An Empirical Study of the Roles of Affective Variables in User Adoption of Search Engines

Heshan Sun
Syracuse University
hesun@syr.edu

Ping Zhang
Syracuse University
pzhang@syr.edu

ABSTRACT

The current study is built upon prior research and is an attempt to explore the roles of affective variables in user technology adoption. Two different affective variables, computer playfulness and perceived enjoyment, were examined and their relationships with each other and with cognitive and behavioral variables were hypothesized. An empirical study using survey method was conducted. Analyses with the PLS technique confirmed most of the hypotheses. Our findings suggest that perceived enjoyment has a significant impact on perceived ease of use, but no direct effect on behavioral intention. Perceived enjoyment mediates the impact of computer playfulness on PEOU, which has not been studied before.

Keywords

Computer playfulness, perception of enjoyment, trait, technology adoption, empirical study, search engines

INTRODUCTION

Existing studies emphasize cognitive determinants of IT use intention and neglect potential influences of other factors (Agarwal and Karahanna, 2000). One of these other factors is affect, which has been proved to be an important concept in the fields of psychology, marketing and consumer research, and organizational behavior. By taking affect into account we should be able to explain more variance in users' intention and behavior (e.g. Davis, Bagozzi and Warshaw, 1992) .

Two affective variables are of interest in this study: computer playfulness (CP) and perceived enjoyment (PE). Computer playfulness is defined as an individual characteristic representing a type of intellectual or cognitive playfulness and describing an individual's tendency to interact spontaneously, inventively, and imaginatively with microcomputers (Webster and Martocchio, 1992). Computer playfulness is frequently referred to as a personal trait. Perceived enjoyment is defined as the extent to which the activity of using computers is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated (Davis et al., 1992). It is often referred to as a perception, as suggested by its name, of enjoyableness of a particular technology.

Prior studies have not examined the relationships between computer playfulness and perceived enjoyment as well as their different relationships with cognitive and behavioral factors. Venkatesh (2000) argued that computer playfulness and perceived enjoyment were two antecedents of perceived ease of use (PEOU). However, the relationship between these two factors was not examined or discussed. Their relationships with PEOU may vary if we take the relationship between them into account. Moon and Kim also proposed another similar concept: perceived playfulness. However, it is not a trait variable and enjoyment is just one of its three dimensions (Moon and Kim, 2001).

Therefore, the main objective of this study is to examine empirically the roles of affective variables in user technology acceptance, especially the mediating role of perceived enjoyment between computer playfulness and perceived ease of use.

THEORETICAL DEVELOPMENT

We use a two-step hierarchical method to examine our arguments and hypotheses. We first examine the relationship among computer playfulness, perceived ease of use, and behavioral intentions (Model 1, Figure 1). Then, PE is presented as a mediator between CP and PEOU (Model 2, Figure 1). We hypothesize that the significant effect of CP on PEOU in Model 1 may no longer be true after perceived enjoyment is introduced as a mediator. Figure 1 shows the hypotheses.

Model 1: Before perceived enjoyment is introduced

Computer playfulness may predict users' PEOU. The rationale is that those people who are more playful with information technologies in general tend to underestimate the difficulties of using a new technology since they quite simply enjoy the process and do not perceive it as requiring effort compared to those who are less playful (Venkatesh, 2000). Hackbarth and colleagues (2003) recently empirically confirmed such a positive relationship. Therefore, we propose:

H1: Computer playfulness has a significant positive effect on perceived ease of use.

Computer playfulness may not have a significant effect on behavioral intention. Researchers argue that the influence of trait variables on behavioral variables is mediated by beliefs (e.g Fishbein and Ajzen, 1975, Karahanna, Ahuja, Srite and Galvin, 2002). Similarly, researchers in the IS field have similar arguments about the mediating effects of perceptions (e.g. Davis, 1989, Davis, Bagozzi and Warshaw, 1989). Therefore we hypothesize that:

H2: Computer playfulness has a non-significant impact on behavioral intention.

PEOU is one of the major factors that antecedes behavioral intention (e.g. Davis, 1989, Davis et al., 1989). A vast body of empirical research already indicates a significant association between PEOU and behavioral intention (Davis and Venkatesh, 1996, Venkatesh and Davis, 1996, Agarwal and Karahanna, 2000, Gefen, Karahanna and Straub, 2003). We thus propose a significant impact of PEOU on BI.

H3: Perceived ease of use has a significant positive effect on behavioral intention.

Model 2: The mediating effect of perceived enjoyment

In Model 2, we introduce PE and re-examine the relationships suggested in Model 1.

Computer playfulness exerts significant impact on perceived enjoyment. Agarwal and Karahanna (2000) proposed a multi-dimensional construct called cognitive absorption, a state of deep involvement with software. In their research, computer playfulness had a significant effect on cognitive absorption. Enjoyment, meanwhile, was one of the sub-dimensions of cognitive absorption. Assuming other factors are equal, it is reasonable to propose a causal relationship between computer playfulness and perceived enjoyment.

H4: Computer playfulness has a significant positive effect on perceived enjoyment.

Perceived enjoyment significantly influences behavioral intention. The rationale is that individuals who experience pleasure or enjoyment from using an information system are more likely to intend to use it extensively than others (Igbaria, Parasuraman and Baroudi, 1996). Empirical studies also support such effects (e.g. Davis et al., 1992, Venkatesh, 2000). Thus, the following hypothesis is offered:

H5: Perceived enjoyment has a significant positive impact on behavioral intention.

Perceived enjoyment may also have significant influence on perceived ease of use. Affective perception makes individuals perceive themselves as possessing ample time to complete a task, which in turn reduces the perception of workload associated with using the technologies (Agarwal and Karahanna, 2000). Enjoyment can also make individuals "underestimate" the difficulty associated with using the technologies since they enjoy the process itself and do not perceive it to be arduous (Venkatesh, 2000). Previous empirical studies also support the casual relationship between perceived enjoyment and perceived ease of use (Davis et al., 1992, Agarwal and Karahanna, 2000, Yi and Hwang, 2003, Venkatesh, 2000). Thus we propose that:

H6: Perceived enjoyment has a significant positive effect on PEOU.

Perceived enjoyment could mediate the impact of computer playfulness on perceived ease of use. Although not stating it explicitly, Agarwal and Karahanna (2000) argued that cognitive absorption mediates computer playfulness' effects on PEOU. In light of the fact that enjoyment has the highest loading score with cognitive absorption, it is reasonable to expect that perceived enjoyment has similar mediating effects. Without further empirical evidence, we propose that the direct impact of computer playfulness on PEOU (Model 1) is no longer significant when perceived enjoyment is introduced (Model 2).

H7: CP's effect on PEOU becomes non-significant when PE is introduced as a mediator between CP and PEOU.

To be consistent, we retest the link between computer playfulness and behavioral intention. We do not think their relationship will change. In other words, the link is still non-significant despite the fact that enjoyment is introduced. The relationship between PEOU and BI is also re-examined. Based on the rationales about these two relationships discussed above, we have:

H8: With PE as the mediator of CP and PEOU, the relationship between CP and BI is still non-significant.

H9: PEOU has a significant effect on BI.

METHODOLOGY

Sample

An online survey research project hosted by a northeastern university was used in this study to recruit participants. Many of the voluntarily registered individuals are from households. Since we have work-related questions, only employed individuals were invited to participate in the study. A total of 750 recruitment emails were sent out. Among the 240 returns, 161 had complete responses for all measures. This set comprised the final sample used for data analysis.

Target Technology

In this study, we chose search engines as our target technology. Prior studies traditionally focused on the objective performance of search engines such as recall, prevision, and response time (Chu and Rosenthal, 1996). However, users may have subjectively affective reactions toward using search engines. For example, examining the searching results, which is also a part of using search engines, could be fun for users. The enjoyment users perceive during the examination of results could be a reason for the users to accept search engines.

Operationalization of Constructs

All the constructs were measured using scales that were previously developed and validated—the seven item Computer Playfulness Scale is used to measure computer playfulness (Webster and Martocchio, 1992, Agarwal and Karahanna, 2000, Yager, Kappelman, Maples and Prybutok, 1997), three items were used to measure perceived enjoyment (Davis et al., 1992, Venkatesh, 2000), four items were used to measure ease of use (Davis et al., 1989, Davis, 1989, Davis et al., 1992, Venkatesh and Davis, 1996, Agarwal and Karahanna, 2000, Gefen et al., 2003, Venkatesh, Morris, Davis and Davis, 2003), and two items were used to measure behavioral intention (Davis et al., 1989, Davis and Venkatesh, 1996, Venkatesh, 2000).

Data Analysis

Partial Least Square (version PLS-graph 03.00) was used to analyze the data. The measurement model in PLS is assessed in terms of item loadings and reliability coefficients (composite reliability), as well as the convergent and discriminant validity. Individual item loadings greater than 0.7 are considered adequate (Fornell and Larcker, 1981). Interpreted like a Cronbach's alpha for internal consistency reliability estimate, a composite reliability of .70 or greater is considered acceptable (Fornell and Larcker, 1981). The average variance extracted (AVE) measures the variance captured by the indicators relative to measurement error, and it should be greater than .50 to justify using a construct (Barclay, Thompson and Higgins, 1995). The discriminant validity of the measures (the degree to which items differentiate among constructs or measure distinct concepts) was assessed by examining the correlations between the measures of potentially overlapping constructs. Items should load more strongly on their own constructs in the model, and the average variance shared between each construct and its measures should be greater than the variance shared between the construct and other constructs (Compeau, Higgins and Huff, 1999).

The structural model in PLS is assessed by examining the path coefficients (standardized betas). T statistics are also calculated to assess the significance of these path coefficients. In addition, R^2 is used as an indicator of the overall predictive strength of the model.

RESULTS

In this section, to ensure comparison, we first present the measurement models for the two theoretical models. Then we present the structural models.

Model 1: Measurement Model

The results show that the measures of the constructs examined in Model 1 are robust in terms of item loadings, their internal consistency reliability as indexed by composite reliabilities, and discriminant validity. Except for CPS1, all other item loadings were above the suggested 0.70 (Table 1). The internal reliabilities, assessed by composite reliability, were all greater than 0.70 (see Table 2). Therefore, no items were dropped. This allowed consistency with the measures used in prior studies. Table 2 also demonstrates satisfactory convergent and discriminant validity of the measures. Average variance extracted (AVE) for all constructs exceeded 0.50. As for the discriminant validity, Table 2 shows that all constructs were more strongly correlated with their own measures than with any of the other constructs. Therefore, discriminant validity was observed.

	CPS	PEOU	BI
CPS1	**0.67**	0.30	0.16
CPS2	**0.83**	0.22	0.06
CPS3	**0.81**	0.37	0.18
CPS4	**0.81**	0.25	0.06
CPS5	**0.75**	0.33	0.11
CPS6	**0.79**	0.22	0.09
CPS7	**0.76**	0.27	0.08
PEOU1	0.38	**0.92**	0.58
PEOU2	0.34	**0.92**	0.51
PEOU3	0.33	**0.91**	0.52
PEOU4	0.35	**0.95**	0.57
BI1	0.09	0.55	**0.95**
BI2	0.19	0.57	**0.95**

Table 1: Item Loadings in Model 1

	CR	AVE	1	2	3
1. CP	.913	.601	**.775**		
2. PEOU	.960	.856	.376	**.925**	
3. BI	.946	.897	.149	.590	**.947**

CR: Composite Reliability; AVE: Average Variance Extracted.

Diagonal Elements are the square root of the variance shared between the constructs and their measurement (AVE). Off diagonal elements are the correlations among constructs. Diagonal elements should be larger than off-diagonal elements in order to obtain the discriminant validity.

Table 2: Reliability, Convergent and Discriminant Validity Coefficients (Model 1)

Model 2: Measurement Model

Except for CPS1, all other item loadings were above the suggested 0.70 (Table 3). Again, to be consistent with the measures used in previous studies and with that in Model 1, we did not drop CPS1, because the internal reliabilities assessed by composite reliability were greater than 0.70 (see Table 4). Table 4 also demonstrates satisfactory convergent and discriminant validity of the measures. Average variance extracted (AVE) for all constructs exceeded 0.50. As for the discriminant validity, Table 4 shows that all constructs were more strongly correlated with their own measures than with any of the other constructs. Thus we obtained the discriminant validity.

	CPS	PE	PEOU	BI
CPS1	**0.67**	0.33	0.30	0.16
CPS2	**0.84**	0.30	0.22	0.06
CPS3	**0.81**	0.33	0.37	0.18
CPS4	**0.81**	0.25	0.25	0.06
CPS5	**0.74**	0.29	0.33	0.11
CPS6	**0.79**	0.22	0.22	0.09
CPS7	**0.76**	0.26	0.27	0.08
PE1	0.35	**0.97**	0.68	0.43
PE2	0.35	**0.97**	0.71	0.42
PE3	0.38	**0.97**	0.65	0.42
PEOU1	0.37	0.59	**0.92**	0.58
PEOU2	0.33	0.69	**0.92**	0.51
PEOU3	0.32	0.64	**0.92**	0.52
PEOU4	0.34	0.67	**0.94**	0.57
BI1	0.08	0.44	0.54	**0.95**
BI2	0.19	0.38	0.57	**0.95**

Table 3: Item Loadings in Model 2

	CR	AVE	1	2	3	4
1. CP	.913	.602	**.776**			
2. PE	.980	.944	.372	**.972**		
3. PEOU	.960	.856	.371	.700	**.925**	
4. BI	.946	.897	.146	.436	.588	**.947**

Table 4: Reliability, Convergent and Discriminant Validity Coefficients (Model 2)

Model 1: Structural Model

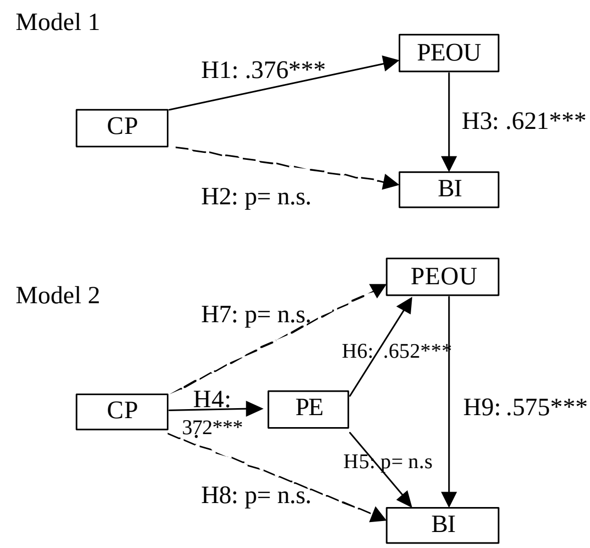
The path coefficients from the PLS analysis are shown in Figure 1 (see Model 1 part). Hypotheses 1, 2 and 3 were all supported. CP demonstrated a direct, statistically significant, and positive effect on PEOU (H1 p<.001). As hypothesized, CP did not have a direct impact on behavioral intention (H2 p= n.s.). Its impacts were fully mediated by users' perception of ease of use, which had a significant direct effect on BI (H3 p<.001).

R^2 values can be used to evaluate the strength of the proposed model. In Model 1, 35.4% of variance in BI was explained by the model. In addition, 14.1% of variance in PEOU was explained by computer playfulness itself.

Model 2: Structural Model

The path coefficients from the PLS analysis for Model 2 are shown in Figure 1 (see Model 2 part). Hypotheses 4, 6, 7, 8 and 9 were all supported. CP demonstrated a direct, statistically significant, and positive impact on PE (H4 p<.001). As hypothesized, perceived enjoyment had a direct effect on perceived ease of use (H6 p<.001). Consistent with our hypotheses, computer playfulness did not have significant impacts on PEOU (H7 p=n.s.) and BI (H8 p= n.s.). The significant effect of PEOU on BI was confirmed again in Model 2 (H9 p<.001). However, PE did not demonstrate a direct, statistically significant positive effect on BI as hypothesized, thus Hypothesis 5 was not supported.

Approximately 35% of the variance in BI and more than 50% of the variance in PEOU was explained by Model 2. In addition, 13.8% of the variance in PE was explained by computer playfulness itself.



***: Statistical significance p<.001; n.s.: non-significant

Figure 1: Summary of Results

CONCLUSION

There are two limitations in this study. The first limitation relates to external validity. Only employed search engine users were recruited. Whether the findings of this study can be generalized to other populations needs to be tested. The second limitation concerns the internal validity. CP scales, albeit statistically satisfying in general, may need to be further tested or refined since CPS1 has a loading less than .70 in both models.

A comparison between the empirical results for Model 1 and Model 2 successfully supported the expected mediating effect of perceived enjoyment. To be specific, the initially significant relationship between CP and PEOU, as suggested in Model 1, was no longer significant when perceived enjoyment was introduced, as in Model 2. Meanwhile, perceived enjoyment had significant relationships with both CP and PEOU. Combined, this indicates the mediating effect of affective perception on the relationship between CP as an affective trait and PEOU as a cognitive belief. This actually presents a different picture of CP's effect on PEOU than those presented in some previous studies (Venkatesh, 2000, Hackbarth et al., 2003).

Both Model 1 and Model 2 indicated that affective factors exerted their influence on users' behavioral intention only through perceived ease of use. Figure 1 shows that perceived ease of use was the only factor that significantly influenced behavioral intention in both Model 1 and Model 2. The influence of affect factors, trait or perceptional, was mediated by users' PEOU.

It is worth noting that R^2 of PEOU increased dramatically from .141 to .504 by introducing PE, indicating the importance of perceived enjoyment in forming users' perception of the ease of use. This result is consistent with previous empirical studies arguing that PE is the primary antecedent of PEOU (e.g. Venkatesh, 2000).

The relatively low R^2 of PE (13.8%) implies that there are other factors besides CP that antecede PE. Given the importance of PE in forming PEOU, further exploration for predictors of perceived enjoyment may be of value.

This study also has practical implications. For example, EC providers should make sure the shopping process is enjoyable, which leads customers to feel that EC systems are easy to use, and therefore form intentions to use them. Second, when EC providers recommend technological products to customers, the enjoyableness of the technologies should be emphasized in order to influence users' perception of ease of use and therefore enhance their intention to purchase. In addition, the enjoyable information should be made accessible and searchable.

REFERENCES

1. Agarwal, R. and Karahanna, E. (2000) Time flies when you're having fun: cognitive absorption and beliefs about information technology usage, *MIS Quarterly,* 24,4, 665-694.
2. Barclay, D. W., Thompson, R. and Higgins, C. (1995) The Partial Least Squares (PLS) Approach to Causal Modeling: Personal Computer Adoption and Use an Ilustration, *Technology Studies,* 2,2, 285-309.
3. Chu, H. and Rosenthal, M. (1996) Search engines for the World Wide Web: A Comparative Study and Evaluation Methodology, *Proceeding of the ASIS 1996 Annual Conference*
4. Compeau, D. R., Higgins, C. A. and Huff, S. (1999) Social Cognitive Theory and Individual Reactions to Computing Technology - A Longitudinal-Study, *MIS Quarterly,* 23,2, 145-158.
5. Davis, F. D. (1989) Perceived usefulness, perceived ease of use, and user acceptance of information technology, *MIS Quarterly,* 13,3, 319-342.
6. Davis, F. D., Bagozzi, R. P. and Warshaw, P. R. (1989) User Acceptance of Computer Technology: A Comparison of Two Theoretical Models, *Management Science,* 35,8, 982-1003.
7. Davis, F. D., Bagozzi, R. P. and Warshaw, P. R. (1992) Extrinsic and intrinsic motivation to use computers in the workplace, *Journal of Applied Social Psychology,* 22,1111-1132.
8. Davis, F. D. and Venkatesh, V. (1996) A critical assessment of potential measurement biases in the technology acceptance model: three experiments, *International Journal of Human-Computer Studies,* 45,1, 19-45.
9. Fishbein, M. and Ajzen, I. (1975) *Beliefs, attitude, intention and behavior: An introduction to theory and research,* Addison-Wesley, Reading, MA.
10. Fornell, C. and Larcker, D. (1981) Evaluating structural equation models with unobservable variables and measurement error, *Journal of Marketing Research,* 18,3, 39-50.
11. Gefen, D., Karahanna, E. and Straub, D. W. (2003) Trust and TAM in Online Shopping: An Integrated Model, *MIS Quarterly,* 27,1, 51-90.
12. Hackbarth, G., Grover, V. and Yi, M. Y. (2003) Computer playfulness and anxiety: positive and negative mediators of the system experience effect on perceived ease of use, *Information & management,* 40,3, 221.
13. Igbaria, M., Parasuraman, S. and Baroudi, J. J. (1996) A motivational model of microcomputer usage, *Journal of Management Information Systems,* 13,1, 127.
14. Karahanna, E., Ahuja, M., Srite, M. and Galvin, J. (2002) Individual differences and relative advantage: the case of GSS, *Decision Support Systems,* 32,4, 327-341.
15. Moon, J. W. and Kim, Y. G. (2001) Extending the TAM for a World-Wide-Web context, *Information & Management,* 38,4, 217-230.
16. Venkatesh, V. and Davis, F. D. (1996) A Model of the Antecedents of Perceived Ease of Use: Development and Test, *Decision Science,* 27,3, 451-481.
17. Venkatesh, V., Morris, M. G., Davis, G. B. and Davis, F. D. (2003) User acceptance of information technology: toward a unified view, *MIS Quarterly,* 27,3, 425-478.
18. Webster, J. and Martocchio, J. J. (1992) Microcomputer Playfulness: Development of a Measure with Workplace Implications, *MIS Quarterly,* 16,2, 201.
19. Yager, S. E., Kappelman, L. A., Maples, G. A. and Prybutok, V. R. (1997) Microcomputer playfulness: stable or dynamic trait?, *The DATA BASE for Advances in Information Systems,* 28,2, 43 - 52.
20. Yi, M. Y. and Hwang, Y. (2003) Predicting the Use of Web-based Information Systems: Self-efficacy, Enjoyment, Learning Goal Orientation, And the Technology Acceptance Model, *International Journal of Human-Computer Studies,* 59,4, 431-449.