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AN ACCEPTANCE MODEL FOR USEFUL AND FUN INFORMATION SYSTEMS

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Abstract: *Investigating the factors associated with user acceptance of new software systems has been an important research stream in the field of information systems for many years. The technology acceptance model has long been used to examine the acceptance of utilitarian systems. Recently, it has been used to examine recreational or pleasure-oriented systems. Many examples exist of software that, depending on the context of use, can be used for productive and pleasurable interaction. This paper examines the determinants of use of one such "dual" system. A survey of users of a dual system was conducted. Results show that perceived usefulness is more important in determining intention to use than perceived enjoyment, and that perceived ease of use has no direct impact on intention, but still has a strong indirect effect.*

Keywords: *Technology acceptance model, utilitarian system, recreational system, context of use.*

INTRODUCTION

Investigating the factors associated with user acceptance of software systems has been an important research stream in the field of information systems for many years. The majority of this work has, appropriately enough, been focused on productivity-oriented or utilitarian systems (Venkatesh & Brown, 2001, p. 72). Other examples of such studies include Adams, Nelson, and Todd (1992); Dennis, Nelson, and Todd (1992); Doll, Raghunathan, Lim, and Gupta (1995); Hendrickson, Massey, and Cronan (1993); Igbaria, Zinatelli, Cragg, and Cavaye (1997); and Segars and Grover (1993). Recently some work has appeared examining recreational or pleasure-oriented systems (Hsu & Lu, 2004; Van der Heijden, 2004) such as games or, in certain contexts, the World Wide Web (Atkinson & Kydd, 1997). A purely

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recreational system is one where interaction with the system is in itself pleasurable for the user, and interacting with the system produces nothing more than this pleasure. The goal of such a system is prolonged use rather than productive use. Van der Heijden (2004, p. 696) states, "In its purest form, interacting with a hedonic system is designed to be an end in itself."

However, utilitarian and recreational systems do not sit at opposite ends of one spectrum. It has been realized for over a decade that much computer technology is used for both work and for fun (Starbuck & Webster, 1991). Many examples exist of software that, depending on the context, can be used for reasons of productivity and are also pleasurable to use. Such systems could include drawing packages, song writing software, video editing software, even word processors. These systems can give productivity and pleasure simultaneously. In addition, other systems may give neither productivity nor pleasure. A scale ranging from productivity-oriented to pleasure-oriented use will not capture this. Instead, a two dimensional scale is needed, as shown in Figure 1. The need for such a scale is supported in consumer research (Babin, Darden, & Griffin, 1994), where it has been long known that products can be purchased for various degrees of recreational and utilitarian purposes.

Where a system will be placed on the scale is highly subjective, and one system can be placed in different quadrants by different people. For instance, using the descriptors given in Figure 1, image editing software might be classed as Utilitarian by a photography student, Dual by someone entering an amateur photography competition, Recreational by someone who is adding captions to photographs of their child, and Useless by someone who just takes snapshots.

Many studies have examined the adoption of utilitarian systems, and some studies have examined the adoption of recreational systems. Studies of systems that are used both for utilitarian and recreational reasons are rare. This paper examines the antecedents of acceptance of such a system.

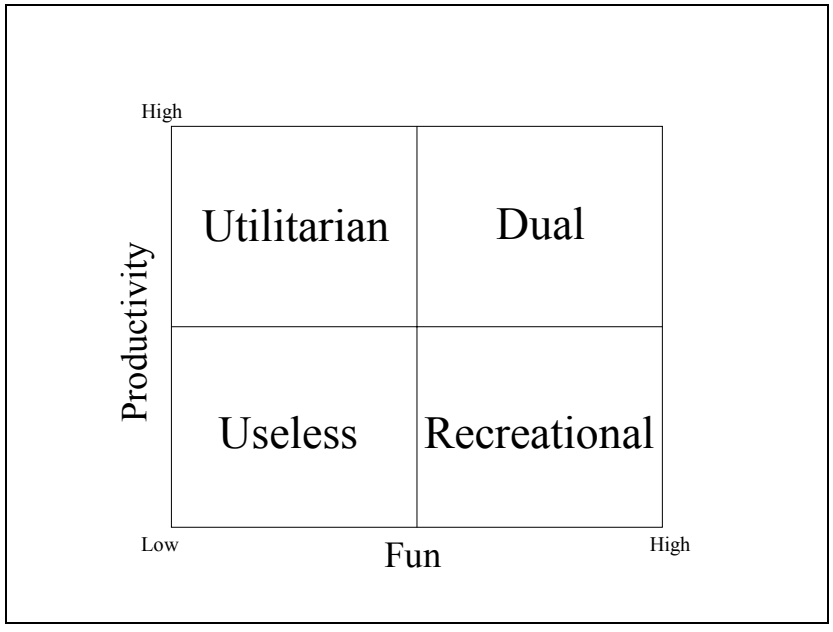

Figure 1. A two-dimensional scale classifying information systems by context of use.

Much of the previous research in this area has used the technology acceptance model (TAM; Davis, 1989). TAM views user acceptance as being dependent upon the perceived usefulness of the system and its perceived ease of use. Significant empirical evidence has built up in support of TAM (for a list see Venkatesh, 1999, p. 240). Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320). Perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320).

When used to examine systems that are used for recreation, TAM has been adapted to include a perceived enjoyment construct. Davis, Bagozzi, and Warshaw (1992, p. 1113) did this when they studied a word processor and a business graphics package. They defined perceived enjoyment as "the extent to which the activity of using the computer is perceived to be enjoyable in its own right." Van der Heijden (2004) used the same model to study a recreational system.

In a similar move, Moon and Kim (2001) adapted TAM with a new perceived playfulness construct, and applied the resulting model to the World Wide Web. Their study highlights the problem of ignoring context of use. The writers rightly point out that as the Web is used for "education, shopping, entertainment, work, communication, personal information, time-wasting, etc.," determinants of use may include extrinsic and intrinsic factors (Moon & Kim, 2001, p. 217). They gave questionnaires to 152 students about their use of the Web, yet they failed to report what the respondents were using it for. It is unlikely that a student researching a dissertation will have the same determinants of use as a student who uses it to play games. The third hypothesis they test—that there is a positive relationship between perceived playfulness and intention to use, and for which they find support—only makes sense when it is known what the intention for using the Web is. Such a playfulness relationship probably only exists for a recreational system; it is doubtful to be present if the student is using the Internet to open a bank account, for instance.

Since whether a system is used for utilitarian or recreational reasons will have an impact on the antecedents of adoption, it is important to consider this context of use when applying TAM, or some other model of adoption, such as Rogers' innovation diffusion theory (Rogers, 1995) or the theory of planned behaviour (Ajzen, 1991). However, few studies consider this. This paper reports work examining the antecedents of use of a "dual" system. The study is unique in that users who are not working within the dual context were removed from the analysis. Other studies select a system and then assume that all of its users are operating in the same context and therefore will have the same model of adoption. This is not necessarily a valid assumption, as shown by the results of Moon and Kim (2001).

The research model used for this study, shown in Figure 2, is the same as used by Davis et al., (1992) and Van der Heijden (2004): TAM with a perceived enjoyment construct. This includes all the elements that might be expected to impact on a dual system. The paths between the variables are as Van der Heijden (2004) describes them.

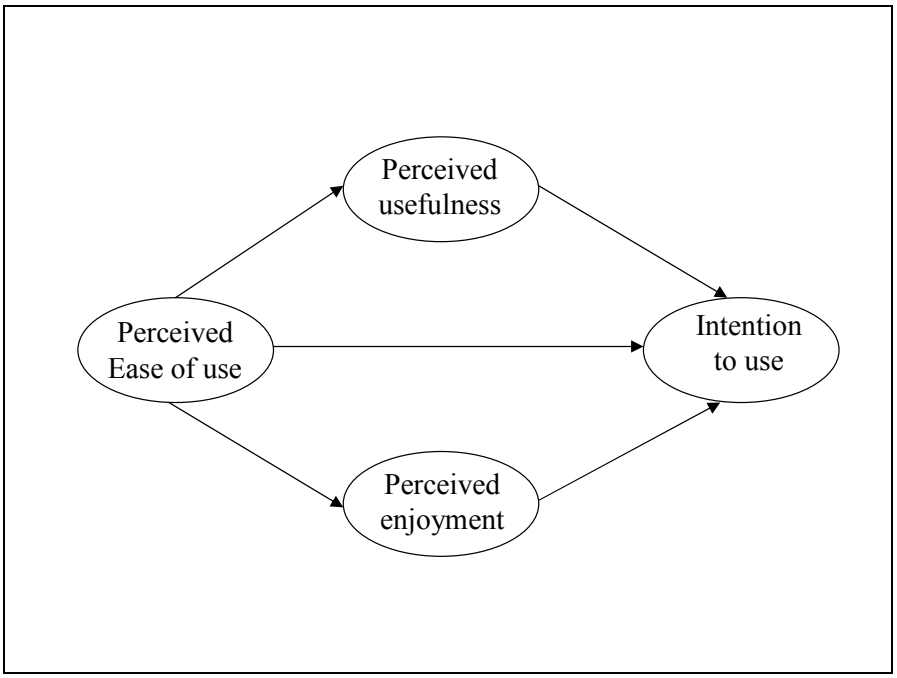

Figure 2. A revised technology acceptance model to include a perceived enjoyment construct, adapted from Davis et al. (1992) and Van der Heijden (2004).

Van der Heijden (2004) found a positive relationship between ease of use and enjoyment, and between enjoyment and intention to use. It is expected that these will hold for dual systems as well, which leads to the first two hypotheses:

- Hypothesis 1. There is a positive relationship between perceived ease of use and perceived enjoyment.
- Hypothesis 2. There is a positive relationship between perceived enjoyment and intention to use.

TAM holds the following relationships, which also should hold for dual systems. As a result, the following hypotheses were tested:

- Hypothesis 3. There is a positive relationship between perceived ease of use and intention to use.
- Hypothesis 4. There is a positive relationship between perceived usefulness and intention to use.
- Hypothesis 5. There is a positive relationship between perceived ease of use and perceived usefulness.

METHOD

A survey of Lego Mindstorms[1] enthusiasts was conducted to test the hypotheses. Mindstorms is a product from the Lego Corporation that is used to build robots. The basic kit consists of standard Lego parts to construct the physical robot and a "programmable brick" known as the RCX. The RCX can be thought of as the robot's brain. It controls the robot according to

whatever program the user has written and installed in it. It does this by taking input through touch, light, and other sensors, and then producing output in the form of signals to turn motors on and off to make the robot move. The official programming environment is called RCX-code and was developed by Lego and MIT. Several enthusiasts have developed their own programming environments to allow robots to be programmed using mainstream languages such as C, Java and Visual Basic.

Participants

A request for participation was posted on a Mindstorms message board. The request asked people to complete an anonymous on-line questionnaire about their experiences of using their development environment of choice. It is estimated that 170 people saw the post during the two-week data collection period, based on the user statistics of the message board Web site and from the experience of other on-line surveys of hobbyists (see Chesney, 2004). Responses were received from 68 people, giving a response rate of around 40%. Most of the participants (92%) were male. The participants' ages varied from 16 to 67 years (M = 38 years, SD = 11). A total of 14 answers (1.15%) were missing from the questionnaires. These 14 missing values were replaced with the respondent's average score for the relevant construct, in line with King, Fogg, and Downey (1998).

Material and data

The questionnaire consisted of six items to measure perceived usefulness, five to measure ease of use and four to measure enjoyment. All items are shown in Appendix A and were adapted from Davis (1989) and Van der Heijden (2004), where their reliability and validity have already been established. Only one of the items from Davis (1989), for perceived ease of use ("I find my CHOSEN DEVELOPMENT ENVIRONMENT to be flexible to interact with") was not used in the study because it was felt that "programming language flexibility" was an ambiguous term. One item was used to measure intention to continue using the technology.

It was not assumed that all users were using the program for productivity and for fun, and those who were not were excluded from hypotheses testing. Three approaches were used to verify that the users included in the study classed their system use as dual. First, all respondents were asked to rate, on a scale from 1-10, how much they were programming robots because the programming itself is fun and, separately, how much they are programming because programming is a good way of completing the job of building robots. To be considered as using a dual system, respondents had to score over 5.5 (effectively greater than or equal to 6) on each scale. Of the respondents, 1 classed his system as useless, 7 persons classed it as utilitarian, 48 as dual, and 12 as recreational. The 48 who classed their system as dual were used to test the hypotheses.

Second, five regular contributors to the message board who are considered Mindstoms community leaders—and among them have developed extensive Web content on Lego robots, written books about programming robots, and created some of the development environments being considered—were contacted personally by e-mail and asked if they agreed or disagreed that most users were using their development environment for fun and for

productivity. Four of these individuals agreed with this position, a similar proportion to the respondents who classified their systems as dual.

Lastly, more than a year after the original request for participation was made, another post requested readers to look at a version of Figure 1 and answer questions about the quadrant in which their usage lies. Thirty-four responses were received and 79% of them agreed that their use was dual, a similar proportion as in the original data.

Results

Table 1 shows the reliability and validity of the measurement scales. Using principle factor analysis, and including all the data and not just the dual system data, three factors were extracted after 5 rotations that accounted for 62% of the total variance. There were no cross construct loadings above 0.50, showing good discriminant validity. All factor loadings were 0.5 or above (USE3 and EASE2 were 0.47 and 0.49 respectively), showing good convergent validity. The constructs are therefore unidimensional and factorially distinct, and all items used to operationalize a construct load onto a single factor. Cronbach's alpha reliability scores were all over 0.8, which is considered adequate.

Table 1. Scale Reliability and Factorial Validity. Principal axis factoring was used with varimax rotation and kaiser normalization, $N = 68$.

Scale item	Factor 1	Factor 2	Factor 3	Cronbach's alpha
Ease1	0.88			
Ease4	0.87			
Ease5	0.85			
Ease3	0.51			
Ease2	0.49			0.87
Use2		0.76		
Use4		0.76		
Use3		0.73		
Use6		0.52		
Use1		0.51		
Use5		0.47		0.83
Enjoy2			0.83	
Enjoy4			0.78	
Enjoy1			0.75	
Enjoy3			0.71	0.88
% of variance explained	24.20	19.30	18.60	
Cumulative percentage	24.20	43.50	62.10	

Rotation converged in five iterations.
Ease = perceived ease of use; Use = perceived usefulness; Enjoy = perceived enjoyment; all items are shown in the Appendix.
Factor 1 = ease of use, Factor 2 = usefulness, and Factor 3 = enjoyment.

The research model shown in Figure 1 was tested by multiple regression analysis using SPSS 11. This is consistent with methods used in similar previous studies, such as Davis et al. (1992) and Moon and Kim (2001). The results are shown in Table 2. Consistent with Hypothesis 1, a positive relationship was found between perceived ease of use and perceived enjoyment. Perceived enjoyment and perceived usefulness both impact positively on intention to use, which provides support for Hypotheses 2 and 4. A positive relationship was found between perceived ease of use and perceived usefulness, which is consistent with Hypothesis 5. No positive relationship between perceived ease of use and intention to use was found, meaning no support was found for Hypothesis 3.

To provide quantitative estimates of the relationships between intention, perceived ease of use, usefulness, and enjoyment, a path analysis of the path diagram shown in Figure 2 was conducted. Figure 3 shows the path coefficients that were computed. Since these coefficients are standardized, it is possible to compare them directly (Bryman & Cramer, 2005). It can be seen that perceived usefulness has a stronger effect on intention to use than perceived enjoyment,

Table 2. Results from running regression analyses to test the hypotheses.

Model	R^2	Beta	t	p	Standard error	Result
1. PE = PEOU + errors	0.124	0.352	2.551	0.014	0.661	H1 was supported
2. I = PE + errors	0.242	0.492	3.831	0.000	0.877	H2 was supported
3. I = PEOU + errors	0.063	0.251	1.755	0.086	0.975	H3 was not supported
4. I = PU + errors	0.379	0.616	5.297	0.000	0.794	H4 was supported
5. PU = PEOU + errors	0.239	0.489	3.805	0.000	0.611	H5 was supported

$P < 0.05$

PE = perceived enjoyment, PEOU = perceived ease of use, PU = perceived usefulness, I = intention to use.

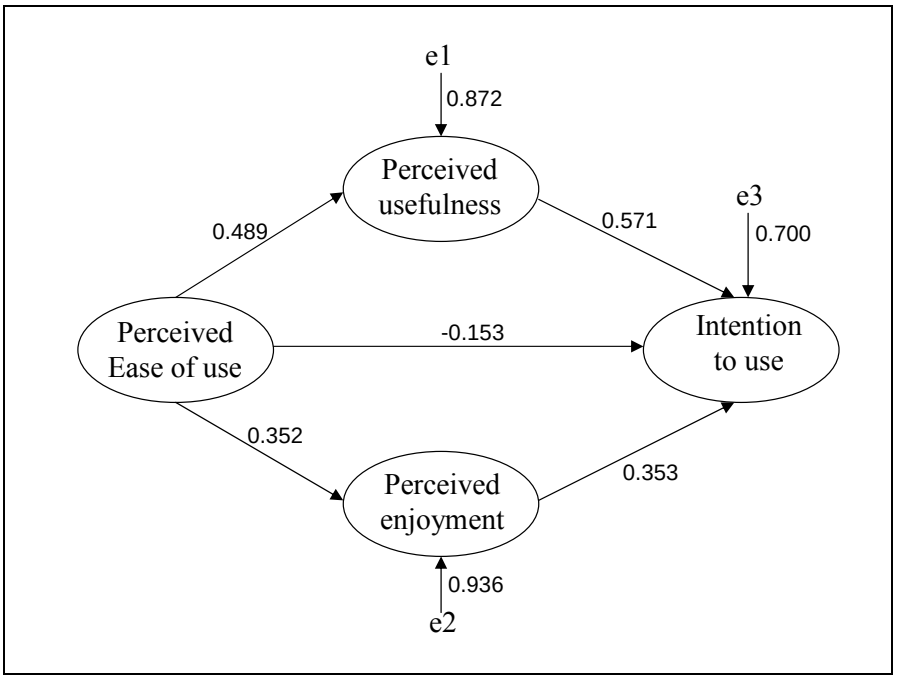

Figure 3. Acceptance model supported by the analysis including the standardized beta path coefficients and error terms.

and that perceived ease of use has a slightly negative direct effect. The indirect effect of perceived ease of use is 0.403; the overall impact is therefore 0.250. Clearly an appreciation of the intervening variables perceived usefulness and perceived enjoyment is essential to an understanding of the relationship between perceived ease of use and intention to use.

DISCUSSION

Hypotheses 1 (There is a positive relationship between perceived ease of use and perceived enjoyment) and 2 (There is a positive relationship between perceived enjoyment and intention to use)—about the relationships between ease of use, enjoyment, and intention, as shown at the bottom of Figure 2—were derived from other studies involving recreational systems. Neither was rejected by the results of this study: Perceived ease of use is significantly related to perceived enjoyment and perceived enjoyment is significantly related to intention to use. Hypotheses 3 (There is a positive relationship between perceived ease of use and intention to use), 4 (There is a positive relationship between perceived usefulness and intention to use), and 5 (There is a positive relationship between perceived ease of use and perceived usefulness) all concern relationships predicted within the original TAM. Hypotheses 4 and 5 were confirmed: There is a positive relationship between perceived usefulness and intention to use, and there is a positive relationship between perceived ease of use and perceived usefulness. However hypothesis 3 was rejected: A positive relationship between perceived ease of use and intention to use was not found.

The acceptance model that these results support is shown in Figure 3. The empirical data show that perceived usefulness does achieve dominant predictive value over perceived enjoyment and perceived ease of use. Further research is needed to see if this result is replicated with other dual systems, although the finding is consistent with Davis et al. (1992). Perceived ease of use loses any direct impact on intention to use but plays an important part in influencing perceived usefulness and enjoyment. Clearly, given the strength of the error terms in Figure 3, there are other unknown factors impacting intention to use, perceived usefulness, and enjoyment, and further work may attempt to identify these. The results also suggest that there may be value in exploring alternative ways to make dual systems more acceptable to users other than by merely increasing ease of use. Increasing enjoyment is one of them. Although ease of use has an impact on enjoyment, identifying the other factors that impact enjoyment would allow investigation into whether these could be exploited to increase acceptance. This study agrees with the finding of Van der Heijden (2004) that purpose of use is important in determining the factors that predict acceptance, and that progress in user acceptance models can be made by focusing on the nature of use. The grid shown in Figure 1 is a useful way of doing this.

This study has a number of limitations. First, almost all of the respondents were male. Future work should repeat the study with a dual system that has an even gender mix. Second, the system studied is very different from a more mainstream system, such as a word processor, not least in the technical ability of the user. Therefore, future work should study more common dual systems. Also, this study, like many other studies, is biased toward users of the technology: The reasons for how and why a technology-minded individual might use a system, or view its context of use, may be quite distinct from someone who is less

technology-minded. Relatedly, the important factors in choosing to use a system may be different from the important factors in choosing not to use a system. These aspects of use should be considered in future studies. Lastly, although the results are consistent with other findings, they cannot be applied to purely utilitarian systems. For instance, the results do not suggest that acceptance of productivity-oriented systems can be increased by adding a fun dimension. The systems studied here were specifically used in part for fun and in part for productivity; for many users, the fun was as important or more so that the productivity. In any case, trying to increase acceptance of utilitarian systems by increasing enjoyment may encourage users to spend their time on frivolous use.

ENDNOTE

1. For more information about Lego Mindstorms see http://mindstorms.lego.com/

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Appendix

SURVEY INSTRUMENT

1. Please rate on a scale of one to ten how much you are programming robots because the programming itself is fun.
2. Please rate on a scale of one to ten how much you view programming as a way of getting the job of building robots done.

Perceived usefulness (6 point Likert scale - strongly agree, agree, slightly agree, slightly disagree, disagree, strongly disagree)
1. Using my CHOSEN LANGUAGE enables me to build robots quickly
2. Using my CHOSEN LANGUAGE improves my performance at building robots
3. Using my CHOSEN LANGUAGE increases my productivity at building robots
4. Using my CHOSEN LANGUAGE enhances my effectiveness at building robots
5. Using my CHOSEN LANGUAGE makes it easy to build robots
6. I find my CHOSEN LANGUAGE useful in building robots

Perceived ease of use (6 point Likert scale - strongly agree, agree, slightly agree, slightly disagree, disagree, strongly disagree)
1. Learning to use my CHOSEN LANGUAGE was easy for me
2. I found it easy to get my CHOSEN LANGUAGE to do what I want it to
3. Interaction with my CHOSEN LANGUAGE is clear and understandable
4. It was easy for me to become skilful at using my CHOSEN LANGUAGE
5. I find my CHOSEN LANGUAGE easy to use

Perceived enjoyment (6 point Likert scale – respondents were asked to select where their CHOSEN LANGUAGE lies between each of the two terms)
Enjoyable- Disgusting
Exciting- Dull
Pleasant- Unpleasant
Interesting-Boring

Intention to use
1. I intend to keep using my CHOSEN LANGUAGE