Microcomputer Playfulness: Development of a Measure With Workplace Implications

By: Jane Webster
Smeal College of Business Administration
The Pennsylvania State University
University Park, Pennsylvania 16802 U.S.A.

Joseph J. Martocchio
Institute of Labor and Industrial Relations
University of Illinois
504 East Armory Avenue
Champaign, Illinois 61820 U.S.A.

Abstract

Microcomputer playfulness represents the degree of cognitive spontaneity in microcomputer interactions. Research on the general characteristic of playfulness has demonstrated relationships with measures such as creativity and exploration. Thus, with the widespread diffusion of computers in organizations, research in microcomputer playfulness can have significant practical implications for organizations. Five independent studies involving more than 400 participants provided initial evidence for the construct validity of a microcomputer playfulness measure with respect to its factor structure, internal consistency reliability, concurrent validity, discriminant validity, predictive validity, predictive efficacy, and test-retest reliability. As hypothesized, the measure related positively to computer attitudes, anxiety, competence, and efficacy, and did not relate to gender or age. In addition, the measure related positively to training outcomes of learning, mood, involvement, and satisfaction. Further, the evidence suggests the predictive efficacy of microcomputer playfulness as compared to other variables, such as computer anxiety and attitudes. Consequently, the findings indicate that researchers should focus more attention on positive influences on human-computer interaction, such as microcomputer playfulness, rather than on negative influences, such as computer anxiety.

Keywords: Individual characteristics, traits, computer attitudes, computer anxiety, computer training, motivation, learning, exploration, spontaneity, creativity, human-computer interaction

ACM Categories: H.1.2, K.6.1, K.8

Introduction

The use of microcomputers in the workplace has reached the same per capita penetration level in only a decade as the telephone did in approximately 75 years (Gantz, 1986). Despite the potential benefits of using microcomputers, such as enhanced individual performance and productivity, there is a significant literature base that deals with individual difference characteristics associated with perceived negative aspects of computers (such as rejection of systems, averse psychological reactions; see Brod, 1984; Meier, 1988). However, recent surveys on attitudes toward computers suggest that attitudes are shifting from the fearful and awesome aspects of computers to positive factors (Gardner, et al., 1989; Howard and Smith, 1986; Lee, 1970; Ruth and Gardner, 1987; Weinberg and Fuerst, 1984). Yet, there is little research on microcomputers examining positive individual characteristics, such as playfulness, in computer interactions.

Playfulness represents a particularly appropriate construct in the study of symbolic systems like human-computer interactions (Csikszentmihalyi, 1990). Hiemstra's (1983) interpretive analysis of employees' descriptions of computer interactions supports this assertion: employees frequently used the word "play" in their descriptions. Further, in Carroll and Mack's (1984) protocol analysis of naive users of computers, they concluded that the capacity to treat work as play characterizes successful adult learners and problem solvers. Microcomputers, specifically, seem to encourage the state of playfulness: they provide quick responses; they are often easy to use; and they can be tailored to the user's requirements (Starbuck and Webster, 1991). Thus, information systems researchers have called for further research in playfulness in human-computer interactions (e.g., Carroll and Thomas, 1988; Davis, 1989; Kamouri, et al., 1986; Katz, 1987; Malone, 1980; Ord, 1989).

Our focus in this research is on microcomputer playfulness. Microcomputer playfulness, a situation-specific individual characteristic, represents a type of intellectual or cognitive playfulness. It describes an individual's tendency to interact spontaneously, inventively, and imaginatively with microcomputers. Because interactions with microcomputers are symbolic in nature, playfulness is an apt construct in the study of human-computer interactions:

> A symbolic system is like a game in that it provides a separate reality, a world of its own where one can perform actions that are permitted to occur in that world, but that would not make much sense anywhere else. In symbolic systems, the "action" is usually restricted to the *mental manipulation of concepts* (Csikszentmihalyi, 1990, p. 118, emphasis added).

Thus, because microcomputer playfulness describes a type of intellectual playfulness, it represents a promising area for research.

Microcomputer playfulness has potentially important practical implications for management information systems (MIS). For example, some research suggests that higher playfulness results in immediate subjective experiences like involvement, positive mood, and satisfaction (Csikszentmihalyi, 1975; Levy, 1983; McGrath and Kelly, 1986; Sandelands, et al., 1983). Therefore, employees higher in microcomputer playfulness will view microcomputer interactions more positively than less playful employees and consequently will be more motivated to engage in microcomputer interactions in the future. Other research indicates that longer-term outcomes, such as learning, result from playfulness (Lieberman, 1977; Miller, 1973). Employees higher in microcomputer playfulness will exercise and develop skills through exploratory behaviors. Thus, these employees will be better able to react to situations requiring these skills in the future.

Potentially negative effects of playfulness, such as longer time to task completion (Sandelands, 1988) and over-involvement (Csikszentmihalyi, 1975) further highlight the importance of microcomputer playfulness to MIS. For example, those high in microcomputer playfulness may create many opportunities for non-productive play, such as playing computer games at work or making trivial revisions to the format of a document (Nash, 1990). In sum, microcomputer playfulness can have significant practical consequences for organizations: playfulness may result in wasted time, but it also may result in higher quality results (Starbuck and Webster, 1991).

The study of microcomputer playfulness also has implications for employee training in particular and human resource management in general. Until recently, individual difference characteristics associated with user performance were predominantly ability factors (e.g., Nelson and Cheney, 1987). Individual motivational characteristics are among the most efficient predictors of human performance in training, yet they have received little research attention (Mumford, et al., 1988; Noe, 1986). Therefore, researchers have called for an increased focus on motivational factors in particular (Bostrom, et al., 1990; Davis, 1989; Noe, 1986) and training issues in general (Brancheau and Wetherbe, 1987).

Research on the causes of ineffective computer use has demonstrated that the majority of causes are behavioral rather than technical (Turnage, 1990), resulting in recommendations for more MIS research on behavioral issues (Culnan, 1986). Thus, another implication deals with designing the appropriate training program for employees based on differences in their motivational orientations toward training. Questions such as, "Does it matter, in terms of desired training outcomes, whether the organization delivers training in the same way for all employees?" merit further research and fall into the domain of aptitude-treatment interaction (Campbell, 1989). It may be that individuals who are playful with microcomputers are unlikely to need external stimuli (such as performance feedback; see Ilgen, et al., 1979 for a review of performance feedback) to sustain motivation, whereas individuals who are not very playful with microcomputers are likely to need external stimuli to sustain motivation. In addition, it may be that individuals who are more playful with microcomputers will learn more quickly or may evaluate new systems more thoroughly because they experiment more.

Although the general characteristic of playfulness has been studied extensively in children and adolescents (e.g., Barnett, 1990; 1991; Lieberman, 1977), it has received less attention in adults. Researchers have demonstrated that employees have differing orientations toward work versus play (e.g., Costa and McCrae, 1988) and differing endorsements of the work versus leisure ethic (e.g., Tang and Baumeister, 1984). Recent empirical research on adults indicates that the general characteristic of playfulness relates positively to individual creativity and to more exploratory behaviors during interactions with tasks (Glynn and Webster, 1992). Furthermore, researchers have advanced the attribute of playfulness as an important but little-studied characteristic of employees (e.g., Lieberman, 1977). Thus, the study of microcomputer playfulness in adults will extend previous research conducted mainly with younger people on the general trait.

Although validity has been examined for a general measure of playfulness (Glynn and Webster, 1992), no evidence on the degree of construct validity of a situation-specific measure of cognitive playfulness—microcomputer playfulness—exists. Therefore, this article provides an initial assessment of the validity of an individual difference measure of playfulness corresponding specifically to microcomputers. This construct validity assessment responds to calls for more MIS research on instrument validation (Davis, 1989; Straub, 1989) and to recent empirical MIS research in this tradition (for example, see Davis, 1989, on usefulness and ease of use, Joshi, 1989, on fairness, and Moore and Benbasat, 1991, on information technology adoption).

The purpose of this article is to begin to develop a valid microcomputer playfulness measure and to demonstrate its implications for both MIS practice and research. The next section presents the theoretical foundations for the concept of microcomputer playfulness. It develops hypotheses explaining relationships of microcomputer playfulness with other individual difference characteristics and with training outcomes, such as positive mood, satisfaction, and learning. To provide an initial assessment of the validity of a microcomputer playfulness measure, the following section presents the results of five studies utilizing the measure. The final section discusses implications for research and practice.

Microcomputer Playfulness as a Trait Versus a State

Playfulness is abundant and pervasive in everyday life (Bologh, 1976); however, characterizing playfulness is difficult (Berlyne, 1969) because both laymen and researchers use the term *play* in several ways (Day, 1981). One usage of the noun play represents our intuitive understanding of play as an opposition to work (Kabanoff, 1980). A second usage of the adjective playful describes a subjective characteristic of an experience (the "state" of playfulness) (Ellis, 1973). A final usage of the adjective playful represents a motivational characteristic of individuals (the "trait" of playfulness) (Lieberman, 1977). This article concerns itself with this final usage. More specifically, it examines situation-specific cognitive playfulness, or playfulness on microcomputers.

At this point, the basic distinction between traits and states merits mention. General traits refer to comparatively stable characteristics of individuals that are relatively invariant to situational stimuli. States, on the other hand, refer to affective or cognitive episodes that are experienced in the short run and fluctuate over time. Unlike general traits, states can be influenced by situational factors and the interaction between the person and the situation. In our research, we are examining playfulness as an individual trait rather than as a state. Our treatment of playfulness as a trait is not meant to suggest that an individual cannot feel more or less playful at various points in time. In fact, we argue that the construct of playfulness also should be studied as a state in human-computer interactions (e.g., Webster, 1989). Our acknowledgement of playfulness as both a trait and a state follows well-developed theoretical and empirical research in organizational behavior and social psychology. For example, researchers have examined positive mood as both a state (e.g., George, 1991; Watson and Pennebaker, 1989) and as a trait (e.g., George, 1989; Watson, et al., 1988).

Another important dimension merits consideration: the notion of situation-specific versus general traits. Situation-specific individual characteristics are becoming more widely utilized in the literature (e.g., Pierce, et al., 1989) because they relate more strongly than more general individual characteristics to organizational outcomes. Situation-specific traits are more likely to operate in specific kinds of situations than in all situations (Day and Silverman, 1989). For example, test anxiety is an example of a situation-specific characteristic. One student may have a relatively enduring tendency to experience test anxiety (the situation-specific "trait" of test anxiety), while a second may experience the "state" of test anxiety temporarily due to lack of sleep. Similarly, computer anxiety may be a situation-specific trait or a state. Thus, the trait of microcomputer playfulness represents a relatively enduring tendency to interact playfully with microcomputers, while the state of microcomputer playfulness represents a temporary state of playfulness with microcomputers (brought on by such influences as characteristics of the software, social influences, and so on (Webster, 1989)).

Explicating the Playfulness Construct

The general, or global, trait of playfulness represents a predisposition to be playful.[1] Dewey (1913) defined playfulness as "the capacity to draw satisfaction from the immediate intellectual development of a topic, irrespective of any ulterior motive" (p. 727). More recently, Barnett (1991) described playful individuals: "Individuals with playful dispositions are said to be guided by internal motivation, an orientation toward process with self-imposed goals, a tendency to attribute their own meanings to objects or behaviors (that is, to not be dominated by a stimulus), a focus on pretense and nonliterality, a freedom from externally imposed rules, and active involvement" (p. 52).

The general trait of playfulness depicts a multifaceted construct encompassing five distinct factors: cognitive spontaneity, social spontaneity, physical spontaneity, manifest joy, and sense of humor (Barnett, 1991; Lieberman, 1977). As argued above, intellectual or cognitive playfulness is particularly appropriate in the study of symbolic systems (Csikszentmihalyi, 1990). Thus, of the five facets of general playfulness, cognitive spontaneity represents the most relevant playfulness factor in the context of human-computer interactions. In contrast, the remaining factors would be more suitable for studies of interpersonal relationships in organizations rather than for studies of human-computer interactions.

Lieberman (1977) states that the "overt manifestations of cognitive spontaneity are curiosity and inventiveness . . . [he] will be testing hypotheses in the propositional 'if-then' manner, will go over his thinking, and the reservoir of factual knowledge through the process of reversibility of operations, and may come out with unique solutions as a result of his 'playing with ideas'" (pp. 57–58). She uses such adjectives as spontaneous, inventive, and imaginative to describe cognitive spontaneity. Similarly, Barnett (1990) describes cognitive spontaneity in children as: ". . . the *imaginative* quality of the child's play—the degree to which the child might assume different character roles, *invent* unique games, or use unconventional objects in his or her play" (p. 54, emphasis added). Therefore, cognitive spontaneity is a type of intellectual playfulness: those higher in microcomputer playfulness tend to be more spontaneous, inventive, and imaginative in their microcomputer interactions.

For example, in the case of interacting with a new software program, more playful individuals are more likely to examine the options available on the user menu *and* experiment with them. Over time, more playful individuals, through their self-motivated interaction, are more likely to have mastered the software and to exhibit more positive attitudes toward the software. Thus, we describe the individual difference construct of microcomputer playfulness as the degree of cognitive spontaneity in microcomputer interactions, where a high level of cognitive spontaneity indicates a high degree of playfulness and a low level of cognitive spontaneity indicates a low degree of playfulness.

A Framework for Assessing the Validity of a Microcomputer Playfulness Measure

Instrument validation represents an important topic for MIS researchers: it helps define research traditions; it brings more rigor to the scientific process; it permits confirmatory research; it brings greater clarity to research questions; and

[1] The trait of playfulness has also been termed the "autotelic personality" (e.g., Csikszentmihalyi, 1990).

it increases the trustworthiness of research findings (Straub, 1989). The objective of construct validation is to develop an operational measure of a psychological construct (in this case, microcomputer playfulness) that adequately samples from the theoretical domain on which the construct is based (Ghiselli, et al., 1981). Having stated the objectives of construct validation efforts, the definition of construct validity merits mention.

Construct validity is defined as representing the correspondence between a construct and the operational procedure to measure or manipulate that construct (Schwab, 1980). The process of assessing the validity of a construct is indirect; yet, it represents the link between psychometric properties of a measure to the theoretical essence underlying that measure. Critical to assessment of construct validity is the nomological network that Cronbach and Meehl (1955) have defined as "the interlocking system of laws which constitute a theory" (p. 290). The nomological network is useful in assessing the extent of convergence and discriminability that is essential in ruling out alternative hypotheses (Campbell and Fiske, 1959).

The following subsections specify the hypotheses that constitute the nomological network for examining the construct validity of a microcomputer playfulness measure. The subsections are organized on the following basis: (1) concurrent validity, (2) discriminant validity, (3) predictive validity, (4) predictive efficacy, and (5) test-retest reliability. A table summarizing the hypothesized relationships and actual findings will be referenced in the discussion section, below.

Concurrent validity: Related individual difference constructs

Concurrent validity is assessed by using the scores on one variable (microcomputer playfulness) to estimate scores on another, where both variables are measured at the same time (Ghiselli, et al., 1981). Here, we examine concurrent validity by relating microcomputer playfulness to other individual constructs. More specifically, we relate microcomputer playfulness to computer attitudes, computer anxiety, computer competence, and computer efficacy. Although no previous empirical research has examined the relationships between microcomputer playfulness and these variables, we propose hypotheses concerning these variables. If microcomputer playfulness relates to these variables as expected, this provides evidence of the concurrent validity of the construct.

Computer Attitudes

Computer attitudes concern perceptions of the competence and productivity of computers (Zoltan and Chapanis, 1982). Those with higher attitudes view computers as more efficient, dependable, precise, and organized (Zoltan and Chapanis, 1982). Researchers have argued that attitudes toward computers have important effects on the usage and ultimate success or failure of computer systems (Igbaria, et al., 1990; Loyd and Gressard, 1984). It may be that those with more positive attitudes feel more inclined to interact spontaneously and inventively with microcomputers. Or, those individuals who interact more playfully with microcomputers may develop more positive attitudes toward them. Thus, we propose that individuals higher in microcomputer playfulness will also demonstrate more positive attitudes.

H1. There will be a positive relationship between computer attitudes and microcomputer playfulness.

Computer Anxiety

Computer anxiety is defined as "the tendency of individuals to be uneasy, apprehensive, or fearful about current or future use of computers" (Parasuraman and Igbaria, 1990, p. 329). In general, individuals who experience high levels of anxiety are likely to behave more rigidly than individuals whose level of anxiety is relatively low. Some people exhibit anxieties around mechanical objects; thus, computers may be a source of anxiety for some users (Turkle, 1984). For instance, computermanics are much more likely to interact playfully with microcomputers than are computerphobics. Thus, we propose that those higher in microcomputer playfulness will demonstrate lower computer anxiety.

H2. There will be a negative relationship between computer anxiety and microcomputer playfulness.

Computer Competence

As Lieberman (1977) argued, individuals will interact playfully with an activity only after a level of competence has been achieved in that activity. In addition, we would expect individuals who are more playful with computers to explore their capabilities more and, therefore, gain a better understanding of them (Malone, 1980). Consequently, users higher in microcomputer playfulness will demonstrate higher competence with computers.

H3. There will be a positive relationship between computer competence and microcomputer playfulness.

Computer Efficacy Beliefs

Self-efficacy is defined as one's beliefs in one's ability to perform a specific task (Bandura, 1977). Research has shown that low efficacy beliefs are negatively related to subsequent task performance (Bandura and Cervone, 1986; Weiss and Knight, 1980). Hill, et al. (1987) found that perceived efficacy beliefs are related to the use of a variety of technologically advanced products. Since many researchers in the play area argue that perceived efficacy is an important precursor to playfulness (e.g., Csikszentmihalyi, 1975; Malone, 1980), we propose that computer efficacy will be positively associated with microcomputer playfulness.

H4. There will be a positive relationship between computer efficacy beliefs and microcomputer playfulness.

Discriminant validity

Evidence for discriminant validity may be demonstrated by examining the relationships between microcomputer playfulness and both unrelated and related individual constructs.

Unrelated Individual Difference Constructs

One method of determining discriminant validity is to ensure that the construct of interest does not relate to variables with which it should not correlate, based on theory (Hollenbeck, et al., 1989). That is, the construct should demonstrate discriminability from other constructs that are not within the nomological net. To examine discriminant validity with respect to unrelated constructs, we draw on prior research on the individual characteristic of playfulness to relate microcomputer playfulness to gender and age.

Gender. We have no direct evidence to suggest that there will be differences between men and women in microcomputer playfulness. For example, Costa and McCrae (1988) found that the mean score for a general measure of playfulness (that is, intellectual curiosity) does not differ for men and women. We can, however, point to studies that demonstrate that men have more *experience* with and, therefore, less anxiety around computers (for example, Gilroy and Desai, 1986; Hess and Miura, 1985; Igbaria, et al., 1990; Lockheed, 1985). We therefore propose that:

H5. Holding computer experience constant, microcomputer playfulness and gender will not relate.

Age. We have no direct evidence to suggest age differences in microcomputer playfulness. However, Costa and McCrae (1988) found intellectual curiosity to be weakly associated with age ($r = .11$, $p < .05$). Similarly, Csikszentmihalyi (1975) found a positive relationship between playfulness and age. On the other hand, many studies demonstrate a negative relationship between computer experience and age (for example, Gist, et al., 1988; Igbaria, et al., 1990). We therefore propose that:

H6. Holding computer experience constant, microcomputer playfulness and age will not relate.

Related Individual Difference Constructs

A more stringent method of determining discriminant validity is to ensure that the construct of interest diverges from other related constructs in the nomological net (Ghiselli, et al., 1981). That is, we should be able to differentiate microcomputer playfulness from related constructs, such as computer attitudes and computer anxiety, which have been widely used in this literature. In short, microcomputer playfulness should not be redundant with other well-recognized constructs. Therefore, we propose that:

H7. Microcomputer playfulness will exhibit discriminant validity from computer attitudes.

H8. Microcomputer playfulness will exhibit discriminant validity from computer anxiety.

Predictive validity: Outcomes of microcomputer playfulness

Predictive validity describes the accuracy of estimating a future measure (e.g., training performance) from our current measure (microcomputer playfulness) (Ghiselli, et al., 1981). To examine predictive validity, we relate microcomputer playfulness to future training outcomes.

Trainees higher in microcomputer playfulness should experience higher involvement, positive mood, and satisfaction than those lower in microcomputer playfulness. Csikszentmihalyi's (1975) Theory of Flow provides the basis for understanding how playfulness influences these affective outcomes. This motivational theory is concerned with the subjective experiences of enjoyment during playful interactions with tasks. When in the flow state, individuals become absorbed in their activities; their focus of awareness is narrowed, and they experience a sense of control over their environments. This theory explains the occurrence of flow through the interaction of an individual's characteristics with the objective characteristics of the activity. The theory has found support in studies of diverse sets of individuals: rock climbers, composers, modern dancers, chess players, basketball players, surgeons, and managers (Bowman, 1982; Csikszentmihalyi, 1975; Csikszentmihalyi and LeFevre, 1989; Kusyszyn, 1977). Moreover, research has demonstrated subjective experiences resulting from higher playfulness, such as positive mood, pleasure, joy, euphoria, satisfaction, and efficacy (Gardner, 1986; Glynn, 1988; Levy, 1983; Piaget, 1962; Sandelands, et al., 1983; Webster, 1989). Extrapolated to training situations, this research implies that employees higher in the trait of microcomputer playfulness will experience higher involvement in the computer interaction, higher positive mood, and higher satisfaction with the training.

H9. Microcomputer playfulness will be positively associated with involvement in the microcomputer interaction.

H10. Microcomputer playfulness will be positively associated with positive mood.

H11. Microcomputer playfulness will be positively associated with satisfaction.

Trainees higher in microcomputer playfulness should learn more than those lower in microcomputer playfulness. As described above, imagination and inventiveness are hallmarks of individuals high in cognitive spontaneity. Therefore, researchers studying playfulness (e.g., Miller, 1973) argue that those who are higher in playfulness will interact more playfully with activities such that they will exercise and develop skills through exploratory behaviors, resulting in enhanced task performance. For example, Malone (1980) proposed that students will spend more time and effort in learning when at play, will enjoy what they are doing more, will be more likely to use what they have learned, and will learn more effectively. Other studies of children using computers have supported these results (e.g., Papert, 1980; Turkle, 1984).

If these outcomes extend to training situations, employees who interact more playfully with microcomputers will be more likely to put effort into learning these systems, will demonstrate more exploratory behaviors, will learn more effectively, will be more likely to extend what they have learned to other situations, will become more self-directed in their learning, and will experience more control. Support for this extension to adults in work situations comes from Lieberman's (1977) and Carroll and Mack's (1984) conclusions that the capacity to treat work as play characterizes successful adult learners and problem solvers. For example, Ghani (1991) found that university students who were higher in cognitive spontaneity reported higher learning than those who were lower in cognitive spontaneity. Consequently, we propose:

H12. Microcomputer playfulness will be positively associated with learning.

Predictive efficacy: Microcomputer playfulness versus other constructs

Predictive efficacy, or incremental validity (Sechrest, 1963), refers to incremental predictive power of our current measure (microcomputer playfulness) as compared with other measures (e.g., computer attitudes) (Pierce, et al., 1989).

That is, if microcomputer playfulness shows stronger relationships with variables of interest than other predictor variables, this lends support to the predictive efficacy of the construct. To examine predictive efficacy, we compare the predictive power of microcomputer playfulness with computer attitudes and computer anxiety.

A plethora of research has examined relationships between both computer attitudes and computer anxiety and organizational outcomes (such as system success and failure and employees' feelings of depersonalization and loss of privacy; see Brod, 1984; Gardner, et al., 1989; Gilroy and Desai, 1986; Heinssen, et. al., 1987; Howard and Smith, 1986; Lee, 1970; Meier, 1988; Nykodym, et al., 1988; Parasuram and Igbaria, 1990; Ruth and Gardner, 1987; Weinberg and Fuerst, 1984); this research has established these constructs as important predictors in MIS research. Therefore, if microcomputer playfulness relates more strongly than computer attitudes or computer anxiety to organizational outcomes, this finding helps to establish microcomputer playfulness as an important construct in MIS research.

H13. Microcomputer playfulness will have greater predictive power than computer attitudes with respect to the outcome measures of (a) involvement, (b) positive mood, (c) satisfaction, and (d) learning.

H14. Microcomputer playfulness will have greater predictive power than computer anxiety with respect to the outcome measures of (a) involvement, (b) positive mood, (c) satisfaction, and (d) learning.

Test-retest reliability

Test-retest reliability examines the stability of a construct over time (Ghiselli, et al., 1981). Whereas high test-retest reliabilities indicate relatively stable constructs, low test-retest reliability coefficients reflect variable characteristics. Some individual characteristics are expected to be more stable over time (e.g., general anxiety), whereas others are expected to be less stable (e.g., test anxiety) (Ghiselli, et al., 1981). It may be that microcomputer playfulness encompasses a dynamic element: that is, as the situation changes (for example, from one category of microcomputer to another, such as from a Macintosh computer to an IBM-compatible computer), the degree of playfulness may change. That is, the general characteristic of playfulness may be more stable than microcomputer playfulness. However, no research addresses this question. Thus, we explore the stability of microcomputer playfulness over time.

The following section describes five studies that provide an initial assessment of the validity of a microcomputer playfulness measure.

Studies

Study designs and participants

Data from five studies examined the validity of a microcomputer playfulness measure. Three were survey studies, while two were training studies. In the three survey studies, students were volunteers from courses taught in business schools of large universities; these surveys were completed during class time. Those students who volunteered received no course credit for participation and were guaranteed confidentiality. In one training study, students received computer training during class time. They were asked to volunteer to participate in the research as part of the course requirements. Again, students received no course credit for participation and were guaranteed confidentiality. In the other training study, employees signed up for regular computer training courses during working hours. They were asked to volunteer to participate in the research as part of their on-the-job training. Employees received a discount on the training fees and were guaranteed confidentiality. Table 1 presents demographic information on the participants and the measures used in the five studies.

Procedures

Table 1 identifies the types of studies and the variables measured in each. Students in an undergraduate MIS class of a large, private Northeastern university were surveyed in the classroom in study 1. Study 2 surveyed undergraduate students in accounting classes in a large, public Northeastern university. Study 3 constitutes part of a larger series of computer training studies of undergraduate accounting

Table 1. Study Characteristics and Measures

	Undergraduate Students			MBA Students	Employees
	1	2	3	4	5
Samples					
Study Site	Classroom	Classroom	Computer Lab	Classroom Lab	Computer
Sample size (N)	61	158	95	32	77
% Male	73.8%	52.6%	49.5%	71.9%	9.1%
Age, years (M/SD)	21.9/1.5	23.1/5.7	21.4/2.7	26.9/4.7	42.1/11.6
Full-time work experience, years (M)	1.5	1	1	3	7
Frequency of microcomputer use	more than once/week	less than once/week	less than once/week	more than once/week	daily
Individual Differences					
Microcomputer playfulness	X	X	X	X	X
Computer attitudes		X	X		X
Computer anxiety		X	X		X
Computer competence	X	X	X		X
Computer efficacy beliefs					X
Gender	X	X	X		X
Age	X	X	X		X
Outcomes					
Involvement			X		X
Positive affect			X		X
Satisfaction					X
Learning			X		X
Microcomputer playfulness (three-month test-retest)				X	

students in a large Northeastern university (Webster, et al., 1990). Participants were trained to use a popular spreadsheet program (Lotus 1-2-3). Study 4 was designed to capture test-retest reliability on microcomputer playfulness. In it, M.B.A. students in an MIS class of a large, public Northeastern university completed a questionnaire containing the microcomputer playfulness scale at the beginning of the semester and again three months later. Finally, study 5 is part of a larger study investigating actual computer training sessions of employees in a large, public Midwestern university (Martocchio and Webster, 1992). Participants were trained to use the advanced features of a popular word processing program (WordPerfect) in a university-sponsored microcomputer training course.

Questionnaires were completed by participants of all of the studies to measure individual differences and demographic variables. Although containing common elements, the questionnaires varied in their content within studies to keep questionnaires short; consequently, sample sizes for the measures used within studies were not equal. Additionally, in the training studies, participants completed quizzes at the beginning of the training to measure their base-line knowledge of the software package. They also completed questionnaires and quizzes at the end of the training to capture both affective outcome variables and objective measures of learning.

Scale development

To develop and validate an instrument to measure microcomputer playfulness, the Computer Playfulness Scale (CPS), several steps took place. These steps were: (1) development of the measure from the literature and an initial pretest of the measure, and (2) a pilot test of the measure. After modifying the measure based on results of the pilot, we conducted five further studies to determine: (1) the factor structure, (2) internal consistency reliability, (3) concurrent validity, (4) discriminant validity, (5) predictive validity, (6) predictive efficacy, and (7) test-retest reliability.

To develop items for a measure of microcomputer playfulness, the literature on the general individual characteristic of playfulness was reviewed. Lieberman (1977) has conducted the most comprehensive research on the topic. She developed playfulness scales for rating children and adolescents. Her scales consisted of five facets or subscales, i.e., physical spontaneity, manifest joy, sense of humor, social spontaneity, and cognitive spontaneity. Since cognitive spontaneity represents the most appropriate facet of playfulness in human-computer interactions, we utilized a self-rating scale for adults that was constructed based on Lieberman's cognitive spontaneity construct—the Adult Cognitive Spontaneity Scale (ACS) (Webster, 1989). This 15-item scale asks individuals to indicate their degree of agreement on seven-point scales for such adjectives as spontaneous, unimaginative, experimenting, and curious. To check for the appropriateness of the items (providing evidence for content validity), this scale was pretested on five adults by Webster (1989) and shared with Lieberman (1988), who developed the cognitive spontaneity construct (Lieberman, 1977).

To pilot this instrument, 90 undergraduate students in an MIS course in a large, public Northeastern university volunteered to complete the questionnaire (as part of a larger study reported by Webster, 1991). Although the measure related as expected to such constructs as involvement, the reliability of the instrument (.70) could be improved. Consequently, after reviewing the literature again on the general characteristic of playfulness, new items were added to the instrument, resulting in a 22-item scale (the items appear in Table 2).

Consistent with Day and Silverman (1989), we modified the self-rated general measure of cognitive playfulness (the ACS, above) to make it situation-specific to microcomputers. We modified the scale's instructions from "characterize yourself *in general*" to "characterize yourself when you use *microcomputers*" and from "a description of yourself" to "a description of yourself *when you interact with microcomputers*."[2] Thus, the instructions read: "The following questions ask you how you would characterize yourself when you use *microcomputers*. For each adjective listed below, please

[2] The term "personal computer" was utilized in the instructions to the scale in earlier studies of the construct. Some subjects viewed "personal computer" as equivalent to "IBM PC" rather than analogous to any brand of IBM or non-IBM compatible microcomputer (including Macintosh computers). Therefore, personal computer was changed to microcomputer for the construct validation studies.

Table 2. Factor Analysis of Microcomputer Playfulness Scale

Items	Factor 1	Factor 2	Factor 3	Factor 4
1. Spontaneous	**.69387**	.19101	−.00028	−.20466
2. Conscientious (R)	−.09385	−.28655	−.25853	**.68403**
3. Unimaginative (R)	**.52598**	.19260	.47152	−.08558
4. Experimenting	.38001	**.45613**	−.00297	−.23821
5. Serious (R)	−.12402	−.21033	−.11154	**.63559**
6. Bored (R)	.33006	.21617	**.58670**	−.18711
7. Flexible	**.63864**	.27045	.19838	−.16789
8. Mechanical (R)	−.15019	−.03229	.25321	**.62432**
9. Creative	**.74909**	.17505	.29441	−.23379
10. Erratic	.04735	−.02115	**−.71711**	.13613
11. Curious	.34570	**.66271**	.19100	−.05917
12. Intellectually Stagnant (R)	.26946	.09708	**.68744**	.04720
13. Inquiring	.25985	**.70777**	.23162	−.09396
14. Routine (R)	−.02272	.29585	**.51395**	.44872
15. Playful	**.60973**	.30518	−.01413	−.16635
16. Investigative	.41466	**.59779**	.17647	−.28706
17. Constrained (R)	.42023	.03594	**.56135**	.24489
18. Unoriginal (R)	**.66134**	.13129	.52404	.02051
19. Scrutinizing	−.37948	**.49021**	−.01506	−.16073
20. Uninventive (R)	**.65706**	.10800	.45341	.13072
21. Inquisitive	.25935	**.74564**	.26562	−.11396
22. Questioning	.12041	**.78234**	−.04776	−.01899
Eigenvalue	7.48	2.45	1.61	1.08
Percentage of Variance	34.0%	11.1%	7.3%	4.9%

(R) = reverse-scored.

circle the number that best matches a description of yourself when you interact with microcomputers." Participants indicated their level of agreement on seven-point scales ranging from strongly disagree to strongly agree.

Other measures

Valid measures of other constructs used in the hypotheses (that is, computer anxiety, computer attitudes, computer efficacy, computer competence, involvement, positive mood, satisfaction, and learning) were developed or chosen from the literature. Appendix A describes these measures.

Results

Factor structure

To determine the factor structure of the Computer Playfulness Scale, we performed a principal components factor analysis that combined data from studies 1 to 3 (see Table 1). Table 2 presents the scale items and the four factors with eigenvalues greater than 1 resulting from varimax rotation (Items 2, 3, 5, 6, 8, 12, 14, 17, 18, and 20 are reverse-scored). For several reasons, we present analyses, below, for a scale made up of the seven items loading on the first factor. First, these seven items represent a reliable, uni-dimensional scale. Second, the first factor contains the majority of the variance in the factor analysis. Third, the factors represent dimensions of a higher-order construct, not multiple constructs.[3] Fourth, both the adjectives "spontaneous" and "playful" load on the first factor, lending face validity to this (cognitive spontaneity) playfulness measure. Finally, researchers have called for "short" scales in MIS research (e.g., Moore and Benbasat, 1991).

Internal consistency reliability

The seven-item scale demonstrates the following characteristics across the five studies: means ranged from 29.5 to 36.1; standard deviations ranged from 6.7 to 8.0; medians ranged from 30 to 38; skewness ranged from −0.9 to −0.2; kurtosis ranged from −0.6 to 0.2; and internal consistency reliability ranged from .86 to .90. Therefore, the scale demonstrates good distributional properties.[4]

Concurrent validity

Table 3 presents correlations between microcomputer playfulness and other variables outlined in hypotheses 1 through 4. Hypothesis 1, predicting a positive relationship between microcomputer playfulness and computer attitudes, was supported. Hypothesis 2, predicting a negative relationship between microcomputer playfulness and computer anxiety, was supported.

Hypothesis 3 predicted a positive relationship between microcomputer playfulness and computer competence. This hypothesis was tested using two measures. The first measure, self-rated computer experiences, related to microcomputer playfulness. Similarly, the second measure, a base-line quiz score, correlated with microcomputer playfulness. Finally, hypothesis 4, predicting a positive relationship between microcomputer playfulness and computer efficacy beliefs, was supported.

Because of the support for hypotheses 1 through 4, these findings are consistent with the concurrent validity of the microcomputer playfulness measure.

Discriminant validity

Table 3 also presents the results of testing hypotheses 5 and 6 for unrelated measures. Hypothesis 5 examined the relationship between microcomputer playfulness and gender, holding computer experience constant. To test this hypothesis, we calculated partial correlations and found that there were no gender effects. Hypothesis 6 examined the relationship between microcomputer playfulness and age, holding computer experience constant. Again, we found no relationship between the two variables, holding computer experience constant. Because microcomputer playfulness does not relate to either gender or age, the results of hypotheses 5 and 6 support the discriminant validity of the microcomputer playfulness measure for unrelated measures (Hollenbeck, et al., 1989).

Hypotheses 7 and 8, examining the discriminant validity of microcomputer playfulness with respect to related measures (computer attitudes and computer anxiety), were tested on the combined set of undergraduate data used in the factor analysis, above. A four-step procedure[5]

[3] Theoretically, the factors should represent multiple dimensions of a higher-order construct. That is, items were chosen to sample from the domain of cognitive spontaneity, not from other types of playfulness, such as social spontaneity. To examine empirically whether the factors represent either multiple constructs or multiple dimensions of a higher-order construct, we conducted several more analyses: (1) correlations between the factors using LISREL (Joreskog and Sorbom, 1989), (2) item-total correlations (Ghiselli, et al., 1981), and (3) all analyses eliminating five items with low item-total correlations (Ghiselli. et al., 1981). (Interested readers can obtain these results from the first author.) Taken together, the results suggest that the factors represent dimensions of a higher-level construct and that the number of dimensions is probably less than four.

[4] A measure demonstrates good distributional properties when its mean and median are similar, skewness is less than 2, and kurtosis is less than 5 (Ghiselli, et al., 1981; Kendall and Stuart, 1958).

[5] Ordinarily, factor analysis would be an appropriate technique to assess discriminant validity. However, our sample size is not large enough to support an analysis of the items from

Table 3. Correlates of the Seven-Item Microcomputer Playfulness Scale

Hypotheses and Measures	Undergraduate Students 1	2	3	Employees 5
1 Computer attitudes		.34**	.20*	.20*
2 Computer anxiety		−.60***	−.56***	−.46***
3 Computer competence:				
Self-rated experience	.38**	.49***	.51***	.37***
Base-line quiz			.26*	.42***
4 Computer efficacy				.32**
5 Gender (1 = male, 2 = female)	.09	.01	−.14	−.10
6 Age	−.07	.09	−.07	−.15
9 Involvement			.14	.49***
10 Positive affect (mood)			.33**	.34**
11 Satisfaction with trainer				.32**
12 Learning			.24*	.42***

Note: Sample sizes within studies were not constant across measures. Study 4 is excluded from the table because it assessed only test-retest ability. Hypothesis 5 uses a partial correlation controlling for computer experience. Hypotheses 7 and 8 do not utilize correlation and, thus, are not included here.

* $p < .05$; ** $p < .01$; *** $p < .001$.

proposed by Schmitt (1991), as deduced from Nunnally (1978), was used.

First, Schmitt (1991) suggests comparing the operational measures in terms of form and content. With respect to form, the measure for computer attitudes (a semantic differential format) presents pairs of adjectives to the participant and asks the participant to place an 'X' in the space that best reflects their attitude for each pair. In contrast, the microcomputer playfulness measure lists single adjectives reflecting self-characterizations of microcomputer interactions. With respect to content, none of the items in the pairs for computer attitudes appears in the microcomputer playfulness scale. The format of the computer anxiety scale (a list of statements) differs from the format of the microcomputer playfulness scale (a list of adjectives). With respect to content, the anxiety scale provides statements concerning computer apprehension, while the microcomputer playfulness scale presents adjectives concerning characterizations of microcomputer interactions. In sum, the operational measures for computer attitudes and computer anxiety differ significantly in form and content from the measure for microcomputer playfulness.

Second, Schmitt (1991) suggests performing a combined reliability analysis (of all items in the microcomputer playfulness, anxiety, and attitude scales). Evidence for discriminant validity can be demonstrated with low corrected item-total correlations (≤ .20, Ghiselli et al., 1981) and a poor internal consistency reliability (Schmitt, 1991).

more than one scale (Nunnally, 1978) without compromising statistical conclusion validity (Cook and Campbell, 1979). Therefore, since we did not have the sample size to support factor analysis, we utilized a procedure outlined by Schmitt (1991) that is independent of sample size. Schmitt, the editor of *Journal of Applied Psychology*, is a leading scholar in the study of psychometrics.

For the combined reliability analysis, an examination of corrected item-total correlations showed a range from .02 to .19 (average: .14) for the microcomputer playfulness items, from .00 to .22 (average: .06) for the computer anxiety items, and from .12 to .57 (average: .44) for the computer attitude items. Therefore, only the computer attitude items demonstrated reliability in the combined measure, and neither computer anxiety nor microcomputer playfulness related to the combined measure. This finding of high item-total correlations for the attitude measure does not represent a negative finding: the evidence would be inconsistent with discriminant validity only if one or more of the other scales also had demonstrated high values. Finally, as a measure of internal consistency reliability, an overall Cronbach's alpha of .67 was found; this is poor considering the large number of items (37 items: seven for playfulness, 19 for anxiety, and 11 for attitudes) (Nunnally, 1978). Therefore, both the low corrected item-total correlations and the poor reliability provide evidence for discriminant validity.

Third, Schmitt (1991) proposes that further evidence for discriminant validity can be obtained by analyzing item correlations. More specifically, correlations (of each item from the computer anxiety and attitude scales with the overall microcomputer playfulness scale) should be compared with the corrected item-total correlations for the microcomputer playfulness scale. If correlations between items and the overall microcomputer playfulness score are generally lower than the corrected item-total correlations for the microcomputer playfulness score, this provides additional evidence for discriminant validity. Here, the correlations for items from the computer anxiety and attitude scales with the microcomputer playfulness scale ranged from .02 to −.49; the corrected item-total correlations for the microcomputer playfulness scale ranged from .57 to .78. Therefore, these results provide further evidence of discriminant validity.

Lastly, Schmitt (1991) suggests comparing scale reliabilities with interscale correlations. Adequate discriminant validity is demonstrated, based on judgment, when internal consistency reliability is higher for each of the respective scales than its correlations with each of the other scales. That is, the reliabilities for each scale should be higher than any interscale correlations. All scale reliabilities for computer anxiety, attitudes, and microcomputer playfulness were over .80. In contrast, interscale correlations ranged from .15 to −.59, again providing evidence for discriminant validity. In sum, the results of these four analyses provide support for the discriminant validity of the microcomputer playfulness scale for related constructs (hypotheses 7 and 8).

Predictive validity

Hypotheses 9 through 12 examined the relationships between microcomputer playfulness and various outcome measures. Here, we found support for these hypotheses: that is, individuals who scored higher in microcomputer playfulness were more likely to report positive affect and satisfaction during computer interactions and to score higher in tests of learning at the end of training sessions (see Table 3). For involvement, we found a statistically significant relationship for the employee sample and a (non-significant) relationship in the expected direction for the student sample. Conflicting results for involvement may be due to differences in the operationalization of the constructs (Webster, 1989, for study 3 and Glynn, 1988, for study 5). Thus, we generally find support for the predictive validity of the microcomputer playfulness measure.

Predictive efficacy

Hypotheses 13 and 14 examined the predictive efficacy of microcomputer playfulness as compared with other constructs. Generally, to test predictive efficacy, correlations are compared (Pierce, et al., 1989); that is, the correlations between microcomputer playfulness and the outcome measures should be larger than the correlations between either computer attitudes or computer anxiety and the outcome measures. As Table 4 demonstrates, this was consistently the case.

In addition, Steiger's (1980) t-test, T_2, for dependent correlations, was used as a more stringent test of these hypotheses (see Table 4). For study 3, the correlations between microcomputer playfulness and the outcome measures differed at the .05 level from the correlations for computer attitudes and computer anxiety in three of the six comparisons. For study 5, the correlations for microcomputer playfulness differed at the .05

level in five of the eight comparisons. Thus, results of these hypotheses provide some evidence for the predictive efficacy of microcomputer playfulness.

Test-retest reliability

Test-retest reliability can be determined by correlating a user's score on the measure at two different time periods. In study 4, users completed the CPS twice at an interval of three months. The correlation between the measure at the two time periods was .85 ($p < .001$). Finding a relatively low test-retest correlation would have provided evidence that we should consider tempering our assertion that microcomputer playfulness is a trait. Our strong test-retest coefficient suggests the possibility that microcomputer playfulness, as we operationalized it, may be invariant to the situation and, thus, a relatively stable trait (compared to a less stable trait that is somewhat malleable). This assertion of stability is supported further by the fact that the test-retest was conducted in an MIS class in which students used

Table 4a. Predictive Efficacy Results for H13: Microcomputer Playfulness Versus Computer Attitudes

	Undergraduate Students (Study 3)			Employees (Study 5)		
	Correlations With:			Correlations With:		
Measures	Microcomputer Playfulness	Computer Attitudes	T_2	Microcomputer Playfulness	Computer Attitudes	T_2
Involvement	.18	.01	1.08	.52	.35	1.33+
Positive mood	.31	.07	1.56+	.35	.25	0.07
Satisfaction				.32	.10	1.52+
Learning	.25	−.02	1.65*	.44	.08	2.61*

Table 4b. Predictive Efficacy Results for H14: Microcomputer Playfulness Versus Computer Anxiety

	Undergraduate Students (Study 3)			Employees (Study 5)		
	Correlations With:			Correlations With:		
Measures	Microcomputer Playfulness	Computer Anxiety	T_2	Microcomputer Playfulness	Computer Anxiety	T_2
Involvement	.18	.09	0.43	.52	−.44	5.68**
Positive mood	.31	−.16	2.20*	.35	−.10	2.30*
Satisfaction				.32	−.25	2.96**
Learning	.25	−.12	1.68*	.44	−.27	3.85***

Note: Correlations for microcomputer playfulness differ slightly from Table 3 (where pairwise deletion was used) because listwise deletion of cases is required for Steiger's test.

+ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

several types of microcomputer software throughout the semester. Consequently, the consistent results between the two time periods suggests that microcomputer playfulness is relatively stable.

Discussion and Conclusions

To provide an initial assessment of the validity of the microcomputer playfulness measure (the CPS), this article reports on three survey studies and two training studies involving more than 400 participants. The results of these studies indicate that the CPS has good psychometric properties. Table 5 contains a summary of the hypothesized relationships as well as the actual relationships found for the nomological network. Generally, we found that microcomputer playfulness relates positively with computer attitudes, computer competence, and computer efficacy, and with outcomes such as involvement, positive mood, satisfaction, and learning. We also found that

Table 5. Summary of Hypothesized Relationships With Microcomputer Playfulness

Hypothesis	Relationship	Hypothesized	Actual
Concurrent Validity			
1	Computer attitudes	+	+
2	Computer anxiety	–	–
3	Computer competence	+	+
4	Computer efficacy	+	+
Discriminant Validity			
5	Gender	0	0
6	Age	0	0
7	Computer attitudes	a	a
8	Computer anxiety	a	a
Predictive Validity			
9	Involvement	+	+
10	Positive mood	+	+
11	Satisfaction	+	+
12	Learning	+	+
Predictive Efficacy			
13	Microcomputer playfulness versus computer attitudes with:		
	Involvement	$r_{play} > r_{attitude}$	$r_{play} > r_{attitude}$
	Positive mood	$r_{play} > r_{attitude}$	$r_{play} > r_{attitude}$
	Satisfaction	$r_{play} > r_{attitude}$	$r_{play} > r_{attitude}$
	Learning	$r_{play} > r_{attitude}$	$r_{play} > r_{attitude}$
14	Microcomputer playfulness versus computer anxiety with:		
	Involvement	$r_{play} > r_{anxiety}$	$r_{play} > r_{anxiety}$
	Positive mood	$r_{play} > r_{anxiety}$	$r_{play} > r_{anxiety}$
	Satisfaction	$r_{play} > r_{anxiety}$	$r_{play} > r_{anxiety}$
	Learning	$r_{play} > r_{anxiety}$	$r_{play} > r_{anxiety}$

Note: + = positive relationship; – = negative relationship; 0 = no relationship; a = microcomputer playfulness demonstrates discriminant validity.

microcomputer playfulness relates inversely with computer anxiety. After controlling for computer experience, we found no relationship between microcomputer playfulness and either gender or age. Further, we found that the measure demonstrated discriminant validity as compared with computer attitudes and computer anxiety. Finally, results indicate that microcomputer playfulness may represent a more efficient predictor of involvement, positive mood, satisfaction, and learning than either computer attitudes or anxiety. In sum, the results suggest that microcomputer playfulness represents a potentially important individual attribute whose influence should be examined in future research on human-computer interactions.

A short, seven-item scale measured microcomputer playfulness. To allow the construct maximum freedom to relate to other constructs, other researchers may wish to utilize the 17 items demonstrating high item-total correlations. Further, although our analyses suggest that the factors found in the factor analysis represent dimensions of a higher-order construct, future research should continue to examine the dimensionality of the construct. Perhaps the second factor portraying a questioning/inquisitive dimension is more applicable for certain types of situations than the first factor depicting a more creative/spontaneous dimension.

Recent research provides further evidence for construct validity of the CPS: the measure relates positively to intrinsic orientation to work and to attitudes toward innovation at work but does not relate to "socially desirable" responding (Glynn and Webster, 1991).[6] However, researchers should continue to assess the validity of the measure. For instance, future research could utilize the classic method of construct validity assessment, the Multitrait-Multimethod Matrix (MTMM) (Campbell and Fiske, 1959), or, preferably, more contemporary approaches (Bagozzi, et al., 1991). While useful, these methods have certain inherent limitations, one of which prevented their use in this article. The limitation focuses on the need for at least two parallel measures of the construct of interest (Campbell and Fiske, 1959). That is, in addition to the microcomputer playfulness measure for which we were assessing construct validity, we would need a parallel measure of microcomputer playfulness for which a degree of construct validity had already been assessed. Given the novelty of this theoretical construct, our empirical work represents the first systematic effort to operationalize microcomputer playfulness.

Another limitation of these methods is their reliance on multiple methods for measuring a construct. Multiple methods are troublesome to develop for constructs representing internal variables. That is, if multiple measures of microcomputer playfulness existed, they would be questionnaire measures (the same method) rather than multiple methods (such as observational techniques). It would be difficult for observers, for instance, to rate the trait of playfulness. For example, Webster (1989) attempted to rate the "state" of playfulness by videotaping users and capturing their keystrokes. These alternative methods correlated positively but weakly with the questionnaire measure of the state of playfulness. These alternative measures are less appropriate for the following reasons. Observational techniques are difficult to apply to constructs representing internal feelings (Davis, 1986) because behaviors may reflect other forces in the environment in addition to feelings (Ajzen and Fishbein, 1977). Thus, Sandelands and Buckner (1989) suggest that self-reports are the most appropriate methods for measuring playfulness. In sum, although future research assessing the validity of the microcomputer playfulness scale would benefit from the use of other assessment methods (see Bagozzi, et al., 1991), the assessment may be restricted by the use of self-reports only rather than multiple methods.

Our studies indicate that microcomputer playfulness relates positively to mood, involvement, and satisfaction. Clearly, if training is perceived by trainees as positive, they are more likely to be motivated to engage in additional training in the future. However, it should be kept in mind that

[6] Because playful individuals are intrinsically motivated (Barnett, 1991; Dewey, 1913) and demonstrate higher creativity and innovation (Amabile, 1988), correlations with intrinsic orientation and to attitudes toward innovation provide further evidence for concurrent validity of the scale. Also, a potential drawback with self-report measures concerns socially desirable responding or the tendency of individuals to characterize themselves in favorable ways. Because the CPS did not relate to Crowne and Marlowe's (1964) social desirability scale, this provides additional evidence of the validity of the construct.

these studies focused on the positive outcomes of microcomputer playfulness. This is not meant to imply that computer playfulness will be universally beneficial for organizations. On the contrary, we would expect more-playful employees to take longer to interact with computers (Sandelands, 1988). Therefore, the tradeoff between increased time to task completion and higher satisfaction, for example, must be made for particular tasks and occupations.

If satisfaction in human-computer interactions affects general satisfaction at work, further practical implications may result. Small positive relationships exist between general satisfaction at work and such outcomes as performance, turnover, and absenteeism. However, these effects do not need to be large in an absolute sense in order to produce meaningful economic consequences (Schneider, 1985; Zedeck and Cascio, 1984). Thus, with the increasing use of microcomputers in the workplace, future research should investigate the relationship between satisfaction resulting from microcomputer playfulness and general satisfaction at work. This research should extend our operationalization of satisfaction. For instance, employee training research recognizes satisfaction as a multi-faceted concept, including such facets as satisfaction with the trainer, the training experience, and the subject matter (Goldstein and Associates, 1989). Further, researchers in human-computer interaction emphasize the importance of satisfaction with the human-computer interaction (e.g., Chin, et al., 1988).

Our research showed that microcomputer playfulness relates positively to learning, as measured with a multiple-choice quiz. Although multiple-choice quizzes have been widely used in the study of learning performance in software training (e.g., Elias, et al., 1987; Gist, et al., 1988; 1989) and represent good measures of recall, future research should explore other, more behaviorally based measures of learning. For example, researchers could present users with a more complex task at the end of the training that requires them to put simple commands together in new ways. That is, researchers could determine whether users could generalize from the learned material to different tasks. Further, research needs to investigate the transfer of learning to the work setting.

More generally, does learning translate into employees who are better able to react to new situations or tasks using the software? Some contend that playfulness in the work context has its greatest value as a means of fostering creativity and flexibility (e.g., Starbuck and Webster, 1991). Because post-industrial societies are creating more and more jobs in which people are required to exhibit creativity and flexibility, playfulness may make these employees more adaptable (Levy, 1983; Miller, 1973; Starbuck and Webster, 1991). Again, future research is needed to determine the extent to which playfulness represents an important ingredient to adaptability in post-industrial societies.

Results of the training studies suggest that microcomputer playfulness may have higher predictive efficacy than either computer attitudes or computer anxiety. Past research on individuals' interactions with microcomputers has focused on general computer attitudes (e.g., Loyd and Gressard, 1984) or on computer anxieties (e.g., Meier, 1988). In line with recent trends suggesting that individual attitudes toward computers have become more positive over time, this research provides support for continued emphasis on positive aspects, such as microcomputer playfulness. However, future research should continue to explore outcome variables for which microcomputer playfulness demonstrates predictive efficacy and those for which computer attitudes or anxiety show superior predictive power.

Our research showed that microcomputer playfulness is relatively stable over the short term. However, subsequent microcomputer training research using playfulness should continue to examine whether this individual characteristic is stable over longer time periods or can be affected by the nature of an individual's interaction with a microcomputer. The stability of microcomputer playfulness has implications for pretraining assessment. If, as the results of this article suggest, microcomputer playfulness is a relatively stable characteristic (i.e., it cannot be changed in a training context), organizations may measure microcomputer playfulness and adopt different training programs for those with high and low microcomputer playfulness (i.e., an adaptive treatment approach). These training programs may differ in regard to training design characteristics, which may differentially affect one group over the other. Perhaps employees high in microcomputer playfulness have less need for formal software training programs because they find it easier to learn new software on their own. Therefore, future research should determine whether different training approaches can be designed to aid those employees low in microcomputer playfulness. For example, one such training program involves labelling the training as play rather than as work (Webster, et al., 1990). If, on the other hand, future research provides evidence that microcomputer playfulness is dynamic (i.e, it can be changed in a training context), we propose that organizations can increase microcomputer playfulness by involving employees in training programs that (1) positively enhance their attitudes toward computers; (2) lessen their computer anxieties; and (3) provide more experiences in using computers.

The general implications of identifying the influence of microcomputer playfulness on training outcomes relates to the emerging recognition of training as a strategic consideration (Schuler and Huber, 1990). Organizations will be concerned with developing and maintaining high performing employees who will make a positive incremental contribution to the bottom line of the organization over time. Strategic objectives may be better served through systematic career development programs that not only address the immediate goals of employees in their present jobs but also consider longer-range career issues (Schuler and Huber, 1990). As such, pre-training assessment activities should be made an integral part of career development activities within organizations (Noe, 1986). Thus, pre-training assessment of microcomputer playfulness may become an important ingredient in training programs.

A strength of this article rests in the use of a variety of samples, ranging from undergraduate students to employees, supporting the external validity of the findings. Additionally, unlike many studies using only self-report measures, our training studies encompassed more objective measures of performance. However, a limitation of our studies concerns the possible generalizability of the findings to first-time learners of microcomputers. These studies examined users familiar with microcomputers, and, thus, future research needs to examine whether the results extend to novices.

The collection of data at multiple time periods constitutes another strength of this article. However, additional longitudinal tests and model development encompassing the correlates and outcomes of both the trait and state of microcomputer playfulness are required. That is, in line with Davis (1989) and Day and Silverman (1989), it is important to take into account such factors as the nature of the computer system and the occupation of the user. For example, how does the state of computer playfulness differ on a mainframe computer as compared with a microcomputer (Katz, 1987)? More specifically, how do characteristics of information technologies influence the playfulness of users' interactions with them (Malone, 1984)? For instance, how do ease of use and usefulness of systems (Davis, 1989) relate to playfulness? Further, how does the nature of one's interaction with a computer differ depending on occupation (e.g., a systems analyst who may use a computer to develop software for end users versus a clerical employee who may use a computer for word processing applications)? More generally, future research should examine the relative influences of individual, task, technology, and situational characteristics on the state of playfulness in human-computer interactions.

In sum, this study provides theoretically based evidence for the continued study of motivational characteristics in human-computer interactions. Because of the potential positive outcomes of playfulness and because of the rapid diffusion of computers in organizations, research on the individual characteristic of microcomputer playfulness will have significant practical implications for organizations.

Acknowledgements

The authors thank the Center for Interdisciplinary Research in Information Systems at The Pennsylvania State University for financial support, the Computer Education Center at the University of Illinois for training support, and S. Banerjee for data collection assistance in study 1. We also thank the associate editor and reviewers for their constructive suggestions. An earlier version of this article was presented at the National Academy of Management Meetings, San Francisco, California, August 1990.

References

Ajzen, I. and Fishbein, M. "Attitude-Behavior Relations: A Theoretical Analysis and Review of Empirical Research," *Psychological Bulletin* (84:5), September 1977, pp. 888–918.

Amabile, T.M. "A Model of Creativity and Innovation in Organizations," in *Research in Organizational Behavior,* B.M. Staw and L.L. Cummings (eds.), JAI Press, Greenwich, CT, 1988, pp. 123–167.

Bagozzi, R.P., Yi, Y., and Phillips, L.W. "Assessing Construct Validity in Organizational Research," *Administrative Science Quarterly* (36:3), September 1991, pp. 421–458.

Bandura, A. "Self-Efficacy: Toward a Unifying Theory of Behavioral Change," *Psychological Review* (84:2), March 1977, pp. 191–215.

Bandura, A. and Cervone, D. "Differential Engagement of Self-Reactive Influences in Cognitive Motivation," *Organizational Behavior and Human Decision Processes* (38:1), August 1986, pp. 92–113.

Barnett, L.A. "Playfulness: Definition, Design, and Measurement," *Play and Culture* (3:4), November 1990, pp. 319–336.

Barnett, L.A. "The Playful Child: Measurement of a Disposition to Play," *Play and Culture* (4:1), February 1991, pp. 51–74.

Berlyne, D.E. "Laughter, Humor, and Play," in *The Handbook of Social Psychology,* 2nd edition, G. Lindzey and E. Aronson (eds.), Addison-Wesley, New York, NY, 1969 pp. 795–852.

Bologh, R.W. "On Fooling Around: A Phenomenological Analysis of Playfulness," *The Annals of Phenomenological Sociology* (1), 1976, pp. 113–125.

Bostrom, R.P., Olfman, L., and Sein, M.K. "The Importance of Learning Style in End-User Training," *MIS Quarterly* (14:1), March 1990, pp. 101–119.

Bowman, R.F., Jr. "A Pac-Man Theory of Motivation: Tactical Implications for Classroom Instruction," *Educational Technology* (22:9), September 1982, pp. 14–16.

Brancheau, J.C. and Wetherbe, J.C. "Key Issues in Information Systems Management," *MIS Quarterly* (11:1), March 1987, pp. 23–45.

Brief, A.P., Burke, M.J., George, J.M., Robinson, B.S., and Webster, J. "Should Negative Affectivity Remain an Unmeasured Variable in the Study of Job Stress?" *Journal of Applied Psychology* (73:2), May 1988, pp. 193–198.

Brod, C. *Technostress: The Human Cost of Computer Revolution*, Addison-Wesley, Reading, MA, 1984.

Campbell, D.T. and Fiske, D.W. "Convergent and Discriminant Validation by the Multitrait-Multimethod Matrix," *Psychological Bulletin* (56:2), March 1959, pp. 81–105.

Campbell, J.P. "The Agenda for Theory and Research," in *Training and Development in Organizations*, I.L. Goldstein and Associates (eds.), Jossey-Bass, San Francisco, CA, 1989, pp. 469–486.

Carroll, J.M. and Mack, R.L. "Learning to Use a Word Processor: By Doing, By Thinking and By Knowing," in *Human Factors in Computer Systems*, J.C. Thomas and M.L. Schneider (eds.), Ablex, Norwood, NJ, 1984, pp. 13–51.

Carroll, J.M. and Thomas, J.C. "Fun," *SIGCHI Bulletin* (19:3), January 1988, pp. 21–24.

Chin, J.P., Diehl, V.A., and Norman, K.L. "Development of an Instrument Measuring User Satisfaction of the Human-Computer Interface," *CHI'88 Conference Proceedings: Human Factors in Computing Systems,* Washington, DC, 1988, pp. 213–218.

Cook, T.D. and Campbell, D.T. *Quasi-Experimentation,* Houghton Mifflin, Boston, MA, 1979.

Costa, P.T. and McCrae, R.R. "From Catalog to Classification: Murray's Needs and the Five-Factor Model," *Journal of Personality and Social Psychology* (55:2), August 1988, pp. 258–265.

Cronbach, L.J. and Meehl, P.E. "Construct Validity in Psychological Tests, *Psychological Bulletin* (52:4), July 1955, pp. 281–302.

Crowne, D. and Marlowe, D. *The Approval Motive*, John Wiley and Sons, New York, NY, 1964.

Csikszentmihalyi, M. *Beyond Boredom and Anxiety*, Jossey-Bass, San Francisco, CA, 1975.

Csikszentmihalyi, M. *The Psychology of Optimal Experience,* Harper and Row, New York, NY, 1990.

Csikszentmihalyi, M. and LeFevre, J.A. "Optimal Experience in Work and Leisure," *Journal of Personality and Social Psychology* (56:5), May 1989, pp. 815–822.

Culnan, M.J. "The Intellectual Development of Management Information Systems, 1972–1982: A Co-Citation Analysis," *Management Science* (32:2), February 1986, pp. 156–172.

Day, D.V. and Silverman, S.B. "Personality and Job Performance: Evidence of Incremental Validity," *Personnel Psychology* (42:1), Spring 1989, pp. 25–36.

Day, H.I. "Play: A Ludic Behavior," in *Advances in Intrinsic Motivation and Aesthetics*, H.I. Day (ed.), Plenum Press, New York, NY, 1981, pp. 225–250.

Davis, F.D. *A Technology Acceptance Model for Empirically Testing New End-User Information Systems: Theory and Results*, unpublished doctoral dissertation, MIT Sloan School of Management, Cambridge, MA, 1986.

Davis, F.D. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly* (13:3), September 1989, pp. 319–339.

Dewey, J. "Play," in *A Cyclopedia of Education*, P. Monroe (ed.), Macmillan, New York, NY, 1913, pp. 725–727.

Elias, P.K., Elias, M.F., Robbins, M.A., and Gage, P. "Acquisition of Word-Processing Skills by Younger, Middle-Age, and Older Adults," *Psychology and Aging* (2:4), December 1987, pp. 340–348.

Ellis, M.J. *Why People Play*, Prentice-Hall, Englewood Cliffs, NJ, 1973.

Gantz, J. "The Growing Power of the Telecom Manager," *Telecommunications Products Plus Technology* (4), 1986, p. 33.

Gardner, D.G. "Activation Theory and Task Design: An Empirical Test of Several New Predictions," *Journal of Applied Psychology* (71:3), August 1986, pp. 411–418.

Gardner, E.P., Young, P., and Ruth, S.R. "Evolution of Attitudes Toward Computers: A Retrospective Review," *Behaviour and Information Technology* (8:2), 1989, pp. 89–98.

George, J.M. "Mood and Absence," *Journal of Applied Psychology* (74:2), April 1989, pp. 317–324.

George, J.M. "State or Trait: Effects of Positive Mood on Prosocial Behaviors at Work," *Journal of Applied Psychology* (76:2), April 1991, pp. 299–307.

Ghani, J.A. "Flow in Human-Computer Interactions: Test of a Model," in *Human Factors in Management Information Systems: An Organizational Perspective,* J. Carey (ed.), Ablex, Norwood, NJ, 1991.

Ghiselli, E.E., Campbell, J.P., and Zedeck, S. *Measurement Theory for the Behavioral Sciences,* W. H. Freeman and Company, San Francisco, CA, 1981.

Gilroy, F.D. and Desai, H.B. "Computer Anxiety: Sex, Race and Age," *International Journal of Man-Machine Studies* (25:6), December 1986, pp. 711–719.

Gist, M., Rosen, B., and Schwoerer, C. "The Influence of Training Method and Trainee Age on the Acquisition of Computer Skills," *Personnel Psychology* (41:2), Summer 1988, pp. 255–265.

Gist, M., Schwoerer, C., and Rosen, B. "Effects of Alternative Training Methods on Self-Efficacy and Performance in Computer Software Training," *Journal of Applied Psychology* (74:6), December 1989, pp. 884–891.

Glynn, M.A. *The Perceptual Structuring of Tasks: A Cognitive Approach to Understanding Task Attitudes and Behavior,* unpublished doctoral dissertation, Columbia University, New York, NY, 1988.

Glynn, M.A. and Webster, J. "A Comparative Examination of the Work Perceptions and Attitudes of the Highly Intelligent," working paper, Yale University, New Haven, CT, 1991.

Glynn, M.A., and Webster, J. "The Adult Playfulness Scale: An Initial Assessment," *Psychological Reports* (71), pp. 83–103.

Goldstein and Associates, *Training and Development in Organizations,* Jossey-Bass, San Francisco, CA, 1989.

Heinssen, R.K., Jr., Glass, C.R., and Knight, L.A. "Assessing Computer Anxiety: Development and Validation of the Computer Anxiety Rating Scale," *Computers in Human Behavior* (3:1), 1987, pp. 49–59.

Hess, R.D., and Miura, I.T. "Gender Differences in Enrollment in Computer Camps and Classes," *Sex Roles* (13:3/4), August 1985, pp. 193–204.

Hiemstra, G. "You Say You Want a Revolution? 'Information Technology' in Organizations," *Communication Yearbook* (7), 1983, pp. 802–827.

Hill, T., Smith, N.D. and Mann, M.F. "Role of Efficacy Expectations in Predicting the Decision to Use Advanced Technologies: The Case of Computers," *Journal of Applied Psychology* (72:2), May 1987, pp. 307–313.

Hollenbeck, J.R. and Brief, A.P. "The Effects of Individual Differences and Goal Origin on Goal Setting and Performance," *Organizational Behavior and Human Decision Processes* (40:3), December 1987, pp. 392–414.

Hollenbeck, J.R., O'Leary, A.M., Klein, H.J., and Wright, P.M. "Investigation of the Construct Validity of a Self-Report Measure of Goal Commitment," *Journal of Applied Psychology*

(74:6), December 1989, pp. 951–956.

Howard, G.S. and Smith, R.D. "Computer Anxiety in Management: Myth or Reality?" *Communications of the ACM* (29:7), July 1986, pp. 611–615.

Igbaria, M., Parasuraman, S., and Pavri, F. "A Path Analytic Study of the Determinants of Microcomputer Usage," *Journal of Management Systems* (2:2), 1990, pp. 1–14.

Ilgen, D.R., Fisher, C.D., and Taylor, M.S. "Consequences of Individual Feedback on Behavior in Organizations," *Journal of Applied Psychology* (64:4), August 1979, pp. 349–371.

Joreskog, K.G. and Sorbom, D. *LISREL 7. A Guide to the Program and Applications*, SPSS Inc., Chicago, IL, 1989.

Joshi, K. "The Measurement of Fairness or Equity Perceptions of Management Information Systems Users," *MIS Quarterly* (13:3), September 1989, pp. 343–358.

Kabanoff, B. "Work and Nonwork: A Review of Models, Methods, and Findings," *Psychological Bulletin* (88:1), July 1980, pp. 60–77.

Kamouri, A.L., Kamouri, J., and Smith, K.H. "Training by Exploration: Facilitating the Transfer of Procedural Knowledge Through Analogical Reasoning," *International Journal of Man-Machine Studies* (24:2), February 1986, pp. 171–192.

Katz, J.A., "Playing at Innovation in the Computer Revolution," in *Psychological Issues of Human Computer Interaction in the Work Place,* M. Frese, E. Ulich, and W. Dzida (eds.), North-Holland, Amsterdam, 1987, pp. 97–111.

Kendall, M.G. and Stuart, A. *The Advanced Theory of Statistics,* Hafner, New York, NY, 1958.

Kusyszyn, I. "How Gambling Saved Me From a Misspent Sabbatical," *Journal of Humanistic Psychology* (17:3), September 1977, pp. 19–34.

Lee R.S. "Social Attitudes and the Computer Revolution," *Public Opinion Quarterly* (34:1), Spring 1970, pp. 53–59.

Levy, J. *Play Behavior*, Robert E. Krieger, Malabar, FL, 1983.

Lieberman, J.N. *Playfulness*, Academic Press, New York, NY, 1977.

Lieberman, J.N. Personal communication with authors, March 10, 1988.

Lockheed, M.E. "Women, Girls, and Computers: A First Look at the Evidence," *Sex Roles* (13:3/4), August 1985, pp. 115–122.

Loyd, B.H. and Gressard, C. "Reliability and Factorial Validity of Computer Attitude Scales," *Educational and Psychological Measurement* (44:2), Summer 1984, pp. 501–505.

Malone, T.W. *What Makes Things Fun to Learn? A Study of Intrinsically Motivating Computer Games,* Cognitive and Instructional Sciences Series, Vol. CIS-7 (SSL-80-11), Xerox, Palo Alto, CA, 1980.

Malone, T.W. "Heuristics for Designing Enjoyable User Interfaces: Lessons from Computer Games," in *Human Factors in Computer Systems,* J.C. Thomas and M.L. Schneider (eds.), Ablex Publishing Corp., Norwood, NJ, 1984, pp. 1–12.

Martocchio, J.J. and Webster, J. "Effects of Feedback and Cognitive Playfulness on Performance in Microcomputer Software Training," *Personnel Psychology,* 1992, forthcoming.

McGrath, J.E., and Kelly, J.R. *Time and Human Interaction,* The Guilford Press, New York, NY, 1986.

Meier, S.T. "Predicting Individual Differences in Performance on Computer-Administrated Tests and Tasks: Development of the Computer Aversion Scale," *Computers in Human Behavior* (4), 1988, pp. 175–187.

Miller, S. "Ends, Means, and Galumphing: Some Leitmotifs of Play," *American Anthropologist* (75), 1973, pp. 87–98.

Moore, G.C. and Benbasat, I. "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation," *Information Systems Research* (2:3), September 1991, pp. 192–222.

Mumford, M.D., Weeks, J.L., Harding, F.D., and Fleishman, E.A. "Relations Between Student Characteristics, Course Content, and Training Outcomes: An Integrative Modeling Effort," *Journal of Applied Psychology* (73:3), August 1988, pp. 443–456.

Nash, J.E. "Working at and Working: Computer Fritters," *Journal of Contemporary Ethnography* (19:2), July 1990, pp. 201–225.

Nelson, R.R. and Cheney, P.H. "Training End Users: An Exploratory Study," *MIS Quarterly* (11:4), December 1987, pp. 547–559.

Noe, R.A. "Trainees' Attributes and Attitudes: Neglected Influences on Training Effectiveness," *Academy of Management Review* (11:4), October 1986, pp. 736–749.

Nunnally, J.C. *Psychometric Theory*, McGraw

Hill, New York, NY, 1978.

Nykodym, N., Simonetti, J.L., and Christen, J. "Compustress: The Fear of Computer Usage Among College of Business Administration Students," *The Journal of Applied Business Research* (4:4), Fall 1988, pp. 84–87.

Ord, J.G. "Who's Joking? The Information System at Play," *Interacting with Computers: The Interdisciplinary Journal of Human-Computer Interaction* (1:3), December 1989, pp. 118–128.

Papert, S. *Mindstorms*, Basic Books, New York, NY, 1980.

Parasuraman, S. and Igbaria, M. "An Examination of Gender Differences in the Determinants of Computer Anxiety and Attitudes Toward Microcomputers Among Managers," *International Journal of Man-Machine Studies* (32:3), March 1990, pp. 327–340.

Piaget, J. *Play, Dreams, and Imitation in Childhood*, W. W. Norton, New York, NY, 1962.

Pierce, J.L., Garner, D.G., Cummings, L.L., and Dunham, R.B. "Organization-Based Self-Esteem: Construct Definition, Measurement, and Validation," *Academy of Management Journal* (32:3), September 1989, pp. 622–648.

Ruth, S.R. and Gardner, E.P. "Establishing User Metrics: New Approaches to an Emerging Problem in Organizations," *Proceedings of the 1987 Annual Meeting of the Decision Sciences Institute,* Boston, MA, 1987, pp. 251–254.

Sandelands, L.E. "Effects of Work and Play Signals on Task Evaluation," *Journal of Applied Social Psychology* (18:12), September 1988, pp. 1032–1048.

Sandelands, L.E. and Buckner, G.C. "Of Art and Work: Aesthetic Experience and the Psychology of Work Feelings," in *Research in Organizational Behavior* (11), L.L. Cummings and B.M. Staw (eds.), JAI Press, Greenwich, CT, 1989, pp. 105–131.

Sandelands, L.E., Ashford, S.J., and Dutton, J.E. "Reconceptualizing the Overjustification Effect: A Template-Matching Approach," *Motivation and Emotion* (7:3), September 1983, pp. 229–255.

Schmitt, N. Personal communication with authors, June 7, 1991.

Schneider, B. "Organizational Behavior," in *Research in Organizational Behavior* (5), L.L. Cummings and B.M. Staw (eds.), JAI Press, Greenwich, CT, 1985, pp. 1–31.

Schuler, R.S. and Huber, V.L. *Personnel and Human Resource Management,* 4th edition, West Publishing, St. Paul, MN, 1990.

Schwab, D.P. "Construct Validity in Organizational Behavior," in *Research in Organizational Behavior* (2), B.M. Staw and L.L. Cummings (eds.), JAI Press, Greenwich, CT, 1980, pp. 3–43.

Sechrest, L. "Incremental Validity," *Educational and Psychological Measurement* (23:1), 1963, pp. 153–158.

Starbuck, W.H., and Webster, J. "When is Play Productive?" *Accounting, Management, and Information Technology* (1:1), 1991, pp. 71–90.

Steiger, J.H. "Tests for Comparing Elements of a Correlation Matrix," *Psychological Bulletin* (87:2), March 1980, pp. 245–251.

Straub, D.W. "Validating Instruments in MIS Research," *MIS Quarterly* (13:2), June 1989, pp. 147–169.

Tang, T.L. and Baumeister, R.F. "Effects of Personal Values, Perceived Surveillance, and Task Labels on Task Preference: The Ideology of Turning Play into Work," *Journal of Applied Psychology* (69:1), February 1984, pp. 99–105.

Turkle, S. *The Second Self*, Simon and Schuster, New York, NY, 1984.

Turnage, J.J. "The Challenge of New Workplace Technology for Psychology," *American Psychologist* (45:2), February 1990, pp. 171–178.

Watson, D. and Pennebaker, J.W. "Health Complaints, Stress, and Distress: Exploring the Central Role of Negative Affectivity," *Psychological Review* (96:2), April 1989, pp. 234–254.

Watson, D. and Tellegen, A. "Toward a Consensual Structure of Mood," *Psychological Bulletin* (98:2), September 1985, pp. 219–235.

Watson, D., Clark, L.A., and Carey, G. "Positive and Negative Affectivity and Their Relation to Anxiety and Depressive Disorders," *Journal of Abnormal Psychology* (97:3), August 1988, pp. 346–353.

Webster, J. *Playfulness and Computers at Work,* unpublished doctoral dissertation, New York University, New York, NY, 1989.

Webster, J. "Studying the State of Playfulness in Human-Computer Interactions," working paper, Pennsylvania State University, University Park, PA, 1991.

Webster, J., Heian, J.B., and Michelman, J.E. "Computer Training and Computer Anxiety in the Educational Process: An Experimental Analysis," *Proceedings of the Eleventh International Conference on Information Systems,* Copenhagen, Denmark, 1990, pp. 171-182.

Weinberg, S. and Fuerst, M. *Computer Phobia: How to Slay the Dragon of Computer Fear,* Banbury Books, Wayne, PA, 1984.

Weiss, H.M. and Knight, P.A. "The Utility of Humility: Self-Esteem, Information Search, and Problem-Solving Efficiency," *Organizational Behavior and Human Performance* (25:2), April 1980, pp. 216-223.

Zedeck, S. and Cascio, W.F. "Psychological Issues in Personnel Decisions," *Annual Review of Psychology* (35), 1984, pp. 461-518.

Zoltan, E. and Chapanis, A. "What Do Professional Persons Think About Computers?" *Behaviour and Information Technology* (1:1), January-March 1982, pp. 55-68.

About the Authors

Jane Webster is assistant professor of management information systems at the Pennsylvania State University. She holds a Ph.D. in management and information systems from New York University. Her research interests focus on human-computer interactions, computer training, electronic communications, and the impacts of information systems. She has published articles in the *Academy of Management Journal, Communication Research, International Conference on Information Systems, Journal of Applied Psychology, Journal of Management, Journal of Personality and Social Psychology,* and *Personnel Psychology.*

Joseph J. Martocchio is assistant professor of labor and industrial relations at the Institute of Labor and Industrial Relations, University of Illinois at Urbana-Champaign. He holds an M.L.I.R. degree and a Ph.D. in human resources management from Michigan State University's School of Labor and Industrial Relations. His research interests include employee absenteeism and employee training. He has published articles in *Human Relations, Human Resource Planning, Journal of Applied Psychology, Journal of Management, Organizational Behavior and Human Decision Processes, Personnel Psychology,* and *Psychology and Aging.*

Appendix
Measures Used in Studies

Computer Anxiety

The Computer Anxiety Rating Scale (CARS) measured computer anxiety. Heinssen, et al. (1987) developed this 19-item self-report inventory to measure computer anxiety. Participants respond on five-point scales (from strongly disagree to strongly agree) to nine positively worded items, and 10 negatively worded items, such as "I feel apprehensive about working at a computer terminal." Scores range from 19 (low computer anxiety) to 95 (high computer anxiety). Heinssen, et al. (1987) reported an internal consistency reliability of .87 and a test-retest reliability of .70 over four weeks. They reported high correlations with other anxiety measures and negative correlations with computer attitudes, computer experience, SAT scores, mechanical interest, and expectations of performance on a computer task. This measure has demonstrated high validity and reliability (Webster, et al., 1990). In the studies reported in this article, internal consistency reliabilities ranged from .81 to .95.

Computer Attitudes

Zoltan and Chapanis' (1982) General Attitudes Scale measured general attitudes toward computers. It is based on 41 pairs of adjectives in a semantic differential format, such as efficient-inefficient. Their factor analysis of the scale resulted in six factors; here, we used the 11 pairs of adjectives (each based on a seven-point scale) making up the first factor. Possible scores range from 11 to 77, where higher scores indicate positive attitudes. Zoltan and Chapanis found that experienced users were more likely to stress positive adjectives than were inexperienced users. This measure has demonstrated high validity and reliability (Webster, et al., 1990). In the studies reported in this article, internal consistency reliability ranged from .88 to .97.

Computer Efficacy Beliefs

Self-efficacy was measured using a six-item scale adapted from Hollenbeck and Brief (1987). We chose to use this scale rather than a scale that requires estimation of one's confidence (e.g., the scale utilized by Gist et al., 1989). We believe that individuals would experience difficulty in estimating confidence levels when complex and abstract features of a word processing program would be learned for the first time. The format of our scale is consistent with other research examining self-efficacy (e.g., Hill, et al., 1987; Hollenbeck and Brief, 1987).

Responses were measured using a seven-point Likert scale ranging from strongly disagree to strongly agree. Sample items include "I believe that WordPerfect Merging is a task on which I can perform well," and "It is just not possible for me to use WordPerfect Merging as well as I would like" (reverse-scored). Coefficient alpha was .95.

Computer Competence

From four to five items captured self-rated computer skills, computer experiences, typing skills, and computer usage. For example, one measure of computer skills asked participants to rate their skill levels with personal computers on five-point scales ranging from very low to very high. Internal consistency reliability ranged from .55 to .77 in the studies reported here.

Additionally, in studies 3 and 5, base-line quizzes captured knowledge of the specific computer packages. In study 3, a 15-item multiple-choice quiz was developed to measure knowledge of Lotus 1-2-3. For example, one item stated, "Which of the following symbols informs the software that a function is to be used? (a.) *, (b.) /, (c.) +, (d.) @." Internal consistency reliability for this quiz was .84.

In study 5, a 10-item multiple-choice quiz was developed to measure knowledge of WordPerfect 5.0; internal consistency reliability was .86. For example, one item stated, "Pressing the <HOME> key: 1. puts you at the top of the document, 2. puts you at the top of the screen, 3. puts you at the top of the page, 4. only works in combination with other keys, 5. is not used in WordPerfect."

Involvement

In study 3, "flow" measured involvement. Csikszentmihalyi (1975) created an interview checklist to rate the "intensity of flow," or the incidence of individual experiences during playful activities (such as the loss of perception of surroundings, the reduction in thinking about other things, and so on). We used Webster's (1989) 11-item self-rated Intensity of Flow Scale developed from Csikszentmihalyi's checklist. Internal consistency reliability of .74 has been found for this scale (Webster, 1989). For this study, it was .94.

In study 5, we used five items from Glynn's (1988) Involvement Scale to measure involvement. Sample items include "I felt very involved" and "I felt like I was just going through the motions." Participants rate their degree of agreement with the items on five-point scales ranging from strongly disagree to strongly agree. Internal consistency reliability of .83 has been reported for the five items, and these items have related positively to a general measure of playfulness (Webster, 1989). In study 5, internal consistency was .94.

Positive Mood

Brief, et al. (1988) developed a Job Affect Scale (JAS) based on 20 markers of positive and negative affect described by Watson and Tellegen (1985). Participants indicate how they feel during the training session by responding to such markers as "active," "calm," and "distressed" on five-point scales ranging from "very slightly" to "very much." The instructions for the scale were modified slightly to make them more appropriate for mood due to the computer interaction itself rather than due to a pervasive mood state. Internal consistency reliability for the 10 positive items ranged from .71 to .96 in the studies reported in this article.

Satisfaction

Satisfaction was operationalized as satisfaction with the trainer. For study 5, a five-item semantic differential scale was developed to assess trainees' satisfaction with the trainer. For example, one pair contained the following: "not satisfied with the instructor" and "satisfied with the instructor." Internal consistency reliability was .89.

Learning

Objective measures of learning were utilized. Multiple-choice quizzes were designed for the training sessions in studies 3 and 5 to capture learning of the materials. For study 3, a 15-item multiple-choice quiz testing learning of Lotus 1-2-3 had an internal consistency reliability coefficient of .88. For example, one item stated, "If you copied the formula +$A$1*B1 from cell C1 to cell C2, the formula in C2 would be: (a.) +$A$1*B2, (b.) +$A$2*B2, (c.) +$A$1*B1, (d.) +$A1*B1, (e.) +$A1*B2."

In study 5, a 10-item multiple-choice quiz testing learning of WordPerfect 5.0 merging had an internal consistency reliability coefficient of .84. For example, one item stated, "The ^C code allows you to: 1. Halt a merge so that you can enter information, 2. Halt a merge so that you can modify a secondary file, 3. Cancel the merge, 4. Find the next record in the secondary file, 5. None of the above."