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# CREATION OF FAVORABLE USER PERCEPTIONS: EXPLORING THE ROLE OF INTRINSIC MOTIVATION[1]

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## Abstract

*A key issue facing information systems researchers and practitioners has been the difficulty in creating favorable user reactions to new technologies. Insufficient or ineffective training has been identified as one of the key factors underlying this disappointing reality. Among the various enhancements to training being examined in research, the role of intrinsic motivation as a lever to create favorable user perceptions has not been sufficiently exploited. In this research, two studies were conducted to compare a traditional training method with a training method that included a component aimed at enhancing intrinsic motivation. The results strongly favored the use of an intrinsic motivator during training. Key implications for theory and practice are discussed.*

**Keywords:** User acceptance, adoption, training, motivation, Technology Acceptance Model

**ISRL Categories:** AA01, AA07, AC0401, AI0108, AI0117

## Introduction

Sometimes when I am at my computer, I say to my wife, "I'll be done in just a minute" and the next thing I know she's standing over me saying, "It's been an hour!" (Collins 1989, p. 11).

Investment in emerging information technology applications can lead to productivity gains only if they are accepted and used. Several theoretical perspectives have emphasized the importance of user perceptions of ease of use as a key factor affecting acceptance of information technology. Favorable ease of use perceptions are necessary for initial acceptance (Davis et al. 1989), which of course is essential for adoption and continued use. During the early stages of learning and use, ease of use perceptions are significantly affected by training (e.g., Venkatesh and Davis 1996). Investments in training by organizations have been very high and have continued to grow rapidly. Kelly (1982) reported a figure of $100B, which doubled in about a decade (McKenna 1990). In spite of such large investments in training, only 10% of training leads to a change in behavior on trainees' jobs (Georgenson 1982). Therefore, it is important to understand the most effective training methods (e.g., Facteau et al. 1995) and to improve existing training methods in order to foster favorable perceptions among users about the ease of use of a technology, which in turn should lead to acceptance and usage. Prior research in psychology (e.g., Deci 1975) suggests that intrinsic motivation during training leads to beneficial outcomes. However, traditional training methods in information systems research have tended to emphasize imparting

knowledge to potential users (e.g., Nelson and Cheney 1987) while not paying sufficient attention to intrinsic motivation during training. The two field experiments in this research attempt to create an enhanced level of intrinsic motivation among users to foster favorable user perceptions about a system. Specifically, this research attempts to induce a state of playfulness, one form of intrinsic motivation (see Webster and Martocchio 1992), during training with the objective of causing positive user perceptions about the ease of use of the target technology. A game-based training (GBT) method, developed as part of this research, is compared to a traditional training approach. The Technology Acceptance Model (Davis et al. 1989) is used as the theoretical perspective to compare user reactions and learning across the two different training methods.

# Theoretical Development ▰▰

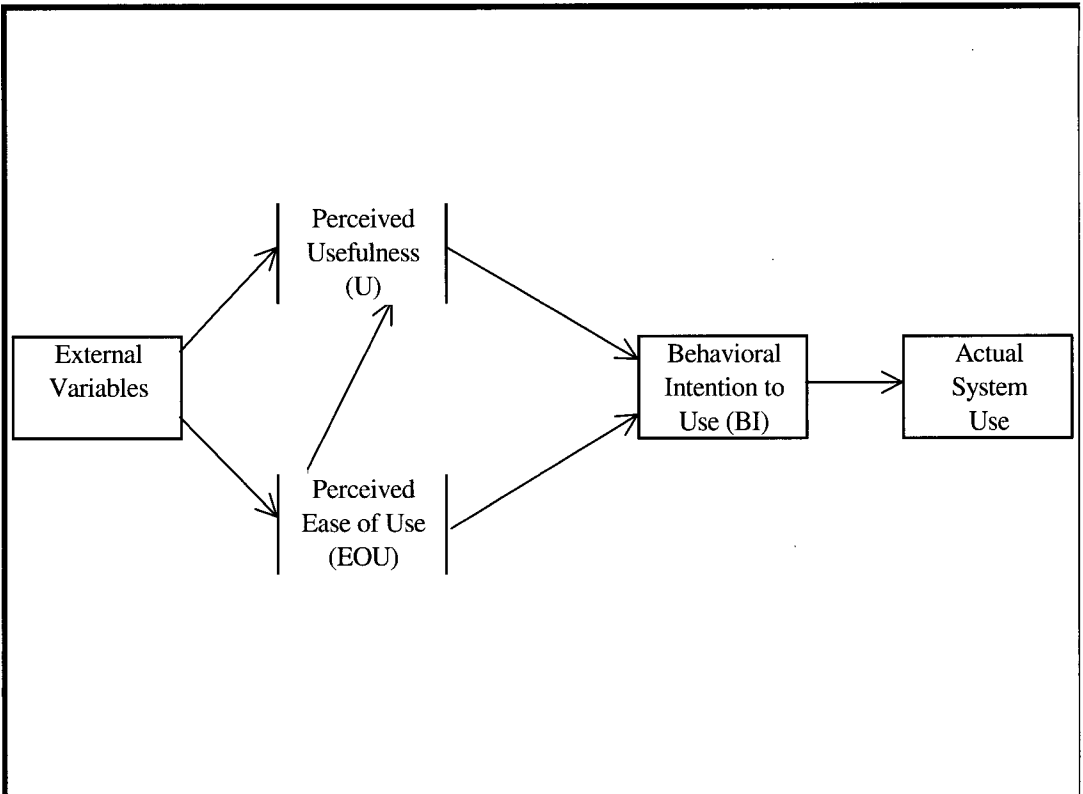## *Background*

### Technology Acceptance Model
The Technology Acceptance Model (TAM) (Figure 1) (Davis 1989; Davis et al. 1989) explains user acceptance of a technology based on user perceptions. TAM was developed from the social psychology theory of reasoned action (TRA) (Ajzen and Fishbein 1980; Fishbein and Ajzen 1975). TAM suggests that two specific behavioral beliefs, perceived ease of use (EOU) and perceived usefulness (U), determine an individual's behavioral intention to use (BI) a technology.[2] Further, it is suggested that

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[2]The original conceptualization of TAM was in keeping with TRA, where beliefs (U and EOU) were hypothesized to be completely mediated by attitude toward using technology (affective response reflecting the extent to which a person likes/dislikes using a technology). However, based on empirical evidence, TAM was refined to exclude attitude toward using technology because it did not fully mediate the effect of perceived usefulness on behavioral intention to use. The partial mediation of the effect of perceived usefulness by attitude toward using technology was conceptually explained to be the result of people intending to perform a behavior in the workplace even if they did not have a positive attitude (affect) toward the behavior. Even recent research (e.g., Venkatesh and Davis 1996) has successfully applied this modified/refined conceptualization of TAM.

the effect of external variables (e.g., design characteristics of the system) on intention are mediated by these two key beliefs. Perceived ease of use is the extent to which a person believes that using a technology will be free of effort. Given that perceived ease of use is defined in terms of effort, users can be expected to report their evaluation/assessment of the process of using a system, thus leading perceived ease of use to be a process expectancy. Perceived usefulness is the extent to which a person believes that using a technology will enhance her/his productivity. In contrast to perceived ease of use, which is a process expectancy, perceived usefulness is an outcome expectancy. Perceived usefulness is expected to be influenced by perceived ease of use because other things being equal, the easier a technology is to use, the more useful it can be. The direct effect of perceived ease of use on behavioral intention to use is stronger in the early stages of learning and behavior. With time/experience, the effect becomes indirect operating through perceived usefulness (see Davis et al. 1989). Significant empirical evidence (Adams et al. 1992; Chin and Gopal 1993; Davis 1989, 1993; Davis et al. 1989; Davis and Venkatesh 1995, 1996; Gefen and Straub 1997; Hendrickson et al. 1993; Igbaria et al. 1997; Mathieson 1991; Segars and Grover 1993; Subramanian 1994; Szajna 1994, 1996; Taylor and Todd 1995; Trevino and Webster 1992; Venkatesh and Davis 1994, 1996, forthcoming; Venkatesh and Morris forthcoming) has accumulated in support of TAM.

### Motivation
Similar to the use of TRA to study human behavior, motivational perspectives have also been widely used to understand behavior. In addition to the Technology Acceptance Model, there is also a motivation-oriented perspective, advanced by Davis and his colleagues (Davis et al. 1992), to predict technology acceptance and usage behavior. Consistent with other motivation research (see Vallerand 1997 for a recent review), Davis et al. (1992) found intrinsic and extrinsic motivation to be key drivers of behavioral intention to use. Intrinsic motivation refers to the pleasure and inherent satisfaction derived from a specific activity (Vallerand 1997), while extrinsic motivation emphasizes performing a behavior to achieve a specific goal (e.g., rewards) (Deci and Ryan 1987).

**Figure 1. Technology Acceptance Model**

## Training

Beginning with early research on TAM (i.e., Davis et al. 1989), training has been seen to be an important factor affecting user perceptions about a technology. In addition to user acceptance research, training has also received considerable attention in other areas of information systems research. Several methods of training have been proposed and tested for effectiveness. Nelson and Cheney (1987), building on the work of Sprague and Carlson (1982), identify seven different methods of software training: tutorial, courses/lectures/seminars, computer-aided instruction, interactive training manual, resident expert, help component, and external training. Similarly, other research describes three training methods: on-line, document-based, and instruction-based training (Czaja et al. 1986). In the research identified above and other related research (e.g., Davis and Bostrom 1993; Eason 1982; Kalen and Allwood 1991; Rockart and Flannery 1983; Webster and Martocchio 1995), the emphasis of the training method has been on communication of knowledge to users. Information systems research (e.g., Compeau and Higgins 1995a) and psychology research (e.g., Gist et al. 1989)[3] have focused on improving such training methods from the standpoint of the knowledge communication process.[4]

Typically, training provides users with conceptual and procedural knowledge necessary to put the technology to effective use. As Kalen and Allwood (1991, p. 88) point out

> ...formal training should not stop at a keystroke level of merely providing the users with sufficient procedural knowledge to perform certain work tasks, but should also give users a good conceptual understanding of the system they are using.

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[3]Gist et al. (1989) studied outcome variables such as satisfaction and frustration.

[4]Both Compeau and Higgins (1995a) and Gist et al. (1989) discuss behavior modeling as a better approach to training.

Along these lines, Glaser (1990) favors a method of describing concepts first to subjects. This facilitates the development of a schema to help users learn procedures at a later time. In contrast, researchers who favor a procedure-first training method suggest that users prefer learning the procedures first because it helps them generalize concepts at a later time (e.g., Wright 1988). There also exists research that reveals equivocal results across concepts-first and procedures-first training methods (e.g., Olfman and Mandviwalla 1994). In sum, training research provides several different training methods emphasizing knowledge transfer as measured by learning outcomes.

## Hypotheses Development

We often hear of people "surfing the net" and being "addicted to the net." The Internet provides an alternative form of entertainment through newsgroups, chatlines, multi-user fantasy, and role-playing games. Recently, *Business Week* (Cortese 1997) presented an extensive special report on the growth of the Internet as a place to "hang out." Thus, current and future forms of computer technology will be used for both work and fun, causing a reduced distinction between work and play (Starbuck and Webster 1991). The traditional view of play is that it is unproductive, pleasant, and involving. In contrast, the modern conceptualization presents two different concepts: unproductive play (something that is unproductive, pleasant, and involving) and playful work (something that is productive, pleasant, and involving) (see Starbuck and Webster 1991 for a discussion). Systems are not necessarily built from the "joy angle" despite people increasingly spending time on computers expecting it to be a pleasurable experience (Brody 1992). While training methods have focused on improving learning outcomes, very little attention has been devoted to enhancing intrinsic motivation in the task during training.

Prior research suggests that motivation in general is an important factor driving perceptions and behavior, even in training contexts. Effective training programs should address the potential lack of self-motivation of trainees by including a motivational component (McCombs 1984). Olfman and Bostrom (1991) compared

the effect of construct-based and application-based training interventions on motivation to use. Perceived usefulness was used as a surrogate measure for motivation to use. From a TAM perspective, perceived usefulness is an outcome expectancy and a measure of extrinsic motivation (see Davis et al. 1992). The current research extends this line of inquiry in an important way by focusing on intrinsic motivation and how that can be leveraged during training to create favorable user acceptance. The role of intrinsic motivation in training is important since it leads to beneficial outcomes (Deci et al. 1991). For example, intrinsic motivation in the early stages of learning leads to sustained behavior (Vallerand and Bissonnette 1992). Thus, paying attention to the role of intrinsic motivation during the training process *is critical. One specific intrinsic motivator is* playfulness (see Bloch and Bruce 1984; Hirschman 1983; Mihalich 1982; Osborne 1979; Unger and Kernan 1983). Prior research on playfulness has primarily studied it as a trait.[5] Webster and Martocchio (1992) examine playfulness as a trait in keeping with Lieberman (1977).[6] However, they suggest the importance of studying playfulness as both a trait and a state just as mood has been examined as both a trait (e.g., George 1989) and a state (e.g., George 1991). In keeping with the idea of playfulness as a state, this research attempts to induce a state of playfulness as an intrinsic motivator during the training process with the specific objective of enhancing perceived ease of use and the role it plays in determining *behavioral intention to use. The remainder of* this section discusses the potential impact of a game-based training intervention aimed at leveraging playfulness (intrinsic motivation) on TAM constructs (user perceptions and intentions), the

[5]Bostrom et al. (1990) explain the distinction between trait and state variables, with particular attention to their role in IS research. A trait is an enduring and static individual difference variable (e.g., personality variables) that has an impact on individual information processing in a wide range of settings and activities. In contrast, states are more dynamic (vary over time) influences on performance (e.g., motivation).

[6]More recently, Webster and Ho (1997) have examined how presentations can be improved from this standpoint.

relationships among TAM constructs, and learning outcomes.

## Effect on TAM Constructs

Past research has shown several positive consequences of intrinsic motivation. A motivational skills training component combined with a traditional curriculum favors positive perceptions of self-efficacy and personal causation leading to a more positive orientation (McCombs 1984). Intrinsic motivation in a task environment has also been associated with willingness to spend more time with the task, lower levels of anxiety, positive mood, and greater learning (e.g., Csikszentmihalyi 1975; Venkatesh and Speier forthcoming). In a piano-playing context, it was found that positive student perceptions of the intrinsic motivation of the teacher had a significant positive influence on intrinsic motivation of the students, their affective reactions and their proximal (volitional) behavior (Wild et al. 1992). In the context of TAM, introducing intrinsic motivation through training can be expected to be mediated by the beliefs: perceived ease of use and/or perceived usefulness. This stems from the fundamental thesis of TAM (and TRA) that the effect of external variables on behavioral intention to use are mediated by beliefs. This general hypothesis has been extensively validated in psychology research (see Ajzen and Fishbein 1980) and in TAM research (e.g., Davis et al. 1989). Specifically, the effect of training interventions have been shown to be mediated by perceived ease of use (e.g., Venkatesh and Davis 1996).

From a standpoint of its definition, theoretical development, and operationalization (Davis 1989), perceived ease of use is a construct focused on an individual's perception about the level of effort needed to use a system, and represents the user's subjective evaluation of the process of interaction with a system. One of the building blocks of the perceived ease of use construct is self efficacy theory (Bandura 1977a, 1982) which suggests two types of expectations, efficacy and outcome, determine behavior. Bandura (1977b) defines an efficacy expectation as "the conviction that one can successfully execute the behavior required to produce the outcomes" (p. 79). An outcome expectancy is defined as "a person's estimate that a given

behavior will lead to certain outcomes" (Bandura 1977b, p. 79). Perceived ease of use is said to be related to efficacy beliefs (Venkatesh and Davis 1996) and thus, a process-oriented construct or a process expectancy. Gattiker (1992), in a framework of training, suggests that individual motivation will have an impact on substantive complexity. Based on intrinsic motivation research and user acceptance research, it can be expected that for a given objective level of effort, greater levels of intrinsic motivation during training will have a favorable impact on perceptions of effort (perceived ease of use).

**H1:** Perceived ease of use will be higher among users in the game-based training intervention compared to users in the traditional training intervention.

The primary purpose of the game-based training is to enhance perceived ease of use. However, it is also important to understand the effect of such an intervention on perceived usefulness. In addition to perceived usefulness being a key determinant of acceptance, it is important to understand the effect of game-based training on perceived usefulness because of potential negative effects of game-based training. It may be possible for users to dismiss a game-based training intervention as being non-work related ("just a game") and thus, while having higher levels of perceived ease of use, users may have lowered perceived usefulness. The theoretical underpinnings and operationalization of perceived usefulness suggest that it is a construct focused on outcome expectancy (Davis 1989). Consistent with such a view, from the perspective of self-efficacy theory (Bandura 1977a), perceived usefulness is an outcome belief (in contrast to perceived ease of use, which is an efficacy belief). While training has been shown to have a strong influence on perceived ease of use, (e.g., Venkatesh and Davis 1996), perceived usefulness is not significantly influenced by training and is more strongly determined by a matching process between a technology's capabilities and a person's job needs (see Venkatesh and Davis, forthcoming). Their finding across multiple studies supports the notion that the impact of the two different training interventions on perceived usefulness will not be different since they found that much direct hands-on experience was not

necessary for the formation of stable perceived usefulness. Further, given that Davis et al. (1992) explained perceived usefulness to be similar to extrinsic motivation, it minimizes the possibility of an intrinsic motivator influencing perceived usefulness. Thus, it is expected that users in both training groups will have similar levels of perceived usefulness.

**H2:** Perceived usefulness will be equivalent between users in the two different types of training interventions.[7]

According to TAM, behavioral intention to use is determined by perceived ease of use and perceived usefulness (BI = EOU + U). Based on this basic TAM hypothesis and the earlier hypothesis that perceived ease of use will be higher in game-based training (H1), it is expected those users will also exhibit higher levels of behavioral intention to use compared to users who underwent traditional training.[8]

**H3:** The behavioral intention to use will be higher among users in the game-based training intervention compared to users in the traditional training intervention.

### Effect on TAM Relationships

A fundamental hypothesis of TAM is that the effect of external variables on intention is completely mediated by beliefs (EOU and U). This mediation of external variables by beliefs is consistent with TRA. As indicated earlier, this hypothesis of mediation has been tested extensively in psychology research and TAM research *and is now an integral part of the model*. The effect of several external variables (including training) has been shown to be mediated by perceived ease of use and perceived usefulness. However, in this research, the basic assumption of complete mediation by TAM constructs is challenged. Typically, following training interventions emphasizing knowledge transfer, out-

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[7]Please note that the hypothesis is presented in its null form. However, in this case, there is strong evidence to suggest that there will be no differences across interventions.

[8]This effect is expected despite the non-significant difference across interventions on perceived usefulness (H2).

come expectancy (i.e., perceived usefulness) emerges as the strongest determinant of behavioral intention to use while process expectancy (i.e., perceived ease of use) is less important as a determinant of behavioral intention to use. The current work argues that by providing an appropriate framing effect (Tversky and Kahneman 1982) using an intrinsic motivator (game-based training, in this case), it is possible not only to create a positive impact on perceived ease of use (H1) but also to have a strong impact on the effect of perceived ease of use on behavioral intention.

Based on social influence theory (Salancik and Pfeffer 1978), prior research suggests that attitude toward a task may quite simply be influenced by labeling a task as "work" or "play" (Webster and Martocchio 1993). This effect of labels on attitude was supported by Sandelands (1988). Further, research on cognitive categorization (Rosch 1975, 1978) suggests that "play" causes the focus to be on the means while "work" causes the focus to be on the ends (Sandelands 1988). The notion of play and means is related to process expectancy (i.e., perceived ease of use) while the idea of work and ends is related to outcome expectancy (i.e., perceived usefulness). Similarly, cognitive evaluation theory suggests that intrinsic motivation will lead to higher levels of effort (Deci 1975). The underlying cognitive phenomenon is termed locus of causality, which is the basic cognitive mechanism driving the performance of any behavior. Locus of causality can be internal or external. When intrinsic motivation is higher, locus of causality is said to be internal to the individual and the behavior is driven by intrinsic needs and rewards. Traditional training interventions tend to emphasize extrinsic value in using a technology in terms of "what a technology can do," causing the locus of causality to be external and more focused on outcome expectancy (i.e., perceived usefulness). On the other hand, game-based training is expected to shift the locus of causality (from external to internal) leading to greater emphasis being placed on process expectancy (i.e., perceived ease of use).

Research in the area of behavioral decision theory also supports this possibility and explains the

compatibility hypothesis as follows: the more compatible the stimulus attribute is with the response mode, the more heavily the particular attribute will be weighted in judgment and choice (Slovic et al. 1990). This hypothesis has also been supported in other decision-making research (e.g., Slovic et al. 1982). In the context of this research, a traditional training method causes respondents to have a greater degree of compatibility with outcome expectancy and, therefore, weight perceived usefulness more than perceived ease of use in determining behavioral intention to use. In contrast, a game-based training method can be expected to cause a greater degree of compatibility with process expectancy because of enhanced levels of intrinsic motivation, thus causing users to place greater weight on perceived ease of use rather than perceived usefulness in determining behavioral intention to use. Other related research in decision making suggests that different types of framing of the problem/decision space can lead to different preferences (Tversky and Kahneman 1982). Similarly, research in the area of social cognition suggests that positive priming can result in shifting judgments (Murphy and Zajonc 1993). In this case, the positive priming/framing is expected to cause the judgment about perceived ease of use to be more significantly emphasized in a game-based training intervention.

**H4:** The influence of perceived ease of use on behavioral intention to use (EOU-BI) will be higher among users in game-based training when compared to users in traditional training.

TAM suggests that perceived ease of use has a direct effect on behavioral intention to use and an indirect effect through perceived usefulness. Empirical evidence suggests that the effect of perceived ease of use during the early stages of learning and use is primarily direct and less strongly indirect (through perceived usefulness), and it is only with significant experience that the indirect effect becomes stronger (e.g., Davis et al. 1989; Szajna 1996). Consistent with this TAM hypothesis, it is expected that the perceived ease of use/perceived usefulness relationship will be significant, although modest. However, since the studies in this research are being conducted to

examine the role of intrinsic motivation during early stages of learning and use, no significant difference in the relationship is expected across interventions.

**H5:** The perceived ease of use-perceived usefulness (EOU-U) relationship will be equivalent across the two types of training interventions.[9]

In a workplace environment, irrespective of the type of training intervention, it can be expected that perceived usefulness will be a key factor determining behavioral intention to use. However, given the nature of the process underlying the formation of perceived usefulness (i.e., a matching between product features and job tasks) per Davis and Venkatesh (forthcoming), it can be expected that users in the two different types of interventions will place similar emphasis on perceived usefulness.

**H6:** There will be no difference in the perceived usefulness-behavioral intention to use (U-BI) relationship across the two types of training interventions.[10]

Further, given the differential influence of training interventions on the perceived ease of use/behavioral intention to use relationship (H4), the variance in behavioral intention to use explained by perceived ease of use and perceived usefulness will be higher in the case of game-based training than traditional training.[11]

**H7:** The variance in behavioral intention to use explained by perceived ease of use and perceived usefulness will be higher for the group of users in the game-based training intervention when compared to users in the traditional training intervention.

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[9]As with H2, please note that the hypothesis is presented in the null form. Once again, as with H2, in this case also, there is strong reason to expect no differences across interventions.

[10]The issues related to a null hypothesis that applied to H2 and H5 apply in this case as well.

[11]This effect is expected despite the non-significant impact of training on the U-BI relationship (H6).

# Method

In order to study the effect of game-based training on user perceptions and learning, two studies are conducted among business professionals. The target system is a Virtual Workplace System (VWS). The game-based training intervention is designed on the basis of an Internet fantasy role-playing game.

## System

The Virtual Workplace System[12] is an Internet-based application aimed at allowing a large number of users at different physical locations to telecommute (interact real-time with each other, exchange information, and work together, as they would in a conventional office setting). There has been an increasing number of technologies supporting telecommuting in organizations (e.g., Microsoft Net Meeting). Target users for the system are knowledge workers who spend a large part of their work day using a computer and attending group/team meetings related to various projects. The potential advantages (at an organizational level) of being able to create a workplace in virtual space (cyberspace) are: (1) it is an inexpensive technology allowing individuals to work from home, which provides flexibility in terms of working hours, (2) it allows organizations to hire valuable knowledge workers without being hindered by issues of relocation and also retain key employees who want to move to a different geographical location, and (3) it also provides for more effective use of (physical) office space. For the knowledge workers, at a job/task level, the system provides: (1) the scope for an increased number of different-place, same-time computer-supported meetings among members of teams and (2) the ability to share information (using electronic mail, file transfer utilities, etc.), to participate in meetings, and to perform the routine office activities (typing a letter, cutting, pasting, printing, and sharing files, etc.) on the computer itself without having to actually be at the same physical location as other knowledge workers in the team, group, department, or organization.

## Game-Based Training (GBT)

As discussed earlier, with traditional training, the goal is to impart knowledge to users. Bruner (1962) suggested that the two criteria to determine whether some information is worth teaching are: (1) the knowledge "gives a sense of delight" and (2) the knowledge "bestows the gift of intellectual travel" (p. 109). Malone (1981a, 1981b) studied computer games and investigated how games can be used to make learning with computers a more interesting and enjoyable experience. Malone (1981a) identified three distinct components of intrinsic motivation: fantasy, challenge and curiosity. In the GBT employed in this research, intrinsic motivation during training is leveraged by introducing a fantasy dimension. There has been very little research focusing on intrinsically interesting activities emphasizing fantasy (Sansone et al. 1989). The fantasy dimension provides cognitive meanings and representations necessary for intrinsic motivation (e.g., Lepper 1985; Parker and Lepper 1987) and discovery-based learning (Bruner 1962). Sansone et al. (1989) also found that fantasy emphasis (compared to skill emphasis) led to higher levels of enjoyment, flow, and interest in further information. From the perspective of Olfman and Bostrom (1991), GBT and the traditional training intervention in this research are application-based training interventions.

The GBT, by leveraging fantasy,[13] attempts to create an enhanced state of playfulness among users, thus making the training program more intrinsically motivating while continuing to provide adequate information to facilitate knowledge acquisition. This is in contrast to a concept-first or procedure-first training method, the typical training method used in IS research aimed solely at knowledge transfer. The GBT employs a game (i.e., Multi-User Dungeon) to which features of the system being studied were related. Multi-User Dungeon (MUD) is a multi-user game on the Internet. MUDs are built on the concept of the popular fantasy role-playing game "Dungeons and Dragons." MUDs are based on the metaphor of physical space (Bruckman 1992) described in a text-based virtual space (i.e., the

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[12]This system was built as part of this research stream. Technical details are available on request.

[13]The game-based training intervention (GBT) can also be related to a narrative (story as a mental representation) (e.g., Orr 1990).

real world, buildings, and offices are described in the form of text as one would see it in reality). Every person (player of the game) creates her/his own character. A character is the representation of the user in the virtual world. Such user-created characters serve as a front for users to interact in the virtual world. It includes a name, gender, and even a description. MUDs employ different-place, same-time online interaction similar to communication among users who are telecommuting. The growth of Internet communities such as those on MUDs has been tremendous. A special report in *Business Week* (Cortese 1997) suggests that there has been a significant growth of chatlines and interactive communication on the Internet. Thus, there appears to be significant potential for "interactive text communication." Hagel and Armstrong (1997) go a step further in pointing out how MUDs are a tremendous source of addiction on college campuses, and it is only a matter of time before effective simulations of such virtual communities are used to create business applications.

The GBT will serve as stimulus to enhance intrinsic motivation consistent with the basic framework of Deci (1975), which suggests that the environment is one of the stimuli that can cause intrinsic motivation, leading to more goal-directed behavior. This intervention is also consistent with other prior research that has primarily focused on identifying a context that would be supportive of intrinsic motivation (e.g., Deci and Ryan 1987). Further, as suggested by Gattiker (1992), developmental factors (in this case, user perceptions and prior experiences with games) will interact with the training environment and affect the evaluation of the situation. Also, other well-established paradigms of research (job-characteristics model) (Hackman and Oldham 1976) suggest that increased levels of task variety, as is the case in the GBT, will lead to enhancement of motivation.

## Manipulation Checks

Two manipulation checks were included. First, perceived enjoyment (intrinsic motivation) was measured using three items adapted from the scale of Davis et al. (1992). It is expected that subjects in the game-based training intervention would test higher on this scale. Second, subjects

completed a 45-minute knowledge test at the end of the training program. More positive learning outcomes are typically associated with intrinsic motivation (e.g., Czikszentmihalyi 1975). Consistent with general intrinsic motivation research, it has been suggested that positive learning can result from playfulness (Lieberman 1977). In contrast, other research has suggested that playfulness causes increased time to complete tasks (Sandelands 1988). Starbuck and Webster (1991) potentially reconcile these contrasting ideas by suggesting that playfulness may lead to increased time spent on tasks but results in higher quality of output. Although Webster and Martocchio (1993) did not find support for their hypothesis that labeling as play will have higher learning outcomes than labeling as work, they did find that the interaction of age and play was significant, with better learning resulting among younger employees in play labeling. While the game-based training was expected to have no positive effect on learning outcomes because of the equivalency of the different interventions in terms of total time and hands-on experience, it was important to ensure that none of the demerits of playfulness (e.g., wasted time) cause a lowered level of learning.

## *Study 1*

### Subjects
Participants were solicited via a letter directly addressed to the individuals selected at random from a list of business professionals (knowledge workers) in the geographical area close to the author's place of employment. A total of 320 letters, announcing the training on the Virtual Workplace System, were mailed. A time commitment of one day (about eight hours excluding breaks) was sought. Eighty-two individuals agreed to participate and the actual attendance was recorded at 69. Only one participant had telecommuting experience and all but four had used electronic mail in the past and were basically familiar with the idea of telecommuting. Also, all except two subjects reported being unfamiliar with MUDs and Dungeons and Dragons. The subjects were employed in a wide range of industries with an average work experience of just over seven years (the range was from four to 19 years). The average age of the subjects was

41.2 (the range was from 29 to 51). Thirty-one of the 69 (45%) participants were female.

## Procedure

Four of the individuals involved with the development of the Virtual Workplace System conducted the training. None of the trainers were aware of any of the research objectives. All subjects were randomly assigned to one of the two training interventions: traditional lecture-based training or game-based training. This was done in an attempt to ensure that the effect of the interventions was not specific to those with higher levels of microcomputer playfulness from a trait standpoint, thus minimizing systematic biases. Pre-experimental microcomputer playfulness was measured using the short seven-item scale of Webster and Martocchio (1992). There was no significant difference in microcomputer playfulness across treatment groups.

Table 1 presents a graphical representation of the two training interventions. The game-based training intervention comprised three two-hour sessions, with 30-minute breaks between sessions, conducted on the same day. The subjects completed a 45-minute knowledge test at the end of the training. In order to compare the impact of the game-based training intervention with a traditional lecture-based training approach, a second training intervention was employed. This training intervention was designed to be a concept-first training on the concepts, features, and procedures of the system. Extensive hand-outs, both on the concepts and procedures of the system, were used to aid the subjects' learning process. The lecture and hands-on use during both types of training interventions required subjects to accomplish a specific set of tasks, which helped users understand the features and procedures of the system, and also fostered user interaction. Similar to the game-based training inter-

vention, the traditional lecture-based training lasted six hours with 30-minute breaks between each two-hour session. The traditional training intervention, therefore, closely mirrored an executive training program on a new software product. The subjects in the traditional training intervention also completed a knowledge test at the end of the training.

The total hands-on experience in both interventions was equivalent (four hours). In order to ensure equivalence between the two hours of game play in the game-based training and the first two hours of hands-on use in traditional training, the activities in which subjects were involved were made as similar as possible. In the game-based training intervention, the subjects were briefly introduced to the game and navigated through the virtual world of the game, interacted with other users of the game (other subjects), and played the game (killing monsters and gathering treasures). During the first two hours of hands-on use during traditional training, subjects navigated through the virtual workspace and interacted with others on the system. During the second two hours of hands-on use in both interventions, the activities were job-oriented. Thus, the key difference across interventions was the game context in the game-based training intervention.

All subjects completed a TAM questionnaire following training. Four-item scales, adapted from Davis (1989), were used to measure perceived ease of use and perceived usefulness. Two items were used to measure behavioral intention to use (see Davis et al. 1989). The items included in the instrument were aimed at testing TAM in the context of the two training interventions. The subjects also completed a 45-minute test aimed at assessing the knowledge acquired during the training process. In keeping with Kalen and

## Table 1. Study 1: Training Interventions

| Traditional Training | 2-hour lecture on the system | 30-min. break | 2-hour actual use of the system | 30-min. break | 2-hour actual use of the system | 45-min. test |
|---|---|---|---|---|---|---|
| Game-Based Training | 2-hour hands-on training on the game (playing the game) | 30-min. break | 2-hour lecture on the system | 30-min. break | 2-hour actual use of the system | 45-min. test |

Allwood's (1991) suggestion for future research, this will allow a comparison of the different training interventions to determine "how much and what type of instructor activities and user interaction with the application program result in the most effective learning" (p. 89).

## Results

The psychometric properties of the scales were consistent with past research. Reliability estimates (Cronbach alpha) for EOU, U, and BI were all over 0.90, suggesting a high degree of reliability. Convergent and discriminant validity were supported by results from factor analyses with cross-loadings lower than 0.20. The results from the manipulation checks were as expected—enjoyment measures were significantly higher among the subjects in the game-based training ($M$ = 6.1; $SD$ = 0.6) compared to the traditional training ($M$ = 4.1; $SD$ = 0.9). The knowledge test scores in the game-based training ($M$ = 86.8; $SD$ = 7.1) were statistically equivalent to the traditional training ($M$ = 87.9; $SD$ = 6.8).

Table 2 presents a comparison of EOU, U, and BI across training interventions. Clearly, users who participated in the game-based training intervention had higher levels of EOU (H1) and were more likely to use the system as indicated by BI in comparison to users in the traditional training intervention (H3). The impact on U was not statistically significantly different across interventions (H2).[14] This pattern of mean differences was confirmed by ANOVAs followed by Tukey's test.

Regression analyses were performed to study the effect of the training interventions on TAM. The data were analyzed for the subjects (n = 34)

who went through the traditional training (TT) and the group of subjects (n = 35) who went through GBT. Table 3 presents a summary of the comparison of training interventions. In both training interventions, consistent with TAM (e.g., Davis et al. 1989), BI was determined by EOU and U. Users in the GBT took into account EOU ($\beta$ = 0.58) more in determining BI than did users in the traditional training intervention ($\beta$ = 0.31), thus supporting H4. This was also confirmed by pooling the data across training interventions and testing for moderation of the EOU-BI relationship by training.[15] This positive moderation effect, as mentioned earlier, challenges the basic TRA/TAM hypothesis that all external variables will be completely mediated by TAM constructs. In the traditional training intervention, the overall effect of EOU ($\beta$ = 0.51) and the overall effect of U on BI ($\beta$ = 0.61) indicated that U emerged as a stronger overall predictor of BI. While U remained a strong determinant of BI ($\beta$ = 0.66) in GBT, the overall effect of EOU on BI was higher in GBT compared to traditional training ($\beta$ = 0.83), challenging the basic TAM tenet (and accumulated TAM research) that U is the strongest predictor of BI. However, the effect of EOU on U while higher in the GBT ($\beta$ = 0.38) was not statistically significantly different from traditional training ($\beta$ = 0.32), confirming H5. The overall effect of U on BI ($\beta$ = 0.61 vs. $\beta$ = 0.66) was also not statistically significant across interventions, confirming H6. The variance in BI explained in the GBT was 67%, which was statistically significantly higher than the variance explained in the traditional training (49%), supporting H7.

## Study 2

The second study was conducted to address one potential limitation of the first study. A potential

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[14]In order to examine the differential impact of the two training interventions on EOU and U on BI, data from the two interventions were pooled and a dummy variable, TRAINING, was introduced (0 = Traditional training; 1 = Game-based training). The results indicated that TRAINING had a significant impact on EOU consistent with Venkatesh and Davis (1996), suggesting that users in the game-based training intervention found the system to be significantly easier to use when compared to users in the traditional training. TRAINING had no effect on U.

[15]In order to examine the differential impact of the two training interventions on the different TAM relationships, data from the two interventions were pooled and a dummy variable, TRAINING, was introduced (0 = Traditional lecture-based training; 1 = Game-based training). The moderating effect of TRAINING on the EOU-BI relationship revealed a significant interaction effect, while the interaction effect in the case of the EOU-U and U-BI relationships were non-significant.

## Table 2. Study 1: Comparison of TAM Constructs Across Training Interventions

| | Perceived Ease of Use | | Perceived Usefulness | | Intention to Use | |
|---|---|---|---|---|---|---|
| | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev. |
| Traditional Training | 4.6 | 0.8 | 5.1 | 0.7 | 5.1 | 0.9 |
| Game-Based Training | 5.7 | 0.7 | 5.3 | 0.9 | 6.0 | 0.6 |

## Table 3. Study 1: Comparison of TAM Relationships Across Training Interventions

| | Variance Explained in Intention | Effect of EOU on Intention | | | Effect of U on Intention | |
|---|---|---|---|---|---|---|
| | | Direct | Indirect | Total | Direct | Total |
| Traditional Training | 0.49 | 0.31 | 0.32 * 0.61 | 0.51 | 0.61 | 0.61 |
| Game-Based Training | 0.67 | 0.58 | 0.38 * 0.66 | 0.83 | 0.66 | 0.66 |

confound in the first study is that the hands-on training was not equivalent across the two interventions. In the first study, although specific efforts were made (in the first two hours of hands-on experience during traditional training) to show subjects various aspects of navigation through the Virtual Workplace System and promote interaction among subjects, it can be argued that the "actual system use" in the traditional training was four hours while in the game-based training it was only two hours because two hours were spent on the game and only two hours on the actual system. Thus, it is possible that the subjects in the traditional training intervention formed a lower yet more *accurate* perceived ease of use, especially if only two hours were necessary to learn the system. In order to address this issue, an additional traditional training intervention with only two hours of total hands-on system use was introduced. Next, to address potential order effects (game-first vs. lecture-first) in the GBT (in the first study, the GBT was a game-first method), in this study, a lecture-first GBT was also included.

**Subjects**
Participants for this study were invited similar to the first study by mailing out 500 letters. A total

of 212 individuals agreed to participate, the actual attendance was recorded at 148, and 146 usable responses were obtained. Only seven participants had telecommuting experience, and all but three had used electronic mail in the past and were basically familiar with the idea of telecommuting. Also, all except nine subjects reported being unfamiliar with MUDs and Dungeons and Dragons. The subjects were employed in a wide range of industries with an average work experience of just over 14 years (the range was from three to 31 years). The average age of the subjects was 44.1 (the range was from 28 to 54). There were 40 (27%) female participants.

**Procedure**
In this study, there were two different traditional training interventions and two different game-based training interventions. Table 4 represents the interventions in the second study. While traditional training intervention #1 (TT1) paralleled the traditional training in the first study, traditional training intervention #2 (TT2) included only one two-hour session of hands-on use. Similarly, game-based training intervention #1 (GBT1) was the same as the GBT that subjects received in the first study. A second game-based training intervention (GBT2) was introduced to counterbalance

## Table 4. Study 2: Training Interventions

| Traditional Training #1 | 2-hour lecture on the system | 30-min. break | 2-hour actual use of the system | 30-min. break | 2-hour actual use of the system | 45-min. test |
|---|---|---|---|---|---|---|
| Traditional Training #2 | 2-hour lecture on the system | 30-min. break | 2-hour actual use of the system | 45-min. test | | |
| Game-Based Training #1 | 2-hour hands-on training on the game (playing the game) | 30-min. break | 2-hour lecture on the system | 30-min. break | 2-hour actual use of the system | 45-min. test |
| Game-Based Training #2 | 2-hour lecture on the system | 30-min break | 2-hour hands-on training on the game (playing the game) | 30-min. break | 2-hour actual use of the system | 45-min. test |

the order of the lecture and game-play. In all four interventions, similar to the first study, the hands-on experience, guided by a set of exercises, was in the context of interaction with other users.

The training was conducted similar to the first study with two trainers in each session. Subjects were randomly assigned to one of the four training interventions: TT1, TT2, GBT1, or GBT2. In this study, to control for prior knowledge/experience with computers and the trait of playfulness, computer self-efficacy (Compeau and Higgins 1995b) and microcomputer playfulness (Webster and Martocchio 1992) were measured. There was no significant difference in computer self-efficacy or microcomputer playfulness (trait) across treatment groups. Similar to the first study, following the training, subjects completed a TAM questionnaire and completed a 45-minute test aimed at measuring learning outcomes.

### Results

The psychometric properties of the scales were consistent with the first study and prior research. Cronbach alpha estimates for EOU, U, and BI exceeded 0.90, supporting a high degree of reliability. Convergent and discriminant validity were supported by results from factor analyses with cross-loadings lower than 0.20. The results from the manipulation checks were also consistent with the first study. Specifically, enjoyment measures were significantly higher among the subjects in the game-based training (GBT1: $M = 6.0$, $SD = 0.7$; GBT2: $M = 6.1$, $SD = 0.6$) compared to the traditional training (TT1: $M = 4.3$, $SD = 0.8$; TT2: $M = 3.9$, $SD = 0.9$). The knowl-

edge test scores in the game-based training (GBT1: $M = 85.2$, $SD = 6.6$; GBT2: $M = 79.6$, $SD = 8.5$) were statistically equivalent to the traditional training (TT1: $M = 84.8$, $SD = 7.2$; TT2: $= 86.7$, $SD = 9.0$).

Table 5 presents a comparison of EOU, U, and BI across the four training interventions. Users participating in both game-based training interventions possessed higher levels of EOU (H1) and were more likely to use the system as indicated by higher levels of BI in comparison to users in the traditional training groups (H3). The impact on U was not statistically significantly different across interventions (H2).[16] This pattern of mean differences was confirmed by ANOVAs followed by Tukey's test. Interestingly, users in the shorter version of the traditional training intervention (TT2) had lower levels of EOU and BI than users in TT1. This rules out the possible confound (in

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[16]In order to examine the differential impact of the two training interventions on EOU and U on BI, similar to Study 1, data from the different interventions were pooled and a dummy variable, TRAINING, was introduced (0 = TT1; 1 = TT2; 2 = GBT1; 3 = GBT2). The results indicated that TRAINING had a significant impact on EOU consistent with Venkatesh and Davis (1996), suggesting that users in the game-based training intervention found the system to be significantly easier to use when compared to users in the traditional training. Further analysis was performed with only the data from traditional training groups. The "amount of experience" had an effect on EOU relationship suggesting that those receiving four hours of hands-on experience had higher EOU. TRAINING had no effect on U.

| Table 5. Study 2: Comparison of TAM Constructs Across Training Interventions | | | | | | |
|---|---|---|---|---|---|---|
| | Perceived Ease of Use | | Perceived Usefulness | | Intention to Use | |
| | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev. |
| Traditional Training #1 | 4.4 | 0.8 | 4.9 | 0.9 | 4.8 | 0.8 |
| Traditional Training #2 | 3.7 | 0.9 | 4.7 | 0.8 | 4.1 | 1.0 |
| Game-Based Training #1 | 5.5 | 0.7 | 5.0 | 0.6 | 5.8 | 0.6 |
| Game-Based Training #2 | 5.4 | 0.7 | 4.9 | 0.8 | 5.7 | 0.8 |

| Table 6. Study 2: Comparison of TAM Relationships Across Training Interventions | | | | | | |
|---|---|---|---|---|---|---|
| | Variance Explained in Intention | Effect of EOU on Intention | | | Effect of U on Intention | |
| | | Direct | Indirect | Total | Direct | Total |
| Traditional Training #1 | 0.38 | 0.26 | 0.28 * 0.55 | 0.41 | 0.55 | 0.55 |
| Traditional Training #2 | 0.33 | 0.20 | 0.23 * 0.51 | 0.32 | 0.51 | 0.51 |
| Game-Based Training #1 | 0.56 | 0.51 | 0.24 * 0.55 | 0.64 | 0.55 | 0.55 |
| Game-Based Training #2 | 0.50 | 0.49 | 0.20 * 0.49 | 0.59 | 0.49 | 0.49 |

the first and second studies) that additional hands-on experience with the actual system in the traditional training (four hours in TT1 and two hours in GBT) had caused lowering of EOU. If the effect observed in the first study was confounded by amount of hands-on experience, EOU in TT2 (with only two hours of hands-on system use) would have been equivalent to GBT (which has only two hours of real system use). The potential confounding by order of lecture in GBT in the first study (second of three components) is also ruled out by the high level of consistency in results across the two GBTs (counterbalanced for order of lecture and game play) in this study.

Regression analyses were performed to compare the effect of the training interventions.

The data were analyzed for the two groups of subjects (n = 33 in TT1 and n = 35 in TT2) who went through traditional training, and the two group of subjects (n = 34 in GBT1 and n = 44 in GBT2) who went through game-based training. Table 6 presents a summary of the comparison of training interventions. In both types of interventions, consistent with the first study and TAM (e.g., Davis et al. 1989), BI was determined by EOU and U. Users in the GBT were more strongly influenced by EOU ($\beta$ = 0.51 in GBT1; $\beta$ = 0.49 in GBT2) in determining BI than were users in traditional training ($\beta$ = 0.26 in TT1; $\beta$ = 0.20 in TT2), thus supporting H4. This was further confirmed by pooling the data across training interventions and testing for moderation of the EOU-BI rela-

tionship by training.[17] This moderation effect, as mentioned earlier, challenges TAM's basic thesis that all external variables will be completely mediated by TAM constructs. In the traditional training interventions, the overall effect of EOU on BI ($\beta = 0.41$ in TT1; $\beta = 0.32$ in TT2) and U on BI ($\beta = 0.55$ in TT1; $\beta = 0.51$ in TT2) indicated that U was the stronger overall predictor of BI. This pattern of results is consistent with the first study. In the GBT, while U remained a strong determinant of BI ($\beta = 0.55$ in GBT1; $\beta = 0.49$ in GBT2), the overall effect of EOU on BI was higher ($\beta = 0.64$ in GBT1; $\beta = 0.59$ in GBT2), challenging the basic TAM tenet (and accumulated TAM research) that U is the strongest predictor of BI. The effect of EOU on U, however, was not statistically significantly different across the different interventions ($\beta = 0.28$ in TT1; $\beta = 0.23$ in TT2; $\beta = 0.24$ in GBT1; $\beta = 0.20$ in GBT2), confirming H5. The overall effect of U on BI ($\beta = 0.55$ in TT1; $\beta = 0.51$ in TT2; $\beta = 0.55$ in GBT1; $\beta = 0.49$ in GBT2) was also not statistically significant across interventions, confirming H6. The variance in intention explained in the game-based training interventions was 56% and 50%. This is statistically significantly higher than the variance explained in the traditional training interventions (38% and 33%), supporting H7.

## Power Analysis

Given null hypotheses H2, H5, and H6, it was important to estimate the likelihood of the occurrence of a type II error. However, it is important to recognize that this is a less critical issue in this research since the primary focus of this research was the perceived ease of use construct and all

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[17]As in the case of the earlier test for moderation, in order to examine the differential impact of the four training interventions on the different TAM relationships, data from the two interventions were pooled and a dummy variable, TRAINING, was introduced (0 = TT1; 1 = TT2; 2 = GBT1; 3 = GBT2). The moderating effect of TRAINING on the EOU-BI relationship revealed a significant interaction effect, while the interaction effect in the case of the EOU-U and U-BI relationships were non-significant. Further analysis was performed to examine differential impacts on TAM relationships between the two different GBTs, and no significant difference was found. Similarly, TAM modeled the relationships comparably in both traditional training interventions.

three null hypotheses pertained primarily to perceived usefulness. In that sense, the null hypotheses allowed us to hold a key determinant (i.e., perceived usefulness) constant and effectively manipulate perceived ease of use.

Its importance notwithstanding, a power test (Cohen 1988) was conducted for each of the two studies separately. Unfortunately, the likelihood of type II error was a little under 50% in the best case (Study 2). However, to more completely address this issue, the data were pooled across the two studies. Specifically, the data were pooled across all three traditional training intervention groups (one from Study 1 and two from Study 2) and all three game-based training intervention groups (one from Study 1 and two from Study 2). In order for the data to be pooled across studies, it is typically necessary for there to be statistical equivalence across the different groups (see Pindyck and Rubenfeld 1981). However, by design this research aimed to create different outcomes across different groups. Based on an analysis of the pooled data set, the pattern of results in the pooled data set was identical to the pattern observed in each of the two studies, lending support to the pooling of the data. The pooling resulted in significantly large sample sizes in the traditional training (n = 102) and the game-based training (n = 113) interventions. Results of power analysis indicated that medium effects would have been detected with a power of almost 0.90, and small effects with a power of just over 0.80.

## Discussion

The results support the theory that the potential acceptance of a system was higher among users who underwent a game-based training program compared to users who were trained using a traditional method. Users in a game-based training intervention, when compared to those in a traditional training intervention, perceived the system to be easier to use, confirming the hypothesis that users who have a more enjoyable experience during training are more likely to perceive the system to be easier to use. This higher level of perceived ease of use led to enhanced behavioral intention to use among users in game-based

training. Users in the game-based training intervention were also more strongly· influenced by perceived ease of use, compared to perceived usefulness, in determining behavioral intention to use. Thus, by departing from the traditional mental representation of training, users are more favorably disposed toward the technology, with no observable negative effects of playfulness on learning.

While it is possible that one could suggest that it is harmful for behavioral intention to use to be enhanced only by perceived ease of use with no increase in perceived usefulness, it is important to note that there was no adverse effect on perceived usefulness or its role as a determinant of behavioral intention to use. This allows for a more optimistic implication that a game-based training method will potentially allow users to scale initial hurdles to acceptance and usage (primarily related to perceived ease of use), and also create higher-level intrinsic motivation, which is more likely to lead to sustained usage behavior.

## Implications for User Acceptance Research

From the standpoint of user acceptance research, this work adds to the body of research on TAM. One basic strength of this research is that it was conducted among business professionals.[18] This lends a high degree of external validity to these findings while also avoiding the particular criticism of playfulness being more of a factor among students and/or those who are younger.[19] Although TAM was largely supported in this research, the results challenge some of the basic tenets of TAM. TAM has emphasized the importance of perceived usefulness (over perceived ease of use) as the key determinant of accep-

tance. Empirical evidence has consistently borne out this claim, leading to perceived ease of use being treated as somewhat of a "step-child." The results of this research indicate that perceived ease of use can be a strong catalyst fostering acceptance in a positive and enjoyable training environment. Contrary to prior TAM research, the results from users who underwent the game-based training indicate that the overall effect of perceived ease of use on intention was greater than the effect of perceived usefulness on intention. This suggests that the appropriate priming of users increases the salience of perceived ease of use.

The current research has shown that the higher levels of perceived ease of use observed in the game-based training methods can have a stronger effect on behavioral intention to use, even compared to the effect of the robust and strong construct of perceived usefulness. This suggests that the effect of perceived ease of use on behavioral intention is different depending on the type of training intervention, thus suggesting that the perceived ease of use-behavioral intention to use relationship is moderated by training. Consistent with some work in psychology (e.g., Tashakkori 1993), the findings of this research challenge the basic TRA/TPB (and TAM) thesis that the effect of external variables on behavioral intention to use will be fully mediated by beliefs—in other words, there will be no moderation of belief-intention relationships. Future research is needed to investigate the generalizability of such a key departure from accumulated TAM research. One important future direction in this regard is to identify other contingencies and boundary conditions of the powerful Technology Acceptance Model.

Prior research has shown perceived enjoyment (intrinsic motivation) and perceived usefulness (extrinsic motivation) to be the two key determinants of behavioral intention to use (Davis et al. 1992). Further, it has been shown that the effect of perceived ease of use on behavioral intention to use was fully mediated by perceived enjoyment and perceived usefulness. The current work, in contrast, showed that manipulating the level of perceived enjoyment has a significant impact on perceived ease of use, and the effect of perceived ease of use on behavioral intention to

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[18]While TAM has been validated in a field setting (e.g., Adams, et al. 1992), it has typically been tested using students (e.g., Davis et al. 1989; Taylor and Todd 1995; Venkatesh and Davis 1996).

[19]This is a particularly interesting finding since the average age of subjects in both studies was over 40. One would not readily expect subjects who are older to find games as appealing as those who are younger, especially given that they were not familiar with Dungeons and Dragons or MUDs. An analysis of the data by dividing it into two groups (under-40 and over-40) revealed no moderating effect for age and the impact it has on the role of the training method.

use. The experimental approach used in this study, in contrast to the survey-based findings of Davis et al. (1992), supports a high level of internal validity for these new findings. However, the departure from the basic tenets of TAM (Davis et al. 1989) and the motivational perspective of Davis et al. (1992) calls for additional research to carefully examine how the different constructs interrelate. Though enjoyment was measured in the current work, the models were not reconciled in this paper to keep the focus on the effectiveness of game-based training.

It is also necessary to examine the generalizability of these findings to other technologies and environments, thus helping the development of principles for the design of game-based training interventions. More broadly, future research should examine the acceptance of telecommuting technologies using a different theoretical perspective (e.g., critical mass) in order to triangulate findings and/or question assumptions. Although this study was conducted among knowledge workers, to further establish external validity, research should be conducted in an organizational context and also for systems designed for use in particular organizations. Another important issue for future research to study is the temporal dynamics associated with the findings from this work. It is also necessary for future research to determine whether the favorable user reactions (enhanced levels of user perceptions and intentions) were only temporary or whether such reactions lasted for longer periods of time to indeed have an impact on acceptance, adoption and usage decisions. Such future work will be of particular significance since the current research challenges a fundamental tenet of TAM (i.e., the relative importance of perceived ease of use and perceived usefulness).

## Implications for Training Research

This research also has important theoretical implications for work in the area of end-user training. The increased potential for acceptance generated in the game-based training intervention presents a key avenue for training researchers to explore. In the early part of the last decade, Malone (1981a; 1981b) set the tone for abstracting principles from computer games to make learning on computers more interesting. The present work builds on that fundamental idea by using a game with features similar to a telecommuting tool. Researchers in the area of user training can now turn to similar approaches to improve the impact of interventions. The results of the current research bear particular implications for training users on unfamiliar systems but it is also possible to understand the role of intrinsic motivation in training of task/technology situations familiar to users. Another key direction for future research is to further our understanding along the three dimensions of intrinsic motivation: fantasy, curiosity, and challenge (Malone 1981a). Fantasy was most suited to this research because a relevant gaming situation (Internet-based fantasy role-playing game, MUD) could be identified. In this and other cases, the role of challenge and curiosity should be examined. Another area for future study is the role of game-based training in distance education, which is becoming increasingly popular while continuing to be a great challenge for educators.

## Limitations and Additional Future Research Directions

One potential limitation of the present research is non-respondent bias. While the specific motivation among the participants to learn/use telecommuting tools is unknown, a possible conjecture is that they perceived some value in learning the tool. Quite possibly, this explains the non-significant difference in the effect on perceived usefulness and the role of perceived usefulness in determining behavioral intention to use. However, this is not seen to be a serious threat in this research since the key objective is to study the impact of training on perceived ease of use and not perceived usefulness. Future research should examine the generalizability of these findings to settings where there is no predisposition to learn the tool. Further research is necessary to address this issue especially in the light of some of the relationships being non-significant. Although both studies taken separately indicated relatively high probability of type II error, power analysis based on the pooled data indicated a power of over 0.80 for small effects, thus alleviating this

concern to a certain extent. As mentioned earlier, this is less of an issue in the current work since the emphasis is on perceived ease of use and the null hypotheses pertain primarily to perceived usefulness.

As mentioned earlier, the generalizability of these findings to other technologies, particularly more complex ones, needs to be studied. As it stands, the results and conclusions are specific to the system studied. Another important limitation and potentially key direction for future research is to examine the generalizability of these findings from multi-user systems (like the one employed in this research) to single-user systems. For example, for training on a DSS, a simulation game (say running a mock company) could be used as part of the game-based training. More broadly, future research should develop guidelines for the identification of games for game-based training.

## Implications for Practice

This research bears key implications for practice. Practitioners interested in end-user training in organizational settings may be well served by attempting to incorporate game-based training programs to create favorable user perceptions by creating a gaming situation that can serve as an introductory base for learning. This can be accomplished by relating features of the target system to the game and vice-versa. Typically, games have been seen as detractors from work and productivity since they cause people to waste time. However, this research suggests that intrinsic motivation induced by games can lower user perceptions of effort of the task at hand. Also, since perceived ease of use is a "hurdle" or "hump" that users have to scale in order to accept, adopt, and use a technology, it appears that game-based training not only leads to favorable perceived ease of use but also causes such higher levels of perceived ease of use to have a greater influence on behavioral intention to use. This is particularly encouraging since the subjects in this research were unfamiliar with telecommuting technologies in general, the target system, and the particular game used as the basis for enhancing intrinsic motivation during training.

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