shown in Figure 4 as voluntariness of use, which makes the relationship between SI and BI the only one moderated by all four factors. SI also appears

to be important only in early stages of mandatory settings, which describes the moderating role of experience and suggests that SI becomes insignificant over time with sustained usage (Venkatesh & Davis, 2000). Nevertheless, Venkatesh et al. (2003) state that the “role of social influence in technology acceptance decisions is complex and subject to a wide range of contingent influences“ (p. 452).

2.1.5.6 Facilitating Conditions

Venkatesh et al. (2003) describe facilitating conditions (FC) “as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system“ (p. 453). The definition of FC is based on perceived behavioral control in TPB/DTPB, facilitating conditions in MPCU, and compatibility in IDT. As one of the newer constructs not included in the basic technology acceptance research, FC was first introduced by Taylor and Todd (1995) as a core component of perceived behavioral control in TPB/DTPB. Venkatesh et al. (2003) argue that compatibility as a construct from IDT is important and “incorporates items that tap the fit between the individual’s work style and the use of the system in the organization“ (p. 453).

As shown in Figure 4, Venkatesh et al. (2003) see FC as a direct antecedent of usage and not intention. They argue, “when both performance expectancy constructs and effort expectancy constructs are present, facilitating condition becomes nonsignificant in predicting intention“ (Venkatesh, et al., 2003, p. 454). Based on Bergeron, Rivard, and De Serre (1990) the effect on usage increases “with experience as users of technology find multiple avenues for help and support throughout the organization, thereby removing impediments to sustained usage“ (Venkatesh, et al., 2003, p. 454). This describes experience as one moderating role of the relationship between FC and use behavior. Venkatesh et al. (2003) identified the second moderator as age, based on organizational psychologists, who “have noted that older workers attach more importance to receiving help and assistance on the job“ (p. 454). These findings are also based on empirical evidence from Morris and Venkatesh (2000).

2.1.5.7 Indirect Determinants of Intention

Research has shown that self-efficacy (SE) and anxiety (ANX) are conceptually and empirically distinct from effort expectancy (Venkatesh, 2000). Although “self-efficacy and anxiety appeared to be significant determinants of intention in SCT, UTAUT does not include them as direct determinants” (Venkatesh, et al., 2003, p. 455).

The third indirect determinant of intention is attitude toward using technology (ATUT). Venkatesh et al. (2003) describe ATUT “as an individual’s overall affective reaction to using a

system“ (p. 455). It is based on the four constructs of attitude toward behavior (TRA, TPB/DTPB, C-TAM-TPB), intrinsic motivation (MM), affect toward use (MPCU), and affect (SCT). Venkatesh et al. (2003) found that “the attitudinal constructs are significant only when specific cognitions - in this case, constructs related to performance and effort expectancies - are not included in the model“ (p. 455). There is also empirical evidence that, for example, intrinsic motivation operates through effort expectancy (Venkatesh, 2000). Therefore, Venkatesh et al. (2003) “consider any observed relationship between attitude and intention to be spurious and resulting from the omission of the other key predictors (specifically, performance and effort expectancies)“ (p. 455). Previous model tests basically came to the same conclusion (see Taylor & Todd, 1995; Thompson, et al., 1991).

2.1.5.8 Empirical Validation

As previously discussed, the introduction phase of a new model takes a couple of years and is then followed by a second phase to check its validity and generalizability (Y. Lee, et al., 2003). Venkatesh et al. (2003) already provided a preliminary test of UTAUT in their paper as well as an additional cross-validation study.

UTAUT was first tested with the original set of data (provided by four organizations) used for the model comparison itself and „found to outperform the eight individual models“ (Venkatesh, et al., 2003, p. 425). After these first results, UTAUT was cross validated by using data from two additional organizations. To counter one of the limitations of previous model comparison studies, Venkatesh et al. (2003) did a longitudinal analysis of all six organizations over a six month period with three points of measurement. Furthermore, Venkatesh et al. (2003) state that „these tests provided strong empirical support for UTAUT, which posits three direct determinants of intention to use (performance expectancy, effort expectancy, and social influence) and two direct determinants of usage behavior (intention and facilitating conditions)“ (p. 467). In the end UTAUT accounted for 70 percent of the variance (adjusted R^2) in usage intention, which is a substantial improvement over any of the original eight models (between 17 and 53 percent variance, adjusted R^2). This finding is even more important because UTAUT „was successful in integrating key elements from among the initial set of 32 main effects and four moderators as determinants of intention and behavior collectively posited by eight alternate models into a model that incorporated four main effects and four moderators“ (Venkatesh, et al., 2003, p. 467).

In terms of generalizability very few studies have been published, due to the newness of the model itself. Moran (2006) investigated college students’ acceptance of tablet PCs based on a modified UTAUT model. He found that “this study confirms the ability of the unified theory of

acceptance and use of technology (UTAUT) model to determine user's acceptance of a technology tool" (Moran, 2006, p. 93).

Wills, El-Gayar, and Bennett (2008) examined healthcare professionals' acceptance of electronic medical records (EMRs) using UTAUT. Similar to the study mentioned before, they state that "overall, the findings indicate that UTAUT is able to provide a reasonable assessment of health care professionals' acceptance of EMR's with social influence a significant determinant of intention and use" (Wills, et al., 2008, p. 396).

As a last example for the generalizability of UTAUT, Venkatesh, Xu, Hong, Tam, and Thong (2008) proposed a model of consumer adoption and use of information and communication technology (ICT) services by extending UTAUT. The developed model "received strong empirical support, with service type moderating key relationships and the moderated model explaining significantly more variance in intention compared to what was explained by the baseline UTAUT" (Venkatesh, et al., 2008, p. 30).

UTAUT has shown its validity and generalizability, but the model is relatively new and still has to go through more research, refinement and extension. As discussed in the beginning of this section, Venkatesh et al. (2003) also discussed directions for future research in their paper. This point, extended to the future of technology acceptance research as a whole, is presented in the following section.

2.1.6 Outlook for the Future of Technology Adoption Research

Technology acceptance has been around for a long time since it first got a great deal of attention with the introduction of TAM by Davis (1989) and Davis et al. (1989). In the last couple of years there "has been impressive progress in technology adoption research" (Venkatesh, et al., 2007, Conclusions, para. 1). Lee et al. (2003), Venkatesh et al. (2003), and Venkatesh et al. (2007) provided an overview of the last decades, compared existing research models, and came up with new synthesized models. Venkatesh et al. (2003) even concluded that we may be "reaching the practical limits of our ability to explain individual acceptance and usage decisions" (p. 471). Considering this prompt, there also have been some studies in the last three years introducing completely new approaches in how to think about technology acceptance (Schwarz, Chin, Morris, & Venkatesh, 2006; Sykes, Gosain, & Venkatesh, 2007; Venkatesh & Bala, 2008).

The next section provides a short summary of potential directions for future technology acceptance research, based on the studies mentioned above.

2.1.6.1 Future Directions

Based on a comparison of the progress in the area of TAM with TPB and job satisfaction, Venkatesh et al. (2007) identified some fruitful areas for future research. Basically they called for research focused on interventions, contingencies, and alternative theoretical perspectives. TPB research has made some substantial progress “in studying interventions and going beyond the basic tenets to consider alternative theoretical mechanisms, both of which should be considered in future work on technology adoption“ (Venkatesh, et al., 2007, TPB Summary, para. 1). They draw pretty much the same conclusion about job satisfaction, where, in relation to technology adoption research, the “literature is richer and more sophisticated with a greater breadth of models, problems studied, contingencies, interventions, and outcomes“ (Venkatesh, et al., 2007, Job Satisfaction Summary, para. 1). In sum, Schwarz et al. (2006) conclude that “rather than continuing to rely on the notion of acceptance-as-usage and chip away at the amount of usage variance explained, we believe that our field needs to move away from a narrow definition of acceptance and towards a more fruitful theoretical consideration of what constitutes IT acceptance“ (p. 4).

Lee et al. (2003) come to the same conclusion and suggest “more studies of TAM per se will die out, unless someone can find a new addition to TAM and the paradigm shifts“ (as cited in Schwarz, et al., 2006, p. 5). Furthermore, some suggest areas of future directions may require going “beyond individual acceptance to organizational and societal acceptance“ (Y. Lee, et al., 2003, p. 767).

2.1.6.2 Examples of Interesting New Research

Considering the findings of the last couple of years, Venkatesh and Bala (2008) introduced TAM3 and a research agenda on interventions. They state, “there is a need to understand how various interventions can influence the known determinants of IT adoption and use“ (Venkatesh & Bala, 2008, p. 273). To address this gap they developed (1) a comprehensive nomological network of the determinants of individual level adoption and use, (2) empirically tested the proposed integrated model; and (3) presented a research agenda focused on potential pre- and post-implementation interventions that can enhance employees’ adoption and use of IT (Venkatesh & Bala, 2008).

Sykes et al. (2007) proposed and tested a model of acceptance with peer support (MAPS) that integrated individual research with social network constructs. They showed that “an individual‘s embeddedness in the social network of the organizational unit implementing a new information system can enhance our understanding of technology use“ (Sykes, et al., 2007, p. 2). Furthermore they found that the „social network constructs of network density and network

centrality predicted system use over and above the predictors from the individual technology adoption perspective, i.e., behavioral intention and facilitating conditions“ (Sykes, et al., 2007, p. 42).

Last but not least, Schwarz et al. (2006) introduced a process-based theory of information technology acceptance. They addressed the need for a change of direction in the technology adoption research and expressed this with the first sentence in their paper: “Research into the acceptance of technology is in need of a shift“ (Schwarz, et al., 2006, p. 3). Basically Schwarz et al. (2006) covered two unanswered questions from prior research into IT acceptance, namely “(1) What is acceptance, and (2) What is a possible cognitive, process based theory of IT acceptance?“ (p. 2). Really interesting is their approach of using etymology by utilizing the derivate definition methodology (DDM) to “define acceptance as the actions of an individual user psychologically receiving, grasping, assessing, being given, and submitting to an information technology application“ (Schwarz, et al., 2006, p. 25). To describe the structural, cognitive process of end user acceptance, Figure 6 shows the four developed stages.

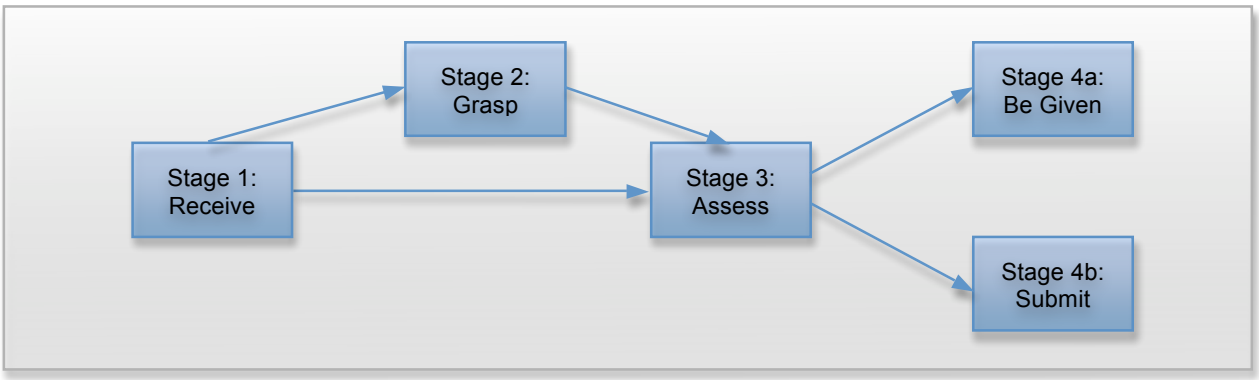

Figure 6. Pictorial Representation of the Process of IT Acceptance, adopted from Schwarz et al. (2006)

By “taking all of the stages together, this research posits that the cognitive process of end user acceptance is: Instinctual Response => Cognitive Attitude => Evaluative Attitude => Emergent belief“ (Schwarz, et al., 2006, p. 39). In their conclusion, Schwarz et al. (2006) suggested that this was a first step “towards a structural, cognitive process-based view of information technology acceptance that may help direct researchers interested in this phenomenon down useful new lines of inquiry“ (p. 47).

At the end of this literature review of technology acceptance, I would like to close by citing Lee et al. (2003) one last time, at least for now. “While there are still contradictory views on TAM research considering the previous and current research trends, many exciting directions remain for making future discoveries“ (Y. Lee, et al., 2003, p. 768).

2.1.7 Transition of Technology Adoption to Virtual Environments

One of those exciting directions that Lee et al. (2003) mentioned is the field of Virtual Worlds, to be more specific, research on user acceptance of Second Life (SL). A brand-new study introduced by Saeed, Yang, and Sinnappan (2009) at the 17th European Conference on Information Systems 2009, presented "findings from an ongoing study about the impacts of using multi-user virtual environments (MUVE) in higher education" (p. 2964). Their study is inspired by previous research, which suggested that traditional technology acceptance approaches may not work well for today's entertainment-oriented technologies like MUVEs such as SL (see Holsapple & Wu, 2007; van der Heijden, 2004). Furthermore, Saeed et al. (2009) based their assumption on the fact that Hsu and Lu (2004) recommended "to consider those facets of human behaviour that are likely to capture the hedonic consumption of such technologies" (p. 2965). "Since Second Life also inherits a large entertainment element, it is important to capture its hedonic consumption in order to explain its usage and acceptance" (Saeed, et al., 2009, p. 2965). In order to explain the user acceptance of SL, they extended TAM 2 with the theory of hedonic consumption behavior.

Hedonic consumption itself has its roots in marketing research and addresses the facets of user behavior that relate to the multi-sensory, fantasy and emotional aspects of one's experience with products (Hirschman & Holbrook, 1982). Saeed et al. (2009) referred to Lacher and Mizerski (1994) and stated that the "theory asserts that emotional and imaginative responses are the main drivers of hedonic consumption, which can be explained through the constructs of emotional involvement, enjoyment and role projection" (p. 2966). Furthermore, according to Saeed et al. (2009), several studies have shown significant impacts of hedonic consumption behaviors on entertainment-oriented technologies like online games, e-learning environments, online retail shops, music, and gambling. Thus they assumed that hedonic behaviors are a strong predictor of attitudes towards using MUVEs like SL, which are largely hedonic in nature.

Indeed the findings of Saeed et al. (2009) suggested that hedonic consumption behaviors are strong predictors of Second Life usage. The model explained "51.4 percent of the users' intentions to use Second Life, which is a significant outcome when compared with similar studies of technology acceptance" (Saeed, et al., 2009, p. 2965). In more detail, the study showed that perceived enjoyment was the most important predictor of users' intention to use SL, followed by perceived emotional involvement. Furthermore, Saeed et al. (2009) discovered that "TAM 2 constructs of perceived ease of use, perceived usefulness, and subjective norms also had significant impact on user intentions to use Second Life, but with lesser significance than that of hedonic consumption behaviors" (p. 2973).

To understand those findings and the impacts they have, the next section will take a closer look at virtuality and, in this context, especially at Virtual Worlds.

2.2 Virtual World Project Management

2.2.1 Introduction

Until now the term technology was used as a hypernym. This was important to get into technology adoption at first, but as the transition (see section 2.1.7 Transition of Technology Adoption to Virtual Environments) has already implied, the general usage of the word technology is now getting more specified. To be exact, the following section is focusing on technology as an enabler of virtual projects with a special focus on virtual world technologies. To accomplish this, in a first step the paradigm shift in project management towards a more collaborative and virtual approach is covered. Including a basic definition of traditional project terms, a workup of virtuality, and a definition of technology for virtual projects and virtual teams. In a second step the focus moves to virtual worlds as a completely new perspective in virtual project management. In the course of this, Second Life, one of the more popular virtual worlds, is thereby examined in more detail.

2.2.2 Virtual Project Management

The rise of the Internet and evolving collaborative software has opened completely new dimensions in project management. It is nowadays possible to set up projects with members in dispersed locations all over the world. According to Cantu (1997) virtual project management (VPM) could be seen as simple as regular projects and teams connected to each other over a reduced set of communication channels using information and communication technologies. Thereby, to fully understand the complexity of VPM the first step is to take a closer look at traditional projects and project management.

2.2.2.1 Projects and Project Management

Project management (PM) is one of the most important issues today and vital to the survival of many organizations. “Ineffective PM can result in budget and schedule overruns, poor quality products, or even project termination” (Chen, Romano, & Nunamaker, 2003, p. 1303). On the other hand, Chen et al. (2003) argue that successful PM may shorten product or service time to market, save development resources, or increase product or service quality. According to Evaristo and van Fenema (1999) traditional PM focuses mainly on a single project at a single location and “is more concerned with project inputs and outputs than with project process” (Chen, et al., 2003, p. 1303). However, the importance of PM is undisputed and also shown by the rapidly increasing membership of the Project Management Institute (PMI) and rising numbers of project-related job opportunities (Chen, et al., 2003).

The PMI defines in the Project Management Body of Knowledge (PMBoK) that “a project is a temporary endeavor undertaken to create a unique product, service or result” (Project Management Institute, 2004, p. 5). The PMI also clearly contrasts projects with operational work and states that operations are ongoing and repetitive in contrast to projects. Furthermore, projects are different “because the project concludes when its specific objectives have been attained, while operations adopt a new set of objects and the work continues” (Project Management Institute, 2004, p. 7). Lewis (2001), for example, defines a project as “a one-time job that has definite starting and ending points, clearly defined objectives, scope, and (usually) a budget” (p. 2). There may also be other definitions of projects. Nevertheless, Engwall (1998) found three features that people agree projects have in common: “(1) a project has a time span, it is temporary with starting and ending point; (2) a project is to produce a product or service; (3) every project is unique given that it has a certain starting and ending point, even though some tasks or activities in projects may be repetitive” (Chen, et al., 2003, p. 1304).

Lewis (2001) defines PM as “the planning, scheduling, and controlling of project activities to achieve performance, cost, and time objectives, for a given scope of work, while using resources efficiently and effectively” (p. 5). Pretty much like the definition of a project, there may be other definitions of PM. However, Chen et al. (2003) identified four essential features, which PM definitions have in common: “(1) Management of a projects’ inputs such as human, material, and financial resources; (2) organization, planning, and control of the project process; (3) achievement of certain project objectives (e.g. performance, quality) within (4) certain constraints (e.g. time, budget, scope)” (p. 1304). In addition to these definitions, Maurer (1996) defined the overall goal of PM to reduce costs and improve process quality.

2.2.2.2 A Paradigm Shift in Project Management

Chen et al. (2003) argue that “over the past decade, the project landscape has undergone a major change” (p. 1306). Powell, Piccoli, and Ives (2004) confirm that “global competition, reengineered product life cycles, mass customization, and the increased need to respond quickly to customers’ needs are just some of the more pronounced trends currently driving organizational trends” (p. 6). Evaristo and van Fenema (1999) support this finding and illustrate that more and more projects involve professionals from locations distributed geographically. Those distributed projects are also called virtual projects or, if used in an organizational context, virtual organizations.

Van Fenema and Kumar (2000) identified three aspects that differentiate single-site projects from distributed or virtual projects: (1) distributed projects lack face-to-face communication and

have reduced communication frequency, (2) cultural differences among different sites may create communication and coordination problems, and (3) advanced information technology and infrastructure are needed to support remote communication and cooperation.

Generally, Chen et al. (2003) state that “distributed projects impose higher demands for more effective PM” (p. 1306). To accomplish these higher demands, they introduced a collaborative PM approach, which is discussed in more detail in the following section.

2.2.2.3 A Collaborative PM Approach

By introducing a collaborative PM approach, Chen et al. (2003) grouped major PM functions in five groups, in order to accomplish a variety of management functions. Those five components or types of support are “(1) basic project support, (2) network view of PM effort, (3) explicit communication and knowledge representation, (4) project process, and (5) project meetings” (Chen, et al., 2003, p. 1306). In the following section these grouped PM functions are discussed in more detail, based on the definitions provided by Chen et al. (2003).

Basic project support is defined as “essential for managing all types of projects and includes activities such as scheduling, task analysis, resource, time and budget management, simple status tracking, and reporting” (Chen, et al., 2003, p. 1306).

Network view of PM effort addresses the changed role of project managers and members in distributed or virtual projects (Chen, et al., 2003). According to Whittaker (2000) virtual project management takes a flattened network view of a project. “Project members share project information, decision-making power, and responsibility for project processes and outcomes” (Chen, et al., 2003, p. 1306). Furthermore, Chen et al. (2003) emphasize the fact that information flow in all directions is very important in a network view of PM.

Explicit communication and knowledge representation “may not be necessary for simple, co-located project[s], but it is critical for complex, and/or distributed project success” (Chen, et al., 2003, p. 1307). Furthermore, knowledge needs to be captured and stored permanently for easy and fast retrieval. Chen et al. (2003) formulated four components that may help virtual project members to gain a better shared-understanding of the project context. (1) A project dictionary “where key terms, concepts, jargon, and methodology are defined and clarified” (p. 1307), (2) business roles and policies, “which allow project members to follow agreed upon standards for project activities and document these activities for later retrieval and use” (p. 1307), (3) project context information, to share “project background, boundary, objectives, and available

resources" (p. 1307) with all project members, and (4) complete capture of "all other project related information" (p. 1307).

Project process often plays a minor role for project members and managers, with the result that little information is documented about the work process of a project (Turner, 2000). "If people only manage project inputs and outputs, the process remains a black box and project members don't know something has gone wrong until it may be too late" (Chen, et al., 2003, p. 1307). Furthermore, Chen et al. (2003) illustrated that collaborative PM must focus on project process tracking in order to increase the process visibility and thereby increase the probability of project success.

Last, but not least, *Project meeting support* addresses the fact that meetings are one of the most important aspects of PM. Holpp (1999) state that "no skill is more critical to the overall success of a team than the ability of its members to conduct focused, effective meetings" (as cited in Chen, et al., 2003, p. 1308). Furthermore, Chen et al. (2003) support this position and define that a "collaboration PM approach should have a very effective distributed meeting mechanism in place" (Chen, et al., 2003, p. 1308).

Based on the main differences between traditional and virtual projects (see van Fenema & Kumar, 2000), this collaborative PM approach by Chen et al. (2003) illustrates a big step towards complex and integrated virtual project management. However, until now the term "virtual" was used in the context of common sense regarding projects and project management, but it is important to clearly define virtuality and how it influenced and changed the view of projects and teams.

2.2.2.4 Virtuality, Virtual Projects, and Virtual Teams

Khazanchi and Zigurs (2005) defined virtuality "as the extent to which project members are dispersed on geographical and other dimensions and rely on information and communication technologies for carrying out project goals" (p. 5). Furthermore, they lay emphasis on the fact that dispersion requires, but is not limited to geography. Other dimension of dispersion might be time, organizational affiliation, culture, continuity of team membership, experience, availability, or availability and variability in technology (Khazanchi & Zigurs, 2005). In addition Katzy, Evaristo, and Zigurs (2000) argued that the greater the dispersion, the more virtual an entity is. Adams and Adams (1997) stated that the "geographical distances involved do not have to be great; individuals who work in the same industrial complex may be functioning in a virtual project if then-schedules do not allow them to meet face-to-face" (p. 37). However, they illustrated that difficulties of communication and team building increase significantly, as

distances increase (J. R. Adams & Adams, 1997). This is referable to the other dimensions of dispersion mentioned before like time, culture, and availability (see Khazanchi & Zigurs, 2005), which can be associated with distance.

Based on virtuality and the previous discussed definition of traditional projects, a virtual project can be summarized as a remote collaborative effort towards achieving a goal (Krill & Juell, 1997). A virtual team on the other side represents this collaborative effort and is thereby defined as a "group of people who interact through interdependent tasks guided by a common purpose" and work "across space, time, and organizational boundaries with links strengthened by webs of communication technologies" (Lipnack & Stamps, 2000, p. 18). This definition basically derived from the description of traditional teams by Sundstrom, DeMeuse, and Futrell (1990). They defined a team as "interdependent collections of individuals who share responsibility for specific outcomes for their organization" (Sundstrom, et al., 1990, p. 120). By adding virtuality and the underlying dependence on communication technologies, Lipnack and Stamps (2000) transformed the traditional definition of teams to the changed reality. Virtual teams offer a whole new perspective for organizations and Powell et al. (2004) even concluded that "virtual teams represent a new form of organization that offers unprecedented levels of flexibility and responsiveness and has the potential to revolutionize the workplace" (p. 20).

In all those definitions of virtuality, virtual projects, and virtual teams technology, especially communication technologies, plays an inherent role. To emphasize this fact once more, Khazanchi and Zigurs (2006) defined VPM itself as the management of any project that is geographically dispersed and relies on technology for communication and the information sharing process. Based on the work of Khazanchi and Zigurs (2005, 2006), this reliance on technology will be discussed in the following section.

2.2.2.5 Technology

The nature of virtuality, as described before, lies on the reliance on technologies, which "is also recognized as a fundamental component of virtuality" (Khazanchi & Zigurs, 2005, p. 5). Very interesting regarding this are the findings of Staples and Webster (2007). They compared traditional with virtual teams and found that "using electronic communication technologies effectively does not relate to any of the effectiveness outcomes for traditional teams; in contrast, it relates to most of the outcomes for virtual teams" (Staples & Webster, 2007, p. 89). This emphasizes how important especially communication technologies are for virtual projects. Furthermore, Powell et al. (2004) stated that "technological support for virtual teams and collaboration in distributed environments is now viable and widespread" (p. 6), which is also supported by the fact that a growing number of organizations are implementing them

(McDonough III, Kahn, & Barczak, 2001). But, the question is how to differentiate technology for virtual project management?

According to Khazanchi and Zigurs (2005) three dimensions are most relevant when talking about technology in the context of virtual projects: (1) communication, (2) process structure and (3) task support. Following these three dimensions, Khazanchi and Zigurs (Khazanchi & Zigurs, 2005) defined "technology for virtual projects as consisting of an integrated and flexible set of tools for communicating among project members, structuring process, and supporting task analysis and performance" (p. 6). This definition could also be seen as an aggregation on the technology level of the collaborative PM approach (see Chen, et al., 2003). Table 3 summarizes examples of the three dimensions of technology, developed by Khazanchi and Zigurs (2005).

Dimension	Example Elements
Communication	• Simultaneous input • Anonymous input • Input feedback • Group display • Physical configuration of communication channels (e.g., synchronous or asynchronous, proximate or dispersed)
Process Structure	• Agenda setting • Agenda enforcement • Facilitation • Complete record of group interaction
Task Analysis and Performance	• Information gathering • Information aggregation • Information evaluation • Information structuring (e.g., allocation, stakeholder analysis, multi-attribute utility analysis, cross-impact analysis) • Project task analysis and tracking (e.g., Gantt chart, PERT/CPM, Work Breakdown Structure, Resource Assignment)

Table 3. Examples of Each Dimension of Technology, adapted from Khazanchi and Zigurs (2005)

Even though the definitions of virtual projects and virtual project management state that a project is virtual if (1) team members or projects are dispersed and (2) forced to rely on technologies to mediate communication, the dimensions of technology described by Khazanchi and Zigurs (2005) further confine this notion of what is seen as technology for virtual projects.

Chen et al. (2003) for example found that “there is no existent well-acknowledged definition for a PM system” (p. 1308). Furthermore, their literature review and web search indicated that “any software that helps with the PM effort can be classified as PM software” (Chen, et al., 2003, p. 1308). This overly broad understanding is problematic, because spreadsheet and word processing, for example, are used by small businesses to conduct PM, but cannot be classified as a PM system at all (Chen, et al., 2003). The same conclusion could be found with e-mail and other electronic communication forms, because these technologies support the communication part of the technology requirements, but not the project management part. However, these findings lead to the conclusion that there is not one technology or software available to fulfill virtual project management as a whole. On the contrary, a set of different technologies and software has to be utilized to successfully engage virtual projects (see Table 1 for some requirements proposed by Khazanchi & Zigurs, 2005).

Basically, virtual teams are using synchronous and asynchronous technologies like e-mail, audio/video/data conferencing, automated workflow, e-voting, and collaborative writing tools (Coleman, 1997). However, Hietikko and Rajaniemi (2000) found that even with the latest innovations of web-based communication and knowledge technologies, e-mail remains the most popular tool for communicating within projects. Khazanchi and Zigurs (2005) found the same pattern of relatively low use of distributed project management tools and stated that “there was generally low use for all of the technologies that we would categorize as providing support for process structure or information processing” (Khazanchi & Zigurs, 2005, p. 68). On the contrary, all the examined teams relied heavily on e-mail and voice media (Khazanchi & Zigurs, 2005). Furthermore, Chen et al. (2003) found that web-based communication technologies offer virtual project members an easy way to access project information and enhance the quality of interaction. This trend is also supported by some newer technologies like wikis, weblogs, and social media platforms, which are gaining more and more acknowledgment in today’s virtual project environments (Brown, Huettner, & James-Tanny, 2006). Very interesting in this context is the introduction of the experience exchange model by Petter and Vaishnavi (2008) to share, apply, and subsequently reuse knowledge in projects using collaborative technologies like wikis. “The Experience Exchange model suggests how knowledge seekers and contributors can create a community around personal war stories” and defines “storytelling via narratives as an effective method to share experiences (i.e., knowledge) with others” (Petter & Vaishnavi, 2008,

p. 1800). Overall, Zigurs, Evaristo, and Katzy (2001) concluded that “the technology needs to create and support a social space in which coordination and task activities can occur – a ‘where’ for the virtual project that gives members a sense of place, even in the midst of the dynamic and volatile environment that characterizes virtual projects” (p. 19).

Amongst those addressed new technologies are virtual worlds, which got a lot of attention in the last couple of years. There has been some research on virtual teams and virtual worlds, but basically this area is new ground in terms of virtual (world) project management, which makes it even more interesting for further investigations.

2.2.3 Virtual Worlds

This section takes a closer look on virtual worlds as a proposed technology for virtual projects. As a first step an overview of the history and evolution of virtual environments is given, followed by the definition and distinction of virtual worlds and metaverses. Finally, Second Life, one of the more popular virtual worlds, is discussed in more detail.

2.2.3.1 A Historical Review

Virtual environments (VEs), also called virtual reality, first caught a great deal of attention by public and researchers during the 1990s (Biocca & Levy, 1995). But much more interesting is the fact that “the seminal ideas and even technical prototypes extend back nearly 45 years” (Blascovich, et al., 2002, p. 105). Furthermore, social psychologists have been creating virtual, or synthetic, environments for decades using hard scenery, props, and real people (Blascovich, et al., 2002). Nowadays we always combine the word virtual with software or computer hardware, but from the psychological point of view a VE is generally defined as ”synthetic sensory information that leads to perceptions of environments and their contents as if they were not synthetic” (Blascovich, et al., 2002, p. 105). Zimbardo (1973), for example, got a lot of attention with his prison-guard study. He created “a synthetic environment that was so compelling as to cause Stanford students randomly assigned to the role of prison guard to abuse fellow students assigned to the role of prisoners” (Blascovich, et al., 2002, p. 106). The impact of this VE was so great that Zimbardo (1973) had to end the study right before its planned duration.

Today, however, the continuing developments in information and communication technologies made it possible to create three-dimensional (3-D) virtual realities, using high-resolution graphics and sophisticated software. The term virtual reality (VR) was coined in 1989 by Jaron Lanier, chief executive officer of VPL Research, Inc., to bring all of the virtual projects under a single rubric (M. W. Krueger, 1991). “The term therefore typically refers to three-dimensional

realities implemented with stereo viewing goggles and reality gloves" (Steuer, 1992, p. 75). The first definitions of VR were particularly defined to a special technology based on particular hardware (Steuer, 1992). This is also apparent in the following definition, provided by Greenbaum (1992).

> *"Virtual Reality is an alternate world filled with computer-generated images that respond to human movements. These simulated environments are usually visited with the aid of an expensive data suit which features stereo-phonic video goggles and fiber-optic data gloves" (Greenbaum, 1992, p. 58).*

"The key to defining virtual reality in terms of human experience rather than technological hardware is the concept of presence" (Steuer, 1992, p. 75). Gibson (1979) defined presence as "the sense of being in an environment" (as cited in Steuer, 1992, p. 75). In a consistent further development, the construct of presence was transformed to telepresence, which is defined "as the experience of presence in an environment by means of a communication medium" (Steuer, 1992, p. 76). By using this concept it was possible to formulate VR without referring to a particular hardware, namely: "A virtual reality is defined as a real or simulated environment in which a perceiver experiences telepresence" (Steuer, 1992, p. 76).

2.2.3.2 Definition of Virtual Worlds, Metaverses and Avatars

According to Schoberth and Schrott (2001) many researchers pointed out the difficulties to define the term "virtual world", because of "the multidisciplinary attitudes needed to approach the subject and considering the variety of languages used to this purpose by academic and unacademic authors" (Tampieri, 2009, p. 409). However, Tampieri (2009) stated that "the threshold to cross from the informatics and technology to business and network dynamics, defining the virtual world as an environment in which the participants, represented by avatars, coordinate their business actions with an unknown speediness and overcoming the normal space and time limits" (Tampieri, 2009, p. 409). Table 4 shows a collection of three other relevant definitions of virtual worlds.

Author(s)	Definition
MacInnes and Hu (2005)	A virtual world is a persistent synthetic environment where people communicate with each other using a virtual person, an avatar.
Jackson (2007)	A virtual world is a technical platform; computer-generated worlds where people participate using avatars, an outgrowth of online gaming, evolving into rich ecosystems of online communities

Author(s)	Definition
Thomas and Brown (2007)	Virtual worlds are persistent, avatar-based social spaces that provide players or participants with the ability to engage in long-term, joint coordinated action

Table 4. Some Relevant Definitions of Virtual Worlds, adapted from Tampieri (2009)

These definitions have several things in common, which are also mentioned by Ives and Junglas (2008). (1) “Virtual worlds are computer-simulated, usually 3-D, representations” (p. 152). (2) A virtual world has to be persistent, which means a 24/7 availability, even “in the absence of any visiting avatar” (p. 152). (3) People are participating using so-called avatars. Thereby, an avatar is defined as “a graphic identity that a virtual world user chooses to represent him- of herself in this environment” (p. 152). (4) Virtual world users use their avatars to “interconnect and communicate in relatively life-like environments” (p. 152).

According to Bainbridge (2007), metaverses are based on the existing definitions and generalizations of VWs. Thereby metaverses can be defined as “immersive three-dimensional virtual worlds (VWs) in which people interact as avatars with each other and with software agents, using the metaphor of the real world but without its physical limitations” (A. Davis, Murphy, Owens, Khazanchi, & Zigurs, 2009, p. 91). VW could thereby be seen as instantiations of metaverses, which have grown into environments that are capable of supporting effective interaction (Schroeder, Heldal, & Tromp, 2006; Sempsey & Johnston, 2000). Furthermore, A. Davis et al. (2009) stated that “metaverses provide virtual team members with new ways of managing and overcoming geographic and other barriers to collaboration” (p. 91). Kahai, Caroll, and Jestice (2007) also came to the conclusion that “virtual worlds offer a rich range of features and new possibilities for virtual team collaboration” (Kahai, et al., 2007, p. 66).

Focusing on this range of features of virtual worlds, mentioned by Kahai et al. (2007), the following section describes a new introduced model to identify and measure technology capabilities of metaverses.

2.2.3.3 Metaverse Technology Capabilities

As part of the development of a research model, A. Davis et al. (2009) introduced technology capabilities of metaverses to evaluate what is possible in VWs from the perspective of technology infrastructure. They basically define metaverse technology as “a set of capabilities for communication, rendering, interaction, and team process” (A. Davis, et al., 2009, p. 95). The basic idea of technology capabilities as a way to identify potential features is not new and

consistent with prior research on groupware and collaboration technologies (see Carte & Chidambaram, 2004; A. Davis, et al., 2009).

To establish the concept of metaverse technology as a set of capabilities, A. Davis et al. (2009) basically provided three reasons. (1) Technology plays a key role in virtual teams, (2) technology capabilities enable the interaction of people and technology, and (3) currently existing technology capabilities do not yet account for the unique characteristics of metaverses (A. Davis, et al., 2009, p. 95). Furthermore, the capability approach allows to take “a more flexible view that has potential to incorporate new features as technology evolves” (A. Davis, et al., 2009, p. 95). Based on the previous cited definition of metaverse technology by A. Davis et al. (2009) the four basic capabilities are covered below in more detail.

Communication capabilities are “fundamental for metaverse technologies, as they are for any environment that needs to support collaboration” (A. Davis, et al., 2009, p. 96). A. Davis et al. (2009) defined five particular capabilities related to communication: (1) feedback, (2) multiplicity of cues and channels, (3) language variety, (4) channel expansion, and (5) communication support. While feedback, multiplicity of cues and channels, and language variety have been a long-standing tenet of media richness theory (Daft & Lengel, 1986), channel expansion “incorporates factors to show how seemingly fixed characteristics of media can be perceived differently by different people or by the same person over time” (A. Davis, et al., 2009, p. 96). The last capability, the concept of communication support is based on task-technology fit theory (Dennis, Wixom, & Vandenberg, 2001; Zigurs & Buckland, 1998) and is thereby defined as “any aspect of a technology that supports, enhances, or defines the capability for a group to communicate” (A. Davis, et al., 2009, p. 96).

Rendering capability “is the process of creating or executing life-like images on the screen and it is supported by the capabilities of personalization and vividness” (A. Davis, et al., 2009, p. 96). Thereby, Daft and Lengel (1986) defined personalization as the extent to which a technology allows for a personal focus among people. Davis et al. (2009) defined this more practically by saying that “people control the rendering of their avatars and can personalize avatar appearance; they can also have a personal focus through direct contact with other avatars” (p. 96). In this context, vividness stands for the richness of a mediated environment in terms of formal features (see Steuer, 1992).

Interaction in metaverses “is supported by the capabilities of interactivity, mobility, and immediacy of artifacts” (A. Davis, et al., 2009, p. 96). Based on Steuer (1992) interactivity is defined as “the extent to which users can participate in modifying the form and content of

mediated environment in real time" (A. Davis, et al., 2009, p. 96). Mobility is defined as "the extent to which avatars are able to move around in a quick and efficient way" (A. Davis, et al., 2009, p. 96). Finally, Davis et al. (2009) defined immediacy of artifacts as "the real-time ability of users (represented by avatars) to individually and/or collaboratively create and use in-world artifacts such as text, images, and three-dimensional models" (p. 99).

Last, but not least, *team process* consists of capabilities for process structure, information processing, and appropriate support (Dennis, et al., 2001; Zigurs & Buckland, 1998). Thereby it is important to mention that "current metaverse technologies do not directly offer these capabilities, but they can be provided through custom objects and tools that can be built via scripting" (A. Davis, et al., 2009, p. 99).

Davis et al. (2009) finally concluded that virtual teams are continuing to face challenges with communication, interaction, and technology limitation, but "the specific capabilities of metaverse technologies offer ways to address these challenges" (p. 111). Furthermore, their study showed that "metaverses present a new environment for organizational roles, behaviors, and expectations" (A. Davis, et al., 2009, p. 111).

So far, virtual worlds as an instantiation of metaverses have been historically worked up, described and a metaverse technology capability approach was presented. As a last step, the following section is focusing on one of the more popular VWs in more detail to give a more practical insight into VWs.

2.2.3.4 Second Life

There are a lot of different VWs available at the moment. Amongst others, the most known are Second Life (SL), There, IMVU, Kaneva, Gaia, Active Worlds, and Habbo Hotel (Ives & Junglas, 2008; Kish, 2007). Also several open source initiatives are on their way "to free virtual worlds from proprietary oversight and, perhaps, to allow cross-platform interoperability" (Ives & Junglas, 2008, p. 153). However, this section is focusing on one of the most popular virtual worlds, namely Second Life.

Philip Rosedale started working on the concept of Linden World, which was the initial name of SL, back in 1991. Twelve years later on June 23, 2003, Linden Labs, the company founded by Philip Rosedale in 1999, introduced SL to the broad public (Rymaszewski, et al., 2007). Rymaszewski et al. (2007) describe SL as "a 3D online digital world imagined, created, and owned by its residents" (p. 4). SL is nowadays the most diffused virtual world and uses a very specialized language (J. B. Thomas & Peters, 2007). A so-called resident, as mentioned in the

definition above, is a registered SL user with an active account, who is represented by an avatar. Residents have the opportunity to “design their own clothing, hair color, dresses and even appearances“ (Saeed, et al., 2009, p. 2965). Furthermore, avatars can walk, run, fly or even teleport themselves throughout the mainland and all the islands developed by the users (Ives & Junglas, 2008). “Many islands, however, are private with access restricted to those who have been pre-authorized“ (Ives & Junglas, 2008, p. 152). Avatars can communicate with other avatars “using text, images, gestures or even voice“ (Saeed, et al., 2009, p. 2965). Furthermore, avatars can create things by using provided proprietary tool for land excavation, graphic design, and script production (Ives & Junglas, 2008). Saeed et al. (2009) stated that SL “provides enormous opportunities to imitate real world situations in a virtual environment“ (p. 2966). Amongst others, Saeed et al. (2009) list the reincarnation of ancient architecture and civilizations, advertising and selling of real life commodities, experiencing complex medical procedures discounting dangerous outcomes, library services, conducting classes and labs, and so on (p. 2966). Copyright issues are clearly regulated and say that the “resulting intellectual property is owned by its creator and can be sold“ (Ives & Junglas, 2008, p. 152). The money used in SL is called Linden Dollars and could be converted into real life money or vice versa. Ives and Junglas (2008) ironically compared the SL economy with the Wild West, because of the lack of regulation. To counter this situation, “Linden Labs has recently outlawed lucrative, but dodgy, enterprises, including gambling establishments and banks“ (Ives & Junglas, 2008, p. 152).

As mentioned previously, SL is currently the most popular metaverse with nearly 14 million registered residents in the beginning of 2009, though the actual in-world population at any time is closer to 50,000 (Ives & Junglas, 2008; Tampieri, 2009). Table 5 shows the continuously growth of SL since 2005 in relation to several key figures.

	Year			
	2005	**2006**	**2007**	**2008**
Total hours used by all Residents	1,968,905	7,337,424	25,646,287	31,990,070
Size of Landscape (Km^2)	-	293.65	963.66	1,429.65
Balance sheet of Linden Labs ($)	520,703,616	1,418,354,523	4,183,573,385	5,173,515,776
Linden Dollars exchanged (L$)	-	-	2,031,208,854	2,507,966,464
Number of Residents	99,623	2,267,092	11,704,934	13,830,008

Table 5. General Profile of Activities in SL, adapted from Tampieri (2009)

From the technology side of view SL is based on a server client architecture, which means that Linden Labs hosts the server infrastructure where the virtual environment is rendered and all the user-generated objects are stored. Currently over 20,000 CPUs (Central Processing Units) are running in three data centers across the United States. This means compared to the actual in-world population at any time (see Ives & Junglas, 2008) that less than three residents, including the rendering of the 3-D environment, are operated per server. The actual expansion rate of the calculating capacity of the server infrastructure is five percent (Rosedale, 2008). To use SL a client is needed, which serves as a monitor and thereby displays the information it is receiving from the server. There are clients developed by Linden Labs available for Windows, Mac OS X and the most common Linux operation systems. Additionally, third party clients are available for Sun Solaris and OpenSolaris. The client server architecture of SL heavily relies on high-speed and/or broadband Internet connections. Furthermore, there are some minimal prerequisites to the hardware of the computer where the client is running to guarantee a flawless presentation of the virtual 3-D environment.

3 Research Methodology

3.1 Introduction

This section introduces the research methodology of this thesis. The literature review (see 2 Literature Review) provided the theoretical foundation for technology adoption and virtual world project management. The following section is meant to complement the theoretical review and provides basic information of the empirical methods and the research design used in the course of this thesis. Basically, a combination of research methods was used to investigate the research question, “How and why is technology acceptance triggering the success of virtual project management, and what are possible business uses of virtual worlds in this context?”

First, an introduction into information systems and qualitative research is covered, followed by a description of the two main methods used to accomplish the research question: (1) a focus group, and (2) several interviews with experts in the field of technology adoption and virtual teams and/or virtual worlds. At the end of this section the research design is present to show how the several methods work together and, of course, to provide a structured and logical integrated research approach.

3.2 Methods in Information Systems Research

In her dissertation, Lu (2007) stated that “applied information systems (IS) has gradually evolved from its origins in technology towards dimensions that are organisational and social” (p. 11). Furthermore, based on the findings of Kaplan and Duchon (1988), “the development of the IS research paradigm has resulted in a broader range of research methods and an increased use of qualitative research” (Lu, 2007, p. 11). This is also in line with the recommendation of Galliers and Land (1987) that “research methods must take account of the nature of the subject matter and the complexity of the real world” (p. 901). Lu (2007) concluded that the “use of qualitative techniques in IS research is widely accepted today and seen as enhancing the effectiveness of IS implementation in organisations, as well as enabling effective assessment of the impact IS has on individuals or organizations” (p. 11).

Qualitative research methods were developed to study social and cultural phenomena in the field of social sciences (Lu, 2007). Since the 1980s, a broader shift from quantitative to qualitative research methods occurred, which also underlines the increased use of qualitative methods in IS research (T. W. Lee, 1999; Litosseliti, 2003). Barbour (2008) stated that

"qualitative research answers very different questions from those addressed by quantitative research" (p. 11). Thereby, she argues that qualitative methods cannot answer questions like "How many?", "What are the causes?", or "What is the strength of the relationship between variables?" (Barbour, 2008). "It can, however, provide an understanding of how official figures are created through social processes" (Barbour, 2008, p. 11). Furthermore, these qualitative techniques provide "additional insight and understanding for IS research, especially in the case of complex phenomena" (Lu, 2007, p. 17).

Qualitative research techniques include documentary and visual sources, observational fieldwork, interviews, focus groups, diaries, enhanced case records, case study research, critical incident techniques, and action research (Barbour, 2008). Two of these techniques were utilized in this thesis: focus groups and interviews. In addition, in order to assess the technology adoption aspects of the research question, a mix of qualitative and quantitative methods was chosen. Barbour (2008) states that a mix of methods is often used "to compensate for the perceived shortcomings of stand-alone methods, with the aim of either providing a more complete picture or enhancing coverage" (Barbour, 2008, p. 151). In this case, a survey was used to measure user intention because of the well-established toolset of technology adoption research with predefined quantitative measurement tools.

3.3 Focus Group

Litoselliti (2003) describes focus groups as "small structured groups with selected participants, normally led by a moderator" (p. 1). Furthermore, they are set up to explore specific topics and individuals' or group experiences, through interaction between the participants (Litosseliti, 2003). Krueger (1994) defines a focus group as "a carefully planned discussion designed to obtain perceptions on a defined area of interest in a permissive, non-threatening environment" (p. 6), extended by the fact that "participants share and respond to comments, ideas and perceptions" (Litosseliti, 2003, p. 1).

The setting of a focus group was chosen primarily to have a representative group of people getting introduced to virtual worlds, especially Second Life, and to encourage a discussion about possible business uses. Furthermore, the opportunity to have a group of business representatives, who have no experience with Second Life, provided a perfect setting for an investigation in technology acceptance. The focus group took place at a computer lab of the Peter Kiewit Institute at the University of Nebraska at Omaha on Friday May 29th, 2009, from 1200 to 1300 hours. A box lunch and beverages were provided to create a pleasant and non-threatening environment, and following the suggestion of Osborn (1963) that some of his best

sessions “have been sandwich-luncheons in the office” (p. 157). A personal computer (PC) was provided for all participants with a pre installed and already running Second Life client.

3.3.1 Participants

Focus groups typically have a size of six to ten participants, but can range from so-called mini focus groups with as few as four participants to as many as twelve, depending on the research purpose (Goss & Leinbach, 1996; Kitzinger, 1995; Litosseliti, 2003). In this situation, a larger group with the maximum proposed size of twelve participants was chosen. Even though larger groups are difficult to manage and moderate, they “can be useful for brainstorming” (Litosseliti, 2003, p. 6), which was the main reason to set up a focus group for this project.

Eleven of the twelve participants were from Omaha based businesses, and the twelfth participant was a current PhD student at the University of Nebraska at Omaha (UNO). The idea was to get a heterogeneous group representing a mixture of different businesses along with one representative from the research area. Among the eleven participants were representatives from local banks, insurance companies, the public sector, health care, and software development firms. All of the companies are members of the Applied Information Management Institute (AIM Institute), a “not-for-profit membership organization that provides information technology leadership to Nebraska and the surrounding regions” (AIM Institute, 2009). The AIM Institute is working closely with the College of Information Science and Technology (CIS&T) at UNO to inform and increase the awareness of virtual world capabilities. Figure 7 shows the demographics of the focus group, providing information about gender, age, and work experience of the participating business representatives.

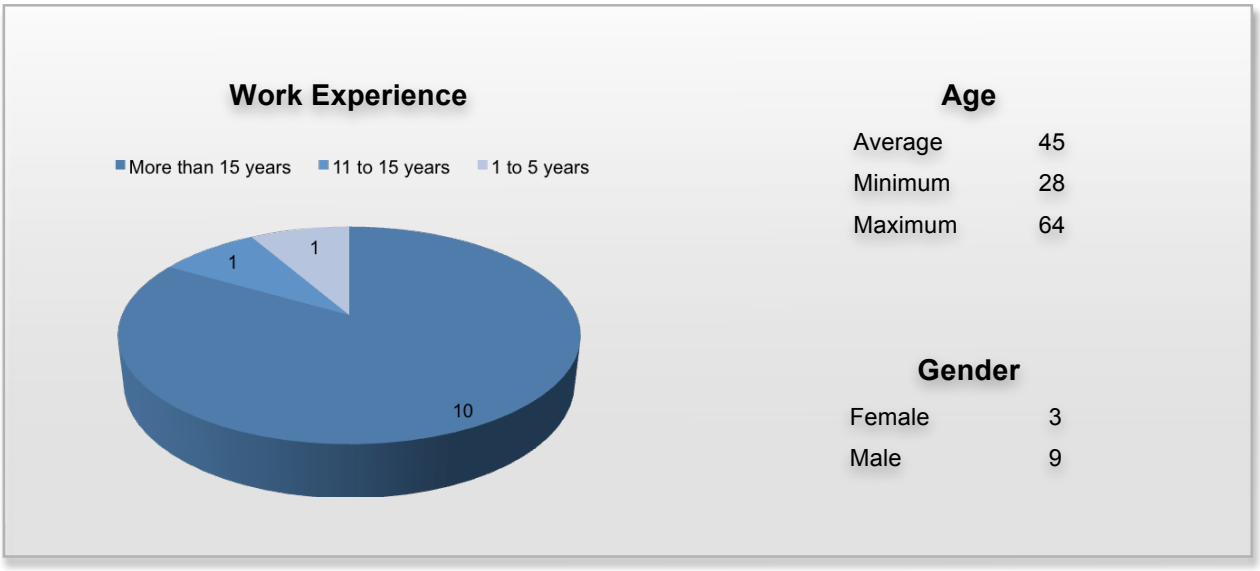

Figure 7. A Demographic Overview of the Second Life Focus Group

None of the participants had any previous experience with SL, nor was any information on SL provided before the focus group started. This fact is very important, because it gives the results even more validity. The focus group session consisted of three parts. First, an in-world introduction of SL was provided to familiarize the participants with the metaverse. Secondly, a UTAUT based survey about technology adoption (see Venkatesh, et al., 2003) was conducted. Third and last was a brainstorming session about possible business uses of virtual worlds.

3.3.2 Introduction of Second Life

After the welcoming words and an introduction by Ilze Zigurs (Department Chair, Information Systems and Quantitative Analysis in CIST&T at UNO) and Deepak Khazanchi (Associate Dean for Academic Affairs in CIS&T at UNO), the densely packed program began.

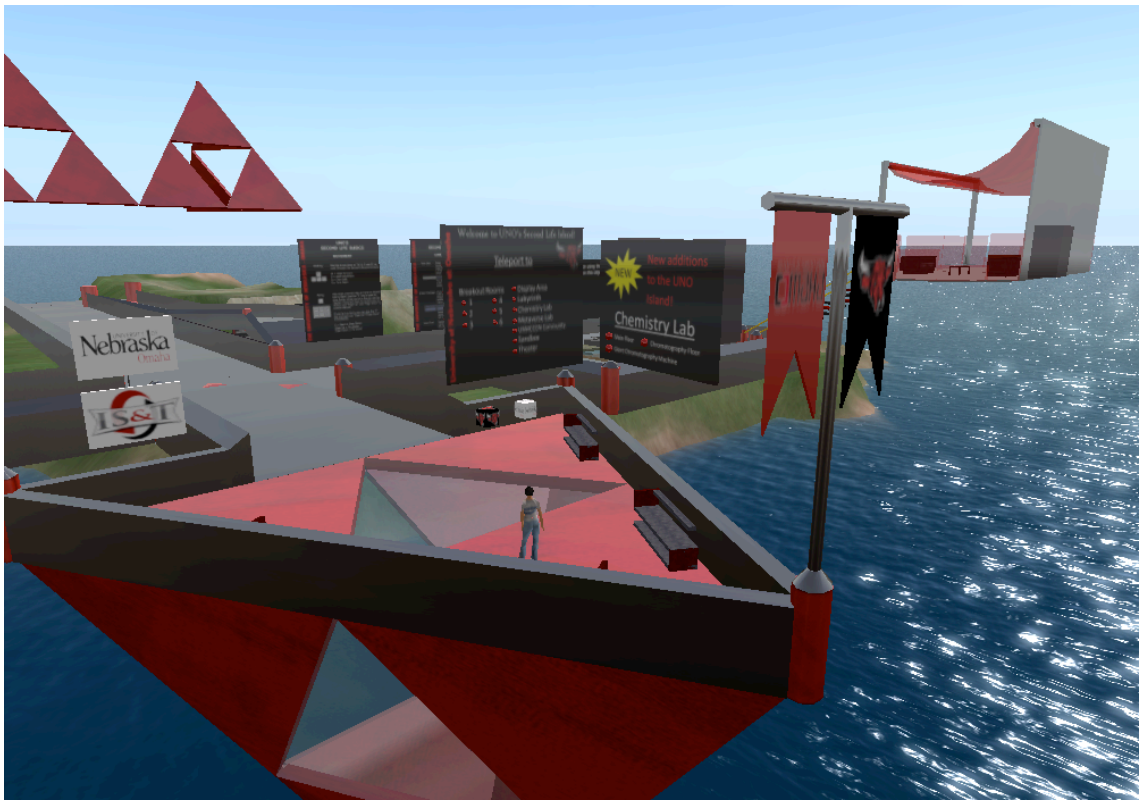

Figure 8. CIS&T Second Life Welcoming Area

The SL session was scheduled for 20 to 25 minutes and took place at the CIS&T island in SL. Avatars were prepared and ready to go for every participant located at the welcoming area of the island (see Figure 8). The introduction was designed to give inexperienced participants a quick and basic overview of SL and how to control and use the virtual world, as well as provide insight into projects currently underway in the College of IS&T. The introduction covered all basic control functions of SL and the client itself, including motion controls like walking, running,

flying, and teleportation, search functionalities, basic orientation functions like maps and the mini map, and the basic elements in SL like objects and how to handle them. Furthermore, the basic elements of data visualization in SL were covered in this first part, to show how information like text, images and data can be displayed. Some time was also provided for participants to have their own first experiences, especially to walk around the welcoming area on their own and get to know the controls and become more familiar with them.

After these first in-world experiences, the next part was a showcase of one of the current projects on the CIS&T island, namely the chemistry lab. The chemistry lab provides a virtual environment for students to experience the microcosm of atoms in the macrocosm. The so-called collider, one of several objects in the chemistry lab, allows students to create atoms and see how they combine to form molecules. For example, if one generates two hydrogen atoms and one oxygen atom, the collider automatically builds H_2O, therefore a water molecule (see Figure 9). This scenario was chosen to show the participants how to use virtual worlds to make things visible that are not possible in the real world. The participants had several minutes to try the collider themselves and take a look around other interesting things in the chemistry lab.

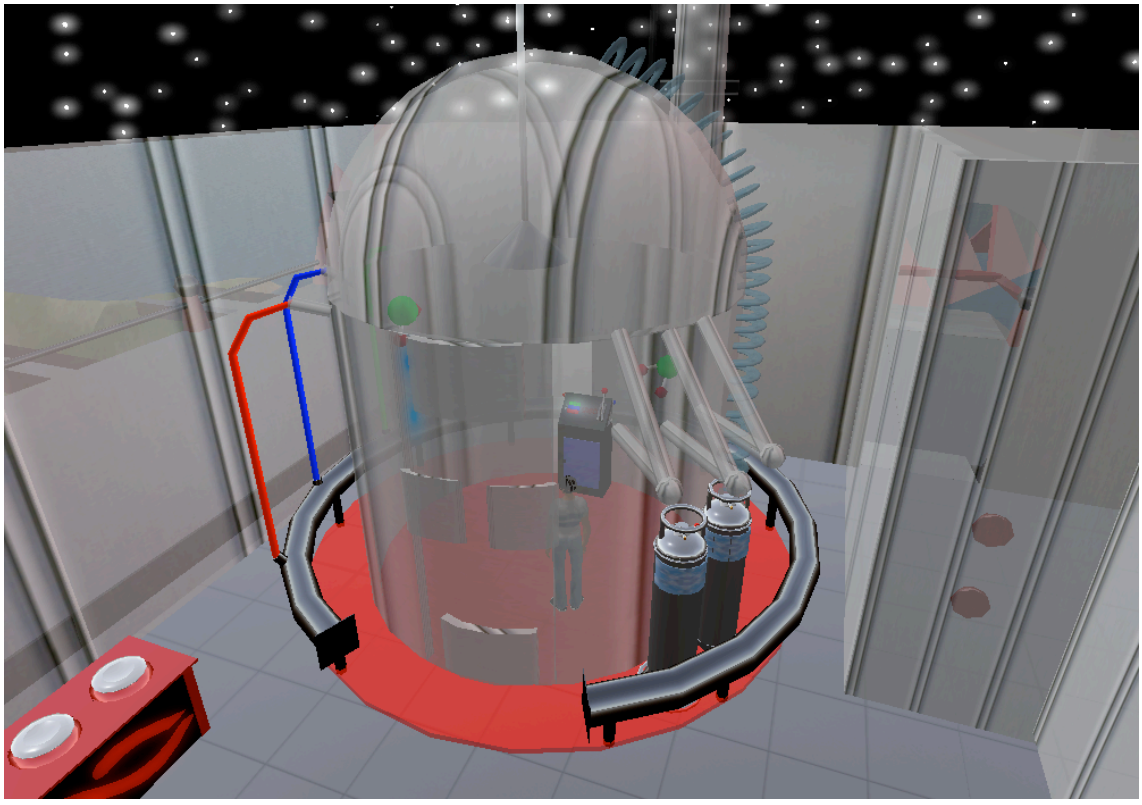

Figure 9. The Collider As a Tool in the UNO Chemistry Lab

Subsequent to this showcase of the chemistry lab, the interaction and collaboration features of SL became the center of attention. To give the participants an overview of the communication

capabilities of SL, the situation of a virtual meeting was simulated. The whole group of participating avatars teleported themselves to one of several meeting areas on the CIS&T island (see Figure 10). In this virtual meeting room, participants were encouraged to use the text-based chat function and communicate with each other about their first experiences with SL. After this short discussion, some additional features of SL were presented, including the use of slideshows in a meeting room, the voice chat functions, and the capability for logging all the communication for documentation purposes.

Figure 10. Virtual Meeting Room on the CIS&T Island

After this 25 minute session in SL, the participants were called on to complete a short survey. The link to this online survey was placed in SL and could be easily accessed by clicking on the object in the middle of the meeting room.

3.3.3 Survey Based on UTAUT

As mentioned before, in addition to the qualitative methods, a survey based on UTAUT (see Venkatesh, et al., 2003) was conducted right after the SL session to evaluate the technology adoption of SL. This special setting of giving inexperienced participants a brief introduction and the possibility to interact with the investigated system followed by a survey is very common in technology adoption research. When Davis (1989) introduced TAM he justified his second study, where he tested the previously developed TAM on two systems, with the fact that “users

are typically given a brief hands-on demonstration involving less than an hour of actually interacting with the candidate system" (p. 330). Furthermore, afterwards the participants are asked to rate the future usefulness and ease of use they "would expect based on relatively little experience with the systems being rated" (F. D. Davis, 1989, p. 330). Of course, the literature review has already shown that perceived usefulness and ease of use are not the only variables affecting attitude and intention towards using a system. That is the reason why a survey based on UTAUT (see Venkatesh, et al., 2003) was chosen.

Because of the pretty tight schedule of the participants and the consequent limited time for the focus group, a modified and shorter version of the suggested UTAUT survey was used. The survey contained the parts of performance expectancy, effort expectancy, attitude toward using SL, anxiety, and behavioral intention to use SL. In the end the survey consisted of 19 questions, instead of the 31 questions in the original version, which reduced the estimated time of completion down to 5 minutes. The complete survey can be found in Appendix A.

In terms of the virtual aspect of the whole focus group and to show how SL could be combined and interact with the Internet, the survey was delivered in an online format. To be exact, LimeSurvey (http://www.limesurvey.org), a very common and open source online survey tool, was utilized. Another advantage of using an online-based survey tool was the automatically generated raw analysis of the data, which saved a lot of time.

3.3.4 Brainstorming Session

As the last part of the focus group, a brainstorming session was held to gain information about future business uses of virtual worlds, based on the limited in-world experience of the participants made during the SL introduction. Brainstorming was originally invented by Alex Osborn in the late 1930's. Webster's International Dictionary defines brainstorming as "a conference technique by which a group attempts to find a solution for a specific problem by amassing all the ideas spontaneously by its members" (as cited in Osborn, 1963, p. 157). Thereby brainstorming is a useful tool for groups to develop ideas and create a creative environment that supports collaboration. Osborn (1963) suggests a group size between 6 and 12 participants for successful brainstorming sessions, which goes along with the previously mentioned ideal size of focus groups. The session itself was accomplished in two steps. First, everybody had enough time to come up with ideas and suggestions for business uses of virtual worlds. In a second step, the participants were encouraged to comment on contributions from other participants and develop some of the ideas in more detail. The goal was to enable a little online discussion to increase the quality of the outcomes.

To address the virtual aspect of this focus group, as with the survey, an online brainstorming tool was used to manage inputs of the participants and document the whole solution finding process. Therefore, ThinkTank (http://groupsystems.com/technology/thinktank), an online collaboration tool from GroupSystems, was utilized to support this virtual brainstorming session. This fact is very important, because the participants were just allowed to use the online tool for communication, which guaranteed virtual collaboration.

3.4 Qualitative Interviews

The second approach to complement the literature review was a series of five interviews with experts on the field of technology adoption and virtual world project management. Barbour (2008) states that “one-to-one interviews are perhaps the most commonly used method in the qualitative ‘toolbox’” (p. 17). Qualitative interviews use open questions, which “allow respondents to focus on the issues of greatest importance to them, rather than the agenda being determined entirely by the researcher’s interests” (Barbour, 2008, p. 17). To be exact, semi-structured interviews were used in this thesis, which according to Barbour (2008) “allow for the ordering of questions to be employed flexibly to take account of the priority accorded each topic by the interviewee” (p. 17). All five respondents have their own special areas of interest, but it was still important to ask all of them the same questions to get the full picture, even though the focus switched from interview to interview.

Due to the novelty of virtual worlds and virtual world project management, the interviews were primarily seen as a complement to the available literature. This fact is very important and, therefore, the interviews are basically handled like literature in this thesis. Furthermore, the interviews were completely independent from the results of the focus group and focused on the newest trends in the different research areas. The main goal was to bring some light into the darkness of those areas not covered by currently available literature.

To accomplish this goal, the leading researchers in each area were identified and asked to attend in a 20 to 25 minutes interview session. The interviews were held in person or via Skype telephone/video conferences. Based on the findings of Lee et al. (2003), who examined 101 papers using TAM in the leading information systems journals and conferences, one researcher was identified for the technology adoption perspective. To be exact, Fred Davis, the founder of TAM. Davis is currently employed at the Sam M. Walton College of Business at the University of Arkansas and leaded the list of Lee et al. (2003) of the most active technology adoption researchers together with Viswanath Venkatesh.

On the virtual team and virtual project management side, Ilze Zigurs and Deepak Khazanchi were asked for an interview. Due to the fact that Ilze Zigurs is one of the academic advisors of this thesis and working together with Deepak Khazanchi at UNO, a personal interview could easily be conducted. Both researchers are leading in the field of virtual teams and virtual project management and also head a research group focusing on metaverses, especially SL. In addition to those three researchers, an interview with Moez Limayem, Information Systems Department Chair of the Sam M. Walton College of Business was conducted. His research area is especially focused on virtual worlds and/or metaverses.

The analyzing process is based on a coding scheme to compare the several different interviews. Even though a systematical and well established approach is important "the researcher and not the medium of analysis that ensures that analysis is systematic and thorough" (Barbour, 2008, p. 196). Due to the fact that there just have been five interviews the comparability is some kind limited. Seale (1999) for example pointed out that "early stages of coding are therefore more appropriately called 'indexing', acting as signposts to interesting bits of data" (p. 154). Based on this assessment the term indexing is definitely more appropriate to use in this case. Furthermore, the literature suggests that one should approach the data without recourse to any preconceived theoretical framework (Barbour, 2008). Even though this is desirable, "it is simply not possible, as our approaches to qualitative research and even the questions we ask are inextricably embedded in our own disciplinary and cultural assumptions" (Barbour, 2008, p. 196). Therefore it is more important to recognize what the reference points are and to make those explicit in the analysis (Barbour, 2008).

The semi-structured questions and the transcripts of all interviews are included as Appendix C and Appendix D. The last part of this section is now dealing with the analysis process itself and describes the approach of how the different research methods were compared with each other to come to the findings described in the results and discussion part.

3.5 Integrated Research Approach

To finally compare all the findings from the literature review over the qualitative interviews and the UTAUT based survey to the results of the brainstorming session a qualitative approach was chosen. Even though the conducted survey is basically a quantitative tool and the basic analysis of the data is quantitative as well, the results are for this purpose handled like qualitative data. This means basically that some of the key findings of the survey are included in the coding and/or indexing scheme and therefore comparable with the other qualitative data. This decision was basically made due to the fact that a universe of twelve is simply too little for

a statistical analysis, but the results still contain interesting and applicable data and therefore must be utilized in the research process.

Figure 11 presents the used research design and is described in more detail afterwards.

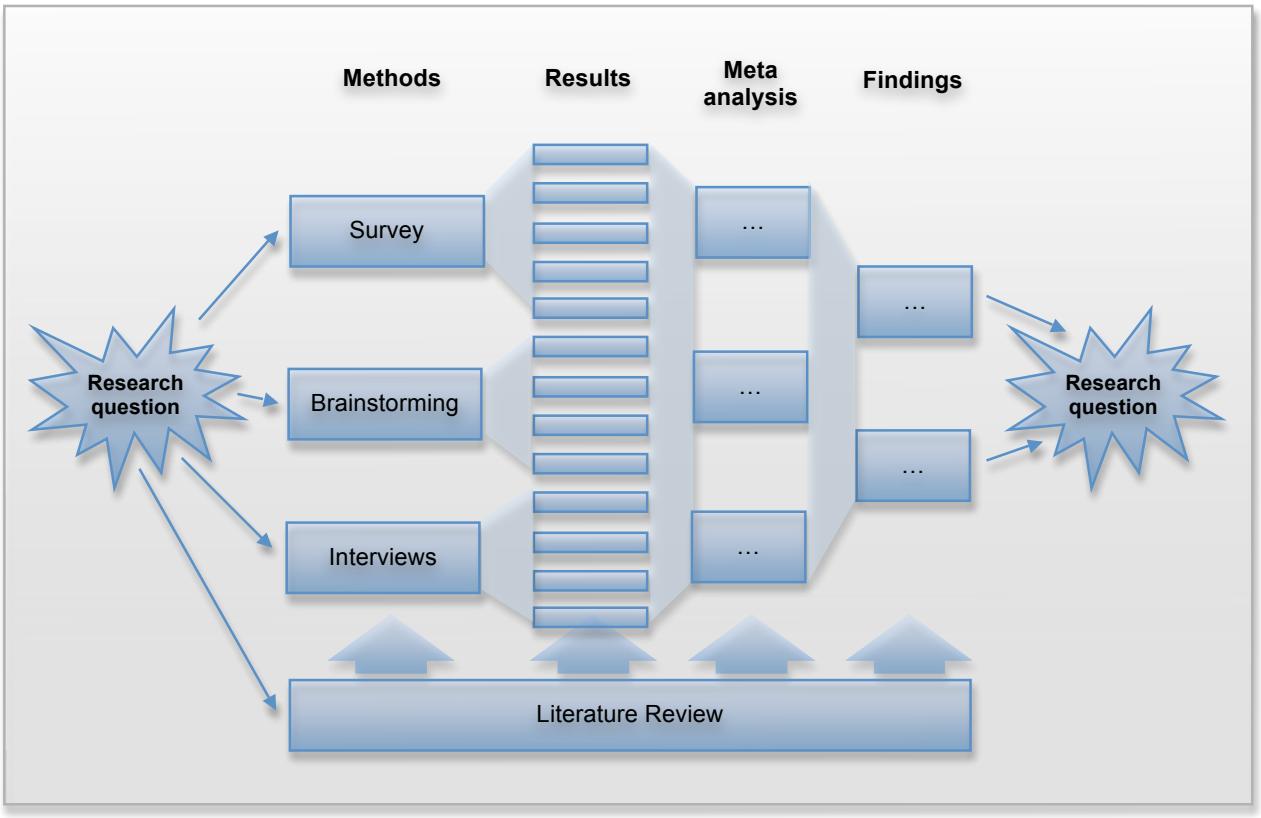

Figure 11. Research Design

Starting from the research question the first step was a thorough literature review on technology acceptance, virtual teams and (virtual) project management, and virtual worlds. In addition to this literature review three other methods were used to get further insights into these mentioned research areas (see the detailed description in this section above). Very important is the fact that the goal was to see the several methods as an addition to the theoretic foundation resulted from the literature review. Thereby the results of the empirical research methods are compared with the literature to see if they support or contradict with this foundation. To compare the results of the different methods a meta analysis was conducted to find similarities and inconsistencies. This step could basically be seen as coding and/or indexing, as already addressed in the qualitative interview section.

The final step was to take a closer look at the information and points compared during the meta analysis and based on this build the main findings. Furthermore, those findings, as the meta

analysis before, was always seen in the context of the theoretical foundation. After this structured approach the key findings were taken and lead back to the starting point, namely the research question. To get back to the main question is important to evaluate the outcomes of this research process and to conclude whether the question could have been properly answered or not.

After the basic description of the research methodology and the research design the next section now focuses on the results and discussion of those methods and how they support, or not support, the theoretical foundation identified during the literature review.

4 Results and Discussion

4.1 Introduction

The following section deals with the results of the empirical methods described above and also includes the discussion and relevance of the respective results. This combined approach was chosen to guarantee a logical workup of the results and compare the interdependency of the several qualitative and quantitative results as well as the findings of the literature review. This is consistent with the research design and guarantees a logical workup of the results and findings of the empirical methods. First, the main points of the literature research and how they support the research question are discussed, followed by the results from the qualitative and quantitative research based on the focus group and the qualitative interviews. There are some occasions where the interviewees made points that fit into the discussion of the other methods, for instance that they support or disagree with points of the technology acceptance literature. Seen from this angle some of the findings of the qualitative interviews are integrated throughout this section. Also it is important to mention that by the regulations of the Management Center Innsbruck the interviews are not listed in the reference list and thereby cannot be cited properly in APA style. To address this issue the interviewees are addressed with their full name when they first appear and with the addition “Interview”, if a longer statement is cited. The full transcripts of all interviews are attached as Appendix D. Finally the last part of this section is about the practical application of the findings and how they can be of use for organizations. This last part is based on the brainstorming session during the focus group and on the qualitative interviews and covers the subtitle of this thesis, namely the business use of virtual worlds.

4.2 The Theoretical and Research Perspective

The literature review has basically shown two main points. The first point is that virtual project management is heavily dependent on information technologies (see Khazanchi & Zigurs, 2005; Lipnack & Stamps, 2000). Second, technology acceptance plays a huge role when it comes to the actual usage of technology (see F. D. Davis, 1989; F. D. Davis, et al., 1989; Y. Lee, et al., 2003; Venkatesh, et al., 2003). Previous research has also shown that the reliance on technology significantly relates to the effectiveness of the outcomes of virtual teams as opposed to traditional teams, where technology does not relate to the outcome of projects (see Staples & Webster, 2007). This fact is very interesting and important, because it shows that to reach sophisticated outcomes of virtual project teams it is necessary to concentrate on technology adoption as a foundation. In addition to these findings, Pinsonneault and Caya (2005) found that

"despite several communication difficulties, virtual team members seem to be able to adjust their work practices and achieve a performance level (i.e., quality, perceived performance, satisfaction with outcomes) that matches that of their face-to-face counterparts" (p. 10). These findings, based on early adoption research of virtual teams by Majchrzak, Rice, Malhotra, and King (2000) and Malhotra, Majchrzak, Carman, and Lott (2001), provide some very interesting insights and also demonstrate that "dispersed team members are able to modify their technology, group, and organizatinoal structures to match their informational needs and ultimately generate outcomes that meet and even exceed previous standards of quality" (Pinsonneault & Caya, 2005, p. 10). Furthermore, these findings, as discussed above and in more detail in the literature review, basically cover the main research question of this thesis of how and why technology acceptance is triggering the success of virtual project management. Even though these findings look promising, the most current research has indicated that technology acceptance as we understand it today may not describe all the things that are going on regarding virtual world adoption (see Saeed, et al., 2009). Thereby and to get an even better and more comprehensive understanding of the problem, the following section presents the key findings regarding technology adoption from the qualitative analysis based on interviews with several leading researchers.

4.3 Leading IS Researchers' Perspectives on Technology Adoption

Technology acceptance itself is a very diverse field, which actually originated several different models and approaches to study the phenomenon. From the early beginnings with TRA to the newer developments of UTAUT and TAM 3, the literature is rich with different models and approaches. The most common model, TAM, is well studied and has reached a level of generalizability and elaboration where a lot of researchers think that technology adoption research needs a shift into new directions and new areas (see Y. Lee, et al., 2003; Venkatesh, et al., 2007). This point was also made by Moez Limayem during one of the qualitative interviews. He stated that "we really have a very good understanding, so we don't need more research with yet one more factor or one more relationship to TAM, because there are so many other interesting things to investigate". For example, Limayem mentioned investigating the continuous use of technology and the underlying physiological and cognitive phenomenon as two very promising future directions for technology adoption research. Fred Davis, the founder of TAM himself, underlined the latter and is now studying the unconscious processes that are taking place in technology use.

> *"Mostly the TAM model taps into consciously intended behavior and conscious believes and motivations. So it doesn't really directly deal that much with the unconscious cognition*

> *or intuitive processes. So I think that's one of the big directions in the future" (Fred Davis, Interview).*

Deepak Khazanchi also took the same line during his interview and stated that "more emphasis on the cognitive side and how people build mental models about technology use is an interesting path, but we haven't studied that really well". Regarding technology adoption in virtual teams and the thereby affiliated increase in complexity, Ilze Zigurs mentioned during her interview that "we need to get a little bit more complex, we need to think about groups and group use of technologies rather than individual use". This is also a very interesting direction, especially regarding the point in the literature review that discussed paradigm shift in project management towards more collaboration-based thinking (see Chen et al., 2003). Complexity is thereby seen as a more detailed view of the adoption process itself, because on the technology side this topic of complexity is also covered by the model of technology adoption by groups (Sarker, Valacich, & Sarker, 2005). This model suggests that "the complexity of a technology will negatively affect a group's attitude toward a particular technology and, thus, overall adoption or use of the technology" (A. Davis, et al., 2009, p. 96).

Due to the newness of this field of research, one part of the qualitative interviews was specially focused on future directions of technology acceptance and on the differences in technology and how they have an impact on adoption itself. The latter subject is one of the big points in technology adoption research which could hardly be found in current available literature and the respective research.

Zigurs first called attention to differences in technologies during one of the first interviews. She mentioned that this leads us to the very interesting question of "how do you characterize technologies and how do you describe the differences between one technology and another?" Due to the mutual research of Zigurs and Khazanchi, he also emphasized this fact and, furthermore, stated that "instead of focusing on specific technologies we should look at what capabilities are interesting". This capabilities view (see Khazanchi & Zigurs, 2005) is getting more and more attention and was actually used by A. Davis et al. (2009) to characterize metaverses (see 2.2.3.3 Metaverse Technology Capabilities) and has thereby been utilized in this thesis. In addition, Davis stated during his interview that "differences in technology could influence the perceptions that people have about the technology" and in the course of that "the characteristics of the technology should be captured by some extend by believes and perceptions". This is very interesting to compare to the technology capabilities approach, because it brings the concept of perception into the game, thus the underlying psychological process of how differences are perceived.

Limayem on the other hand compared traditional technologies with newer technologies like Facebook, Twitter and Second Life during his interview. He pointed out that "some technologies are similar, but some technologies, especially the new ones, are really different and it is interesting to study why people adopt to that". He then moved completely into the area of virtual worlds and made the following point.

> *"I think more traditional TAM like approaches maybe explain small parts of the variance, but not everything, because these are new technologies, they have other things and people go there not because it's easy to use or just because it's useful. They go there for different factors, social factors" (Moez Limayem, Interview).*

These differences of mainly newer technologies, as Limayem mentioned, are also represented in the literature review, which has shown that to describe the adoption of virtual worlds a more hedonic consumption oriented view must be utilized (see Holsapple & Wu, 2007; Saeed, et al., 2009; van der Heijden, 2004). This is mainly based on the large entertainment element of virtual worlds, like Second Life, and also shows the growing interdependency of IS research with, in this case, research in marketing, where hedonic consumption is originated.

In order to get first-hand data and to get further insights into the technology adoption of virtual worlds, a UTAUT based survey (see Venkatesh, et al., 2003) was conducted during the focus group (see 3.3.3 Survey Based on UTAUT). The following section presents and discusses the main findings of this survey and how they compare with the theoretical foundation and/or the qualitative interviews.

4.4 Key findings of the UTAUT Based Survey

This section presents the main results and key findings of the UTAUT based survey on technology adoption of Second Life. The entire data set for the analysis is attached as Appendix B. Table 6 shows the scale that was used for all questions in the survey.

Strongly Disagree	Disagree	Slightly Disagree	Neither Agree or Disagree	Slightly Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

Table 6. UTAUT Survey Scale

Regarding performance expectancy, participants basically agreed that Second Life would help them to attain gains in job performance, even though they tended to not expect to gain a raise just because of using Second Life. Table 7 shows the average values for the questions that relate to performance expectancy.

Statement	Average
I would find Second Life useful in my job	5.25
Using Second Life would enable me to accomplish tasks more quickly	4.5
Using Second Life would increase my productivity	4.58
If I use Second Life, I will increase my chances of getting a raise	3.75

Table 7. Summary of the Performance Expectancy Survey Results

Figure 12 highlights the interesting result of the statement that “I would find Second Life useful in my job”, with which 50 per cent agreed and another 25 per cent slightly agreed.

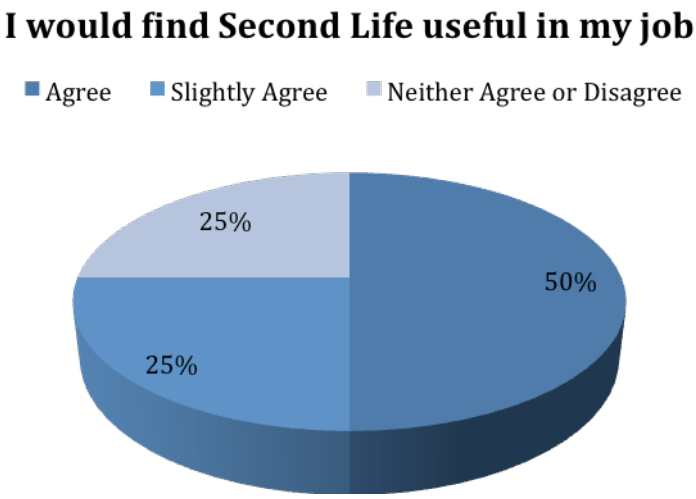

Figure 12. Detailed results of “I would find Second Life useful in my job”

The second part of the survey dealt with effort expectancy and thereby with the degree of ease associated with the use of Second Life (see Venkatesh, et al., 2003). Given the fact that all of the participants have never used Second Life and had no previous in-world experience the results shown in Table 8 are even more interesting.

Statement	Average
My interaction with Second Life would be clear and understandable	5.4
It would be easy for me to become skillful at using Second Life	6
I would find Second Life easy to use	5.75
Learning to operate Second Life is easy for me	5.8

Table 8. Summary of the Effort Expectancy Survey Results

As shown in Table 8, there was a big consensus that Second Life is easy to use. The second statement that “It would be easy for me to become skillful at using Second Life” was especially interesting with an average of 6 (Agree). This high agreement with the ease of use of Second Life supports the notion that virtual worlds are a new kind of technology, as mentioned by Limayem during his interview session. These results also support the fact that virtual worlds are more entertainment-oriented and in the course of that perceived easier to use. This new entertainment element becomes quite obvious by taking a closer look at the results of the attitude toward using part of the conducted survey (see Table 9).

Statement	Average
Using Second Life is a good idea	5.2
Second Life makes work more interesting	5.8
Working with Second Life is fun	6
I like working with Second Life	5.9

Table 9. Summary of the Attitude toward Using Survey Results

The results are above average and the high agreement with the third statement that “Working with Second Life is fun” provides especially strong support for the hedonic consumption theory and the entertainment-based nature of virtual worlds, in this case Second Life. Figure 13 underlines this even more with over 90 per cent of the participants stating that they agree and/or strongly agree with this statement.

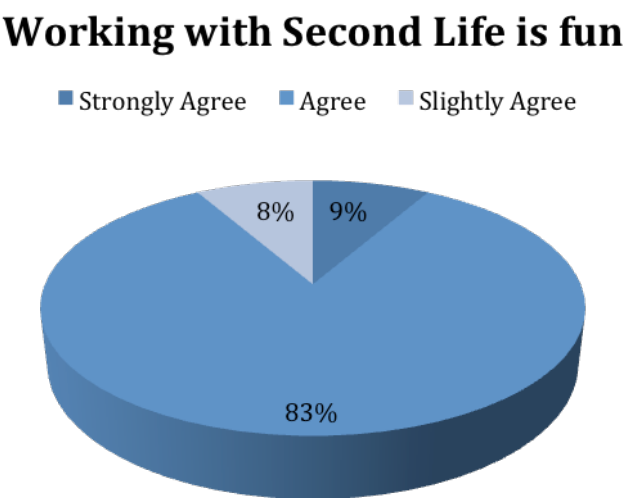

Figure 13. Detailed Results of “Working with Second Life is fun”

The fourth part of the survey was about the anxieties of the participants regarding using Second Life. Table 10 presents a summary of the results of the four statements related to anxiety.

Statement	Average
I feel apprehensive about using Second Life	3
It scares me to think that I could lose a lot of information using Second Life by hitting a wrong key	2.4
I hesitate to use Second Life for fear of making mistakes I cannot correct	2.3
Second Life is somewhat intimidating to me	2.6

Table 10. Summary of the Anxiety Survey Results

These results relate to the previous parts and show that the participants have seen Second Life as an environment where the anxieties of making mistakes are inferior opposed to the ease of use and the attitude toward using. Furthermore, this could also be related to the more natural control of a three-dimensional environment, which makes it somewhat more intuitive. Davis also made this point about the intuitive and unconscious factors and the thereby affiliated anxieties during the interview session. He even described this area as “one of the big directions in the future”, especially when it comes to virtual worlds.

The last part of the survey focused on the behavioral intention to use Second Life. Basically all of the participants stated that they would use Second Life in the next twelve months. Table 11

presents the detailed answers with an average and the maximum and minimum stated amount of months.

Statement	Average in months	Maximum	Minimum
I intend to use Second Life in the next … years	4.8	12	1
I predict I would use Second Life in the next … months	5.2	12	1
I plan to use Second Life in the next … months	5.2	12	1

Table 11. Summary of the Behavioral Intention to Use Survey Results

These results show that the intention to use Second Life in the near future appears quite positive. Reinforcing these results is the fact that four of the participants have already decided to participate with their companies in the AIM Institute's Second Life project and are now building a presence in Second Life.

Three main findings arise from the results of this survey. First, the participants agreed that Second Life would help them in their jobs and they perceived it as easy to use. Second and even more important, Second Life was perceived as "fun to use" which supports the entertainment-based nature and the advantages of a more intuitive and natural three-dimensional environment. Third and last the behavioral intention to use Second Life was clearly there. This last finding is also supported by a Gartner report that Zigurs mentioned during her interview session that stated that by 2011 nearly 80 per cent of all the businesses will use virtual worlds. Ives and Junglas (2008) are not that optimistic as Gartner, but they believe that by 2018 "there will be virtual world business applications that go well beyond the current examples" (p. 154) and will thereby attract most of the global acting organizations.

4.5 Leading IS Researchers' Perspective of Virtual Worlds

After focusing on technology adoption and especially on the question of how differences of technology have an impact on adoption, the second part of the qualitative interview sessions focused on virtual world and virtual project management issues. In order to connect to the

previous discussion about differences in technology, Zigurs mentioned in her interview that "there are several things about virtual worlds I think that are very different".

> *"First of all, I don't think people see it as a tool the way they see many applications. A software application is a tool for people; it's a tool to get jobs done. So spreadsheet is a tool for me. Word processor is a tool for me. Whereas a virtual world is an environment; it's a general environment in which I can do a variety of things" (Ilze Zigurs, Interview).*

To see virtual worlds as an environment and not as a tool is very important, especially when it comes to collaboration. Khazanchi confirmed that point and described virtual worlds as environments that "are essentially collaboration, whether social collaboration, whether social interaction, whether social networking and/or actual collaboration in projects".

Limayem addressed another implication referring to the meaning of the word environment itself. He stated that, for example, "the interface is completely different, where I think you feel the presence of others and the co-presence is so important, because you feel others right next to you without actually being right next to you". That is another very important step toward a new understanding of virtual teams and collaboration based on new technologies like virtual worlds. This phenomenon has also been discussed in the literature review and was first introduced as telepresence (see Steuer, 1992). Another very tangible term in this context is "being there", which Zigurs (2003) suggested to team leaders to consider when they choose a communication medium. Virtual worlds enable co-presence and give virtual team members the feeling of being there and having a common place together with others they can see and even touch. Davis took the same line and mentioned during his interview that "virtual worlds can be effective in overcoming barriers of time and space and culture to create more of a sense of co-presence".

After this basic definition and distinction of virtual worlds, a very interesting discussion took place in all of the interviews about the use of virtual worlds for virtual project management. Zigurs and Khazanchi had done some experiments on this issue and provided feedback about it during their interviews. Khazanchi stated that "we actually gave people a brainstorming tool and they never used it".

> *"I think that the project management tools or the brainstorming tools that are used in traditional environments are not really applicable for Second Life. I'd say the things you can do in this environment are quiet different from how we have done collaboration in the past" (Deepak Khazanchi, Interview).*

Zigurs argued that a “virtual environment for project management is more about communication and bringing the project team together in a shared space”, which also supports this previously discussed notion of being there.

> *“It might also be about teambuilding in the project and prototyping and using the virtual world capabilities to prototype an artifact. But the traditional tools that are associated with managing the project, like Microsoft Project or whatever it might be, have not been adapted for virtual worlds yet” (Ilze Zigurs, Interview).*

Davis stated that it is important to take “advantage of the natural intelligence that people have for dealing with a three-dimensional world that has special characteristics and properties”, instead of trying to push old ideas into new environments. On the other hand, Limayem concluded that virtual worlds “will include some project management specific tools like Microsoft Project ” in the future.

But this view of project management tools evolving into virtual words is just one side to look at in terms of future developments. Khazanchi encouraged looking at other ways and stated that he thinks “the future lies in taking these capabilities of virtual worlds and merging them into collaboration tools”. Limayem took the same line.

> *“So, expect also, that traditional project management tools will have some similar 3-D interfaces like virtual worlds and also will be compatible with virtual worlds. From the virtual worlds we will have more tools, but also see it from the project management tools that will also be compatible with virtual worlds” (Moez Limayem, Interview).*

Until now the question remains unsolved as to which way future developments will go, and even a completely new direction could be a possible solution. Another very apparent fact that this discussion underlined is that we are just at the beginning of studying the capabilities of virtual worlds and how users adapt to this completely new type of environment.

4.6 Business Uses of Virtual Worlds

This part closes the results and discussion section by showing possible business uses of virtual worlds. Considering the previous discussion about brainstorming tools in Second Life, the decision was made to use a traditional online-based brainstorming tool, accessed by a link from inside Second Life (see 2.2.3.4 Second Life). The following section presents the results from this brainstorming session and also compares them with the inputs from the qualitative interviews. The uncategorized raw data and the full-categorized list of the findings of the brainstorming session are attached as Appendix E.

Zigurs talked about her experiences with focus groups, demos, and experiments with virtual worlds during her interview and she made the comment that people who are introduced to virtual worlds “seem to have no shortage of ideas about business uses of virtual worlds”. This is very interesting and consistent with the experience of the focus group conducted in the course of this thesis. The participants were having their very first contact with Second Life and/or virtual worlds and there was absolutely no shortage of ideas for business uses. At the end of the brainstorming session, a total of 59 ideas had been produced, which were summarized into 6 categories by the author. Figure 14 presents the categorized results of the brainstorming session including the number of ideas in each category.

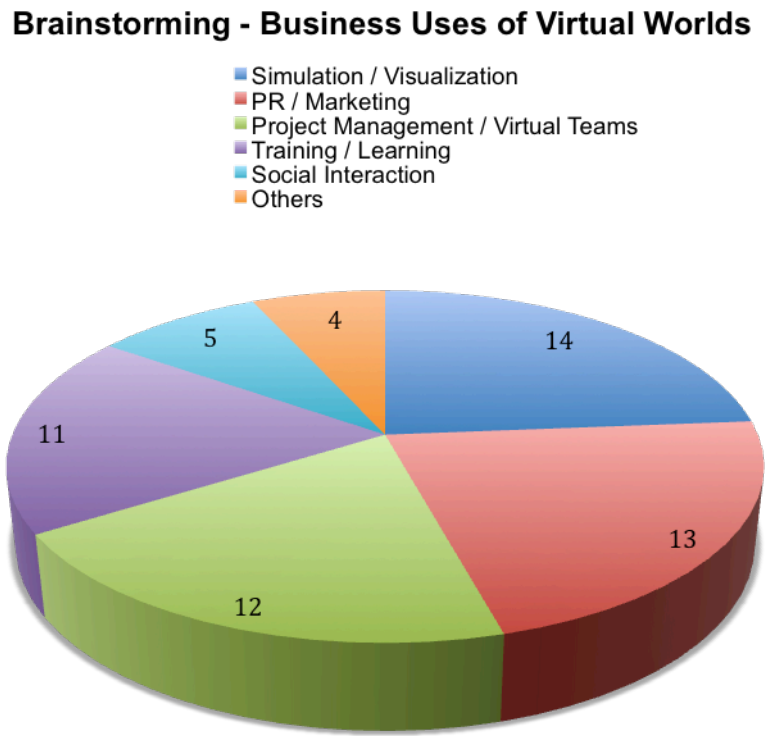

Figure 14. Results of the Brainstorming Session of Business Uses of Virtual Worlds

The greatest number of ideas (14) was in the category of simulation and visualization, including ideas like the visualization of process flow charts, architectural usage, and natural disaster simulation. The public relations and marketing category had 13 ideas, e.g., communicating with customers, conducting market research, and organizing focus groups. With twelve ideas each, project management and virtual teams were the third most mentioned category, followed by training and learning with eleven ideas. In the project management and virtual teams part, the ideas of collaboration and team-building measures were present. In terms of training and learning, ideas like equipment and software usage, data visualization, and online classes were mentioned. The category of social interaction trailed with a total of five ideas, followed by a summarized category called other with four ideas.

Table 12 presents the most discussed ideas based on the frequency with they were mentioned and on the number of comments from other participants summarized into one variable (Counts).

Ideas	Counts
Virtual Meetings	7
Communication with Customers	6
Visualization of process flow charts	4
Market Research / Focus Groups	3
Architecture / Building Design	3

Table 12. Summary of the Attitude toward Using Survey Results

The most mentioned and discussed topic was virtual meetings (seven counts), followed by communication with customers (six counts) and the visualization of process flow charts (four counts). Market research and focus groups and architecture and building design were mentioned three times each.

Even though project management and virtual teams were ranked in third place, counting the initial indications, the idea of virtual meetings was the most discussed in the second step of commenting the ideas of other participants. These results emphasize the focus on the collaboration side of virtual worlds and the capabilities of visualizing and presenting data in a three-dimensional and more interactive way.

Coming back to the conducted interviews, Zigurs also highlighted interactivity and the advantages of it.

> *"The best business uses, I think, are about that interactivity where you can create an interactive experience in a virtual world, so that a costumer can try out your product, customize your product in a variety of ways. […] The interactivity is the most important use, the most important aspect of a virtual world that you cannot do in other ways" (Ilze Zigurs, Interview).*

Regarding the two most mentioned categories during the brainstorming session, simulation/visualization and PR/marketing, Khazanchi stated that the latter is basically the most common category of today's business uses. Furthermore, he mentioned that "to get people to

actually accept the idea of using three-dimensional environments it has to be merged into tools that can be used for whatever activity we need to do, for example, three-dimensional visualization of data".

Limayem also talked about business uses like virtual project meetings, training or learning in a virtual environment, and the promotion of products and services during his interview. But he added a very interesting idea as a natural evolution of promoting products.

> *"And another thing, we don't see it yet, but probably to sell. Sell products, you know, like Walmart who is thinking about having stores in Second Life, where avatars can go to a virtual store and shop in a 3-D environment" (Moez Limayem, Interview).*

Regarding the further development of the World Wide Web, Davis suggested using the three-dimensionality of virtual worlds to present website content in a more natural way. Basically his point was to take advantage of the "natural navigational and perceptional ability that is oriented towards three-dimensional space and so it would be possibly more effective to navigating a complex website compared to a traditional hyperlink structure". Limayem took the same line and added the previous discussed interactivity to the notion of Davis. He basically mentioned that the capability to look at the same website with a team and discussing an idea right at the same time, "this will make virtual worlds even more useful to project management usage".

All in all the undertone of the interviews was that virtual world capabilities and, of course, the resulting business uses still need to gain a lot more attention by future research. Ives and Junglas (2008) even stated that "virtual world business applications are still at an embryonic stage" (p. 154). But on the other side, after the initial hype from a few years ago, there is now a lot of interest in the business world for virtual worlds. Zigurs underlined this at the end of her interview when she noted that she is "quite amazed and pleased that how much interest we keep getting with the metaverse project in the different places we go and people we expose it to". Based on the experiences obtained during this thesis and especially with the participants of the focus group, the author completely agrees and shares the belief in the future of virtual worlds and/or metaverses regarding virtual project management.

5 Limitations, Conclusions, and Future Directions

5.1 Limitations

As with any thesis and research of this kind, several limitations apply. Even though the literature review was carried out thoroughly and systematically, there is always the chance of missing an important study. Also there were several working papers used in this thesis. Due to the newness of the investigated field this was inevitable. Although working papers are an important source of the most current research, they are still to some degree not finalized as they have not been reviewed by journal editors.

The main limitations apply to the empirical and/or research part of this thesis. Only one focus group was conducted, which implies the possibility of flaws within the results of the focus group. Usually several focus groups are conducted, either with the same participants to investigate changes over time or with different participants to have cross-references and data to compare and validate the results (see Litosseliti, 2003). Furthermore, the conducted UTAUT based survey, to investigate the adoption of Second Life, had only twelve participants, which is far too little to actually use common statistical evaluations and thereby limits its validity.

There were also just four qualitative interviews conducted. Even though leading IS researchers were interviewed, it would have been interesting to include more opinions to compare and evaluate the findings. Based on this fact, the qualitative interviews were analyzed by indexing just the main reference points and not by doing a complete coding. Another very common limitation with using qualitative interviews is that during the transcription there is potential for information about how the interviewee said or specially emphasized something to be lost.

Finally, this is still a diploma thesis and conducted by just one student, which also implies that the discussions and conclusions are based on the student's endeavors and understanding of the concepts. Nonetheless, this thesis is not meant to be a dissertation nor a published journal paper and thereby it should be seen in the context of the first steps of an author as a researcher in the field of information systems.

5.2 Conclusions

This thesis makes at least a few contributions. First of all the literature review covers the most current state of technology acceptance and virtual world project management research. A big emphasis was put on the usage of both, the standard and/or common literature as well as the newest papers and journals, to illustrate the whole picture and give an insight on the current state of the respective research areas. Furthermore, clear definitions of key concepts related to technology acceptance and virtual world project management were provided, based on the existing literature. Regarding the research question, this thesis showed the reliance of virtual project management on technology and in this context the importance of technology acceptance for successful outcomes. Furthermore, it has also been shown that models and constructs of technology acceptance, as we know them today, can just explain small parts of virtual world adoption. Based on this fact the investigative goals of this thesis were extended to give some possible answers and show future directions and business uses of virtual worlds.

Thereby the empirical research, besides the mentioned limitations, provided some interesting further insights. First, the UTAUT based survey provided some obvious indications of the differences of virtual worlds and traditional technologies regarding hedonic consumption. It was shown that the more intuitive three-dimensional interface of Second Life increases the perceived ease of use and also that it actually is more fun to use these new entertainment-based technologies.

Second, the qualitative interviews helped to deepen the understanding of future directions of technology acceptance itself and showed how differences in technologies, especially between traditional and virtual worlds, have an impact on technology adoption. Thereby it emerged that current technology acceptance research needs a shift into new directions, for example to investigate the continuous use of technology and the underlying physiological and cognitive phenomenon, just to mention two. Furthermore, the notion that virtual worlds are different was affirmed by the mutual agreement that they have to be seen as environments and not as tools. Another conclusion of the interviews was that virtual worlds offer a more intensive sense of co-presence and thereby give the involved virtual team members a feeling of actually having a shared place of “being there” together. Also the interviews showed that it remains unknown in which directions virtual worlds will evolve, even though some very interesting forecasts were made. However, all of those findings support the importance of virtual worlds for future virtual project management, based on the high collaborative nature and the perceived ease of use and, especially, the “fun to use” of those new technologies.

Third, the brainstorming session showed that there is no shortage of ideas for business uses of virtual worlds. Based on the findings and conclusions described above business uses of virtual worlds were mainly seen for collaboration, interactivity, and presentation issues. The most mentioned areas were simulation and visualization, PR and marketing, and project management and virtual teams.

Basically this thesis project started with the goal of investigating the link between technology acceptance and the success of virtual project management and by investigating this link evolved furthermore into an analysis of the main differences between traditional collaboration tools and virtual worlds and how those differences have an impact on technology adoption. Additionally, the capabilities of virtual world environments and thereby possible business uses for virtual worlds regarding a new collaborative project management approach were investigated.

5.3 Future Directions

The thesis provides a starting point for future research directions. The literature review and the qualitative research have shown that the currently used concept of technology acceptance has come a long way, but cannot explain all of the things that are going on regarding adoption of virtual worlds. Thereby research based on the preliminary investigations in this thesis of differences in technologies and how they have an impact on technology adoption must be pushed. Since we do not know in exactly what ways virtual worlds are different, there is no way to explain the adoption of those new technologies properly. The entertainment-based nature of virtual worlds with this present “fun-factor” and the more hedonic consumption view mentioned in the most current literature (see Saeed, et al., 2009) also show some promising directions. Also the limitations mentioned above give some ideas where refinement and a more in-depth investigation and analysis are needed. Furthermore, the qualitative interviews with leading IS researchers also showed numerous interesting areas of further research, for example the development of virtual project management tools for virtual worlds or the enhancement of existing tools with the more intuitive three-dimensional features of virtual worlds. Also a completely new way could be the ideal solution; everything is possible. This is a time of change and these new technologies had their first boom and are now waiting for the big break-through.

The investigated business uses give some very interesting areas of demanded solutions and also need some further research, especially to validate or contradict the findings of this thesis.

This thesis is published under a creative commons license for one reason, namely to make it easier to share and distribute these basic and preliminary findings and conclusions to support the research at least a little bit and to share the enthusiasm of the author for this emerging new era of virtual worlds and how they could be utilized to enhance current collaboration processes. Thereby it is not important to validate or contradict these findings; every progress is important and should be supported.

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7 Appendices

Appendix A: Focus Group Survey Based on UTAUT

Scale: Septempartite (except last block: Behavioral intention to use Second Life)

1: Strongly Disagree
2: Disagree
3: Slightly Disagree
4: Neither Agree or Disagree
5: Slightly Agree
6: Agree
7: Strongly Agree

Method: Online survey (LimeSurvey, URL: http://slsurvey.bhofer.eu)
Number of items: 19
Expected duration: 5 to 7 minutes

Part 1: Performance Expectancy
PE1: I would find Second Life useful in my job.
PE2: Using Second Life would enable me to accomplish tasks more quickly.
PE3: Using Second Life would increase my productivity.
PE4: If I use Second Life, I will increase my chances of getting a raise.

Part 2: Effort Expectancy
EE1: My interaction with Second Life would be clear and understandable.
EE2: It would be easy for me to become skillful at using Second Life.
EE3: I would find Second Life easy to use.
EE4: Learning to operate Second Life is easy for me.

Part 3: Attitude toward using Second Life
A1: Using Second Life is a good idea.
A2: Second Life makes work more interesting.
A3: Working with Second Life is fun.
A4: I like working with Second Life.

Part 4: Anxiety
ANX1: I feel apprehensive about using Second Life.

ANX2: It scares me to think that I could lose a lot of information using Second Life by hitting the wrong key.
ANX3: I hesitate to use Second Life for fear of making mistakes I cannot correct.
ANX4: Second Life is somewhat intimidating to me.

Part 5: Behavioral intention to use Second Life

BI1: I intend to use Second Life in the next <n> months.
BI2: I predict I would use Second Life in the next <n> months.
BI3: I plan to use Second Life in the next <n> months.

Appendix B: Results of the UTAUT Based Survey

Part 1: Performance Expectancy

Participant ID	PE1	PE2	PE3	PE4
1	6	5	4	5
2	5	5	5	4
3	6	5	5	5
4	6	4	5	2
5	4	4	4	4
6	5	4	4	4
7	6	4	5	5
8	4	5	5	4
9	5	5	4	5
10	4	4	4	3
11	6	5	6	3
12	6	4	4	3

Part 2: Effort Expectancy

Participant ID	EE1	EE2	EE3	EE4
1	6	6	6	6
2	5	5	5	6
3	7	7	7	7
4	6	6	6	6
5	5	6	6	6
6	4	6	6	6
7	6	7	6	6
8	7	7	7	7

Participant ID	EE1	EE2	EE3	EE4
9	5	5	5	5
10	5	7	5	5
11	5	7	6	6
12	4	4	4	4

Part 3: Attitude toward using Second Life

Participant ID	A1	A2	A3	A4
1	5	6	6	6
2	5	6	5	6
3	6	6	6	6
4	5	6	6	6
5	4	4	6	6
6	6	6	6	6
7	5	7	6	5
8	5	6	6	6
9	5	5	6	6
10	4	5	6	5
11	6	7	7	7
12	6	6	6	6

Part 4: Anxiety

Participant ID	ANX1	ANX2	ANX3	ANX4
1	2	2	2	2
2	3	2	2	4
3	1	1	2	1
4	5	2	2	5

Participant ID	ANX1	ANX2	ANX3	ANX4
5	6	6	6	6
6	5	2	2	2
7	2	4	2	1
8	1	1	1	1
9	2	2	2	3
10	2	1	1	1
11	5	4	4	3
12	2	2	2	2

Part 5: Behavioral intention to use Second Life

Attention: Another scale is used for these items. The specified values are months!

Participant ID	BI1	BI2	BI3
1	12	12	12
2	12	9	9
3	-	6	6
4	3	6	3
5	-	-	-
6	-	-	-
7	1	1	1
8	1	1	1
9	1	1	1
10	-	-	-
11	2	2	2
12	6	9	12

Appendix C: Qualitative Interview Guide

Method: Telephone conference and personal interviews
Type: Semi-structured qualitative interview
Duration: 20 to 25 minutes
Number of questions: 5

Question 1: TAM has come a long way since its introduction in 1986. Where do you see the future of technology acceptance research?

Question 2: How do you think differences in technology have an impact on technology acceptance research?

Question 3: Regarding virtual worlds, where do you see main differences in technology acceptance to “traditional” software tools?

Question 4: How would you classify virtual worlds in comparison to other virtual project management tools?

Question 5: Based on your experiences. What do you think are possible business uses of virtual worlds?

Appendix D: Transcripts of the Qualitative Interviews

Interview with Ilze Zigurs, PhD
Position: Department Chair, Information Systems and Quantitative Analysis
Organization: University of Nebraska at Omaha
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Date: June 29th, 2009
Duration: 26 minutes
Type: Personal interview
Place: PKI, University of Nebraska at Omaha

Hofer: TAM has come a long way. Where do you see the future of technology acceptance research?

Zigurs: Well, there is no doubt that the technology acceptance model has had significant influence in the field. People keep saying we are done with that now and we need to move on. But still, at the same time, there are people continuing to do research in that area. I think one of the reasons that people continue to do research in that area is that, I mean it's absolutely fundamental to what we do. This desire to understand the factors behind acceptance and use is absolutely fundamental. I think that where we need to go… I mean the technology acceptance model is pretty simple and sometimes the simplest things are the best and the most elegant things, there is nothing wrong with simple. But it's based in an individual view and/or individual use of technology and it's also based… I think in some, you know, fairly generic assumptions about a kind of technology that's being used… the sort of user driven tools. So I think we need to get a little bit more complex, we need to think about groups and group use of technologies rather than individual use. We need to think about all the different… you know, a little bit more about the technology itself, because all of this is from the users' perspective. I perceive it as being useful, but why? I perceive it as being easy to use, but why? What is it about from the technology perspective and the technology capabilities perspective? What is it that makes it useful or makes it easy to use for particular kinds of tasks? We need more refinement on the other hand and more complexity on the other hand.

Hofer: There have been a couple of adaptations and enhancements in the last years regarding TAM, like UTAUT and TAM 2 or TAM 3. Venkatesh, for example, introduced a new thinking of acceptance as a process. What do you think about these directions?

Zigurs: That makes a lot of sense, a sort of a process approach rather than a variance approach… a process theory rather than a variance theory. I haven't really looked that carefully at Venkatesh's writing on TAM as a process theory, but that's the kind of thing I am talking about that we need to reflect the complexity in the world today. The understanding of the why, which to me means understanding the process. And it also means understanding not just an individual's behavior, but an individual's behavior in the context of a group and how that group dynamic or organization level dynamic or whatever it might be, because these decisions about the technology use get made in groups and at the organization level too. Those are part of a more in-depth understanding of what's going on… and more contextual as well. That's where I think a process theory often helps is that it really brings the context into play.

Hofer: So what you are basically saying is that it is also important that not only what I think about the use of technology, but what others think about it and how they influence me.

Zigurs: Yes, that's exactly right. How it influences me. Let's face it, it's a connected, collaborative world and I don't just sit in my office and use a technology all by myself. I am constantly working with people and so that matters.

Hofer: That's how it was 20 years ago when TAM was introduced and technology was more like a single "I alone" task.

Zigurs: Very much individual applications like studying spreadsheets with a very individual adoption.

Hofer: That's very interesting and brings me to the next question. How do you think differences in technologies have an impact on technology acceptance research?

Zigurs: Well that leads us to a very, very interesting question, which is how do you characterize technologies. And how do you describe the difference between one technology and another. The fact that TAM has been shown to be valid across a wide variety of different types of technologies… well, ok… but how are people characterizing the differences in those technologies and what aspect of those differences is really being examined. You know, this gets down to a whole bunch of interesting questions about how different, different kinds of

innovations in technology are over time, right? Like we have talked about before with virtual worlds and when we were getting our conceptional paper published on virtual worlds… during the review process, you know, reviewers really pushed us to say how different are virtual worlds and how do you characterize them. That's a question everybody always has and so I think that's really one of the interesting things to look at. Because if you say well, TAM applies to spreadsheet, it applies to e-mail, it applies to ERP, it applies to databases, well… exactly what aspect of that, how can you characterize those technologies, what aspect of that technology is really in the user's mind who interacts with it.

Hofer: There was also a point made by Venkatesh that a lot of research is focusing on the moment and not on the over time development of acceptance. What do you think about the more longitudinal approach?

Zigurs: Yeah, the longitudinal approach is really important and it's that way in a lot of IS research. When people first start studying a phenomenon, you know, they take the easy way to do it; you have to be practical in research too right. You can't effort to study something for two years and wait two years to publish any papers. If you are an assisting professor trying to get a tenure, that's the practical side of things. But a lot of studies initially are about a very fixed point in time, a snapshot in time. This is why as a field the launch of longitudinal studies is very, very important. And different things then come into play. That's were the context comes so much more important, because then over time all of these other factors come into play. Those are the things you need to examine. You don't really have a lot of good examples for how to do research over time.

Hofer: We talked about technology as a whole, but now I would like to go more into virtual worlds. Where do you see the main differences in technology acceptance to "traditional" software?

Zigurs: There are several things about virtual worlds I think that are very different. It also depends upon which role you are playing. I mean if you are just sort of a visitor to a virtual world and using what's there you are not really changing the world yourself very much, you are using what's presented to you. Then I think it's a different kind of environment in a variety of ways. First of all, I don't think people see it as a tool, the way they see many applications. A software application is a tool for people; it's a tool to get jobs done. So spreadsheet is a tool for me. Word processor is a tool for me. Whereas a virtual world is an environment; it's a general environment in which I can do a variety of things. And there might be tools within that environment, but the environment is very, very flexible, it's very changeable; I can kind of make it whatever I want it

to be. Whereas with a tool like spreadsheet, I mean yes there are different options and I can change the interface if I want, but there is still a linear path through the task I have to accomplish. Most of these tools are specifically associated with a particular kind of task or set of tasks. Whereas the virtual world is an open environment that is not associated with any particular task at all. And again, it's what I think of it and what I create in it. There are capabilities in virtual worlds that are different than what we have in traditional software tools.

Hofer: Virtual worlds have a unique way of experience, which takes you completely into a virtual world in comparison to just interacting with a user interface. New research has shown that it is easier for users in virtual worlds, because it's a more intuitive experience. What do you think about these findings?

Zigurs: Well, for instance we just did a demo last Friday out at the Omaha Public Power District. It wasn't just a demo, we set up avatars for them and we had them walk through and those were people who have never seen Second Life before. And then, of course, you did your focus group with people who have never seen it before. But I think it's an open question whether it's more intuitive or not. You have to ask yourself what's intuitive for people these days, in a world that is so full of technology. Our workplaces are just… it's everywhere, right? In most of our office workplaces and what does in intuitive mean for people. It might mean something, you know, I think it's a very interesting question in the whole world of human computer interaction. Over time has the very definition of what's intuitive or what's easy to use. It changed, because of the things that we have given to the people that they have been forced to adapt to. There are studies of different preferences people have in terms of their personality type and so on.

Hofer: I've read this really thrilling working paper from Schwarz and Venkatesh. It is from 2008 and they basically stated that we are investigating acceptance for a long time now, but haven't even answered the question what acceptance itself is. They took an etymological approach to describe acceptance and transferred these findings into a process theory approach of technology acceptance. Do you think that's one of the big problems that a lot of people are just using TAM and not paying that much attention on the depended variable?

Zigurs: That's always. I mean that has been an issue in a whole variety of ways. Ultimately acceptance… I mean, what is it what you really want. You want a set of positive outcomes and whether you call it acceptance or user satisfaction or effective use technology or efficient use of technology. I mean there are whole multiple dimensions of that depended variable that you could name and that you could define. So yeah, it is. It's definitely still an issue.

Hofer: Coming back to virtual worlds with a focus on project management. How would you classify virtual worlds in comparison to other virtual project management tools?

Zigurs: The small experiment that we did with our virtual project management tools was just a tiny baby step and we couldn't get in that one hour of time that we forced people to work together and create something in a virtual project. We couldn't get them to use the specialized tools we've designed for them. The brainstorming tool for instance, because they were so busy building their artifact. I think this kind of gets back to the differences we talked about earlier. A virtual world is an environment in which many things are possible and the software applications are the tools. So bringing those tools into the environment is something we haven't done really. We have experimented with it a little bit. The virtual environment for project management is more about communication and bringing the project team together in a shared space. It might also be about teambuilding in the project and prototyping and using the virtual world capabilities to prototype an artifact. But the traditional tools that are associated with managing the project, like Microsoft Project or whatever it might be, have not been adapted for virtual worlds yet.

Hofer: So you would say it's more about the social part of a project?

Zigurs: Yes, it's the social part and the artifact building part like prototyping. The social part, the teambuilding or communication part and then being able to create something together.

Hofer: Based on your experience. What do you think are possible business uses of virtual worlds?

Zigurs: I actually see a lot of business uses and I have seen the people that we have done this focus groups and the demo with OPPD and the other people we have exposed to our island and to this idea. They seem to have no shortage of ideas about business uses of virtual worlds. What we come down to typically… I mean, there is the usual let's display what we have available to the public and the virtual world; the same way we could at the web, just in a three-dimensional way. But beyond that, when they have passed this first step, they think about what we can do that is interactive that engages either our clients in what we are doing or our supply chain partners or our own internal employees. So the best business uses I think are about that interactivity where you can create an interactive experience in a virtual world, so that a costumer can try out your product, customize your product in a variety of ways or you know, if you are talking about internal communication then we get back to things like meetings and supporting communication with inside the company or trying out new ideas. The interactivity is

the most important use, the most important aspect of a virtual world that you cannot do in other ways.

Hofer: So you are basically saying that a virtual world makes it easier for dispersed teams all over the world.

Zigurs: Yes, it takes care of all this geographic barriers, but it also creates an interactive opportunity.

Hofer: Do you think in about five to ten years that project management tools we use now will evolve into virtual worlds?

Zigurs: Yes, I definitely think there is an opportunity there for that to happen. And I think there is a Gartner report on virtual worlds that makes some sort of forecast that 80 per cent of all companies will get into virtual worlds by the year 2011. That's a natural thing, right. Vendors are looking how can take things into this new environment.

Hofer: Do you have any other aspects you would like to add or something you think is of great importance?

Zigurs: I am quite amazed and pleased that how much interest we keep getting with the metaverse project in the different places we go and people we expose it to; so many different links, educational partnerships, business partnerships, academic partnerships, research partnerships. And after this initial wow effect we are in a second phase now where we are really looking at some things that are unique we can take advantage of. I am quite amazed about the level of interest.

Hofer: That's sounds very good.

Zigurs: Yeah it is, and it is fun too.

Hofer: Yeah, it is and this is what a lot of people say that it is fun and this makes it easier to use in a business environment.

Zigurs: You know, and there is sort of a natural link to the new generation, right. People of your generation and sorts of interesting things they hope to do at the work place.

Hofer: Because you just mentioned it… just a very quick statement to generation differences and how do you see this issue?

Zigurs: I think those generation differences we have yet to see how they play out. There is a lot of literature about this whole thing of digital natives and how things will change when this generation has more influence on the workplace. So I think there are a lot of unknowns and they are interesting.

Hofer: Thank you very much for the interview.

Zigurs: You are very welcome!

Interview with Deepak Khazanchi, PhD
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Date: July 7th, 2009
Duration: 31 minutes
Type: Personal interview
Place: PKI, University of Nebraska at Omaha

Hofer: TAM has come a long way. Where do you see the future of technology acceptance research?

Khazanchi: Wow. I guess the traditional technology acceptance model has been expended to include many more variables, but I think that one facet of it that would be of interest is how does it actually explain behavior in terms of technology use at the ground level. What happens is that we might have perceptions of how technology can help, but in reality there are so many contents and factors that influence that perception. So I think even though we have the larger model with ratio of corporate culture, ratio of even team culture, ratio of how people actually incorporate technology into work practices. That is really… I think from a behavioral perspective the important factors to address. From a technology acceptance perspective the question really is if acceptance is a cognitive outcome or behavioral outcome. I personally have the notion that it maybe a cognitive outcome. If I have success with technology in the past I build a mental model that allows me to use next generation of technologies better. If you take, for example, the Windows operating system. Even though it is a very difficult operating system, people are comfortable with the way it works; they like the features and they like to see the same features in subsequent generations. So I think this is because our mental model of what a graphical interfaces look like is almost build on top of what Windows looks like. So I think people haven't really explored this idea or maybe there is this alternative explanation of why people accept technology and actually use it. I think more emphasize on the cognitive side and how people build mental models about technology use and that's an interesting path, but we haven't study that really well.

Hofer: So you basically mean to go back to the roots of the problem?

Khazanchi: No, I think what we know is good. Just what it tells is really… you know, we ask people what do you think will happen with technology. Will you use it based on what you have seen now? Will you actually behave in a way that will result in the usage of technology? Essentially we are arguing that it is a good recommendation. The whole TAM is based on the theory of reasoned action, right? That believes drive intentions and intentions drive behavior. But I am saying that it has nothing to do with that. Maybe it has to do with the whole structure of believes. So that's what I mean. My dissertation about 20 years ago was about a cognitive lens. I created this concept called a cognitive lens that people make decisions based on prior experience and beliefs and filter them through this lens. Essentially when I come to a new decision this lens kind of helps you to make choices. Especially when the decisions are unstructured. I think technology acceptance is a very unstructured decision, because there are now things there, where you can look at and know for sure. If there is a different tag that can be taken to understand belief structures and cognitive structures about how our mental model is build.

Hofer: Basically this drives us into the next question. How do you think differences in technology have an impact on technology acceptance research?

Khazanchi: Well, I think a part of TAM is right there. If I have good experiences, if I believe that anything that Apple makes is going to work for me… so in some sense this believe drives my intention to use new Apple technology, right? If you use the iPhone, I mean people are fanatic about that. But I think, again, it's not about the fact that technology differences are driving it, I think it's because it's, of course, easy to use or at least it is perceived as easy to use, which is what TAM says. But on the other hand there is also the whole issue of… you know, even if technologies are different why do people choose the one or another? I think a lot of it just depends on comfort and also I think those decisions depend on prior experiences.

Hofer: So it comes back to the cognitive aspect.

Khazanchi: Still, it has to do with the cognitive aspect.

Hofer: We were talking about how to characterize technology. Where do you see a possible way in future research to compare technologies or make them comparable?

Khazanchi: Well, I think then you have to go to what we, Ilze and I, have talked about in our papers about this idea of technology capabilities. So I think instead of focusing on specific technology we should look at what capabilities are interesting. Why people use devices that

have such capabilities. So are there distinguishing capabilities? I don't think there are actually. I mean between a BlackBerry and an Apple iPhone, they really have the same features. You can do e-mails, you can do messaging, you can do games. But I think in that specific instance to compare boils down to and people are willing to pay a higher price and that's another thing. It's not like it's cheap. It's not price sensitive. I think what makes a difference is branding, so a little bit of it is psychology and influence on your behavior by marketing. And then the other part of this is that people find it fits better with their way of doing things. So, again, there is this a mental model where they think how this thing should work. It seems like there are no age differences. Younger people and older people like that. So I'd say that.

Hofer: About diffusion of innovation. Based on what you just said, how would you see this model in this context?

Khazanchi: I really don't know. Again, it really depends on organizational use or personal use of technology. I think when we are talking about an accounting application the diffusion of innovation is maybe different than from a personal device. When I am talking about devices that are used on a day-to-day basis, whether it's an iPhone or a cell phone or a computer, I have a different… I would say the diffusion would be influenced by different factors than if it's a transaction system or accounting or finance. I would say the difference lies more in the nature of the system. And I think marketing and branding have a big influence on the personal choice of technology. Organizations look at whether they can do the job they wanted to do, people look at not just something that is doing the job, but also should look cool and nice. It should be interesting, it should be different. So I think those factors affect personal technology acceptance. You have to look on it from many… actually almost like categorizing technologies and things that people use on a daily bases like personal systems or organizational based systems.

Hofer: Let's move a little bit away from technology acceptance. Where do you see the main differences from virtual worlds to "traditional" software tools?

Khazanchi: First of all I think there will be a convergence between traditional software. Let's just talk about collaboration software. Virtual world environments are essentially collaboration, whether social collaboration, whether social interaction, whether social networking and/or actual collaboration in projects. Ultimately the capabilities of virtual worlds allow us to do all of that. Be socialized, be interactive, be engaged, be immersed. So I think to that extend virtual worlds are quite different from any technology that exist. But I think the future lies in taking these capabilities and merging them into collaboration tools. Or incorporating it into the Internet, like

Google's Lively. It failed, because they tried to do the same thing as in the web. It was actually rendered by the browser itself. I think social sense or presence and all these factors that the virtual worlds provide and also this ability of immediately build something, we call this elegancy of artifacts. These capabilities I think ultimately will be the once that will stay. I think what will happen in the next five years is a convergence between virtual world applications and real world applications and collaboration tools. Actually they will share features and in fact there are already products, for example QWAQ, which is actually a collaboration software that uses a three-dimensional environment. That's the other way, because it is actually designed for collaboration but it uses avatars by using the virtual world kind of context. It is very focused collaboration. So I think that convergence will happen, even in the near future.

Hofer: If you think about Virtual Worlds, especially Second Life, and available brainstorming or collaboration tools. What do you think about the nature and level of development of those existing tools?

Khazanchi: I think that the project management tools or the brainstorming tools that are used in traditional environments are not really applicable for Second Life. Because Second Life provides a very different… I'd say the things you can do in this environment are quiet different from how we have done collaboration in the past. To some extend that and the environment itself allows to do what you do in face-to-face interaction. And so to that extend traditional collaboration tools may not be able to be successful in this new environment. We tried it in our experiments where we actually gave people a brainstorming tool and never used it. We told them how to use it and how to generate ideas. They didn't really like it. I really think that what will happen is that there will be tools like QWAQ that will actually incorporate a three-dimensional experience.

Hofer: So, you say basically that the "good" parts from virtual worlds will be taken into traditional collaboration tools?

Khazanchi: Yes, exactly. Those things will be incorporated. I think that's the way it will be. There will be three-dimensional rooms, because now Allen K., the inventor of SmallTalk, had a project for the last two years, which is called Kobalt. It is basically a peer-to-peer virtual world. This is very interesting, because instead of running it on a server you can create you own virtual environment on your machine and invite other people to it. Now you have your virtual world. That's a tool for collaboration and it's in its alpha phase.

Hofer: That's very interesting. Based on your experience. What do you think are possible business uses of virtual worlds? Or in this context also tools that incorporate virtual world aspects, like QWAQ.

Khazanchi: I think those things we talked about are the future. Traditional ideas that virtual worlds can be used for branding and marketing and for selling products that don't exist today. So actually get buying consumers for products that you are currently designing. I think that's really in the current use of virtual worlds, but I think to get people to actually except the idea of using three-dimensional environments it has to be emerged into tools that can be used for whatever activity we need to do, for example, three-dimensional visualization of data. Maybe we should have virtual world environments where avatars can go in and plug-in data from databases and visualize it. Or maybe even in the context of… you know, like we said project management has tools that use three-dimensional components to do virtual teaming. So I think you can create features in current tools that will allow you to have these capabilities, without having to actually take everything. So I think Second Life as a standard will go away, in my view. It will not exist in the same way.

Hofer: How do you think businesses can use virtual worlds nowadays?

Khazanchi: I think training, education… you can do real life… like we talked about this nuclear energy company to teach nuclear safety… to teach employees nuclear safety. We can build realistic models and you can use Second Life there. So I think very realistic three-dimensional training can be one area, clearly. And virtual collaboration is another area. Those are the two and, of course, marketing and branding. So there are these three key areas, I don't think you can use it for anything else. Until somebody comes up with an innovative way to show accounting statements (laughs). But I think there are possibilities that allow you to do design. You know, if I want to buy a product, if it could be done inside Second Life with some tools… that would be interesting.

Hofer: So that the consumers are an active part of the whole process?

Khazanchi: Yes, you can actually engage them to develop something that would be very interesting. There are capabilities to do that, but I don't think we have the tools to manage the process. So process tools or maybe collaboration doesn't have to be that way… I don't know. I am kind of… I look at my children and I think maybe that's not the way… people don't collaborate the way we talk collaboration ship, right? Collaborating of people, together to do a task is not as relevant as almost chaos. Chaotic collaboration is my concept. It is almost like… it

looks like chaos, but people are actually working together and trying to do something. So if I see my son who is dealing… it's a great example, he is trying to schedule an activity for his friends and he wants to have them over to the house. So the goal is to get 16 to 17 friends all together on a single day at a given time to do something at our house, just to get together, to hang out. And it's amazing how many communication mediums they use. For example Facebook chat and he put it on Facebook events to share it with his friends and then he is doing instant messaging with his cell phone, answering questions if his parents will be there, because it's kind of the first time. But my point is that it seems very chaotic and my wife and I are like... this is very difficult to manage, how many people are actually going to attend? And you know they all go to Facebook and say maybe, they don't say yes. So I call it chaotic collaboration.

Hofer: That's very interesting, because even when I grew up there were no cell phones and no Internet, so we met at school and tried to arrange us there. But know the situation is changing every minute… they grew up with this kind of technology and this highly flexible environment seems to become normal.

Khazanchi: For their experience it's very normal and they are comfortable with it. You know, Twitter and Facebook or cell phones. My son has already started to update his status from his cell phone and I said don't do that… it's drastically, but to them it's natural. I think we have to come up with a new theory of collaboration, something like chaotic collaboration. It's a totally different way… I think there are differences when people, young people, collaborate.

Hofer: It shall be interesting to see when this generation is starting to work and will bring all these technologies and habits with them.

Khazanchi: Right, they have to force the structure and that's hard for people. In fact that's why I think collaboration systems don't work. Collaboration software doesn't work, because they are too structured.

Hofer: So basically virtual worlds, for instance Second Life, gives you this environment where you just meet each other and see how it will work out for you.

Khazanchi: Yes, you can figure it out. But I think that's not completely there, but it has a lot of the capabilities.

Hofer: There is this one article and report from Gartner, which says that in 2011 80 per cent of all business will use Second Life. What do you think about this approximation? Do you think this is realistic?

Khazanchi: No, I really don't think so. I think Second Life won't exist that long, as I said before, or at least not in it's current form. It will evolve in something more useful I believe.

Hofer: Do you have a specific picture in your mind how it will evolve?

Khazanchi: I really think it will have to be tool based. You would have three-dimensional formats on your cell phone. So you'll have some services that will be three-dimensional.

Hofer: So, in your opinion, it will change to a more service based architecture?

Khazanchi: Yes, service based. I mean like if I want to talk to you I can do it over the phone or maybe with an avatar right on my PDA. I can imagine doing that on the iPhone or an iPod and having the chance to seeing each other. And then there is the whole research on real… I mean creating more realistic avatars, to allow people to customize their avatars that they look more like them. To me that's a problem that will not going to work. Because from a behavioral perspective the reason people are having avatars is, because it allows them to be a person they are not in some way.

Hofer: I think that's one of the main points of virtual worlds now. People are using it to be a better me.

Khazanchi: Yes, or a different me.

Hofer: Sure, that's right. And probably there will be the possibility to take oneself into the virtual word and use it as it would be the real world.

Khazanchi: That's also very unlikely. I don't think that will happen either, that we will completely… well, I guess there are people how don't distinguish between themselves and what is virtual, their avatars, but I think the most people know the difference between the real and the virtual world. And so I think it will never be equivalent.

Hofer: At the end, I would like to close this discussion with the technology acceptance perspective. Based on our discussion, do you think that the acceptance of virtual worlds is different than the acceptance of traditional project management tools like Microsoft Project?

Khazanchi: No, I don't think so. I think they are the same. In terms of this just overcoming resistance to trying something new and in terms of it is being useful for me and would I use it. I think those are all still the same issues. I'd say that there are probably some demographic differences and there are some people who are more comfortable with these 3-D environments, but I don't think it's… you know, from a straight technology acceptance view I would say it's pretty much similar with any new technology.

Hofer: Basically it's just to go back to the differences in the technologies themselves. For example is it possible to compare the technology acceptance of Microsoft Project with the acceptance of virtual worlds.

Khazanchi: If you are saying there is a difference in virtual world project management and virtual project management, the only difference you are able to be synchronously, which you cannot in virtual projects. So I think virtual worlds also help you to build and show your ideas, that's interesting.

Hofer: So you say it's the more social part that is important in virtual world projects.

Khazanchi: Yes. I think that's different and it allows us to change how we think about virtual projects. We can create more trust. So the question is and I think one of my PhD students, I think you met her, Dawn Owens.

Hofer: Yes, I met her ones and read two of her papers.

Khazanchi: She is now working with me on the issue of trust in virtual worlds. So if you have a virtual team, it's interesting how the trust is different in virtual projects and virtual world projects. My theoretical view is that you get better trust if you use virtual worlds than traditional collaboration tools like e-mail and so. So let's see, we will study that.

Hofer: Thanks a lot for theh interview.

Khazanchi: No problem. You are welcome.

Interview with Fred Davis, PhD

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Date: July 8th, 2009
Duration: 25 minutes
Type: Skype telephone conference

Hofer: TAM has come a long way since you introduced it about 20 years ago. Where do you see the future of technology acceptance research?

Davis: One of the important areas in the future of it is going to be to investigate more of the unconscious processes that are taking place in technology use. For example, when people acquire skills the behavior of using the technology becomes automatic. There has been some research, but that part of it needs to be better understood. Mostly the TAM model taps into consciously intended behavior and conscious believes and motivations. So it doesn't really directly deal that much with the unconscious cognition or intuitive processes. So that's I think one of the big directions in the future.

Hofer: There is this fairly new paper from Schwarz et al. about a more process based thinking of technology acceptance. What do you think about this new process theory approach?

Davis: Well, I am not sure about that one. There has been for years some interest in investigating process theory as opposed to variance theory. I think there is something promising about that, but I am not really too sure about it.

Hofer: Basically they described the process of acceptance in four steps. The first one is how someone is receiving information about new technology, followed by grasping. The third step is about how people assess the information and then it splits up in two ways. They divided it into two different areas. On the one hand some information is given and on the other hand oneself also submits information.

Davis: Yes, I mean I am not too sure about that.

Hofer: Of course, that's absolutely no problem. Let's move on to the next question. How do you think differences in technologies have an impact on technology acceptance research?

Davis: I think that differences in technology would be… or could influence the perceptions that people have about the technology. And it would depend on their tasks and their needs and preferences and so on. What form different perceptions of usefulness or ease of use or other things depending on the characteristics of the technology. So the characteristics of the technology should be captured by some extend by believes and perceptions.

Hofer: We were talking about characterizing technology. Do you see any differences in technologies there? Especially when we are looking at single task technologies like Word Processor for example or more multi-user tasks like collaboration tools?

Davis: Yes, I think for one thing there is greater complexity. There is also greater interdependency between individuals so that the nature of the process of using it is collective behavior involving multiple individuals opposed to a single individual acting alone. So this creates more challenges in terms of whether people have the same preferences. That various people are using a collaborative tool whether they agree on the benefits and the costs of the tool and also there are some situations where a technology that is collaborative provide more advantages to some of the users involved and provide less advantages to others. So it might be desirable or favorable only for a subset of the multiple users of the technology, which means that the ones who perceive it as an unfavorable benefit cost ratio might reject it. And if they reject it than it means that the functionality is not available to deliver the benefits to those who do see a favorable pattern of benefits and the technology could fail even though some people see positive benefits regarding the acceptance.

Hofer: So basically it is very important to be more focused on this social networking and peer-to-peer part of technology?

Davis: Yes, I think more applications that are being introduced today are once that are multiple users and multiple stakeholders involved and all of them must see a positive benefit, net benefit, in order for the overall technology to be successful and accepted.

Hofer: You talked about innovations. How different do you think are innovations over time? Basically in the last twenty years and how do you see the impact of innovations in the future?

Davis: I guess one of the answers to that would be a lot of the earlier research was focusing on the initial adoption of innovations and now a lot of the attention has shifted from initial adoption toward sustained adoption, which is sometimes called continuants. And there maybe some different variables involved with sustained adoption as opposed to initial adoption. There has also been some interest in how the use of an innovation or use of a technology can evolve over time as opposed to just being adopted as a static technology. In other words people who learn new ways of using the technology and they alter the way they use the technology to try to better fit their needs and there has been some interest in that aspect as well. In terms of how they can band or shape or extend a technology to capture their evolving needs. So I think one of the dynamics that takes in place is in terms of the technologies themselves with enterprise systems like SAP and large packages have been fairly large and monolithic and not very flexible. And then there have been a lot of interest in, and it created a lot of problems, the inflexibility made it difficult to do this adaptation to adjust to evolving requirements. And then another paradigm coming along, actually two different paradigms, one would be service oriented architectures, pushed a lot by IBM, where it emphasizes smaller units of functionality that can be deployed fairly quickly and add to existing functionality in a modular way that would allow more of a flexible and agile adaptation as requirements evolve and I think this is a shift in a direction of how innovations are being structured. Related to that is the interest in agile methodologies, where similarly the emphasize is placed on extreme programming and paired programming and developing just the minimum functionality that is needed and developing and deploying it quickly to get it into use and then dealing with change in terms of adding increments of functionality more frequently. We are heading away from this monolithic paradigm.

Hofer: How do you see the impact of these more service oriented and agile approaches to the technology acceptance of the end user?

Davis: I think one of the benefits there is that the degree of change required for the behavior of the users is a smaller amount of change and the functionality is often times more relevant and so it is often times easier to accomplish the change. Maybe there is less resistance to the change, because it is not a large disruptive change as much. So it is less radical in terms of the degree of change and maybe it is possible to create new versions of systems that are more compatible with the way people are currently performing their work. So I do think its… I do believe it generates higher user acceptance.

Hofer: That's very interesting. But for now I would like to go more into virtual worlds. Where do you see main differences in technology acceptance to "traditional" software tools?

Davis: I think there are some consideration or attributes of the technology that are salient, which are not as salient in traditional. For example, there maybe in some cases a fantasy component as people can take and have avatars that take on different personalities. There can be an emersion, a high degree of interactivity. There maybe a fantasy emersion and there maybe also some sense of anonymity that people can experience. There maybe additional factors or attributes that were not as salient or important in more traditional productivity tools that come into play with virtual worlds.

Hofer: If we are talking about more conventional virtual project management tools, like what we are doing now with using Skype or online brainstorming tools. Where would you see virtual worlds in this context?

Davis: I think one example of an opportunity in virtual worlds is to really leverage more the idea of simulating the business process that is being supported and maybe simulating the functionality of a new system so it can be more realistically experienced and evaluated by users. Taking advantage of natural intelligence that people have for dealing with a three-dimensional world that has special characteristics and properties. I think that part of it is the ability to simulate at the level of prototyping whether or not a new system is going to be effective in carrying out what purpose it is supposed to achieve in supporting the real world. So I think there are some advantages there. Another one would be the potential for the use of personas. There is a thing going with software development in terms of expressing requirements by creating sort of idealized users or examples of users who have a real identity and give them a story. So that as the developers are developing the system they are not developing it relative to a set of written requirements that are some sort of abstract and removed from context but rather they trying to deal with entities that are very much more like humans. People that have a story, people that have personalities, people that have needs and concerns. And this seems to activate something within the developers that makes them more empathetic to the needs of the users and to take their true requirements more seriously. So I think that's another advantage when it comes to project management of what might be leveraged with virtual worlds.

Hofer: Based on your experience. What do you think are possible business uses of virtual worlds?

Davis: I think that one example would be if we had a three-dimensional presentation of websites that this would enable users to take advantage of their natural navigational and perceptional ability that is oriented towards three-dimensional space and so it would be possibly more effective to navigating a complex website compared to a traditional hyperlink structure.

Hofer: So you basically say that virtual worlds would be more natural for users to interact with the system and/or with other people.

Davis: Yes, just as a desktop metaphor, which is contagious with previous operating system interfaces. Similarly three-dimensional would be a powerful step beyond two-dimensional desktop metaphor in terms of making a natural and powerful environment for rich interaction. Not just between one user and a website, but it could also provide a context for collaboration that is closer to what people are costumed to and become more natural I think.

Hofer: At the end, how do you see technology acceptance and, of course, the technology acceptance model regarding virtual worlds. Would you say it's easier to handle virtual project management in virtual worlds than with traditional software tools?

Davis: I think it can help, but when I noticed that there is a pretty steep learning curve in Second Life for example. I am not sure that it's obviously automatically going to be easier to use. I think it's unclear to me at this point. I believe it can be, but there is a lot of design work that might have to be done to make it cognitively easier.

Hofer: Thank you so much. Based on our discussion, do you have any points or comments you would like to add? Something that is important for you regarding these topics we talked about.

Davis: No, I think… well, a big challenge with virtual project management is that you are dealing with virtual teams and people who are not co-located and so to the extent that the virtual world can become a platform that helps to reduce that sense of social distance. I believe virtual worlds can be effective in overcoming barriers of time and space and culture to create more of a sense of co-presence. I think it could be very promising for that. But I also encourage you contacting Moez Limayem, our department chair. He probably has more insights about virtual worlds than me. He is doing work on a research project with regards to Second Life and so I think you should interview him too.

Hofer: That would be great, I would love to. Thank you very much for the suggestion!

Davis: He has also done some work on technology acceptance. So it would be a perfect match.

Hofer: Yes, that's right. Sounds perfect to me. Thank you so much for the opportunity to talk with you.

Davis: Ok, you are welcome and have a great day.

Hofer: Thanks, have a great day too and I wish you a good recovery from the surgery.

Davis: Thank you. Take care.

Interview with Moez Limayem, PhD

Position: Information Systems Department Chair, Walton Professorship in Information Systems
Organization: University of Arkansas, Sam M. Walton College of Business
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Date: July 30th, 2009
Duration: 21 minutes
Type: Skype telephone conference

Hofer: TAM has come a long way. Where do you see the future of technology acceptance research?

Limayem: Good. I think this is a very good question. Now we have a very good understanding of the underlying mechanism and the factors that affect users acceptance of technology. However, I think research that will add yet one more factor, one more relationship… I think we are ok and we don't need this type of research anymore, because we had enough. However, we still need a much better understanding of, for example, other related phenomenon. For example, the continuous use of technology. I think we still don't really understand it and we need some good research there. We also need to investigate the switching behavior. So, why people are switching from one technology to the other? I also think we need to better understand this and we have to move a little bit more to the organizational level, where we say ok, how can we translate what we know on the individual level to explain how organizations adopt technology. And what for example Fred and Paul are doing is also very interesting, because they say ok… what are the underlying physiological phenomenon and cognitive phenomenon. What really happens in our brain that makes us accept or reject a technology? So these are very promising areas of research. So, just to summarize it, we really have a very good understanding, so we don't need more research with yet one more factor or one more relationship to TAM, because there are so many other interesting things to investigate.

Hofer: How do you think differences in technologies themselves have an impact on technology adoption?

Limayem: Once again, I think you are asking really good questions here.

Hofer: Thanks ☺

Limayem: How would I classify categories of technology? So for example, you know, if you talking about Windows 3.1 versus Windows XP. I think for me, the differences are not that much. These are operating systems, a lot of factors are included and organizations are using them. However, if you compare it to another types of technology, like social media. That is a very different ball game, you know, Facebook, Twitter, and MySpace… I think these are new types of technologies where more traditional theories do not apply the way they are. Just to continue this, if you take for example virtual worlds. I think more traditional TAM like approaches maybe explain small parts of the variance, but not everything, because these are new technologies, they have other things and people go there not because it's easy to use or just because it's useful. They go there for different factors, social factors. The gap between the virtual and real life is getting smaller and smaller. Maybe they are going there to run away from their real life. You see, these factors are not accounted for like traditional technologies and approaches like TPB, TRA, or TAM. So, to summarize my answer to your question is that yes, some technologies are similar, but some technologies, especially the new ones we talked about, are really different and it is interesting to study why people adopt to that.

Hofer: That's actually a part of my next question. Regarding virtual worlds, where do you see main differences in technology acceptance to more "traditional" software tools?

Limayem: Ok, I think first of all they are much newer technologies and we really don't know very much and still don't have a very good understanding of who goes there and what they do there, how long they stay there and what are companies finding when they use these technologies. The fact that I think that whole thing is newer, a new ball game, I think that's interesting by itself. Another thing is for example… I take an e-mail system. You go there and use it in your job and it's easy to use and the usefulness, but virtual worlds, they are not unique content there. You need content there and other people to talk to and that will affect and comes into play more than just using something like e-mail. The interface is completely different, where I think you feel the presence of others and the co-presence is so important, because you feel others right next to you without being right next to you. These virtual worlds bring new dimensions of affiliating real life that other technologies don't. If I am using e-mail and sending an e-mail to a person I don't see that person, I don't feel the person to be here. However, when my avatar is in the same room and there is another avatar in this room in the virtual world, this is a completely different sensation. That you don't get when you are sending an e-mail or doing a phone call or even talking face-to-face to a person, it's very different. And just to give you an idea, I have even given courses in Second Life and people are behaving very different as they behave in face-to-face.

Hofer: So do you think there is a big difference of how people act in virtual worlds with their avatars as opposed to how they act in face-to-face communication in the real world?

Limayem: Oh, absolutely. Absolutely. You know, in so many times I met some avatars or the people behind the avatars and they even refused to answer any questions about their real life. So they are saying something or doing something and they think they feel more liberated and less pressure to say or to be politically correct or to say things that… that makes it very interesting to study.

Hofer: Yes, it is very interesting. Because there are a lot of other facts, like trust in the technology itself or the age difference of users. Do you think there is a difference in how people use a virtual world and especially act in it based on their age?

Limayem: Yes, I really think so. I think this new generation, the X or Internet generation. I think they are very different from older generations, they communicate differently. They use technology differently. Technology plays a much more important role in their lives than it plays for other people. So that's a big challenge because we were in a meeting with some managers just a week ago and they were saying it's challenging for companies, because companies have policies like not to use Facebook or Twitter. But they say these people we are hiring now, they cannot function without these tools. So we are artificially limiting their productivity while we think we are doing something good by prohibiting these tools. So you see, this is where the generation gap is. So for now it would be smarter to say how we can use these tools in a productive way, so that this new generation feels comfortable and creative in the job. But the gap is absolutely there. I hope that answers your question.

Hofer: Yes, for sure. That was exactly the point. Let's talk a little bit more about project management. How would you classify virtual worlds in comparison to other virtual project management tools?

Limayem: I think it could be very useful. Why? Of course, you have these classic resources, but now people who are working at the same project can work in different parts of the world. So getting them together could be very expensive. And unfortunately also using technologies like videoconferences or anything, it is not cheap. Phone and let's face it, it's not cheap. So the time and the costs and all that is very classic how we now it. However, I think what virtual worlds bring is that capacity to work on a free environment and to simulate. For example, you work on designing a room. It could be anything. Now, in a 3-D environment you could design it in a team

and the team members, even they are in the same virtual room, some of them could be in Europe, Asia, Australia, and so on… So that capacity of building and simulating in a 3-D environment is just amazing. And so that's why I think virtual worlds are more than adequate for that. In addition of the classic reasons for virtual teams and virtual meeting tools that allow them to meet without travelling.

Hofer: Nowadays, when we are talking about traditional project management tools like Microsoft Project, there is a lot of functionality that is not build into virtual worlds like Second Life, at least for now. So where do you see the trends here?

Limayem: Yes I think some of those functions will evolve into virtual worlds. And, of course, vice versa. Virtual worlds and as we move on in development they will include some project management specific tools like Microsoft Project and the others. I think… and people will predict that in about ten years the web as we use it know will slowly change to a 3-D environment where people are represented as avatars. So, expect also, as mentioned before, that traditional project management tools will have some similar 3-D interfaces like virtual worlds and also will be compatible with virtual worlds. You see, from the virtual worlds we will have more tools, but also see it from the project management tools that will also be compatible with virtual worlds.

Hofer: You talked about this forecast of how the web will evolve. I really like this idea. If we think about that we are sitting in front of a PC and look at a website alone, virtual worlds as opposed give you the opportunity to actually see who else is watching the same page or reading the same content at the same time. That's amazing.

Limayem: Absolutely. I think you mentioned this and a lot of progress is made. This will make virtual worlds even more useful to project management usage.

Hofer: This is basically the last question. Based on your experience. What do you think are possible business uses of virtual worlds?

Limayem: Oh, that's a very good question. I think meetings for project management or others; I mean that's great. Training also is very good. I think it eventually will be a very good way of promoting products and services. And another thing, we don't see it yet, but probably to sell. Sell products, you know like Walmart who is thinking about having stores in Second Life, where avatars can go to a virtual store and shop in a 3-D environment.

Hofer: Interesting. So they have their cart and they can put in it whatever they want.

Limayem: Yes, they have their cart, go to the shelves and pick the merchandize and they check out.

Hofer: That's a nice idea.

Limayem: I think also maybe research and development. Test some new processes, test some new products. So I think these are the main directions I see.

Hofer: At the end and based on our discussion, would you like to add something? Something that is important for you regarding these topics we talked about.

Limayem: I think the whole topic is really important. I mean virtual worlds, maybe not Second Life, for different reasons, maybe technical issues like the client. It is very heavy, but I think the concept it is very appealing and I believe it will stay. It's not really a game any more and I don't like it when people still call it a game. I see companies spending a lot of money and even universities are offering degrees, it's not longer a game.

Hofer: You were talking about Second Life and that new technologies will evolve. Do you think there is one platform that will be successful, maybe a more open platform or what do you think the optimal virtual world technology should look like?

Limayem: I heard about a version of Second Life that is open source. I think new technology… it has to be open source. Otherwise I think… it has to be open source so that people can easily add things or change something. But also I think and this is really important that the client have to be thin. What I mean by a thin client is that if you need an extremely high speed internet, a lot of memory in your computer, a certain soundcard, a certain graphic card, that is really making the usage more difficult. So the thinner the client is, the better the solution will be. And I think people do understand these things and I think new technologies have to have these two characteristics.

Hofer: Ok, thank you so much.

Limayem: Yes, I really appreciate. If you have anything finished I would like to read it.

Hofer: Yes, of course. I will send you my literature review.

Limayem: That would be great. I also have some articles for you and I will send you them to you.

Hofer: Sure, I would love to use these articles and include them into my thesis.

Limayem: Ok, sounds good. Thank you very much and please say Hi to Ilze.

Hofer: Sure, I will. Have a great day and thanks again.

Appendix E: Protocol of the Brainstorming Session

Uncategorized Ideas (Original Data)

communication - let clients talk with support reps

At some point clients need to speak in person to rep's

agreed with the first comment

we could use Second Life for Training (we do a lot of physical training)

What kind of training?

Safety, general plant training--how to enter different secured areas,etc.

virtual meetings

I would expect this to be a very heavy usage of Second Life

There are already many applications that support online meetings. The ability to move around makes this application unique. I don't see how it would enhance our current online meetings. Does anyone have any thoughts on that?

If you have the ability to intigrate the webcams, you can see everyone virtually in the virtual room.

I see it as an advantage if you have lots of people (like >10)

otherwise, I've got 10+ windows open on my desktop, one with each person in it

SL is much more 'collaborative' in this aspect

Thank you! Great points.

brain storming

Training sessions

Currently used for auditing training

web walkthroughs, like screen sharing, but 1 to many rather than 1 to 1

Demonstrations of equipment and software use

I was thinking of this too. Building simulators of our real plant equipment could save us time and dollars by doing virtual walk through training.

Online classes

Would significantly enhance participation in online classes.

I am not sure how it would enhance participation. Maybe I just can't see it...

Could be used to create online programs for nursing.

Process flow simulation.

Substitute for six sigma

Market research eg focus groups

Test social interaction such as dating online services

Test leadership in specific work environments

I think this is a great idea!

A very interactive social networking site

Project Teams?

I wonder how it would tie in with project mgt software

This could be used with the daily standups implemented in the Agile process

Maybe Second Life could be used as Edutainment for our internal staff as well as external customers...

communicate with Gen Y customers and constituents

THis could easily appeal to older generations as well - especially those shut ins and thise with disabilities

data visualization

Use it to demonstrate software

Wonder how

if the software is web based, you could show the website on a 'wall' in second life

Wouldn't webex let you do that today?

true, but this is free :)

once this becomes popular, I'm sure there will be a price tag to this.

Meetings

walk through of building design -- architecture to test layout

Good Idea

market to Gen Y customers/constituents

Good idea

Student group projects

use it for networking and meeting others with similar interest

Process flow demonstrations

giant, walk through flowcharts! I love it

Great idea! Making the process multi-demensional will improve retention

communicate with Gen Y customers/constituents

demonstrate advertising and marketing options - billboards, signs, tshirts, etc

Presentations

Collaboration between project team members (located in geographically different locations)

how is this better than a live meeting for project teams??

This is a live meeting not asynchronous

demo workspace changes - use SL to rearrange your cubes, see what it looks like

great idea; virtual design w/ or w/o a professional

Great idea

Trade conference or seminar

This would be a good precursor for a trade conference; eventually participants want to touch/feel, etc. the actual product but would work well to guage interest without investing the resources for a physical show.

Use it to build a knowledge bank where we can direct our clients (or co-workers) to find the information they need

Is there database or history functionality or an addin that would help this?

Have to dig deeper into the development tools options

to find out

Technical demonstrations

focus groups for web sites

Use it to build software applications with programmers located in other places

The next best thing to the Holodeck

beam me up Scotty

Is there database or history functionality or an addin that would help this?

Customer Complaints

Interesting if it where anonymous, you might get more feedback about your services (both negative and positive)

How to deal with customers --training

A multimedia launching point

How to approach customers for sales

Simulating new ideas to be installed in bank branches, and guaging market interest

you could demo ATM or other self-serve bank interfaces

Suggestion box

Use as a media for negotiating deals

Give feedback on architecture design

Using anonymity, an opportunity to elicit responses from the ENTIRE team

Use it for locating specific information about products

Could we do a disaster scenario?

Interesting idea...

This seems to be a good use of the system

How about a library or different libraries (book clubs, reference, education, etc....)

simulation - model your office building, start a fire, see how long it takes an avatar to get out

Prescreening interviews for new hires

Simulations of real events with active interaction of participants, not sure how rich the environment is at present?

Training for interviewers

Go to a movie theater and see movies or read reviews

go to the moon

and back?

Categorized Ideas

Categories / Subcategories	Counts (without comments)
Simulation / Visualization	**14**
Visualize process flow charts	*4*
Architecture / Building design	3
Desaster scenarios / natural, fire alarms	2
Data Visualization	
Workspace changes / rearrange things	
Technical demonstrations	
First step to a Holodeck	
Simulation of UI's / ATM e.g.	
PR / Marketing	**13**
Communicate with custormers	*6*
Market Research / Focus groups	*3*
Building a knowledge bank for customers	
Billboards, Signs, T-Shirts, etc.	
Trade conferences	
Product informations	
Project Management / Virtual Teams	**12**
Knowledge management / Database	2
Brainstorming sessions	
Advantage if more than 10 people at a meeting	
Collaborative aspect of SL	
Daily standups in Agile process	
Meetings in SL	
Student group projects	
Presentations	
Collaboration	
Software development environment	
Anonymus feedback of team members	
Training / Learning	**11**
Equipment and Software usage / demonstration	2
Safety issues of plants	
Auditing	
Web walkthrough	
Online classes	
Online nursing programmes	
Leadership test in different environments	
Edutainment intern/extern	
Sale reps training - how to deal with customers	
Job interview training	
Social Interaction	**5**
Mulitmedia lounging point	
Dating service	
Social network	
Networking	
Movies in SL	
Others	**4**
Negotiating deals, media support	
Recruiting / Job interviews	
Digital Libraries	
Travelling where it's very hard to get normally, e.g. Moon	
Total	**59**

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