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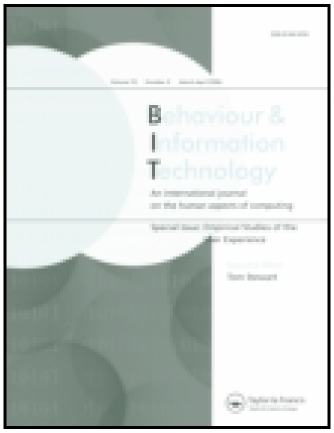

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The respective roles of perceived usefulness and perceived fun in the acceptance of microcomputer technology

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The respective roles of perceived usefulness and perceived fun in the acceptance of microcomputer technology

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Abstract. This study examined the effects of two main factors affecting microcomputer technology acceptance: perceived usefulness and perceived fun. We examined whether users are motivated to accept a new technology due to its usefulness or fun. Results of this study suggest that perceived usefulness is more influential than perceived fun in determining whether to accept or reject microcomputer technology. We also examined the impact of computer anxiety on acceptance. Results showed that computer anxiety had both direct and indirect effects on user acceptance of microcomputer technology, through perceived usefulness and fun. We also found attitude (satisfaction) to be less influential than perceived usefulness and fun. Implications for the design and acceptance of microcomputer technology and future research are discussed.

1. Introduction

Microcomputers are ubiquitous in today's offices. Though microcomputers were viewed largely as a technological curiosity in the 1970s, the rapid growth of microcomputers in organizations represents a significant development in the field of Management Information Systems (MIS) (Benson 1983, DeLone 1988, Guimaraes and Ramanujam 1986, Igbaria *et al.* 1989, Lee 1986). Microcomputers have been hailed as a revolution that will change the nature of professional work (Guimaraes and Ramanujam 1986, Lee 1985, Strassman 1985).

Researchers have attempted to identify a meaningful dependent variable to evaluate MIS success or failure. Several measures of MIS success have been used: user satisfaction (Bailey and Pearson 1983, Baroudi and Orlikowski 1988, Cheney and Dickson 1982, Doll and Torkzadeh 1988, Ives *et al.* 1983, Galletta and Lederer 1989); improved decision-making (Ein-Dor and Segev 1978, 1982, King and Rodriguez 1978); perceived usefulness (Franz and Robey 1986); and system usage (DeLone 1988, Igbaria *et al.* 1989, Lucas 1978, Robey 1979).

The two most widely used measures of MIS success are system usage and user satisfaction because they are easier to measure and are generally considered very important in their own right (Ein-Dor and Segev 1978, 1982, Galletta and Lederer 1989). Thus, they are considered appropriate indicators of computer technology acceptance in this study. However, user satisfaction and system usage have rarely been included in the same study or measured simultaneously within a single sample (Igbaria 1990, Srinivasan 1985). Thus, the purpose of this study was to examine both aspects of microcomputer acceptance.

The acceptance of microcomputer technology has become a fundamental part of MIS planning for most organizations. Many companies are already putting a major share of their MIS resources into microcomputers, including desktop computing, and a further relative shift from the mainframe to the microcomputer is expected in the future. Companies are accelerating their investments in various computer applications such

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as word processors, spreadsheets, communications (mainly electronic mail), graphics, and database management. It has been estimated that computers and business equipment will have the sharpest increase in revenues in the 1990s and that microcomputer shipments will increase steadily while mainframes will remain flat (*Computerworld* 1989). In addition, a recent estimate in the UK predicted that the ratio of computer terminals or microcomputers to office workers was already approaching an average of one to one (Stewart 1990). It is expected that almost all knowledge workers are likely to have their own microcomputer to perform both stand-alone tasks and network services.

Despite this proliferation of microcomputers, the potential benefits of microcomputers as aids to managerial decision-making may not be fully realized due to poor acceptance (Swanson 1988). There is evidence that the use of microcomputers by professionals and managers appears to be limited due to computer anxiety or fear of computers, negative attitudes toward computers in general, and individuals less motivated to adopt a new technology (Davis *et al.* 1989, 1992, Igbaria *et al.* 1989, Thompson *et al.* 1991). In addition, most of the related research, except Davis *et al.* (1992), focused on the impact of perceived usefulness on acceptance with less thought given to the beneficial effects of experiencing fun or joy in the use of computers and software (Brody 1992).

Davis *et al.* (1992) examined two motivators to use computer technology: perceived usefulness and enjoyment. They reported that perceived usefulness and enjoyment both had significant effects on intentions to use the word processing program. Further, they reported that usefulness and enjoyment mediated the effects of ease of use and quality on intentions. Although their model provided insights into the user acceptance of computer technology, college students (full-time MBA students) were used in their study, and the applicability of the findings to the population of employed adults is problematic. In addition, they studied a specific application, a word processing application (WriteOne) rather than microcomputer applications in general. Furthermore, their research used one aspect of computer technology (system usage) rather than both aspects of acceptance (satisfaction and usage). Thus, the present study seeks to extend previous research by focusing on the impact of usefulness and perceived fun on acceptance, and investigating the factors affecting both and their consequences among professionals and managers. It seeks, in general, to investigate the factors contributing to managerial and professional users' decision of whether to accept or reject microcomputer technology. Specifically, this paper focuses on two main factors affecting technology acceptance: perceived usefulness and perceived fun.

Our purpose here is to examine the impact of perceived usefulness and perceived fun on the acceptance of microcomputer technology using a structural equation modeling approach with Partial Least Squares (PLS) (see Lohmoller 1989). PLS is a second generation multivariate analysis technique used to estimate the parameters of causal models. PLS embraces abstract and empirical variables simultaneously, and recognizes the interplay of these two dimensions of theory development. The causal modelling technique, often termed structural equation modelling, accommodates *a priori* knowledge derived from theory and/or previous empirical findings, and 'because these methods can combine as well as confront theory with empirical data, they offer a potential for scientific explanation that goes far beyond description and empirical association' (Fornell 1982: 3).

What motivates people to accept or reject microcomputer technology? Microcomputers are considered simultaneously fun to use and serious tools for managerial decision making. Because microcomputer applications (compared to other computer categories) are more fun, respond nearly instantaneously to users' actions, can be custom tailored and are more user friendly (Gardner *et al.* 1989, Katz 1987, Webster 1989), this paper focuses specifically on microcomputers. We examined four interrelated perceptions: computer anxiety, fun, usefulness, and satisfaction and their relationships with usage. First, we examined whether these four perceptions (i.e., computer anxiety, perceived fun, perceived usefulness, and user satisfaction) were distinct unidimensional constructs. Second, we examined the impact of computer anxiety on usefulness and fun. Third, we also examined the impact of usefulness and fun on microcomputer acceptance. And, finally, we examined whether perceived usefulness and fun mediate the effects of computer anxiety on user acceptance of microcomputer technology. Also, we examined whether user satisfaction mediates the effects of computer anxiety, perceived fun and perceived usefulness on system usage. The research described here used a second generation multivariate analysis to test these four research questions, as presented in our model.

1.1. *Conceptual model and research hypotheses*

The theoretical grounding for this research comes from the work of Davis *et al.* (1989, 1992), Fishbein and Ajzen (1975), and Vroom (1964). Attitudes and motivation theorists argued that behaviour (usage) is determined by perceived usefulness and perceived fun.

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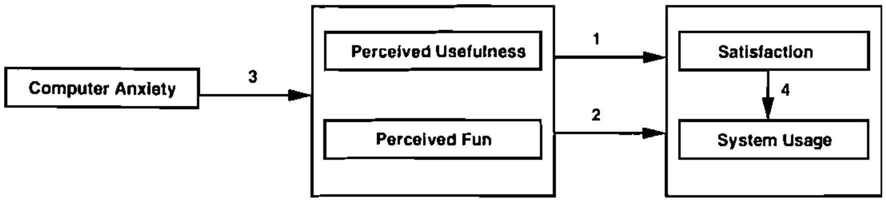

Fig. 1. The antecedents and consequences of perceived usefulness and fun. The numbered arrows correspond to the hypotheses described in the body of the paper.

Further, the theory of reasoned action (Fishbein and Ajzen 1975) and the acceptance model (Davis *et al.* 1989) provide a theoretical basis for the link between attitude (satisfaction) and behaviour (usage) by postulating that an attitude is a state of readiness which exerts influence over one's reaction. Figure 1 presents the model examined in this study. A review of the relevant literature suggests that perceived usefulness and fun are the motivators for accepting or rejecting a new technology. Furthermore, computer anxiety had direct and/or indirect effects on acceptance through perceived usefulness, fun, and satisfaction. Finally, satisfaction mediates the relationships between perceived usefulness and fun and usage.

Computer anxiety is defined as 'the tendency of individuals to be uneasy, apprehensive, or fearful about current or future use of computers' (Igbaria and Parasuraman 1989:375). 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 1989:320). Perceived fun is defined as 'the extent to which the activity of using the computer is perceived enjoyable in its own right' (Davis *et al.* 1992). Satisfaction 'in a given situation is the sum of one's feelings or attitudes toward a variety of factors affecting that situation' (Bailey and Pearson 1983:531).

In this study, we restrict the term 'satisfaction' to a person's evaluation of the system (e.g., microcomputer) quality and we draw a clear distinction between computer anxiety, fun, perceived usefulness, and satisfaction.

Note that, whereas satisfaction is conceptualized as the affective attitude toward the system quality by someone who interacts with the system directly, perceived usefulness represents the information he/she has about the object. Specifically, perceived usefulness links an object to some attribute (for more details about the distinction between perceived usefulness and attitude, see Davis *et al.* (1989) and Fishbein and Ajzen (1975)). Further, computer anxiety refers to the apprehension cued by a threat to some value that the individual holds essential to his/her existence as a person. Specifically, it reflects the tendency of a particular person to experience a level of uneasiness over the impending use of computers. It refers to the tendency of an individual to be uneasy, apprehensive, or phobic toward current or future use of computers in general. For example, the sentiment 'I feel apprehensive about using a computer terminal' reflects a threat perceived in the use of computers. Perceived fun refers to the use of microcomputer systems for no apparent reinforcement other than having fun and joy in using the system. Finally, behaviour refers to microcomputer acceptance or microcomputer usage.

1.1.1. *Perceived usefulness:* The significance of perceived usefulness derives from the TAM model (Davis *et al.* 1989) stating that perceived usefulness affects attitude and behavioural intentions both directly and indirectly. Perceived usefulness influences user acceptance of computer systems due to the reinforcement value of outcomes. Adams *et al.* (1992) and Davis *et al.* (1989, 1992) found that perceived usefulness is a major determinant of usage behaviour and intentions. It is based on the motivation theory which argues that if an individual perceives an activity to be instrumental for achieving valued outcomes, he or she will be more likely to accept the new technology. It has been pointed out that perceived usefulness appears to exhibit a stronger and more consistent relationship with usage behaviour and intentions than other variables reported in the literature including attitude (i.e., satisfaction) (Davis 1989). Furthermore, the MIS literature also reported that perceived usefulness is positively associated with system usage (Hill *et al.* 1987, Igbaria 1990, Robey 1979, Robey and Zeller, 1978). Therefore, Hypothesis 1 is that *perceived usefulness will be positively related to both dimensions of user acceptance of microcomputer technology (satisfaction and usage)*. It is also predicted that perceived usefulness will have a stronger effect on usage than satisfaction.

1.1.2. *Perceived fun:* Perceived fun is an example of intrinsic motivation, referring to the performance of an activity for no apparent reinforcement other than the process of performing the activity *per se*. Individuals who themselves experience immediate pleasure and joy from using the machine and perceive any activity of using the computer to be enjoyable in its own right, apart from any performance consequences that may be anticipated, will be more likely to use it more extensively than others (Davis *et al.* 1992, Malone 1981,

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Webster, 1989). Thus, Hypothesis 2 is that *perceived fun will have a positive effect on user acceptance of microcomputer technology.*

1.1.3. *Computer anxiety:* A number of studies have documented the importance of computer anxiety as a key variable related to perceived usefulness, attitude, and usage (Gilroy and Desai 1986, Igbaria and Chakrabarti 1990, Morrow *et al.* 1986). Computer anxiety may function as a source of information relevant to feelings of self-efficacy, judgements of mastery and self-determination, and hence as determinants of intrinsic motivation (fun). Davis *et al.* (1989) also suggested that computer anxiety should be brought into the future analysis of factors affecting technology acceptance. It has been suggested that computer anxiety is associated with negative beliefs (perceived usefulness) about computers, problems in playing with them, and avoidance of the machine (Igbaria and Chakrabarti 1990, Webster 1989). It is suggested that individuals who feel comfortable with the machine are more likely to produce desired consequences and eventually enjoy playing with it. On the other hand, individuals who experience high levels of anxiety are likely to behave more rigidly than individuals whose levels of anxiety are relatively low. Furthermore, computer anxiety, which represents a source of information relevant to feelings of self-efficacy, will have a positive impact on both fun and usefulness. People who are less anxious (computerphrenics) are much more likely to interact joyfully with microcomputers than people who are more anxious (computerphobics). The results reported by Igbaria and Chakrabarti (1990) provide empirical support for the notion that computer anxiety is a predictor of perceived usefulness and suggest that usefulness may operate as an intervening variable between anxiety and usage. Thus, Hypothesis 3 is that *computer anxiety will have negative effects on both fun and usefulness.* Furthermore, it is predicted that fun and usefulness will mediate the effect of computer anxiety on the user acceptance of microcomputer technology.

1.1.4. *Satisfaction:* The reasoned action theory (Fishbein and Ajzen 1987) and the acceptance model (Davis *et al.* 1989) suggest that satisfaction leads to usage rather than usage stimulating satisfaction. Baroudi *et al.* (1986) also found an empirical support for this direction. Furthermore, individuals, who are satisfied with the quality of the system, owe much to the perceived benefits and perceived fun of using the system. Therefore, Hypothesis 4 is that *satisfaction will have a direct effect on usage.* Furthermore, satisfaction will mediate the effect of perceived usefulness and fun on system usage.

To summarize, we examined the antecedents and consequences of the two broad classes of motivation to perform an activity: extrinsic (perceived usefulness) and intrinsic (perceived fun) motivation. First, four distinct components of perception (usefulness, fun, anxiety, and satisfaction) were identified. Second, we proposed that perceived usefulness influences user acceptance due to the reinforcement value of outcomes (perceived usefulness) and to joy and pleasure from the process of performing the activity *per se*. It is important to distinguish between the use of a system because it is fun and the use of a system because it is beneficial in getting the job done. Lastly, we hypothesized that computer anxiety will serve as antecedents of both perceived usefulness and fun. It is suggested that the less fear of using the system, the less effort needed to perform the task.

2. Method

2.1. *Sample and procedure*

The data for this study were gathered by means of a questionnaire survey. Seventy-seven companies having extensive operations in North America agreed to participate in a comprehensive study of microcomputer usage. Within each company, contact persons were identified and were reached by telephone to inform them of the purpose of this study and to identify all the managers who would be participating in this study. Contact persons in the participating organizations were asked to distribute the surveys to members who had microcomputers on their desks or who had easy access to a microcomputer in the daily performance of their job. Out of the 77 companies, 15 companies declined to participate due to time constraints. Seven hundred and sixty-six questionnaires were sent to the contact persons in the remaining 62 companies, with a letter explaining how the questionnaires should be distributed and a brief statement describing the purpose of the study. The 766 managers were selected randomly by the contact persons from their organizations. The exclusion of 8 companies where no questionnaires were returned resulted in a sample of 54 companies and 519 managers (response rate of 67.75%). The final sample consisted of 471 managers and professionals; it excluded incomplete questionnaires and responses from non-microcomputer users.

The respondents were employed in a variety of manufacturing, service, merchandising, insurance, and financial organizations. They held managerial positions in a wide range of functional areas including accounting, finance, MIS, marketing, sales, operations and

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production, general management, research and development, and engineering. Of the 471 participants, 84% of the participants were male and 16% were female. The age range was 21–63 years and the mean age of the respondents was 38.2 years. Approximately 15% of the managers had completed some college, and an additional 68% of the managers were college graduates. The remaining managers had attended some community college (13.9%) or just high school (4%). The majority of the participants were middle management (65.8%), and the remaining were executives (8.4%), first level supervisors (17.4%), and first line managers (8.4%).

2.2. *Measures*

2.2.1. *Computer anxiety:* This refers to the tendency of an individual to be uneasy, apprehensive, and/or phobic towards current or future use of computers in general. The computer anxiety items were selected from the original scale developed by Raub (1981) and validated by Igbaria and Chakrabarti (1990). The instrument asks individuals to indicate their agreement or disagreement with four statements reflecting anxiety, apprehension, confusion, hesitation, etc. in using computers in general ('I hesitate to use a microcomputer for fear of making mistakes I cannot correct'; 'I have avoided microcomputers because they are unfamiliar to me'; 'I feel apprehensive about using a microcomputer'; and 'If given the opportunity to use a microcomputer, I am afraid I might damage it in some way'.) The response options, anchored on a five-point Likert-type scale, range from (1) strongly disagree to (5) strongly agree.

2.2.2. *Perceived usefulness:* This measure is defined as 'the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context' (Davis 1989:320). The items used to construct the perceived usefulness scale were adapted from prior research (Davis 1989, Davis *et al.* 1989, Igbaria 1990), with appropriate modifications to make them specifically relevant to microcomputers. Individuals were asked to indicate the extent of agreement or disagreement with the following four statements concerning microcomputers on a seven-point Likert-type scale ranging from (1) strongly disagree to (7) strongly agree: 'Using a microcomputer improves my productivity on the job'; 'Using a microcomputer helps me make better decisions by giving me access to higher quality information'; 'Using a microcomputer allows me to be more innovative by providing the opportunities for more creative analysis and outputs'; and 'Using a microcomputer gives me the opportunity to enhance my managerial image'.

2.2.3. *Perceived fun:* Six different pairs from the evaluation dimension of the semantic differential were used on seven-point semantic differential items to assess perceived fun. Individuals were asked to rate the six items according to how they feel about using microcomputers and to make a check in the place that best describes their opinion or feeling (i.e. 'Using a microcomputer in my job is: rewarding/unrewarding, pleasant/unpleasant, fun/frustrating, enjoyable/unenjoyable, positive/negative, and interesting/uninteresting').

2.2.4. *Satisfaction with the system quality:* Satisfaction was assessed by four items asking participants to rate how satisfied they were with the following characteristics of their microcomputer system: quality of printout, quality of video display, speed of response, and quality of maintenance. The response options, anchored on a five-point Likert-type scale, ranged from (1) extremely dissatisfied to (5) extremely satisfied.

2.2.5. *System usage*: Based on several studies (Cheney and Dickson 1982, DeLone 1988, Igbaria *et al.* 1989) four indicators of microcomputer acceptance were included in this study: (1) perceived daily use of microcomputers; (2) perceived frequency of use of microcomputers; (3) the number of software packages used by the participants; and (4) the number of business tasks for which the system is used.

Following Lee (1986) and Igbaria *et al.* (1989), individuals were asked to indicate the amount of time spent on the microcomputer per day, using a six-point scale ranging from (1) 'almost never' to (6) 'more than 3 hours per day'. Frequency of use has been suggested by Raymond (1985) and used by Igbaria *et al.* (1989) and provides a slightly different perspective of use than time. Frequency of use was measured on a six-point scale ranging from (1) 'less than once a month' to (6) 'several times a day'.

In a microcomputer environment, users have a wide choice of software packages to use. In such an environment a good indication of overall microcomputer acceptance can be provided by measuring the number of different packages used (Igbaria *et al.* 1989, Pentland 1989). A list of 10 packages was given and respondents were asked to indicate the extent of use of each one of these packages on a five-point scale ranging from (1) not at all to (5) to a great extent. In addition, the number of business tasks performed by the participants can be another indicator of the user acceptance of the system (Cheney *et al.* 1986, Igbaria *et al.* 1989). For the purpose of this study, eight tasks were defined and the

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participants were asked to indicate the extent of use of microcomputers to perform these tasks on a five-point scale ranging from (1) not at all to (5) to a great extent.

These indicators are typical of the kinds of self-reported measures often used to operationalize system use and acceptance, particularly in cases where objective use and acceptance metrics are not available. Objective use logs were not practical in the present study since participants used different microcomputers as well as different applications for different tasks. Self-reported usage should not be regarded as precise measures of actual usage, although previous research suggests they are appropriate as relative measures (Blair and Burton 1987).

The psychometric properties of the scales in terms of their internal consistency reliability, convergent and discriminant validity for use in this study were assessed by means of the test of the measurement model that constitutes the first stage of the data analytic technique of Partial Least Squares (PLS), which is described in the section that follows.

2.3. *Data analyses*

The first stage of the analysis involved assessment of the reliability of the measures used to operationalize the variables in the study. We used the Partial Least Squares (PLS) test of the measurement model to determine the correspondence of the set of items used in the multiple item scales to the construct they are assumed to represent. PLS is a second-generation multivariate technique that facilitates testing of the psychometric properties of the scales used to measure a variable, as well as estimating the parameters of a structural model, i.e., the magnitude and direction of the relationships among the model variables (Fornell 1982, Lohmoller 1989, Wold 1982).

The hypothesized multivariate network of relationships among the study variables depicted in figure 1 was tested by means of Partial Least Squares (PLS). PLS is a powerful analytical technique in testing structural equation models, and is particularly applicable in research areas where theory is not as well developed as that demanded by LISREL (Fornell and Bookstein 1982, Igbaria 1990). As suggested by Lohmoller (1981:7) 'PLS methods are more close to the data, more explorative, more data analytic'. Of particular relevance to this study is the fact that PLS does not depend on having multivariate normally distributed data (distribution-free). Finally, it can be used with non-interval-scaled data, and importantly, with small samples.

PLS recognizes two components of a causal model: the measurement model and the structural model. Figure 1 represents the structural model being examined. The model describes the relationships or paths among theoretical constructs. Furthermore, for each construct in figure 1, there is a related measurement model, which links the construct in the diagram with a set of items. For example, perceived usefulness is a composite of four related items and perceived fun is a composite of six related items. The measurement model consists of the relationships between the observed variables (items) and the constructs which they measure. The characteristics of this model demonstrate the construct validity of the research instruments, i.e., the extent to which the operationalization of a construct actually measures what it purports to measure. Two important dimensions of construct validity are (*a*) convergent validity, including reliability; and (*b*) discriminant validity.

The test of the measurement model includes estimation of the reliability coefficients (Cronbach's alpha) of the measures, as well as an examination of the convergent and discriminant validity of the research instruments. In determining the appropriate minimum loadings required for the inclusion of an item within a scale, we used Fornell's (1982) recommendation to retain items that loaded highly (0.70 is considered to be a high loading since the item explains almost 50% of the variance in a particular construct) on their respective constructs. Fornell and Larcker's (1981) criterion that an average extracted variance should be 0.50 or more was used to assess the average variance extracted for all constructs. We also used the guidelines recommended by Hair *et al.* (1992), in determining the relative importance and significance of the factor loading of each item, i.e., loadings greater than 0.30 are considered significant; loadings greater than 0.40 are considered more important; and loadings 0.50 or greater are considered to be very significant. Finally, the criteria suggested by Nunnally (1978) were applied to determine the adequacy of the reliability coefficients obtained for each measure.

To assess discriminant validity of the measures, i.e., the degree to which items differentiate among constructs, or measure distinct concepts, we examined the correlations between the measures of potentially overlapping constructs (Igbaria 1990). If the items comprising an instrument that measures a construct correlate more highly with each other than with items measuring other constructs in the model (Fornell *et al.* 1982, Grant 1989), the measure is determined to have adequate discriminant validity.

PLS is also used to test the structural model. A structural model is a regression-based technique, with its roots in path analysis, and often loosely termed as a causal modelling technique, and is a relatively new

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approach to testing multivariate models with empirical data (Wold 1982). The structural model consists of the unobservable constructs and the theoretical relationships among them (the paths). It evaluates the explanatory power of the model and the significance of paths in the structural model which represent hypotheses to be tested. Together, the structural and measurement models form a network of constructs and measures. The item weights and loadings indicate the strength of measures, while the estimated path coefficients indicate the strength and the sign of the theoretical relationships.

The evaluation of the structural model was conducted with the overall sample. The computer program used for this analysis was LVPLS 1.6 (Latent Variables Path Analysis using Partial Least Squares), developed by Lohmoller (1981, 1989). To test the estimated path coefficients, *t*-statistics were calculated using a non-parametric test of significance known as jackknifing (Tukey 1958, Wildt *et al.* 1982). For more information on PLS, the interested reader can refer to Fornell (1982), Lohmoller (1989) and Wold (1985).

The path coefficient of an exogenous variable represents the direct effect of that variable on the endogenous variable. An indirect effect represents those effects interpreted by the intervening variables; it is the product of the path coefficients along an indirect route from cause to effect via tracing arrows in the headed direction only. When more than one indirect path exists, the total indirect effect is their sum. The sum of the direct and indirect effect reflects the total effect of the variable on the endogenous variable (Alwin and Hauser 1975, Ross 1975).

3. Results

Factor analysis was used to confirm the four distinct perceptions constructs. Although construct structure may be different in a factor analytic context than in this model, this was useful in the measurement model revision. A factor analysis (using principal components analysis with varimax rotation) produced four factors with eigenvalues $\geqslant 1.0$ that accounted for 54.56% of the total variance. All four factors were examined against the four perceptions described above. The criteria used to identify and interpret factors were that a given item should load 0.50 or higher on a specific factor and have a loading no higher than 0.35 on other factors. All the four factors were identical to or corresponded very closely to the four perceptions. Table 1 shows that factor 1, labelled 'perceived fun', consisted of the six items used to measure fun. Factor 2 consisted of four items identified as reflecting perceived usefulness. A third factor, labelled computer anxiety, consisted of the four items representing the computer anxiety construct. Finally, the last four items loaded on one factor, labelled satisfaction. This suggests that fun, usefulness, computer anxiety, and satisfaction were found to be unidimensional and factorially distinct. All the items used to operationalize a given construct loaded on a single factor.

3.1. *The measurement model*

The results of the tests of the measurement model are reported in table 2. The internal consistency of the measurement model was assessed by computing the composite reliability (Cronbach's alpha coefficients). These alpha coefficients are displayed for each of the four perception constructs as well as the two usage constructs in table 2. The data show that the composite reliabilities of the constructs range from 0.82 to 0.91, which satisfy Nunnally's guidelines. Furthermore, table 2 also demonstrates satisfactory convergent validity of the constructs. Average variance extracted for all constructs exceeded 0.50 as recommended by Fornell and Larcker (1981). The item reliabilities of all the constructs (not presented here) were also significant.

Table 1. Factor analysis results.

Item	Factor 1	Factor 2	Factor 3	Factor 4
Anxiety-1			*0.64*	
Anxiety-2			*0.65*	
Anxiety-3	−0.21		*0.76*	
Benefit-1		*0.65*		
Benefit-2	0.25	*0.76*		
Benefit-3		*0.67*		
Benefit-4	0.21	*0.74*		
Fun-1	*0.65*	0.48		
Fun-2	*0.73*	0.28		
Fun-3	*0.66*		−0.23	
Fun-4	*0.74*			
Fun-5	*0.64*	0.25		
Fun-6	*0.68*			
Satis-1				*0.73*
Satis-2				*0.82*
Satis-3				*0.73*
Satis-4	0.25	0.21		*0.64*
Eigenvalue	4.74	1.99	1.86	1.23
Cumulative % of explained variance	26.33	37.39	47.72	54.56

Note: Loadings less than 0.20 are not shown.
Factor 1. Perceived fun.
Factor 2. Perceived usefulness.
Factor 3. Computer anxiety.
Factor 4. Satisfaction.

Table 2. Assessment of the measurement model.

Variables	The composite reliability (Alpha coefficients)	Average variance extracted/explained
Computer anxiety	0.82	0.53
Perceived usefulness	0.83	0.55
Perceived fun	0.87	0.53
Satisfaction	0.83	0.55
System usage		
Business tasks and applications	0.82	0.69
Duration (frequency and time of use)	0.91	0.84

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The results of the test conducted to assess discriminant validity of the measures revealed no violation of the criteria for discriminant validity. Table 3 presents the intercorrelations among the study variables. In all of the 15 entries examined, the squared correlations, representing the shared variance among variables, were found not to exceed the average variance explained. In summary, the convergent and discriminant validity of our instruments was satisfactory.

3.2. *Intercorrelations among the study variables*

Table 3 shows that perceived usefulness is negatively correlated with computer anxiety ($r = -0.19$, $p \leq 0.001$) and positively with satisfaction ($r = 0.38$, $p \leq 0.001$). Similarly, perceived fun is highly correlated with computer anxiety ($r = -0.34$, $p \leq 0.001$) and satisfaction ($r = 0.41$, $p \leq 0.001$). Results also show that perceived usefulness and perceived fun are positively correlated ($r = 0.53$, $p \leq 0.001$). Finally both dimensions of system usage (i.e., business tasks and applications and duration) are correlated with satisfaction ($r = 0.12$, $p \leq 0.01$, and 0.24, $p \leq 0.001$, respectively), perceived usefulness ($r = 0.32$, 0.29, $p \leq 0.001$, respectively), perceived fun ($r = 0.24$, 0.31, $p \leq 0.001$, respectively), and computer anxiety ($r = -0.25$, -0.29, $p \leq 0.001$, respectively). Finally, duration is positively correlated with business tasks and applications ($r = 0.43$, $p \leq 0.001$).

3.3. *Tests of the structural model*

The results showing the direct effect of computer anxiety on perceived usefulness and perceived fun are presented in table 4. Hypothesis 1 predicted that computer anxiety would have a direct effect on both perceived usefulness and fun.

3.3.1. *Perceived usefulness:* The results reported in table 4 show that computer anxiety explained small but significant variation in perceived usefulness ($R^2 = 0.03$, $p \leq 0.001$). Consistent with Hypothesis 3, the standardized regression coefficients reported in table 4 show that computer anxiety had significant direct effects on perceived usefulness ($\gamma = -0.18$, $p \leq 0.001$).

3.3.2. *Perceived fun:* Consistent with Hypothesis 3, table 4 also shows that computer anxiety ($\gamma = -0.34$, $p \leq 0.001$) is highly related to perceived fun. Note that the effect of computer anxiety on perceived fun was roughly two times stronger than its effect on perceived usefulness.

3.3.3. *Satisfaction:* The results reported in table 5 show that the model variables explained significant variation in satisfaction ($R^2 = 0.21$, $p \leq 0.001$). Consistent with Hypotheses 1, 2, and 3, the standardized regression coefficients reported in table 5 show that computer anxiety, fun, and perceived usefulness had significant

Table 3. Matrix of intercorrelations among study variables.

Variables	1	2	3	4	5
1. Computer anxiety					
2. Perceived usefulness	−0.19***				
3. Perceived fun	−0.34***	0.53***			
4. Satisfaction	−0.21***	0.38***	0.41***		
System usage					
5. Business tasks and applications	−0.25***	0.32***	0.24**	0.12**	
6. Duration (frequency and time of use)	−0.29***	0.29***	0.31***	0.24***	0.43***

**$p \leq 0.01$
***$p \leq 0.001$

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Table 4. Prediction of perceived usefulness and fun.

Variables	Perceived usefulness	Perceived fun
Computer anxiety	−0.18***	−0.33***
R^2	0.03***	0.22***

***T-values for the path coefficients and R^2 are significant are 0.001. T-values were calculated using Tukey's jackknifing method.

direct effects on satisfaction. While computer anxiety is negatively related to satisfaction ($\gamma = -0.08$, $p \leq 0.001$), fun and perceived usefulness are positively related to satisfaction ($\beta = 0.27$ and 0.22, $p \leq 0.001$, respectively). Note that computer anxiety had also an indirect effect on satisfaction through fun and perceived usefulness.

3.3.4. *System usage:* The final step in the test of the model was to assess the relationships of the study variables with both dimensions of system usage (i.e., business tasks and duration). Table 6 presents the results of the test of the model pertaining to system usage. The data show that 14% and 17% of the variance ($p \leq 0.05$) in business tasks and duration, respectively was explained. Consistent with expectations, perceived usefulness, reflecting the extrinsic motivation, is directly related to both dimensions of system usage (i.e., business tasks and duration) ($\beta = 0.28$ and 0.16, respectively). Perceived fun, reflecting the intrinsic motivation, was also found to be positively related to business tasks ($\beta = 0.05$, $p \leq 0.05$) and duration ($\beta = 0.13$, $p \leq 0.01$). Note that the extrinsic motivation had a larger effect on system usage than the intrinsic motivation. Furthermore, computer anxiety had both direct and indirect effects on both dimensions of system usage. Note that computer anxiety had a strong direct effect on business tasks ($\gamma = -0.19$, $p \leq 0.001$) and duration ($\gamma = -0.21$, $p \leq 0.001$). Consistent with

Table 5. Prediction of satisfaction.

Variables	Direct	Indirect	Total
Computer anxiety	−0.08***	−0.12	−0.20***
Perceived usefulness	0.22***		0.22***
Perceived fun	0.27***		0.27***
R^2	0.21*		

***T*-values for the path coefficients and R^2 are significant are 0.01. *T*-values were calculated using Tukey's jackknifing method.
****T*-values for the path coefficients and R^2 are significant are 0.001. *T*-values were calculated using Tukey's jackknifing method.

Hypothesis 4, satisfaction had a positive effect on both dimensions of system usage (tasks and duration; $\beta = 0.04$ and 0.10, $p \leq 0.05$, respectively). Note that perceived usefulness and perceived fun played a very important role in mediating the relationships between both computer anxiety and system usage. Satisfaction also mediated the relationships between computer anxiety, fun and perceived usefulness and system usage.

In summary, the picture that emerges is that while perceived usefulness had a much stronger effect on business tasks than on duration, fun had a stronger effect on duration than on business tasks. Furthermore, computer anxiety had strong direct and indirect effects on both business tasks and duration. The effect of computer anxiety on business tasks and duration is mainly direct. Finally, satisfaction had a direct effect on system usage, but, it is much smaller than the effects of fun and perceived usefulness.

4. Discussion

Our research showed that system usage in the workplace is affected by individuals' perception about both usefulness and fun. Microcomputers have forced many people to rethink the concept of work and joy. They are all over offices, homes and are used by executives, managers, professionals, secretaries, kids, spouses, and more who are having to deal with the temptation to have fun. The model was able to distinguish between the use of a system because it is fun and the use of a system because it is useful and beneficial in getting the job done. More specifically, our study showed that managers and professionals use microcomputers mainly because they perceive them as useful tools to improve their performance and productivity and secondarily because they are fun to use. Results also show that computer anxiety plays a very important role in affecting people's decision whether to accept or reject this technology. Attitude (satisfaction) was also found to have an impact on the people's decision whether to accept or reject it.

Results of this study suggest that perceived usefulness is more influential than fun in determining whether to accept or reject microcomputer technology. While the results showed that perceived usefulness is about six times more influential than fun in determining the reasons for using the system (business tasks and applications), perceived usefulness and fun had similar effects on the frequency of use and the time of use. Further, fun was found to have a stronger effect on satisfaction than perceived usefulness. This implies that for those who measure the technology acceptance by

Table 6. Prediction of system usage.

Variables	Business tasks and applications Direct	Indirect	Total	Duration Direct	Indirect	Total
Computer anxiety	−0.19***	−0.07	0.26***	−0.21***	−0.06	0.27***
Perceived usefulness	0.28***	0.01	0.29***	0.16***	0.02	0.18***
Perceived fun	0.05**	0.01	0.06**	0.13***	0.03	0.16***
Satisfaction	0.04**		0.04***	0.10***		0.10***
R^2	0.14*			0.17*		

**T-values for the path coefficients and R^2 are significant are 0.01. T-values were calculated using Tukey's jackknifing method.

***T-values for the path coefficients and R^2 are significant are 0.001. T-values were calculated using Tukey's jackknifing method.

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duration or satisfaction, perceived fun is an important factor affecting it. It suggests that fun has its greatest value as a means of accepting the new technology and making individuals more adaptable and satisfied with the quality of the system. Managers should understand that there are positive consequences of using microcomputers for fun. Some fun features, such as sounds, colours, games, or cartoons, may encourage people who are learning to use new software packages. Other features, such as accelerated responses, elaborate options, or user dictated rules, may open up options that would bewilder inexperienced users (Webster and Martocchio 1992). Consistent with the findings of Davis *et al.* (1989), for those who focus on the business tasks and number of applications, perceived usefulness (i.e., the expected performance impacts due to using the specific system) is a major determinant of system usage. This suggests that individuals are more likely to accept a new technology primarily because of the functions it performs for them. Therefore, MIS managers should also emphasize the functionality of the system and should convey to end-users in a realistic way what the proposed system will consist of and what functions will be available to them.

Results of this study showed that usefulness and fun mediate the effects of computer anxiety. Computer anxiety was found to have a stronger impact on fun than on perceived usefulness. This suggests that efforts to reduce computer anxiety could be instrumental in improving individuals' perception about the system, mainly perceived fun and thereby increasing the likelihood of their using them. The results reiterated the importance of computer anxiety in inhibiting system usage both directly and indirectly through its influence on perceived fun, usefulness, and satisfaction. Igbaria and Chakrabarti (1990) and Igbaria and Parasuraman (1989) suggested different ways to reduce anxiety. Training is reported to be one of the most important factors affecting computer anxiety, therefore, organizations should design training programs to increase individuals' knowledge about computers which may be beneficial in alleviating computer anxiety and reducing potential barriers to the use of microcomputers (Igbaria and Parasuraman, 1989). Insofar as computer anxiety represents a specialized type of stress, education about the basic facts about computers during initial contact with them could be augmented with training in coping skills in order to break the vicious cycle of computer anxiety. It is suggested that employees who use computers for fun may be less anxious of using them, therefore, need less formal training programs. Webster (1990) suggested that training programs may be labeled as play or fun rather than as work for those employees who like to have fun. Since, computer anxiety is strongly related to fun and perceived usefulness, organizations can increase the use of computers for fun to 'get the job done' by involving employees in training programs that lessen their computer anxieties. Future research should examine the antecedents of computer anxiety and their influence on perceived usefulness, fun, and eventually on the individual's decision whether to accept or reject a new technology.

This study also showed that satisfaction mediated the effect of computer anxiety, fun, and perceived usefulness. Our results show that computer anxiety, perceived usefulness and fun are more influential than satisfaction in determining system usage. This may suggest that individuals are more likely to use a computer-based information systems, which has certain functionality (extrinsic motivation) and also has certain intrinsic benefits of use (joy and fun), and has attractive output and less complex functions. More effective training and education programs should focus on helping individuals use the system by teaching them how to use different options that allow them to have control or that encourage them to explore the capabilities of the system. Further, it is suggested that using design features which have been proven to be successful in computer games or having incorporated some of these fun and game features into the system (Davis *et al.* 1992, Malone 1981). It is also suggested that developing a system requires a study of what the user expectations are. Also, it is important to understand the potential benefits of using the system. This knowledge may be applied to investigate why individuals use microcomputers and to evaluate the discrepancies between the user expectations and potential benefits and the system interface. The closer the system is matched to user expectations, the more easily and quickly user learning takes place, and the more satisfied the users are.

In summary, system usage is affected by both extrinsic motivation (usefulness) and intrinsic motivation (fun). Both are important in affecting the individual decision whether to accept or reject a new technology. They had significant effect on system usage and they mediate the effect of computer anxiety on system usage. Further, satisfaction was also found to have a direct effect on usage, however, its effect is much smaller than computer anxiety, perceived usefulness, and fun. Our paper also provided support for factorial validity: the pattern of factor loadings confirmed the a priori structure of the four perceptions, with usefulness items loaded highly on one factor, fun items loaded highly on another factor, computer anxiety items loaded highly on a third factor, satisfaction loaded highly on the last factor, and one item loaded above the recommended level. The measurement model was confirmed: both construct validity and discriminant validity were found to be valid for all the constructs. Finally, all four hypotheses were supported using the structural equation modelling technique.

Although these findings have important implications for the introduction of microcomputer technology, additional research is needed on a number of fronts. First, the use of self-report scales to measure the study variables suggest the possibility that common method variance may account for some of the results obtained. In order to pursue further investigation of the conceptual model, it would be appropriate to develop more direct and objective measures for the user acceptance of microcomputer technology. Alternatives to self-report data sources would certainly reduce the likelihood of obtaining spurious relationships. Second, other variables such as organizational size, age, decentralization, the existence of an information center, perceived ease of use, and user involvement may affect user perceptions (Davis *et al.* 1989, Franz and Robey 1986). We did not collect data about such variables and so could not test for their effects in this study. Further research is needed to include these variables, among others, and examine the relationships between all the variables and perceptions and usage in other settings. Since the four perceptions (i.e., usefulness, fun, satisfaction, and computer anxiety) are influenced by various externally controllable factors such as development methodologies, training, organizational support and policy, individual and task characteristics, user participation and involvement, further research is needed to examine the relative influences of those external factors (individual, task, situational, technology, organizational, and system characteristics) on perceptions and acceptance. Further, other factors may also explain additional variance in microcomputer acceptance beyond usefulness and fun. For example, Fishbein and Ajzen (1975) proposed that social influences may have an impact on people's behaviour. Third, the impact of microcomputer acceptance on a company's performance needs to be examined. Information technology is an expensive resource, with many hidden costs. Those costs are growing rapidly. On the other hand, Keen (1991) reported that the gross national product (GNP) has dropped, indicating an unexplained productivity gap. Therefore, more research is needed to examine the influence of the system usage on individual and organizational performance. Nevertheless, a structural equation model of the impact of four distinct perceptions on the acceptance of microcomputer technology using PLS provides important insights into MIS and emphasizes the need for additional research using multivariate structural equation models for predicting user acceptance of microcomputer technology.

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