Extending the TAM for a World-Wide-Web context

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Abstract

Ease of use and usefulness are believed to be fundamental in determining the acceptance and use of various, corporate ITs. These beliefs, however, may not explain the user’s behavior toward newly emerging ITs, such as the World-Wide-Web (WWW).

In this study, we introduce playfulness as a new factor that reflects the user’s intrinsic belief in WWW acceptance. Using it as an intrinsic motivation factor, we extend and empirically validate the Technology Acceptance Model (TAM) for the WWW context. © 2001 Elsevier Science B.V. All rights reserved.

Keywords: Technology acceptance; Technology Acceptance Model (TAM); Playfulness; World-Wide-Web

1. Introduction

In the past decades, perceived ease of use and perceived usefulness constructs have been considered important in determining the individuals’ acceptance and use of IT [24,26]. These variables are fundamental salient beliefs (motivational factors) comprising the Technology Acceptance Model (TAM) [12]. IS researchers have investigated and replicated these two constructs and agreed that they are valid in predicting the individual’s acceptance of various corporate information technologies [1,7,18,30,35]. However, depending on the specific technology context, additional explanatory variables may be needed beyond the ease of use and usefulness constructs. Davis [10,11] himself argued that future technology acceptance research needs to address how other variables affect usefulness, ease of use, and user acceptance. Factors contributing to the acceptance of a new IT are likely to vary with the technology, target users, and context. Now, the World-Wide-Web (WWW) is seen as an emerging new IT, with such potency that it has made individuals change their information access methods and organizations to change their business strategy. Thus, research on the acceptance of the WWW will enhance our understanding of the individual’s beliefs or motives to use the WWW and to show how these factors affect individual’s acceptance the use of the WWW.

According to a recent survey on WWW usage (http://www.cc.gatech.edu/gvu/user_surveys/papers/), the individual’s primary use of the WWW is for education, shopping, entertainment, work, communication, personal information, time-wasting, etc. So, unlike other traditional ITs, the WWW is used both for work, and thus pleasure and perceived usefulness and perceived ease of use may not fully reflect the WWW user’s motives, necessitating a search for additional intrinsic motivation factors.
The purpose of this study is to extend the Technology Acceptance Model (TAM) in the WWW context. We propose a new variable (‘perceived playfulness’) to enhance understanding of an individual’s WWW acceptance behavior. This research also assesses the effect of the difference between an individual’s intrinsic and extrinsic motivation factors on his or her acceptance behavior.

2. Literature review

2.1. Technology acceptance model (TAM)

Technology Acceptance Model (TAM) was conceived to explain and predict the individual’s acceptance of IT. TAM is based on the Fishbein and Ajzen’s [17] Theory of Reasoned Action (TRA), which suggests that social behavior is motivated by an individual’s attitude toward carrying out that behavior, a function of one’s beliefs about the outcome of performing that behavior and an evaluation of the value of each of those outcomes. According to TRA, behavior is determined directly by the intention to perform, because people, in general, behave as they intend to do, within the available context and time.

TAM adopts TRA’s causal links to explain the individual’s IT acceptance behaviors. It suggests that perceived usefulness and perceived ease of use of IT are major determinants of its usage. Davis [11] defined perceived usefulness as “the degree of which a person believes that using a particular system would enhance his or her job performance” and perceived ease of use as “the degree of which a person believes that using a particular system would be free of effort.” Consistent with TRA, user’s beliefs determine the attitudes toward using the system. Behavioral intentions to use, in turn, are determined by these attitudes toward using the system. Finally, behavioral intentions to use lead to actual system use. Previous research has demonstrated the validity of this model across a wide variety of corporate ITs.

One obstacle to using TAM has been problems in applying it beyond the workplace. This is because TAM’s fundamental constructs do not fully reflect the variety of user task environments. Recently, Dishaw and Strong [16] pointed out that a weakness of TAM is its lack of task focus. Therefore, to increase external validity of TAM, it is necessary to further explore the nature and specific influences of technological and usage-context factors that may alter the user’s acceptance.

2.2. Extrinsic and intrinsic motivation and IT acceptance

Recently, motivation theories have been used to understand individuals’ IT acceptance behaviors [13,21,22,37]. Motivation theorists have often distinguished the effects of extrinsic and intrinsic motivation on individuals’ behaviors [6,14,15,31,34]. In Deci’s work, extrinsic motivation refers to the performance of an activity: it is perceived to help achieve valued outcomes that are distinct from the activity itself, such as improving job performance, pay, etc. Intrinsic motivation refers to the performance of an activity for no apparent reason other than the process of performing it.

In technology acceptance research, most of the work has been conducted from an extrinsic motivation perspective. Davis et al. [13] investigated the relative effects of extrinsic and intrinsic motivation source on intention to use, and usage of, the computer in the workplace and, they defined perceived usefulness as an extrinsic source of motivation and perceived enjoyment as an intrinsic source of motivation. They found that perceived enjoyment and perceived usefulness mediated the influence of perceived ease of use on intention. They also argued that “while usefulness will once again emerge as a major determinant of intentions to use a computer in the workplace, enjoyment will explain significant variance in usage intentions beyond that accounted for by usefulness alone.” Igbaria et al. [21,22] found that system usage is affected by both extrinsic motivation (perceived usefulness) and intrinsic motivation (perceived fun). However, adoption of individual’s intrinsic motivation factor, such as perceived enjoyment or perceived fun, as a research construct needs further theoretical validation. For example, Davis et al.’s measurements of perceived enjoyment do not reflect a comprehensive set of intrinsic motivation states such as activity absorption, exploratory behaviors, curiosity, and arousal. We propose the ‘playfulness’ concept as an individual’s intrinsic salient belief to explain the individual’s intrinsically motivated behaviors.
2.3. Research on playfulness in human–computer interaction

Playfulness, which is based on Lieberman's pioneering works [25] and Barnett's studies [4,5], provides a strong theoretical base for our work.

There are two possible approaches: the first, focusing on the trait of playfulness, treats it as a motivational characteristic of individuals; the second, emphasizing the state of playfulness, defines it as a situational characteristic of the interaction between an individual and the situation. General traits refer to comparatively stable characteristics of individuals; these are relatively invariant to situational stimuli. States, however, refer to affective or cognitive episodes that are experienced in the short run and fluctuate over time. Unlike traits, states can be influenced by situational factors and the interactions between the individual and the situation. Playfulness represents a relatively enduring tendency, while being playful represents a temporary state at some specific time.

In the trait-based approach, Webster and Martocchio's Microcomputer Playfulness Scale is a specific adaptation of Barnett's work to the study of computer usage [41]. They conceived playfulness as the characteristic of an individual. Martocchio and Webster [29], however, found that individuals considered to be high on the playfulness trait demonstrated higher performance and showed higher affective responses to computer training tasks. Also, Atkins and Kydd [2] examined the influence of individual characteristics of playfulness on the use of the WWW. They found that both playfulness and usefulness affect its use in different ways, depending on its use for entertaining or for course work. While the trait-based approach focused on playfulness as the individual's characteristic, state-based research emphasized playfulness as the individual’s subjective experience of human–computer interaction. The majority of the research on playfulness as the individual’s interaction state are based on the Csikszentimihalyi’s ‘flow theory’ [9]. It emphasizes the role of a context rather than individual differences in explaining human motivated behaviors. He defined the flow as “the holistic sensation that people feel when they act with total involvement.” When in the flow state, a person may have more voluntary interaction with his or her environment. Based on the flow theory, several IS researchers felt that it is useful in understanding playfulness and the individuals’ evaluation of IT usage. Trevino and Webster [38] investigated the effects of flow on the computer-mediated communication environment. They found that it is influenced by the technology type, ease of use, and computer skill. Also, Webster et al. [42] examined the state of flow in a specific human–computer interaction. They found that the flow experience is associated with perceived characteristics of the computer software as well as with relevant work-related outcomes. But, from the point of technology acceptance research, their studies cannot explain the effects of playfulness on the individual’s attitude and actual behaviors. To overcome this problem, we consider playfulness as an intrinsic belief or motive, which is shaped from the individual’s experiences with the environment. More specifically, we examine it as an intrinsic salient belief that is formed from the individual’s subjective experience with the WWW. Therefore, individuals who have more positive playfulness belief in the WWW should view its interactions more positively than those who interact less playfully.

On the basis of the Csikszentimihalyi’s and Deci’s works, we define three dimensions of perceived playfulness: the extent to which the individual

(a) perceives that his or her attention is focused on the interaction with the WWW;
(b) is curious during the interaction; and
(c) finds the interaction intrinsically enjoyable or interesting.

Concentration: In the playfulness state, an individual’s attention will be focused on the activity. The focus is narrowed to a limited stimulus field, so that irrelevant thoughts and perceptions are filtered out. In this way, the person loses self-consciousness, becomes absorbed in the activity, and be more intensely aware of mental processes. When people fall into a playful state during their interaction with the WWW, their attention will be focused on the interactions.

Curiosity: Malone [27,28] suggested that, during playfulness, an individual’s sensory or cognitive curiosity is aroused. For example, the WWW can encourage sensory curiosity through technological characteristics such as hyper-links and multimedia effects. It can also stimulate cognitive curiosity and the desire to attain competence with the technology by providing options
such as bookmarks and hyper-links that encourage exploration and competence attainment.

**Enjoyment:** When individuals are in the playfulness state, they will find the interaction intrinsically interesting: they are involved in the activity for pleasure and enjoyment rather than for extrinsic rewards.

While these three dimensions are linked and interdependent, they do not always occur together in practice. For example, involvement often accompanies feelings of control and enjoyment, but it may also occur during highly stressful activities [19,33]. Thus one playfulness dimension by itself may not reflect the total experience.

3. Research model and hypotheses

The model for this research (Fig. 1) is an extension of the TAM based on an individual's intrinsic motivation theory. Perceived playfulness, the extended part of the model, is the construct of interest because it operationalizes the question of how intrinsic motives affect the individual’s acceptance of the WWW.

The basic assumption is that playfulness will have a positive effect on the individuals’ attitude toward using WWW and their behavioral intentions to use WWW.

The first hypothesis examines the link between the user’s beliefs about perceived ease of use and perceived playfulness. The former has been found to influence IT usage indirectly via perceived enjoyment, because ITs that are difficult to use are less likely to be considered enjoyable. Also, Csikszentmihalyi argued that feasibility of the activity for an individual encourages flow, the state of playfulness. ITs that are easier to use will be less threatening to the individual. Past research has related perceived ease of use to the enjoyment of interacting with computer systems, and to the flow experience during computer interaction. Therefore, perceived ease of use is expected to have positive influence on user’s perception of playfulness in their interaction with the WWW.

**Hypothesis 1.** There is a positive relationship between perceived ease of use and perceived playfulness of using the WWW.

Triandis [39] argued that affect, the feelings of joy, elation, or pleasure, or depression, disgust, displeasure, or hate associated with a particular act, has an impact on the person’s behavior. Previous research has found that attitudinal outcomes, such as positive affect, pleasure, and satisfaction, result from the playful experience [32]. Webster, et al.’s [40] study shows that playfulness highly correlates with the user’s positive attitudes. Also, such relationships have been supported by comparisons between the users microcomputers and mainframes [23]. Therefore, individuals who perceive that the WWW is playful will have a positive attitude toward using it.

**Hypothesis 2.** There is a positive relationship between Perceived Playfulness and Attitude toward Using the WWW.

![Fig. 1. Research model.](image-url)
According to flow theory, a positive subjective experience becomes an important reason for performing an activity. If an activity ‘feels good’, it is intrinsically motivating and people are more likely to engage in the activity for its own sake. Individuals using the WWW and experiencing playfulness are more absorbed and interested in their interaction. Webster, et al.’s study shows that playfulness highly correlates with the expected voluntary use. Also, Deci and Ryan’s work suggests that people expend efforts for both intrinsic and extrinsic motivations. Perceived playfulness is an example of an intrinsic motive, whereas perceived usefulness is an example of an extrinsic motive. Thus, in addition to positive attitudes, playfulness is expected to be associated with increased behavioral intention to use the WWW.

Hypothesis 3. There is a positive relationship between Perceived Playfulness and Behavioral Intention to Use the World-Wide-Web.

Because TAM is used as the baseline model, we also verify the following TAM hypothesized relationships in the context of WWW.

Hypothesis 4. There is a positive relationship between Perceived Ease of Use and Perceived Usefulness in the WWW context.

Hypothesis 5. There is a positive relationship between Perceived Ease of Use and Attitude toward Using in the WWW context.

Hypothesis 6. There is a positive relationship between Perceived Usefulness and Attitude toward Using in the WWW context.

Hypothesis 7. There is a positive relationship between Perceived Usefulness and Behavioral Intentions to Use in the WWW context.

Hypothesis 8. There is a positive relationship between Attitude toward Using and Behavioral Intentions to Use in the WWW context.

Hypothesis 9. There is a positive relationship between Behavioral Intentions to Use and Actual Use in the WWW context.

4. Research methodology

4.1. Subjects

The unit of analysis in our research is the individual user of the WWW. The population of interest is individuals who use it for their tasks. The sample consisted of 152 graduate students, who were majoring in the School of Management. All of the subjects had prior experience with the use of the WWW.

The data were gathered by means of a questionnaire. Overall, of the 208 that were distributed, 152 usable questionnaires were received and used for analysis, giving a response rate of 78 percent. Ninety-one percent of the respondents were male, and 62 percent have more than a year of experience with the WWW. Detailed descriptive statistics relating to the respondents’ characteristics are shown in Table 1.

4.2. Measurement development

In order to develop and validate the instrument, several steps were taken:
1. development of the measure from the literature;
2. initial pre-test; and
3. pilot test of the measure.

The questionnaire used for data collection contained scales to measure the various constructs of the research model. These are shown in Appendix A. The scales for perceived ease of use, perceived usefulness, attitude toward using, behavioral intentions to use, and actual use were adapted from Davis’ studies, which established their reliability and validity. The measures for perceived playfulness was based on existing research on flow theory and intrinsic motivation theory.

Pre-testing and pilot testing of the measures were conducted by selected users from the IS field, as well as experts in the IS research area. The pre-test respondents were asked to rate the relevance of the items in terms of each construct with WWW. The items were modified to make them relevant to the WWW usage context. Individuals indicated their agreement or disagreement with the survey instruments using a seven-point Likert-type scale.
Here, perceived playfulness is defined as “the strength of one’s belief that interacting with the WWW will fulfill the user’s intrinsic motives.” To measure it, we measured it in terms of the degree of an individual’s statements relating to their perceptions about concentration, enjoyment, and curiosity while using WWW.

Refinement of measures for the TAM constructs Churchill’s paradigm [8]. Principal component analysis and maximum likelihood analysis employing varimax rotations were used and compared for each of the proposed constructs, as well as the pre-existing constructs that were used in prior research on TAM. Distinct factors resulting from the principal components analysis are confirmed from the corresponding scree test plots. Cronbach’s $\alpha$ was used for assessing the reliability of individual scales and sub-scales. Convergent validity and discriminant validity of the measures were verified by observing the correlations between items of the various scales.

### 4.3. Measurement assessment

#### 4.3.1. Content validity

Content validity deals with how representative and comprehensive the items were in creating the scale. It is assessed by examining the process by which scale items are generated [36]. In this research, definitions of perceived ease of use, perceived usefulness, and perceived playfulness were proposed based on the review of theory and research in IS and other disciplines. In generating scales for perceived ease of use and perceived usefulness, nine items were selected and adapted from TAM research. For developing scales for perceived playfulness, Csikszentimihalyi’s flow theory and Deci’s intrinsic motivation theory were used. Also, several existing measures of playfulness (individual traits), enjoyment, fun and flow were reviewed to generate the scales.

#### 4.3.2. Construct validity

Construct validity determines the extent to which a scale measures a variable of interest. Many different aspects have been proposed in the psychometric literature [3]. In this study, we follow the Straub’s processes of validating instruments in MIS research in terms of convergent and discriminant validity. The former is the degree to which multiple attempts to measure the same concept are in agreement: two or more measures of the same item should co-vary highly if they are valid measures of the concept. The latter is the degree to which measures of different concepts are distinct: if two or more concepts are unique, then

<table>
<thead>
<tr>
<th>Measure</th>
<th>Items</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Female</td>
<td>13</td>
<td>8.6</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>139</td>
<td>91.4</td>
</tr>
<tr>
<td>Age</td>
<td>24–29</td>
<td>67</td>
<td>44.1</td>
</tr>
<tr>
<td></td>
<td>30–35</td>
<td>62</td>
<td>40.8</td>
</tr>
<tr>
<td></td>
<td>$\geq$36</td>
<td>23</td>
<td>15.1</td>
</tr>
<tr>
<td>Primary place of World-Wide-Web use</td>
<td>Campus</td>
<td>131</td>
<td>86.2</td>
</tr>
<tr>
<td></td>
<td>Home</td>
<td>19</td>
<td>12.5</td>
</tr>
<tr>
<td></td>
<td>etc.</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>Browser programs</td>
<td>Netscape browser</td>
<td>65</td>
<td>42.8</td>
</tr>
<tr>
<td></td>
<td>Internet explorer</td>
<td>63</td>
<td>41.4</td>
</tr>
<tr>
<td></td>
<td>Both</td>
<td>24</td>
<td>15.8</td>
</tr>
<tr>
<td>Degree of World-Wide-Web experiences</td>
<td>1–6 months</td>
<td>16</td>
<td>10.6</td>
</tr>
<tr>
<td></td>
<td>6–12 months</td>
<td>42</td>
<td>27.6</td>
</tr>
<tr>
<td></td>
<td>$&gt;1$ year</td>
<td>94</td>
<td>61.8</td>
</tr>
<tr>
<td>Purposes of World-Wide-Web use</td>
<td>Work</td>
<td>55</td>
<td>36.2</td>
</tr>
<tr>
<td></td>
<td>Entertainment</td>
<td>87</td>
<td>57.2</td>
</tr>
<tr>
<td></td>
<td>Both</td>
<td>10</td>
<td>6.6</td>
</tr>
</tbody>
</table>

Table 1

Descriptive statistics of respondents’ characteristics

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measures of each should not correlate well. To test construct validity, a principal components factor analysis of the perceived playfulness was conducted and a confirmatory factor analysis of the perceived playfulness, perceived ease of use, and perceived usefulness items was performed with varimax rotation.

Table 2 shows that the principal component analysis with varimax rotation for the proposed construct of perceived playfulness yielded three distinct factors: concentration, enjoyment, and curiosity. All three items loaded on a distinct factor. Factor loadings for all variables were greater than 0.55. Together, the three observed factors accounted for 77.3 percent of the total variance. Three factors emerged with no cross-construct loadings above 0.50, indicating good discriminant validity. To validate appropriateness of factor analysis, some measures examine the entire correlation matrix. In this study, Bartlett’s test of sphericity (p=0.00) indicates that the statistical probability that the correlation matrix has significant correlations among at least some of the variables, and the Kaiser–Meyer–Olkin measure of sampling adequacy (0.744) showed middling sampling adequacy.

Also, we conducted the principal factor analysis to investigate the distinctions among perceived ease of use, perceived usefulness, and perceived playfulness concept. Table 3 represents the result of the factor analysis. Three factors were extracted after five rotations. The principal component analysis result shows that these three constructs are distinct uni-dimensional scales. The results confirm the existence of three factors with eigenvalues greater than 1.0 that accounted for 70.2 percent of the total variance. The primary criterion for discriminant validity is that each indicator must load more highly on its associated construct than on any other construct. Table 3 provides the factor pattern matrix that shows the loadings of each item on perceived ease of use, perceived usefulness, and perceived playfulness.

Three factors emerged with no-cross construct loadings above 0.50, indicating good discriminant validity. The instrument also demonstrated convergent validity with factor loadings exceeding 0.50 for each construct. These results, therefore, confirm that each of these constructs is uni-dimensional and factorially distinct and that all items used to operationalize a particular construct is loaded onto a single factor.

4.3.3. Internal consistency reliability
The internal consistency was assessed by computing Cronbach’s zs. These coefficients are represented for each of the constructs in Table 4.

The values range from 0.83 (for actual use) to 0.96 (for perceived playfulness). Given the exploratory nature of the study, validity and reliability of the scales were deemed adequate. Three indicators of actual usage were derived from previous research on computer usage. These measure the usage in terms of the frequency of WWW access (‘how often’) and the degree of WWW usage (‘how much’).
5. Results

The intent of our study was to extend TAM by adding a playfulness concept in the WWW context. We hoped to explain user acceptance of the WWW. The hypothesized relationships were tested using regression analysis to maintain consistency with earlier studies. Table 5 presents a summary of the hypothesis tests. In such research, a stepwise multiple regression analysis technique is recommended examining the contribution of each predictor variables to the regression model [20]. More detailed results of the stepwise regression results are shown in Table 6. Also, a standard multiple regression analysis was conducted to compare the model’s overall predictive fit (adjusted $R^2$) of the original TAM to that of the extended TAM. Table 7 shows results of this comparison.

5.1. Hypothesis testing

Hypotheses 1 and 4 examine the links between the user’s beliefs about perceived ease of use and perceived playfulness and perceived usefulness: perceived ease of use is significantly related with perceived playfulness ($\beta=0.378$, $t$-value=5.007, $p<0.001$) and perceived usefulness ($\beta=0.305$, $t$-value=3.928, $p<0.001$). Therefore, hypotheses 1 and 4 were not rejected.

Hypotheses 2, 5, and 6 examine the effects of individual’s perceptions of WWW on the attitude toward using WWW. To investigate the hypothesis, entering all variables in a single block, we found that the proposed model explains a significant percentage

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Table 3
Scale reliability and factorial validity

<table>
<thead>
<tr>
<th>Scale items</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
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<tbody>
<tr>
<td>PPLF3</td>
<td>0.918</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPLF4</td>
<td>0.909</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPLF5</td>
<td>0.899</td>
<td></td>
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</tr>
<tr>
<td>PPLF8</td>
<td>0.891</td>
<td></td>
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<tr>
<td>PPLF1</td>
<td>0.877</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPLF7</td>
<td>0.863</td>
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</tr>
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<td>PPLF2</td>
<td>0.861</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPLF9</td>
<td>0.853</td>
<td></td>
<td></td>
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<td>PPLF6</td>
<td>0.823</td>
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</tr>
<tr>
<td>PEOU2</td>
<td>0.951</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEOU7</td>
<td>0.917</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEOU4</td>
<td>0.914</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEOU9</td>
<td>0.884</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEOU3</td>
<td>0.759</td>
<td></td>
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<td>PEOU1</td>
<td>0.783</td>
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<td>PEOU6</td>
<td>0.710</td>
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<td>PEOU5</td>
<td>0.656</td>
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<tr>
<td>PEOU8</td>
<td>0.652</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PUSF6</td>
<td>0.865</td>
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<tr>
<td>PUSF4</td>
<td>0.854</td>
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<tr>
<td>PUSF7</td>
<td>0.832</td>
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<td>PUSF5</td>
<td>0.827</td>
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<td>0.761</td>
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<td>PUSF9</td>
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<td>PUSF2</td>
<td>0.690</td>
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<tr>
<td>Eigenvalues</td>
<td>7.077</td>
<td>6.131</td>
<td>5.742</td>
</tr>
<tr>
<td>Percentage of variance explained</td>
<td>26.211</td>
<td>22.707</td>
<td>21.265</td>
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<tr>
<td>Cumulative percentage</td>
<td>26.211</td>
<td>48.918</td>
<td>70.183</td>
</tr>
</tbody>
</table>

a Note: Suppress absolute values <0.30.

b PPLF1–PPLF9, perceived playfulness items; PEOU1–PEOU9, perceived ease of use items; and PUSF1–PUSF9, perceived usefulness items; $n=152$.

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Table 4
Operational definition and internal consistency reliability

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Definition</th>
<th>Items</th>
<th>Cronbach’s $\alpha$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived ease of use</td>
<td>The strength of one’s belief that interacting with a WWW would be free of effort</td>
<td>9</td>
<td>0.9348</td>
</tr>
<tr>
<td>Perceived usefulness</td>
<td>The strength of one’s belief that using a WWW will enhance his or her work performance</td>
<td>9</td>
<td>0.9348</td>
</tr>
<tr>
<td>Perceived playfulness</td>
<td>The strength of one’s belief that interacting with a WWW will fulfill his or her intrinsic motives</td>
<td>9</td>
<td>0.9644</td>
</tr>
<tr>
<td>Attitude toward using</td>
<td>The strength of one’s feeling of favorableness or unfavorableness toward WWW use</td>
<td>4</td>
<td>0.9047</td>
</tr>
<tr>
<td>Behavioral intentions to use</td>
<td>The strength of one’s willingness to use a WWW</td>
<td>4</td>
<td>0.8755</td>
</tr>
<tr>
<td>Actual use</td>
<td>User’s self-reported frequency and volume of WWW use</td>
<td>3</td>
<td>0.8320</td>
</tr>
</tbody>
</table>
of variance in attitude ($R^2=38\%, \text{ } F\text{-value}=30.692, p<0.001$). It is observed that at the 0.001 significance level, perceived playfulness influences user’s attitude toward using the WWW. The positive influences of perceived usefulness and ease of use on attitude toward using, as suggested by the original TAM, are confirmed here. Also, we conducted a stepwise multiple regression to examine the contribution of each predictor variable to the regression model. The attitude toward using is apparently influenced by three fundamental beliefs. Therefore, hypotheses 2, 5, and 6 were not rejected.

In hypotheses 3, 7, and 8, we investigate the influence of attitude, perceived usefulness, and perceived playfulness on the behavioral intention to use the WWW. Entering all variables in a single block and eliminating poor predictors, we obtained the model in Table 5 as a result of the stepwise multiple regression: behavioral intention’s 39 percent of the variance is explained by attitude toward using, perceived

Table 5
Results of hypotheses tests

<table>
<thead>
<tr>
<th>Model</th>
<th>$R^2$</th>
<th>$R^2$ change</th>
<th>$\beta$</th>
<th>Hypothesis result</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Actual use (AU) AU=BI+errors</td>
<td>0.378&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td>0.615&lt;sup&gt;b&lt;/sup&gt;</td>
<td>H9 was not rejected</td>
</tr>
<tr>
<td>(2) Behavioral intentions to use (BI) BI=A+U+P+errors</td>
<td>0.394&lt;sup&gt;b&lt;/sup&gt;</td>
<td>A 0.265&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.285&lt;sup&gt;b&lt;/sup&gt;</td>
<td>H8 was not rejected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U 0.084&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.269&lt;sup&gt;b&lt;/sup&gt;</td>
<td>H7 was not rejected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P 0.045&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.245&lt;sup&gt;b&lt;/sup&gt;</td>
<td>H6 was not rejected</td>
</tr>
<tr>
<td>(3) Attitude toward using (A) A=E+P+U+errors</td>
<td>0.384&lt;sup&gt;b&lt;/sup&gt;</td>
<td>E 0.248&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.330&lt;sup&gt;b&lt;/sup&gt;</td>
<td>H5 was not rejected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P 0.091&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.256&lt;sup&gt;b&lt;/sup&gt;</td>
<td>H2 was not rejected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U 0.045&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.232&lt;sup&gt;b&lt;/sup&gt;</td>
<td>H6 was not rejected</td>
</tr>
<tr>
<td>(4) Perceived playfulness (P) P=E+errors</td>
<td>0.143&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td>0.378&lt;sup&gt;b&lt;/sup&gt;</td>
<td>H1 was not rejected</td>
</tr>
<tr>
<td>(5) Perceived usefulness (U) U=E+errors</td>
<td>0.93&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td>0.305&lt;sup&gt;b&lt;/sup&gt;</td>
<td>H4 was not rejected</td>
</tr>
</tbody>
</table>

<sup>a</sup> AU, Actual Use; BI, behavioral intentions to use; A, attitude toward using; E, perceived ease of use; U, perceived usefulness; and P, perceived playfulness.
<sup>b</sup> $p<0.001$. 

Table 6
Results of stepwise regression analysis

<table>
<thead>
<tr>
<th>Model</th>
<th>$R^2$</th>
<th>$R^2$ change</th>
<th>Beta</th>
<th>VIF</th>
<th>SE Beta</th>
<th>$t$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATT=PEOU+PPLF+PUSF</td>
<td>0.384&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEOU</td>
<td>0.248&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.330&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.211</td>
<td>0.025</td>
<td>4.648</td>
<td></td>
</tr>
<tr>
<td>PPLF</td>
<td>0.091&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.256&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.276</td>
<td>0.032</td>
<td>3.513</td>
<td></td>
</tr>
<tr>
<td>PUSF</td>
<td>0.045&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.232&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.206</td>
<td>0.037</td>
<td>3.271</td>
<td></td>
</tr>
<tr>
<td>BI=ATT+PEOU+PPLF</td>
<td>0.394&lt;sup&gt;b&lt;/sup&gt;</td>
<td>ATT</td>
<td>0.265</td>
<td>0.289</td>
<td>1.415</td>
<td>0.77</td>
</tr>
<tr>
<td>PEOU</td>
<td>0.084</td>
<td>0.142</td>
<td>1.285</td>
<td>0.38</td>
<td>3.707</td>
<td></td>
</tr>
<tr>
<td>PPLF</td>
<td>0.045</td>
<td>0.108</td>
<td>1.343</td>
<td>0.33</td>
<td>3.302</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> ATT, Attitude toward using; PEOU, perceived ease of use; PUSF, perceived usefulness; PPLF, perceived playfulness; and BI, behavioral intentions to use.
<sup>b</sup> $p=0.001$. 

usefulness, and perceived playfulness. Attitude toward using the WWW has a strong significant influence on the behavioral intention ($\beta=0.285$, $t$-value$=3.750$, $p<0.001$). Also, perceived usefulness ($\beta=0.269$, $t$-value$=2.69$, $p<0.001$) and perceived playfulness ($\beta=0.245$, $t$-value$=3.302$, $p<0.001$) have a significant effect on the behavioral intention. The positive influences of perceived usefulness and attitude toward using, as suggested by TAM, are confirmed. Also, perceived playfulness has a significant positive effect on behavioral intentions to use. Therefore, hypotheses 3, 7, and 8 were not rejected.

Individual's actual behavior is highly correlated with his or her behavior intentions. In our research, it was observed that, at the 0.001 significance level, behavioral intention to use the WWW in the future has a strong positive relationship with actual WWW use. Therefore, Hypothesis 9 was not rejected.

5.2. Comparing extended TAM with the original TAM

As shown in Table 7, both models explained a significant proportion of the variance in individual’s attitude toward using the WWW. TAM accounted for 33 percent of the variance and extended TAM explained 38 percent of the attitude variance. Within the extended TAM, perceived ease of use ($\beta=0.330$) and perceived usefulness ($\beta=0.269$), as well as perceived playfulness ($\beta=0.256$), has a strong significant influence on attitude. Especially, perceived playfulness had a stronger effect than perceived usefulness. Perceived ease of use had a very strong effect in both models. Also, as expected, both TAM and extended TAM explain a significant percentage of variance in behavioral intention. TAM explained 35 percent of variance and extended TAM explained 39 percent of variance of behavioral intention to use the WWW. Attitude toward using ($\beta=0.375$; $\beta=0.285$) and perceived usefulness ($\beta=0.321$; $\beta=0.269$) had a strong significant effect on behavioral intention in both models. In extended TAM, perceived playfulness had a significant influence on behavioral intention ($\beta=0.245$). The contributions of perceived playfulness to the increase of $R^2$ is also shown. Thus, extended TAM explains the individual’s WWW acceptance behaviors better than TAM.

5.3. Comparing entertainment with work-purposes group

In order to compare the effects of usefulness and playfulness under different task contexts, we divided our sample into two groups based on the purpose of their web usage: entertainment-purpose group and work-purpose group. The entertainment-purpose group is an intrinsically motivated group that uses WWW primarily for leisure or play purposes. The work-purpose group consists of people who use WWW primarily for work purposes.

We conducted a regression analysis to compare the effect of perceived playfulness and perceived

<table>
<thead>
<tr>
<th>Variable</th>
<th>Original TAM</th>
<th>Extended TAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATT</td>
<td>0.332&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.349&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>0.323</td>
<td>0.341</td>
</tr>
<tr>
<td>PEOU</td>
<td>0.405&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.378&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>0.024</td>
<td>0.074</td>
</tr>
<tr>
<td>PUSF</td>
<td>0.305&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.321&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>0.037</td>
<td>0.039</td>
</tr>
<tr>
<td>PPLF</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>BI</td>
<td>0.349&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.394&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>ATT</td>
<td>0.378&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.285&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>0.074</td>
<td>0.077</td>
</tr>
<tr>
<td>PUSF</td>
<td>0.321&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.269&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>0.039</td>
<td>0.038</td>
</tr>
<tr>
<td>PPLF</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

<sup>a</sup> ATT, Attitude toward using; PEOU, perceived ease of use; PUSF, perceived usefulness; PPLF, perceived playfulness; and BI, behavioral intentions to use.

<sup>b</sup> $p\leq0.001$. 

Table 7
Comparing extended TAM with the original TAM
usefulness on the behavioral intentions in the two
groups. Table 8 summarizes the comparison results
for the two groups. For the entertainment-purpose
group \((n=87)\), perceived playfulness had a more sig-
nificant effect \((\beta=0.491)\) on behavioral intentions than
perceived usefulness \((\beta=0.202)\). But, for the work-
purpose group, perceived usefulness had more a sig-
nificant effect \((\beta=0.409)\) than perceived playfulness
\((\beta=0.239)\). Perceived playfulness had significant
effects for both groups, while perceived usefulness
had a significant effect only for the work-purpose
group. While it is not really surprising that entertain-
ment-purpose users are motivated by playfulness, the
fact that playfulness also motivates the work-purpose
users leaves clear implications for WWW system
design.

6. Implications

An individual’s attitude toward the use of the
WWW is significantly affected by the individual’s
perception about ease of use, usefulness, and play-
fulness. At the same time, behavioral intentions to use the
WWW is highly related to the attitude, perceived
playfulness, and perceived usefulness. These results
imply that the individual’s acceptance of the WWW is
significantly related to both intrinsic and extrinsic
motivation factors.

6.1. Implications for IS researchers

From the standpoint of individual-level techno-
logy acceptance research, this study extends TAM
with playfulness concept. Although TAM-related
hypotheses are all supported here, the results chal-
gen some of the basic tenets of TAM. TAM empha-
sized the importance of perceived usefulness as the
key determinant of user acceptance of IT. In our study,
perceived ease of use had a more significant effect on
individual’s attitudes than perceived usefulness in the
WWW context. Indeed, perceived playfulness had a
more significant effect on individuals’ attitudes than
perceived usefulness. This means that the intrinsic
motivational factors have more powerful effect than
extrinsic factor to build positive attitude.

6.2. Implications for IS practitioners

We demonstrated the importance of playfulness as
an intrinsic motivation factor in an individual’s accep-
tance of the WWW. From the usability issues, many
researchers and practitioners have argued that the key
barrier to user acceptance is the lack of user friendli-
ness of current systems, and that adding user interfaces
that increase usability is the key to success. The
traditional approach toward increasing usability has
been to focus on ease of use. The HCI research has
focused primarily on the more objective aspects of
usability, such as execution time and error rates, and
has exhibited a technology-centered view of usability.
However, the WWW is used for leisure or play as well
as for work. Although ease of use and usefulness are
conceived as important issues in the traditional IS
environments, playfulness concept will play an impor-
tant role in increasing usability in the WWW envir-
onment. Therefore, IS practitioners must reflect
intrinsic motivation as well as extrinsic motivation
issues in user interface design.

<table>
<thead>
<tr>
<th>Table 8 Comparing entertainment and work group</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="https://example.com/table8.png" alt="Image" /></td>
</tr>
</tbody>
</table>

\(a\) Behavioral intentions to use. 
\(b\) Perceived usefulness. 
\(c\) Perceived playfulness.
7. Conclusion and limitations

Perceived ease of use and perceived usefulness were shown to be important to user’s perceptions of the WWW systems. In addition, perceptions of playfulness appear to influence user’s attitude toward using the WWW. Thus, perceived playfulness may also be an important consideration in the design of future WWW systems: they must provide more concentration, curiosity, and enjoyment.

Although our findings provide meaningful implications for WWW technology, our study has some limitations. First, the use of self-report scales to measure study variables suggests the possibility of a common method bias for some of the results. In order to pursue further investigation, it would be appropriate to develop a more direct and objective measure for user acceptance of the WWW. Second, three beliefs (ease of use, usefulness, and playfulness) are influenced by externally controllable factors such as development methodologies, training, organizational support and policy, individual and task characteristics, and user participation. Finally, this study was conducted with a snapshot research approach, but a longitudinal approach also should be considered.

Appendix A.

Perceived playfulness [seven-point Likert type scale]
(1) When interacting with WWW, I do not realize the time elapsed
(2) When interacting with WWW, I am not aware of any noise
(3) When interacting with WWW, I often forget the work I must do
(4) Using WWW gives enjoyment to me for my task
(5) Using WWW gives fun to me for my task
(6) Using WWW keeps me happy for my task
(7) Using WWW stimulates my curiosity
(8) Using WWW leads to my exploration
(9) Using WWW arouses my imagination

Perceived ease of use [seven-point Likert type scale]
(1) It will be impossible to use WWW without expert help
(2) Learning to operate WWW is easy for me
(3) It is difficult to learn how to use WWW
(4) I find it easy to get WWW to do what I want it to do
(5) It takes too long a time to learn to use WWW
(6) It is easy to remember how to use WWW
(7) Using WWW requires a lot of mental effort
(8) My interaction with WWW is clear and understandable
(9) It is easy for me to become skilful at using WWW

Perceived usefulness [seven-point Likert type scale]
(1) Using WWW improves my task quality
(2) Using WWW improves the performance of my tasks
(3) Using WWW supports the critical part of my tasks
(4) Using WWW enables me to accomplish tasks more quickly
(5) Using WWW increases my task productivity
(6) Using WWW enables me to have more accurate information
(7) Using WWW enables me to access a lot of information
(8) Using WWW enables me to access the newest information
(9) Using WWW enables me to acquire high quality information

Attitude toward using [seven-point semantic difference type scale]
All things considered, my using World-Wide-Web in my tasks is a(n)___ idea.
(1) Using WWW is a (good/bad) idea
(2) Using WWW is a (wise/foolish) idea
(3) Using WWW is a (pleasant/unpleasant) idea
(4) Using WWW is a (positive/negative) idea

Behavioral intentions to use [seven-point Likert type scale]
(1) I will use WWW on a regular basis in the future
(2) I will frequently use WWW in the future
(3) I will strongly recommend others to use WWW

Use of World-Wide-Web (Table 9).
Table 9
Actual use

(1) How many times do you use WWW during a week?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Less than once a week</th>
<th>About once a week</th>
<th>2 or 3 times a week</th>
<th>Several times a week</th>
<th>About once a day</th>
<th>Several times each day</th>
</tr>
</thead>
<tbody>
<tr>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
</tbody>
</table>

(2) How many hours do you use WWW every week?

<table>
<thead>
<tr>
<th>&lt;1 h</th>
<th>1–5 h</th>
<th>5–10 h</th>
<th>10–15 h</th>
<th>15–20 h</th>
<th>20–25 h</th>
<th>&gt;25 h</th>
</tr>
</thead>
<tbody>
<tr>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
</tbody>
</table>

(3) How frequently do you use WWW?

<table>
<thead>
<tr>
<th>Infrequent</th>
<th>Extremely</th>
<th>Quite</th>
<th>Slightly</th>
<th>Neither</th>
<th>Slightly</th>
<th>Quite</th>
<th>Extremely</th>
<th>Frequent</th>
</tr>
</thead>
<tbody>
<tr>
<td>( )</td>
<td>( )</td>
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<td>( )</td>
<td>( )</td>
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<td>( )</td>
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</table>

References


