Information & Management 40 (2003) 221–232

INFORMATION & MANAGEMENT

www.elsevier.com/locate/dsw

Computer playfulness and anxiety: positive and negative mediators of the system experience effect on perceived ease of use

Gary Hackbarth[a], Varun Grover[b], Mun Y. Yi[c*]

[a]*Iowa State University, Ames, IA, USA*
[b]*Clemson University, Clemson, SC, USA*
[c]*Moore School of Business, University of South Carolina, Columbia, SC 29208, USA*

Received 15 March 2000; received in revised form 22 September 2001; accepted 24 December 2001

Abstract

Perceived ease of use plays a critical role in predicting and determining a user's decision to use an information system. Users perceive a system easier to use as they gain more knowledge and confidence through direct experience in using the system. Our research traced the link between system experience and ease of use via both positive (computer playfulness) and negative (computer anxiety) responses using a sample of 116 users of electronic spreadsheets. As expected, system experience was significantly related to perceived ease of use. Both computer playfulness and computer anxiety were found to be significant mediators of the effect that system experience has on ease of use. However, the effect was fully mediated only by computer anxiety, revealing that the negative side of user reaction is a more potent mechanism than the positive side. Moreover, the findings indicate that those interventions found to influence the mediating variable of computer anxiety should be used to effectively enhance ease of use perceptions.

Keywords: Computer anxiety; Computer playfulness; Ease of use; System experience; Technology acceptance; IS implementation

1. Introduction

The expected productivity gains and organizational benefits delivered by information systems (IS) cannot be realized unless they are actually used. Acceptance and utilization of IS has been identified as one of the critical issues by IS executives [33] and researchers [9]. However, IS users are not likely to adopt or use a system if they perceive it to be difficult to use. The technology acceptance model (TAM) [8], the most widely applied model among a variety that have been advanced to date to explain user acceptance and usage behavior of information technology, theorizes that perceived ease of use is an important determinant of an individual's intention to use the system and a significant body of research has accumulated empirical support to show that it plays a critical role in predicting and determining a user's technology acceptance behavior [42,44].

Users generally perceive a system easier to use as they gain more knowledge and confidence through direct experience in using the system. Social cognitive theory [2] identifies enactive mastery attained through direct experience as the most influential mechanism that raises an individual's confidence in attaining effective performance levels. Prior studies of user

* Corresponding author. Tel.: +1-803-777-4351;
fax: +1-803-777-6876.
E-mail address: myi@moore.sc.edu (M.Y. Yi).

0378-7206/02/$ – see front matter
PII: S0378-7206(02)00006-X

acceptance found that experience played an important role in an individual's decision to use the system [39], and the amount of experience was positively related to the individual's perception that it was easy to use [20]. However, it is unclear whether the increased experience improves perceived ease of use by augmenting positive feelings toward the technology or by reducing negative feelings against it. From a practical perspective, the answer to this question allows the designer to direct limited resources to producing more effective training interventions that foster desirable user perceptions of IS. For example, depending on the training objective, it might be more appropriate to provide game-based training [41] to enhance positive feelings than to develop modeling-based training [6,36] to reduce negative feelings; however, the opposite strategy may be better in other situations.

Our study involved 116 novice and expert users of a spreadsheet program (i.e. Microsoft Excel). It examined the effects of system experience on perceived ease of use as affected by playfulness and anxiety. Prior IS research has examined the playfulness and anxiety constructs to understand individual reactions to computer systems [17,47], but few studies, if any, have directly compared and contrasted them to understand the impact of experience on user perceptions. Building upon prior work on user acceptance of IS, this study seeks to advance our understanding of the effects of system experience on perceived ease of use via both the positive (i.e. playfulness) and negative (i.e. anxiety) routes of affective responses.

2. Research hypotheses

2.1. System experience and perceived ease of use

Perceived ease of use is defined as the extent to which a person believes that using a technology will be free of effort [7]. Computer users change their ease of use perceptions about a particular system over time. They may see a computer system as difficult to use when they first interact with it because they are not equipped with the necessary skills and confidence. As they build up their techniques and become familiar with the system, most users develop more favorable perceptions of its ease of use. Kanfer and Ackerman [23], and Kanfer et al. [24] provide a theoretical rationale for the causal link between experience and ease of use perception. Their theory of resource allocation posits that, during the initial phase of skill acquisition, great demands for cognitive attentional effort are placed on users because they must first acquire the knowledge required to perform their task. However, as users acquire skills by practicing sequences of cognitive and motor processes and "automatizing" those sequences, the demands on their attentional systems are markedly reduced, thereby freeing cognitive resources for a secondary task. Thus, as skills are improved and automated with experience, the task becomes less dependent on cognitive resources, leading people to perceive the task and the technology as easier than when they first started.

Several researchers have confirmed that individual experience with a particular system exerts a strong impact on perception of the system's ease of use and utilization. For example, Igbaria et al. [19] found that computer experience had a strong direct effect on the perception of ease of use ($\beta = 0.13$, $P \leq 0.001$ and $\beta = 0.10$, $P \leq 0.01$ for the split-half data and holdout sample, respectively) over and above the effects of organizational support and system quality factors on perceived ease of use. Similarly, Igbaria et al. [22] reported a strong negative effect ($\beta = -0.32$, $P \leq 0.001$) of computer skill or expertise on perceived complexity of the system (opposite of ease of use) using their survey data. In addition, Thompson et al. [40] tested the relationship between computer experience and computer utilization to find a strong correlation of 0.45 and a substantive direct effect of experience on utilization ($\beta = 0.23$, $P < 0.005$), along with the presence of indirect effects mediated by several intervening variables. The findings suggest that system experience is positively related to each individual's perceived ease of use and to increased utilization of the system. On the basis of the findings, we hypothesize as follows:

H1. System experience has a significant (positive) effect on perceived ease of use.

2.2. Computer playfulness

Computer playfulness refers to an individual's tendency to interact spontaneously with a computer [45]. It can be considered to be either a state of mind or an individual trait. A *state of mind* is a short-lived cognitive experience felt by the individual. A *trait* represents a characteristic of the individual, which tends to be stable but also slowly changes over time. For our study, we define playfulness as being a system-specific trait that can change because the experience in using a specific technology increases over time. While an individual may be considered a generally playful person, his or her specific level of playfulness toward a technology may differ. This view is consistent with previous IS literature [50].

When users first interact with a computer system, they typically feel intimidated and stressed [30,48]; as a result, their degree of playfulness is low. As they attain some level of familiarity with the system, they are more apt to explore the system and interact spontaneously with it. Across four studies involving students and IS employees, Webster and Martocchio [46] found a strong correlation between computer experience and computer playfulness, with the correlation coefficient ranging from 0.37 to 0.51. Venkatesh [41] recently compared game-based training to traditional training to find a significantly higher level of perceived ease of use among users in game-based training. He theorized that this yielded more favorable ease of use perceptions, because the method induced a higher level of playfulness and enhanced the users' intrinsic motivation, although the actual levels of playfulness were not measured in that study. Taken together, the findings suggest that system experience influences individual user's playfulness with the system, and that this increase significantly influences an individual's perception of the complexity of the system. Therefore, we hypothesize:

H2. Playfulness significantly mediates the effect of system experience on perceived ease of use.

2.3. Computer anxiety

Studies show that many computer users feel anxious when dealing with computer systems, especially when initially interacting with them [13]. However, users generally overcome their initial anxious feelings and develop favorable perceptions as they familiarize themselves with the system interface and functionality. Computer anxiety may be defined as the apprehension or fear that results when an individual is faced with the possibility of using an IS [37]. Social cognitive theory acknowledges that, although emotional arousal is a negative mechanism that can impede performance, mastery attained through direct experience is a more powerful source of confidence in performing the task, and this can eventually counterbalance any negative emotional effect.

Development of computer experience over time has been repeatedly shown to be effective in reducing computer anxiety [26]. Igbaria and Chakrabarti [18] reported a significant correlation of 0.28 ($P < 0.001$) between computer experience and computer anxiety. In a separate survey, Igbaria and Parasuraman [21] found computer anxiety to be the strongest predictor of negative attitude toward computers among the demographic, personality, and cognitive style variables. Similarly, Necessary and Parish [32] found that college students with little or no computer experience had more anxiety toward computers than those who had previous experience. These findings suggest that system experience contributes to the reduction of a user's anxiety in relation to the system and that the degree of computer anxiety significantly influences user attitudes toward the system. Because ease of use is viewed as a significant determinant of a user's attitude toward the technology [29], we hypothesize:

H3. Anxiety significantly mediates the effect of system experience on perceived ease of use.

In sum, prior research suggests that computer playfulness and computer anxiety are both intervening mechanisms between system experience and ease of use. However, their significance is largely unknown. Further, their relative sizes of the mediation effects have not been compared. Fig. 1 summarizes the research hypotheses.

3. The study

The research was conducted in a field setting using Microsoft Excel as the target system because it is a software program widely used in business organizations. The study was carried out in two distinct steps. First, a survey instrument was developed and a pilot survey was conducted with 55 undergraduate students at a major university in the Southeastern United States.

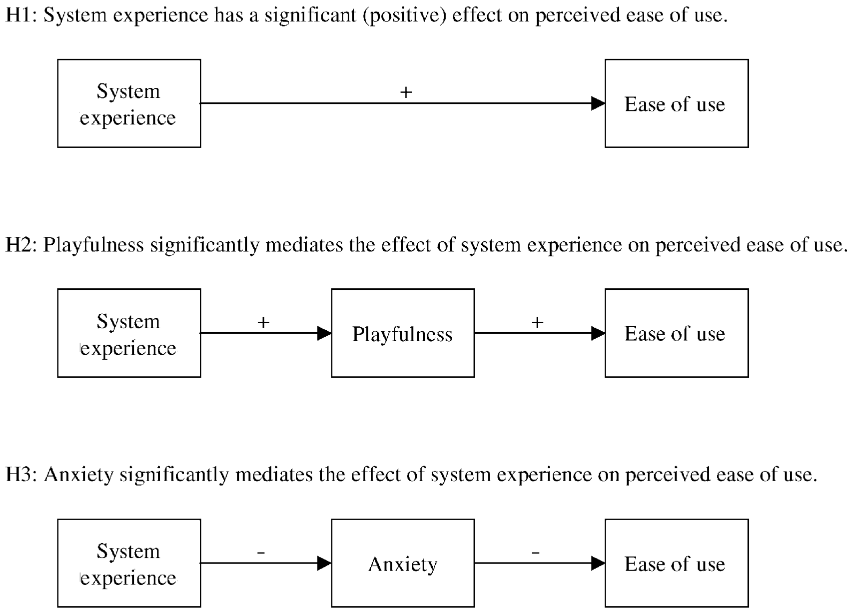

Fig. 1. Research models.

The survey instrument was then refined, based on the respondent feedback. Next, the new survey was administered to 116 graduate and upper level undergraduate students enrolled in an IS course at the same university (on a volunteer basis).

Respondents were 70% male and 30% female with a mean age of 30 years. Since it was important to have adequate variance in the sample, the survey was administered after all subjects had had some exposure to Excel through class exercises, although some had previously used the software. The respondents had an average of 5.6 years of work experience. Consistent with previous research [7,46], all the measures of system experience, computer playfulness, computer anxiety, and perceived ease of use were situation-specific. That is, the questions were all related to the target Excel system.

According to Morrision and Brantner [31], experience is not an objective time-based function, but rather an individual's perception. Thompson et al. [40] argue that, within the context of IT use, expertise is the most relevant component of experience because it is related to the quality of time spent using the system. More recently, King and Xia [25] used time, competency, and comfort as components of experience with respect to media technologies. These studies indicate that experience can be measured by capturing each user's perception of his or her expertise with regard to a specific IT application. Thus, our study measured experience by asking participants to self-select their level of expertise with Excel. In addition, consistent with past research [27] that used categorical measures of experience, participants were asked to read descriptions of three expertise levels (novice, intermediate, and expert) and choose the level with which they most closely identified.

Forty three percent of the respondents ($n = 50$) self-selected themselves as expert Microsoft Excel users. The remaining respondents classified themselves as either novice ($n = 12$) or intermediate ($n = 54$). Because the number of novice users was very small, and non-significant differences were found between the novice and intermediate categories across the study variables of playfulness ($t = -0.07$, $P = 0.94$, ns), anxiety ($t = -1.32$, $P = 0.19$, ns), and ease of use ($t = 1.78$, $P = 0.08$, ns), the two categories were combined to form a non-expert group to be distinguished from the expert group.

As suggested by Webster and Martocchio [46], the playfulness measure consisted of seven items that described how subjects would characterize themselves when interacting with the system. More specifically, the subjects were asked to select a number that best matches a description of themselves on a scale of 1 (strongly agree) to 7 (strongly disagree) for each adjective of spontaneous, unimaginative, flexible, creative, playful, unoriginal, and uninventive.

The computer anxiety measure developed by Bandalos and Benson [1] was adopted for this study. The original instrument consists of 23 items and measures computer anxiety by tapping into its three sub-dimensions: computer liking, computer confidence, and computer achievement. Because the pilot study showed that the computer confidence sub-dimension consisting of nine items was the most reliable and dominant factor, those confidence items were adopted in the final survey. One confidence item (''Using Excel is very difficult for me'') was dropped because of its similarity to the ease of use items.

The perceived ease of use construct was measured with four items adopted from the instrument developed by Davis et al. [7]. As with the playfulness and anxiety items, the ease of use items were measured on a scale of 1 (strongly agree) to 7 (strongly disagree). The Appendix A shows the instruments used to measure the study variables of system experience, computer playfulness, computer anxiety, and perceived ease of use.

Table 1
Factor analysis of computer anxiety and computer playfulness items

Scale items	Factor 1 (anxiety)	Factor 2 (playfulness)
Computer anxiety		
Does not scare	0.88	−0.11
Have lots of self-confidence	0.58	−0.30
Get a sinking feeling	0.90	−0.13
Feel comfortable	0.91	−0.12
Feel okay about trying a new problem	0.88	−0.16
No good	0.86	−0.20
Not the type to do well	0.64	−0.27
Do not feel threatened	0.45	0.12
Computer playfulness		
Spontaneous	0.13	0.80
Unimaginative	−0.28	0.31
Flexible	−0.33	0.58
Creative	−0.18	0.72
Playful	0.18	0.68
Unoriginal	−0.26	0.58
Uninventive	−0.36	0.59

4. Results

Cronbach alpha measures of internal consistency reliability were acceptable at 0.76 for playfulness, 0.92 for anxiety, and 0.96 for ease of use [34]. Table 1 presents the factor analysis performed on the playfulness and anxiety items. The factors, underlying variables that reflect combinations of observable variables, were extracted using the principal components method (varimax rotation), which is an optimum approach to condensation prior to rotation. The table clearly shows that the two-factor solution (factor 1: anxiety, factor 2: playfulness) is appropriate and the items display desirable convergent and discriminant validity. None of the anxiety items load more highly onto the playfulness factor and none of the playfulness items load more highly onto the anxiety factor (discriminant validity). The items that belong to the same construct show high loading scores (convergent validity). As expected, the results show that anxiety and playfulness constructs are distinct, measuring different aspects of user responses. One playfulness item loaded at 0.31 within its construct, a lower score than the recommended 0.4 [15]. Given that it is not substantially different from the criteria and is only one item, it was retained. Overall, the psychometric properties of the measures were more than adequate.

The proposed mediation hypotheses were tested using a statistical technique suggested by Baron and Kenny [3]. According to them, the following conditions must hold in order to establish mediation: (1) a significant relationship exists between the independent variable and the dependent variable; (2) a significant relationship exists between the independent variable and the presumed mediator; and (3) in the presence of a significant relationship between the mediator and the dependent variable, the previous significant relationship between the independent variable and the dependent variable is no longer significant or the strength of the relationship is significantly decreased.

H1 hypothesized that system experience has a significant positive effect on perceived ease of use. As shown in Fig. 2 and Table 2, the effect of experience on perceived ease of use was significant ($\beta = 0.30$,

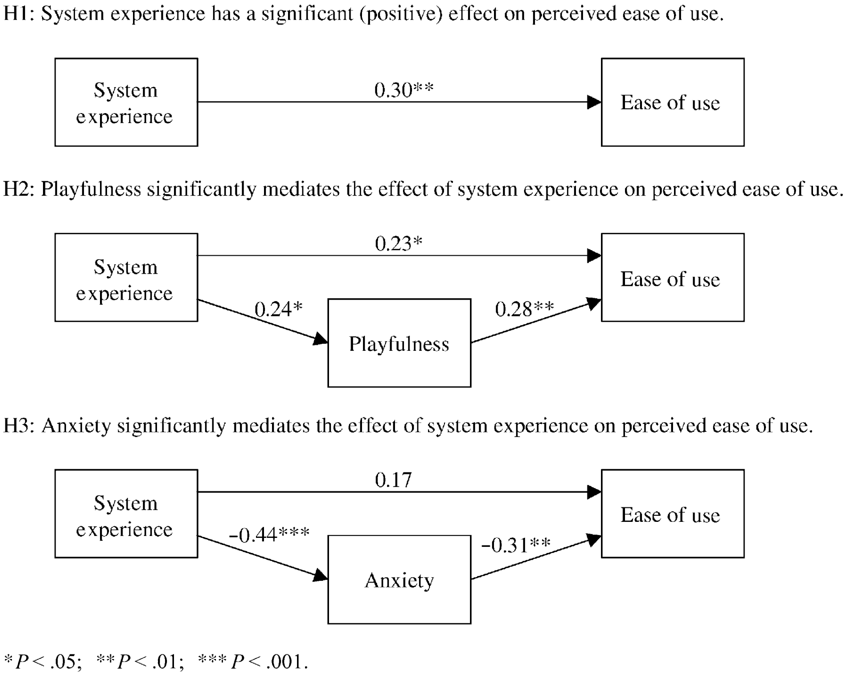

Fig. 2. Regression results of the research models.

$P < 0.01$), supporting H1. H2 and H3 hypothesized that the effect of system experience on perceived ease of use would be significantly mediated by computer playfulness and computer anxiety, respectively. The link between system experience and playfulness was significant ($\beta = 0.24$, $P < 0.05$). When ease of use was regressed on both playfulness and experience, a significant relationship was found between system experience and ease of use ($\beta = 0.23$, $P < 0.05$), as well as between playfulness and ease of use ($\beta = 0.28$, $P < 0.01$). Although the effect of experience on ease of use was still significant, the strength of the effect was reduced (from $\beta = 0.30$, $P < 0.01$ to $\beta = 0.23$, $P < 0.05$) when playfulness was included as a mediator, thus partially supporting H2. However, the indirect effect of experience on ease of use through

Table 2
Results of hypothesis testing

Hypothesis	Result	Dependent variable	R^2	Independent variable	β	Significance level
H1	Supported	Ease of use	0.09	Experience**	0.30	0.001
H2	Partially	Playfulness	0.06	Experience*	0.24	0.010
	Supported	Ease of use	0.16	Playfulness**	0.28	0.002
				Experience**	0.23	0.011
H3	Supported	Anxiety	0.19	Expertise***	−0.44	0.000
		Ease of use	0.16	Anxiety**	−0.31	0.001
				Experience	0.17	0.085

* $P < 0.05$.
** $P < 0.01$.
*** $P < 0.001$.

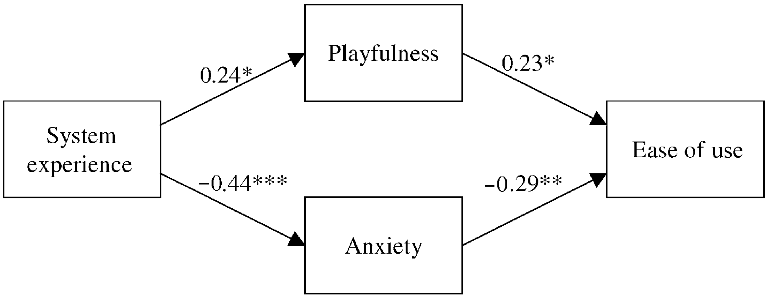

Fig. 3. Comparison of mediation effects

playfulness ($0.24 \times 0.28 = 0.07$) was relatively small when compared to the direct effect of experience on ease of use (0.23). In contrast, H3 was fully supported. The link between system experience and anxiety was significant ($\beta = -0.44$, $P < 0.001$). When ease of use was regressed on both anxiety and experience, the link between anxiety and ease of use was significant ($\beta = -0.31$, $P < 0.01$) and the link between system experience and ease of use was no longer significant ($\beta = 0.17$, ns), indicative of full mediation.

In order to compare the relative sizes of the mediation effects, ease of use was regressed on playfulness and anxiety together. As shown in Fig. 3, the effect mediated by anxiety ($-0.44 \times -0.29 = 0.13$) was about 2.3 times larger than the effect mediated by playfulness ($0.24 \times 0.23 = 0.06$).

Excluding the subjects who belonged to the novice user category, an additional analysis was conducted between the intermediate and expert users to examine the robustness of the hypothesis testing. Consistent with the previous results, system experience had a significant effect on ease of use ($\beta = 0.26$, $P < 0.01$), playfulness ($\beta = 0.24$, $P < 0.05$), and anxiety ($\beta = -0.41$, $P < 0.001$). When ease of use was regressed on both playfulness and experience, the relationships were significant both between system experience and ease of use ($\beta = 0.20$, $P < 0.05$) and between playfulness and ease of use ($\beta = 0.27$, $P < 0.01$), thus showing only partial mediation. In contrast, when ease of use was regressed on both anxiety and experience, the link between anxiety and ease of use was significant ($\beta = -0.26$, $P < 0.05$), but the link between experience and ease of use was no longer significant ($\beta = 0.15$, ns), indicating full mediation.

5. Discussion

5.1. Summary of findings

The purpose of this investigation was to trace the effect of system experience on perceived ease of use mediated by playfulness and anxiety in order to understand whether system experience influences ease of use perceptions via positive or negative aspects of user reactions. As theorized, system experience was significantly related to the perception of ease of use, indicating that more experienced users tend to regard the system as easier to use. Both playfulness and anxiety were significant mediators of the effect that system experience had on perceived ease of use. In the presence of these two variables, experience was no longer a significant antecedent of ease of use. Szajna [38] proposed that adding a variable to account for experience with the system would be a worthwhile extension of TAM. Our findings demonstrate that system experience is a significant antecedent of ease of use and that it has no significant effect on ease of use over and above the effects mediated by anxiety and playfulness.

It is noteworthy that computer anxiety was a full mediator, whereas computer playfulness was only partial. The indirect effect of system experience on ease of use via anxiety was more than twice the indirect effect of playfulness. Thus, decreasing anxiety through system experience is a stronger approach to achieving perceived ease of use than increasing spontaneous playful reactions. Similarly, in an experiment conducted to examine the impact of peer influence in a self-paced computer training setting, Galletta et al. [12] found that negative word-of-mouth comments were more salient and had more of an impact (negatively) on trainee learning outcomes than positive comments. Positive comments were no more effective than no comments.

In our study, both playfulness and anxiety were found to be significant antecedents of ease of use, with anxiety having a relatively stronger effect. A recent study [42] focused on identifying various antecedents of ease of use and found that the effect of anxiety on ease of use was relatively more stable and stronger than playfulness. However, there are several measurement differences between the two studies. The other study measured anxiety and playfulness at the general computing level, capturing individual perceptions about general computer use. In our study, the measures were all tied to a specific system. Also, we measured the effects of playfulness and anxiety on ease of use without including extraneous variances explained by other variables, thus more precisely comparing the effects of playfulness and anxiety. Finally, the two studies used the same playfulness measure but different anxiety measures. Despite these differences, the two studies complement each other and lend credibility to the results.

5.2. Limitations

Several limitations of the study should be noted. First, it did not measure the change of user reactions over time. All measures were taken at a single point of time. Second, the study's results were obtained within the context of one software program and would need further validation across other systems. Finally, individuals might display different anxious feelings or playful reactions for the same technology, depending on where they use the technology: at home or work. The study did not differentiate the usage settings. Prior studies in user acceptance of technology found a different set of mechanisms involved between mandatory and voluntary usage settings [16,43].

TAM provides a parsimonious representation of the key constructs in user acceptance research with strong predictive power. However, it does not offer tangible guidelines to system developers or managers who want to ensure successful acceptance of technology. Given the increasing importance of IS today, the diversity of technologies available, and the rapidity of technological adoption, understanding the antecedents of ease of use is critical. Recognizing the importance of this issue, recent studies have attempted to extend TAM by incorporating various factors, such as control, intrinsic motivation, emotion, perceived enjoyment, objective usability, and innovation characteristics [42,43]. Our study contributes to the growing body of research by examining the link between system experience and ease of use mediated via positive (i.e. playfulness) and negative (i.e. anxiety) user responses.

5.3. Implications for managerial interventions

Our findings suggest that interventions, training, and organizational support designed to facilitate successful use of technology should include mechanisms for reduction of anxiety. In general, studies suggest that computer anxiety can be successfully overcome by creating a low stress atmosphere without time pressure and choosing user-friendly software [35], providing highly supervised foolproof assignments [49], and using on-line non-intrusive tutorials [4]. Martocchio [28] found that when a context was created in which trainees believed they could build on their present abilities, there was a significant decline in computer anxiety. Martocchio concluded that people who believed their ability to be malleable viewed training as an opportunity or positive challenge, whereas those who believed their ability to be fixed viewed training as a threat.

Creating an environment that cultivates playfulness could also be beneficial. Some studies suggest that users be allowed to experiment (free play) with new software before it is incorporated into their daily activities [10]. Software designs that employ "game playing" and friendly icons to reduce monotony and exploit users' playful characteristics can contribute to acceptance of new systems. Fisher [11] showed that groups that had fun in the training sessions by playing games and engaging in humor used the system more frequently and adventurously in the month following the training. Also, influencing the psychological state of the user by reframing the context of the training as "fun" or "play", instead of "work", could reduce stress and pressure, and allow the user to engage in playful behavior [47].

While there are many alternative implementations of training, including hand-on exploration, instruction, and computer-based approaches among others, a new training method called behavioral modeling appears to contain training elements that can reduce anxious feelings and possibly enhance playful reactions. This method centers on the idea of imitating and extending a role model's behavior by watching the model's demonstration (vicarious learning), practicing the desired skills, and receiving positive reinforcement from others on one's own effectiveness in demonstrating the desired behavior [14]. The key idea is to create an atmosphere that reduces negative feelings (fear of failure, anxiety, boredom) and enhances positive effects (excitement, need to learn) [5]. This approach is consistent with our results regarding desirable aspects of training. Social cognitive theory emphasizes the importance of actual and vicarious experience, social persuasion, and psychological states in influencing self-efficacy judgments. From a training standpoint, an approach including these factors would involve allowing users to watch others perform the desirable actions, experience success on their own, and receive positive encouragement from others. The behavior modeling structure allows the user to be less anxious through physical demonstration, guided mastery, and social reinforcement, in addition to facilitating positive reactions through experimentation and hands-on practice.

6. Conclusion

Perceived ease of use plays a critical role in predicting and determining a user's technology acceptance behavior. Building upon prior research on user acceptance of IS, this study examined whether computer anxiety or computer playfulness were significant mediators of the system experience effect on perceived ease of use. Data showed support for the hypotheses and the significant mediating nature of both these variables, but especially that of anxiety. Given that it takes a considerable amount of time for a user to develop expertise on a target system, identifying a variable that fully mediates the effect of experience on perceived ease of use is an important finding. Those interventions found to influence the mediating variable can be used to enhance ease of use perceptions without solely relying on experience, thus reducing the time and cost. Therefore, the findings of our study open the door to more cost-effective and powerful solutions for creating successful user acceptance of information technology.

Appendix A. Measures of the study variables

System experience was measured by a respondent self-selecting themselves as novice, intermediate, or expert users of Excel. Respondents were asked: "In general, *how would you best characterize your experience with Excel*? Place an × in the box next to the description that best describes your level of expertise with Excel."

☐ *Novice*—You are a beginner computer user with *little or no experience* using Excel. You can work with Excel using an Excel book, on-line tutorial or the assistance of a knowledgeable Excel user to help build basic spreadsheets.

☐ *Intermediate*—You have *adequate knowledge and experience* using Excel spreadsheet applications. You presume that your basic spreadsheet knowledge is transferable between spreadsheet different applications (i.e. build a simple budget spreadsheet in either Excel or Lotus 1–2–3 with little difficulty). You are able to apply templates and formulas to solve standard problems. You use Excel books and on-line tutorials to a lesser extent than the novice user but still seek answers to questions about lesser-used formulas, formatting and issues that improve the user interface with Excel.

☐ *Expert*—You have practical experience and knowledge using Excel spreadsheet applications. You consider yourself an advanced user even though you may not understand all the features available in Excel. You are reasonably comfortable applying Excel spreadsheet features to ill-defined problems. The spreadsheet knowledge you do have would be easy to transfer to other spreadsheet applications (Lotus 1–2–3, Quattro-Pro, etc.). You use a book or on-line tutorial to answer questions about rarely used functions and feel comfortable explaining Excel features to other Novice, Intermediate and Expert users.

Computer playfulness was measured as the mean of the seven items given below, proceeded by the statement: "The following questions ask you how you would characterize yourself when you use Excel. For each adjective listed below, please circle the number that best matches a description of yourself when you interact with Excel."

	Strongly agree						Strongly disagree
Spontaneous	1	2	3	4	5	6	7
Unimaginative	1	2	3	4	5	6	7
Flexible	1	2	3	4	5	6	7
Creative	1	2	3	4	5	6	7
Playful	1	2	3	4	5	6	7
Unoriginal	1	2	3	4	5	6	7
Uninventive	1	2	3	4	5	6	7

	Strongly agree							Strongly disagree
Excel does not scare me	1	2	3	4	5	6	7	
I have lots of self-confidence when it comes to working with Excel	1	2	3	4	5	6	7	
I get a sinking feeling when trying to use Excel	1	2	3	4	5	6	7	
I would feel comfortable working with Excel	1	2	3	4	5	6	7	
Generally, I feel okay about trying a new problem with Excel	1	2	3	4	5	6	7	
I am no good with Excel	1	2	3	4	5	6	7	
I am not the type to do well with Excel	1	2	3	4	5	6	7	
I do not feel threatened when others talk about Excel	1	2	3	4	5	6	7	

Computer anxiety was measured as the mean of the eight items given below, proceeded by the statement: "The following questions ask you how you would characterize yourself when you use Excel. For each adjective listed below, please circle the number that best matches a description of yourself when you interact with Excel."

Perceived ease of use was measured as the mean of the four items given below, proceeded by the statement: "The following questions ask you how you would characterize yourself when you use Excel. For each adjective listed below, please circle the number that best matches a description of yourself when you interact with Excel."

	Strongly agree							Strongly disagree
Learning to use Excel is easy for me	1	2	3	4	5	6	7	
I find it easy to get Excel to do what I want it to do	1	2	3	4	5	6	7	
My interaction with Excel is clear and understandable	1	2	3	4	5	6	7	
I find Excel easy to use	1	2	3	4	5	6	7	

References

[1] D. Bandalos, J. Benson, Testing the factor structure invariance of a computer attitude scale over two grouping conditions, Educational and Psychological Measurement 50, 1990, pp. 49–60.
[2] A. Bandura, Social Foundations of Thought and Action: A Social Cognitive Theory, Prentice-Hall, NJ, 1986.
[3] R.M. Baron, D. Kenny, The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations, Journal of Personality and Social Psychology 51 (6), 1986, pp. 1173–1182.
[4] V. Bartlett, Technostress and librarians, Library Administration and Management 9 (4), 1995, pp. 226–230.
[5] R.D. Bretz, R.E. Thompsett, Comparing traditional and integrative learning methods in organizational training programs, Journal of Applied Psychology 77 (6), 1992, pp. 941–951.
[6] D.R. Compeau, C.A. Higgins, Application of social cognitive theory to training for computer skills, Information Systems Research 6 (2), 1995, pp. 118–143.
[7] F.D. Davis, Perceived usefulness, perceived ease of use, and user acceptance of information technology, MIS Quarterly 13 (3), 1989, pp. 319–340.
[8] F.D. Davis, R.P. Bagozzi, P.R. Warshaw, User acceptance of computer technology: a comparison of two theoretical models, Management Science 35 (8), 1989, pp. 982–1003.
[9] W.H. DeLone, E.R. McLean, Information systems success: the quest for the dependent variable, Information Systems Research 3 (1), 1992, pp. 60–95.
[10] T.J. Deloughry, 2 Researchers say technophobia may afflict millions of students, The Chronicle of Higher Education 39 (34), 1993, pp. A25–A26.
[11] J. Fisher, Using perceived fun to reduce computer anxiety amongst new adult users, in: Proceedings of the Second International Cyberspace Conference on Ergonomics, Perth, 1999.
[12] D.F. Galletta, M. Ahuja, A. Hartman, T. Teo, A.G. Peace, Social influence and end-user training, Communications of the ACM 38 (7), 1995, pp. 70–79.
[13] R. Ganzel, Feeling Squeezed by technology? Training 35 (4), 1998, pp. 62–70.
[14] A.P. Goldstein, M. Sorcher, Changing Supervisor Behavior, Pergamon, NY, 1974.
[15] J.F. Hair, R.E. Anderson, R.L. Tatham, W.C. Black, Multivariate Data Analysis with Readings, Prentice-Hall, NJ, 1992.
[16] J. Hartwick, H. Barki, Explaining the role of user participation in information system use, Management Science 40 (4), 1994, pp. 440–465.
[17] G.S. Howard, R.D. Smith, Computer anxiety in management: myth or reality? Communications of the ACM 29 (7), 1986, pp. 611–615.
[18] M. Igbaria, A. Chakrabarti, Computer anxiety and attitudes towards microcomputer use, Behaviour & Information Technology 9 (3), 1990, pp. 229–241.
[19] M. Igbaria, T. Guimaraes, G.B. Davis, Testing the determinants of microcomputer usage via a structural equation model, Journal of Management Information Systems 11 (4), 1995, pp. 87–114.
[20] M. Igbaria, J. Iivari, The effects of self-efficacy on computer usage, Omega 23 (6), 1995, pp. 587–605.
[21] M. Igbaria, S. Parasuraman, A path analytic study of individual characteristics, computer anxiety and attitudes toward microcomputers, Journal of Management 15 (3), 1989, pp. 373–388.
[22] M. Igbaria, S. Parasuraman, J.J. Baroudi, A motivational model of microcomputer usage, Journal of Management Information Systems 13 (1), 1996, pp. 127–143.
[23] R. Kanfer, P.L. Ackerman, Motivation and cognitive abilities: an integrative/aptitude-treatment interaction approach to skill acquisition, Journal of Applied Psychology—Monograph 74 (4), 1989, pp. 657–690.
[24] R. Kanfer, P.L. Ackerman, T.C. Murtha, B. Dugdale, L. Nelson, Goal setting, conditions of practice, and task performance: a resource allocation perspective, Journal of Applied Psychology 79, 1994, pp. 826–835.
[25] R.C. King, W. Xia, Media appropriateness: effects of experience on communication media choice, Decision Sciences 28 (4), 1997, pp. 877–910.
[26] M. Liu, W. Reed, P. Phillips, Teacher education students and computers: gender, major, prior computer experience, occurrence, and anxiety, Journal of Research on Computing in Education 24 (4), 1992, pp. 457–467.
[27] J.M. Mackay, C.W. Lamb, Training needs of novices and experts with referent experience and task domain knowledge, Information & Management 20 (3), 1991, pp. 183–189.
[28] J.J. Martocchio, Effects of conceptions of ability on anxiety, self-efficacy, and learning in training, Journal of Applied Psychology 79 (6), 1994, pp. 819–825.
[29] K. Mathieson, Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior, Information Systems Research 2 (3), 1991, pp. 173–191.
[30] T. McCarroll, What new age? Time 138 (6), 1991, pp. 44–46.
[31] R.F. Morrision, T.M. Brantner, What enhances or inhibits learning a new job? a basic career issue, Journal of Applied Psychology 77 (6), 1992, pp. 926–940.
[32] J.R. Necessary, T.H. Parish, The relationship between computer usage and computer-related attitudes and behaviors, Education 116 (3), 1996, pp. 384–387.
[33] F. Niederman, J.C. Brancheau, J.C. Wetherbe, Information systems management issues for the 1990s, MIS Quarterly 15 (4), 1991, pp. 475–500.
[34] J.C. Nunnally, Psychometric Theory, 2nd Edition, McGraw-Hill, New York, 1978.
[35] B. Quinn, Reducing stressful aspects of information technology in public services, Public and Access Services Quarterly 1 (4), 1995, pp. 1–34.
[36] S. Simon, V. Grover, J. Teng, K. Whitcomb, The relationship of information system training methods and cognitive ability to end-user satisfaction, comprehension, and skill transfer: a longitudinal field study, Information Systems Research 7 (4), 1996, pp. 466–490.
[37] M.R. Simonson, M. Maurer, M. Montag-Torardi, M. Whitaker, Development of a standardized test of computer literacy

and a computer anxiety index, Journal of Educational Computing Research 3 (2) 231–247.
[38] B. Szajna, Empirical evaluation of the revised technology acceptance model, Management Science 42 (1), 1996, pp. 85–92.
[39] S. Taylor, P.A. Todd, Assessing IT usage: the role of prior experience, MIS Quarterly 19 (2), 1995, pp. 561–570.
[40] R.L. Thompson, C.A. Higgins, J.M. Howell, Influence of experience on personal computer utilization: testing a conceptual model, Journal of Management Information Systems 11 (1), 1994, pp. 167–187.
[41] V. Venkatesh, Creation of favorable user perceptions: exploring the role of intrinsic motivation, MIS Quarterly 23 (2), 1999, pp. 239–260.
[42] V. Venkatesh, Determinants of perceived ease of use: integrating control, intrinsic motivation, and emotion into the technology acceptance model, Information Systems Research 11 (4), 2000, pp. 342–365.
[43] V. Venkatesh, F.D. Davis, A theoretical extension of the technology acceptance model: four longitudinal field studies, Management Science 46 (2), 2000, pp. 186–204.
[44] V. Venkatesh, F.D. Davis, A model of the antecedents of perceived ease of use: development and test, Decision Sciences 27 (3), 1996, pp. 451–481.
[45] J. Webster, Playfulness and computers at work, Unpublished Doctoral Dissertation, New York University, 1989.
[46] J. Webster, J.J. Martocchio, Microcomputer playfulness: development of a measure with workplace implications, MIS Quarterly 16 (2), 1992, pp. 201–226.
[47] J. Webster, J.J. Martocchio, Turning work into play: implications for microcomputer software training, Journal of Management 19 (1), 1993, pp. 127–146.
[48] S.H. Wildstrom, They're mad as hell out there, Business Week 3600, 1998, pp. 32–33.
[49] J.H. Wilson, H. Daubek, P. Okonkwo, Marketing students' computer attitudes: A comparison across schools, in: Proceedings of the Annual Meeting of the Southern Marketing Association, Richmond VA, 1992, pp. 177–182.
[50] S.E. Yager, L.A. Kappleman, G.A. Maples, V.R. Prybutok, Microcomputer playfulness: stable or dynamic trait, Data Base 28 (2), 1997, pp. 43–51.

Gary Hackbarth is an Assistant Professor at Iowa State University. His current areas of interest include virtual communities and diffusion–innovation of technology, knowledge management, organizational memory, and strategic applications of electronic commerce. He has published in *Information Systems Management*, *Financial Times*, and international conference proceedings.

Varun Grover is the William S Lee Distinguished Professor of information systems at Clemson University. Prior to this he was a Business Partnership Foundation Fellow and Professor of information systems in the Management Science Department at the University of South Carolina. Dr. Grover has published extensively in the information systems field, with over 100 publications in refereed journals. He was recently recognized as the most productive researcher in the field from 1991–1997 based on publications in the top IS journals. Dr. Grover's current areas of interest are electronic commerce, business process change, and organizational and inter-organizational impacts of IT. His work has appeared in the *MISQ*, *ISR*, *JMIS*, *CACM*, *Decision Sciences*, *IEEE Transactions*, *California Management Review*, among others. He recently co-edited two special issues of the *JMIS* and a second book on business process change entitled *Making Business Process Change Payoff: Guidelines for the 21st Century*. Dr. Grover has also served as the special Editor for issues of *Database* that focused on IT future, celebrating the 50th anniversary of ACM, and issues of *Decision Sciences* and the *International Journal of Electronic Commerce*. He is the recipient of the Outstanding Achievement Award from the Decision Sciences Institute and two-time winner of the Alfred G. Smith Award for Excellence in Teaching. Dr. Grover is currently serving on the board of Editors/Associate Editor of eight IS journals and is an active member of INFORMS, ACM, DSI and AIS.

Mun Y. Yi is an Assistant Professor of information systems at the Moore School of Business, University of South Carolina. He received his PhD in information systems from University of Maryland, College Park, and MS in computer information systems from Georgia State University. His current research focuses on computer skill acquisition and training, information technology adoption, and electronic commerce. His research has appeared in *Information Systems Research* and *Decision Sciences*.