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MANAGEMENT USE OF COMPUTER TECHNOLOGY: A COMPARISON OF TWO THEORETICAL MODELS

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FOR DISCUSSION PURPOSES ONLY

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Abstract

Computer-based management support systems do little good if they aren't used. Unfortunately, underutilization is a widespread problem which undermines efforts to bring computer power to bear on complex management problems. In order to develop strategies for increasing user acceptance, we first must gain a better understanding of what causes managers to accept or reject computers. We compare two alternative models of the underlying beliefs and attitudes that determine user acceptance: Ajzen and Fishbein's (1980) theory of reasoned action (TRA) and Davis's (1987a; 1987c) technology acceptance model (TAM). Empirical results from a longitudinal study of 107 users indicate that TAM provides a significantly better explanation of why users decide to use or not use computers. Measuring peoples' intentions to use a particular application after a brief introduction, we were able to predict their frequency of use 14 weeks later. Perceived usefulness was the single most influential determinant of peoples' intentions. Perceived ease of use was also significantly linked to intentions, but had less influence than usefulness. Perceived accessibility of the system emerged as a third influential determinant of intentions. Attitudes mediated some, but not all, of the effects of perceptions on intentions. This research contributes toward a paradigmatic foundation for future theorizing and research concerning user acceptance of computer systems. Moreover, the models, measures and results presented herein have several direct implications for MIS practice.

1. Introduction

It's well-known that managers are often unwilling to use computers. The development of advanced computer-based tools to support managerial planning, decision-making, and communication processes chronically outpaces the effective implementation of those tools in the organization. Managers tend to forego the opportunity to utilize available computing that, if used, would generate significant performance gains (e.g., Alavi & Henderson, 1981; Nickerson, 1981). The raw power of computer hardware continues to increase tenfold each decade (Peled, 1987), creating the possibility for sophisticated new management support applications. As technical barriers get removed, our ability to create software systems that managers are willing to use increasingly becomes the pivotal factor in harnessing the expanding power of the computer. Recognizing this reality, designers are devoting more and more attention and development resources toward assuring the acceptability of new systems (e.g., Alavi, 1984; Bewley, et al., 1983; Branscomb & Thomas, 1985; Gould & Lewis, 1985). This has caused practitioners and researchers to take stock of what we really know about why managers resist computers.

Understanding what causes people to accept or reject computers has proven to be one of the most challenging research areas in MIS. Investigators have studied the impact of users' underlying beliefs and attitudes on their usage behavior (e.g., Bailey & Pearson, 1983; DeSanctis, 1983; Fuerst & Cheney, 1982; Ginzberg, 1981; Ives, Olson & Baroudi, 1983; Swanson, 1974; Lucas, 1975; Maish, 1979; Schewe, 1976; Schultz & Slevin, 1975; Robey, 1979; Swanson, 1974; 1987), and how these beliefs and attitudes are, in turn, influenced by various managerially controllable factors, such as the system's technical design characteristics (e.g., Benbasat & Dexter, 1986; Benbasat, Dexter & Todd, 1986; Dickson, DeSanctis & McBride, 1986; Gould, Conti & Hovanyecz, 1983; Malone, 1981), user involvement in

development (e.g., Baroudi, Olson & Ives, 1986; Franz & Robey, 1986; Swanson, 1974), the type of system development process used (e.g., Alavi, 1984; King & Rodriguez, 1981, McKeen, 1983), and the nature of the implementation process (e.g., Ginzberg, 1978; Vertinsky, Barth & Mitchell, 1975; Zand & Sorensen, 1975).

In general, however, these research findings have been mixed and inconclusive (Baroudi, Olson & Ives, 1987; Kwon & Zmud, in press). The difficulty stems largely from the absence of established theory concerning the cognitive and affective determinants of user behavior. A wide array of different belief, attitude, and satisfaction measures have been employed, often without adequate theoretical or psychometric justification (for further analysis of previous research, see Davis, 1987b and Swanson, 1982). Progress has been impeded by the lack of an integrating paradigm to guide theory development and provide a basis for cumulative research programs. MIS investigators are increasingly looking to attitude theory from psychology (e.g., Fishbein & Ajzen, 1975) as a reference paradigm and conceptual foundation for MIS theorizing and research (Baroudi, Olson & Ives, 1987; Swanson, 1982; Trice & Treacy, 1986; Christie, 1981).

One specific model from attitude theory, Ajzen and Fishbein's (1980; Fishbein & Ajzen, 1975) theory of reasoned action (TRA), has been suggested as a model appropriate for the study of computer usage behavior (Christie, 1981; Trice and Treacy, 1986), although to date, its applicability to computer usage has not been tested. TRA is a widely-studied model from psychology "designed to explain virtually any human behavior" (Ajzen & Fishbein, 1980, p. 4) which may be applied to computer usage behavior as a special case.

Davis (1987a; 1987b; 1987c) recently introduced a second theoretical model, the technology acceptance model (TAM), which is specifically designed to explain computer usage behavior. TAM uses attitude theory as a basis for integrating a small number of

fundamental variables and relationships observed repeatedly across numerous MIS studies. In designing TAM, the attitude paradigm was used to guide (a) the formation of conceptual definitions of theoretical constructs, (b) the development of valid, reliable measures for the constructs, and (c) the specification of causal relationships among the constructs. TAM is considerably less general than TRA, designed to apply only to computer usage behavior. But because it takes advantage of context-specific knowledge accumulated from over a decade of research within MIS, TAM may be more powerful than TRA for explaining people's decisions to use or not to use computers.

The purpose of the present research is to empirically compare TRA and TAM from the standpoint of their ability to explain user acceptance and rejection of computer-based technology. We first examine and compare the major characteristics of the two models. A longitudinal study of 107 MBA students provides empirical data for assessing which of the two models best explains voluntary usage of a word processing system.

2. Theory of Reasoned Action (TRA)

The theory of reasoned action (TRA) is a widely studied model from social psychology which is concerned with the determinants of consciously intended behaviors (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) (see Figure 1). According to TRA, a person's performance of a specified behavior is determined by his or her behavioral intention (BI) to perform the behavior, and BI is jointly determined by the person's attitude (A) and subjective norm (SN) concerning the behavior in question:

$$(1) \quad BI = w_1 A + w_2 SN$$

Intention is typically defined as an individual's subjective probability that he or she will perform the specified behavior (e.g., Fishbein & Ajzen, 1975, p. 288). Attitude (A) refers to an individual's degree of evaluative affect toward the target behavior

(e.g., Fishbein & Ajzen, 1975, p. 216). Subjective norm refers to "the person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein & Ajzen, 1975, p. 302). The weights (w_1 and w_2) reflect the relative influence of A and SN on BI, and are typically estimated via multiple regression.

According to TRA, a person's attitude toward the target behavior is determined by his or her salient beliefs (b_i) about consequences of performing the behavior multiplied by the evaluation (e_i) of those consequences:

(2) $A = \Sigma\, b_i\, e_i$

This equation is based on the expectancy-value attitude model originally introduced by Rosenberg (1956) and refined by Fishbein (1963). Beliefs (b_i) are defined as the individual's subjective probability that performing the target behavior will result in consequence i. The evaluation term (e_i) refers to "an implicit evaluative response" to the consequence (Fishbein & Ajzen, 1975, p. 29). Equation 2 represents an information-processing view of attitude formation and change which posits that external stimuli influence attitudes only indirectly through changes in the person's belief structure (e.g., Ajzen & Fishbein, 1980, 82-86).

TRA theorizes that an individual's subjective norm (SN) is determined by a multiplicative function of his or her normative beliefs (nb_i), or perceived expectations of specific referent individuals or groups, and his or her motivation to comply (mc_i) with those expectations (Fishbein & Ajzen, 1975, p. 302):

(3) $SN = \Sigma\, nb_i\, mc_i$

A substantial body of empirical data in support of TRA has accumulated (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975; Ryan & Bonfield, 1975; Sheppard, Hartwick & Warshaw, in press). TRA has been widely used in applied research settings spanning a variety of subject areas (Brinberg & Durand, 1983; Davidson & Morrison, 1983;

Hom, Katerburg & Hulin, 1979; Jaccard & Davidson, 1972; Manstead, Proffitt & Smart, 1983), while at the same time stimulating a great deal of theoretical research aimed as understanding the theory's limitations, testing key assumptions and analyzing various refinements and extensions (Bagozzi, 1981, 1982, 1984; Bentler & Speckart, 1979; 1981; Ryan, 1982; Saltzer, 1981; Warshaw, 1980a, 1980b; Warshaw & Davis, 1984, 1985, 1986; Warshaw, Sheppard & Hartwick, in press).

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3. Technology Acceptance Model (TAM)

The technology acceptance model (TAM), introduced by Davis (1987a; 1987b; 1987c) (See Figure 2), is specifically tailored for modeling user acceptance of information systems. TAM's formulation takes into consideration (1) findings from a large number of MIS studies dealing with the cognitive and affective determinants of user acceptance and (2) several theoretical and psychometric considerations from psychology.

According to TAM, computer usage behavior is determined by an individual's behavioral intention to use (BI), and intention is jointly determined by the person's attitude toward using (A) and perceived usefulness (U), with relative weights estimated by regression:

(4) $BI = w_{1,1} A + w_{1,2} U$

Perceived usefulness (U) is the prospective user's subjective probability that using the particular system will increase his or her performance within an organizational context. Perceived usefulness (U) is theorized to have both a direct effect on intention to use (BI) and an indirect effect via attitude toward using (A). Attitude toward using (A), in turn, is jointly

determined by perceived usefulness (U) and perceived ease of use (E):

(5) $A = w_{2,1} U + w_{2,2} E$

Perceived ease of use (E) refers to the degree to which the prospective user expects the target system to be free of effort, and is theorized to have a direct effect on perceived usefulness:

(6) $U = w_{3,1} E + \Sigma w_{3,i+1} S_i$

To understand the rationale behind the impact of ease of use on usefulness, consider that perceived usefulness (U) is the expected impact on one's own organizational performance if one uses the target system. Ease of use is the opposite of one's perceived effort of using. All else being equal, the easier to use a system is perceived to be (E), the greater will be the perceived overall productivity impact of using (U). Time and effort saved from the particular task for which the computer is being used can be reallocated to other activities. Hence, according to TAM, perceived ease of use is a determinant of perceived usefulness. (For a further discussion of the ease of use-usefulness link, see Davis (1987a).)

Perceived usefulness (U) can obviously be affected by factors other than ease of use (E) however. For example, consider two forecasting systems which are equally easy to operate. If one of them produces a more accurate forecast, it would likely be seen as more useful (U) than the other, despite the ease of use parity. If one graphics program produces higher quality graphs than its equally easy to use counterparts, it should be considered more useful. Hence, the design characteristics of the system (S_i) have a direct effect on usefulness.

Perceived ease of use (E) is also determined by the design characteristics of the system (S_i). Many system features are specifically intended to enhance usability, such as menus, icons, mice, and touch screens (e.g., Bewley, et al., 1983). A system's

functional content may also exert an influence on perceived ease of use. For example, a more advanced computer model may be more difficult to use, due to its relative complexity, than its easier to use counterpart, although the two systems may use basically the same user interface technique. Ease of use is therefore influenced by the design characteristics of the system.

(7) $E = \Sigma w_{4,i} S_i$

The specification of these two beliefs for TAM is based on several previous MIS studies spanning a wide range of system types and user populations. Perceived usefulness (U) and variables similar to it such as perceived relevance and importance have been empirically linked to usage and self-predicted usage, as specified in equation 4 (e.g.,DeSanctis, 1983; Fuerst & Cheney, 1982; Robey, 1979; Robey & Zeller, 1978; Schultz & Slevin, 1975; Swanson, 1987); to attitudes, as specified in equation 5 (e.g.,Barrett, Thornton & Cabe, 1968; Ginzberg, 1981; Ives, Olson & Baroudi, 1983; Swanson, 1987), and to system characteristics, as specified in equation 6 (e.g., Benbasat & Dexter, 1986; Benbasat, Dexter & Todd, 1986; Lucas, 1981, Miller, 1977). Similarly, perceived ease of use (E) has previously been found to be correlated with attitudes (equation 5) (e.g., Barrett, Thornton & Cabe, 1968; Ives, Olson & Baroudi, 1983; Swanson, 1987); perceived usefulness (equation 6) (e.g., Barrett, Thornton & Cabe, 1968; Schewe, 1976; Swanson, 1987), and system characteristics (equation 7) (e.g., Benbasat, Dexter & Todd, 1986; Bewley, et al., 1983; Dickson, DeSanctis & McBride, 1986; Magers, 1983; Miller, 1977; Poller & Garter, 1983). Additionally, several studies have found that perceived usefulness and perceived ease of use are statistically distinct dimensions (Hauser & Shugan, 1980; Larcker & Lessig, 1980; Swanson, 1987).

Thus, TAM uses attitude theory as a basis for combining previous empirical MIS findings into an integrated model. Several

empirical studies of TAM provide support for its hypothesized structure (Davis, 1987a; 1987b; 1987c).

4. Comparison of TRA and TAM

The theory of reasoned action (TRA) (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980) and the technology acceptance model (TAM) (Davis, 1987a, 1987b; 1987c) differ in several important theoretical and methodological respects. In this section we examine some of these differences and analyze their implications.

Belief Identification

TRA is intended as a general model, and, as such, it does not specify the beliefs (b_i) that are operative for a particular behavior. Researchers using TRA must first identify the beliefs that are salient for subjects regarding the behavior under investigation. Fishbein and Ajzen (1975, p. 218; Ajzen & Fishbein, 1980, p. 68) suggest eliciting salient beliefs using free response interviews with representative members of the subject population. As a rule of thumb, Fishbein and Ajzen (1975, p. 218) suggest that five to nine beliefs be elicited, since: "Research on attention span, apprehension, and information processing suggests that an individual is capable of attending to or processing only five to nine items of information at a time (e.g., G.A. Miller, 1956; Woodworth and Schlosberg, 1954; Mandler, 1967)." Fishbein and Ajzen (1975) recommend using the "modal" salient beliefs for the population, obtained by taking the beliefs most frequently elicited from a representative sample of the population.

In contrast, TAM specifies a priori the key beliefs hypothesized to determine usage behavior: perceived usefulness and perceived ease of use. Because these beliefs have emerged across so many different independent studies, they are likely to be quite general. Since TRA's free elicitation approach entails eliciting beliefs from specific subjects concerning specific target systems, the resulting belief set may contain some belief items that are

idiosyncratic to the specific context. Moreover, it is difficult to separate the beliefs that are more general from those that are context-specific. Thus, TAM takes advantage of existing MIS research to identify salient beliefs. Since these studies span a wide range of user populations and systems, the likelihood that perceived usefulness and perceived ease of use are idiosyncratic is reduced, resulting in a model which should be more general and applicable across various computer usage contexts.

To what extent are TRA and TAM susceptable to the omission of key beliefs? An important consideration for any model is the possibility that key variables have been omitted. Models, by their nature, are abstractions and simplifications of reality which deliberately omit numerous variables in the interest of parsimony and generality. From a statistical point of view, the linear regression model assumes that there are many omitted variables, each having a minor impact on the dependent variable, the sum of which is uncorrelated with the independent variables. In such cases, the central limit theorem argues that their joint impact on a dependent variable can be modeled by a normal, independently distributed error term. Problems arise in cases where a variable having a significant influence on the dependent variable has been omitted. Such an omission reduces the explained variance, and, of greater concern, to the extent that the omitted variable is correlated with other independent variables, the omission would bias the estimated effects of independent variables on the criterion.

In the case of TRA, if one assumes that the elicitation procedure yields a complete set of salient beliefs, the model would appear to be protected from the omitted variable problem. However, very little research has been done to validate the recommended elicitation procedure. One study that has addressed the issue found that, counter to Fishbein and Ajzen's conjecture (1975, pp.

223-224; Ajzen & Fishbein, 1980, pp. 63-64), the salience of beliefs, as indicated by the order in which beliefs were elicited using the recommended TRA procedure, was unrelated to the relative statistical importance of those beliefs in determining people's behavioral decisions, as reflected by their regression weights (Jaccard & Sheng, 1985). This raises some doubt about the ability of the TRA procedure to avoid omitting variables. TAM, on the other hand, has identified those beliefs repeatedly found to be statistically linked to computer usage in numerous prior MIS studies. However, since TAM is designed to be general across the entire domain of managerial computer use, it may exclude one or more variables operative in a particular context in which it is applied. Hence, for different reasons, both models are in jeopardy of omitting variables. The empirical data presented below allow us to guage the extent to which each model contains influential beliefs omitted by the other in one specific context.

Number of Beliefs

TAM and TRA differ in the number of beliefs being modeled. Whereas TRA posits that five to nine beliefs are salient for a given behavior, TAM contains only 2 beliefs (perceived usefulness and perceived ease of use). However, researchers often disagree with the TRA view that each belief item elicited using the TRA method corresponds to a distinct belief construct, observing that individual items frequently correlate differentially with one another (e.g., Bagozzi, 1982; Hauser & Simmie, 1981; Hauser & Urban, 1977; Holbrook, 1981). Factor analysis is often used to identify the belief dimensions (constructs) underlying a set of raw items, although multidimensional scaling is also used for this purpose (e.g., Schocker & Srinivasan, 1979; Silk, 1969). Quite often, two to five underlying belief dimensions are observed using these techniques (e.g., Bagozzi, 1982; Silk, 1969). Factor analysis and multidimensional scaling are especially helpful in

cases where the researcher does not have an a priori model of the operative belief constructs. The items that are found to correspond to particular factors are often used as measurement scales for operationalizing the factors. These more exploratory techniques lose some of their appeal in cases where particular belief constructs are specified a priori, though. Starting with a priori conceptual definitions of the salient beliefs permits the researcher to develop valid, reliable measurement scales specifically tailored for those constructs (Cook & Campbell, 1979; Nunnally 1978). This is the measure development strategy that was used for TAM (Davis, 1987b), as discussed further below.

Belief Summation

Recall from equation 2 above that TRA models the relationship between beliefs and attitudes using the following equation:

$$A = \Sigma\, b_i e_i$$

The belief-attitude linkage is assessed by computing the summation on the right hand side of this equation and assessing its correlation with A. Note that this is equivalent to computing the standardized regression coefficient (Beta weight) in the following regression model (e.g., Pindyck & Rubinfeld, 1981):

$$A = a + \beta\, [\Sigma\, b_i e_i] + e$$

From the standpoint of determining the effect of beliefs on attitudes, the summed belief-evaluation term is treated as a single independent variable. By lumping together many beliefs that may have differing, possibly countervailing, effects on A, this approach can mislead the investigator about the overall effect of beliefs on attitude. Further, it masks the relative influence of individual beliefs making up the summation.

In contrast, TAM represents each belief separately in the regression equation for attitude (see equation 5 above). Modeling the belief structure in a disaggregated way using multiple regression enables one to compare the relative influence of each

belief in determining attitude. Regression has long been used in this way within a variety of theoretical domains to model how people integrate various beliefs or information elements when forming overall evaluative judgments (Anderson, 1971; Brunswik, 1955; Slovic & Lichtenstein, 1971). Regression-based models appear to accurately reflect the importance of cues used in judgmental processes observed via fine-grained protocol analyses, even when highly non-compensatory judgmental processes are employed by subjects (Einhorn, Kleinmuntz & Kleinmuntz, 1979; Hogarth, 1974; Johnson & Meyer, 1984).

In addition to gaining information about the relative direct influence of individual beliefs on attitude, representing beliefs separately allows the researcher to better model the effect of external variables, such as system characteristics (S_i) on beliefs. According to TRA, such external variables influence attitude only indirectly through their effect on beliefs (b_i), or evaluations (e_i). From a diagnostic standpoint, treating beliefs as separate constructs permits one to assess the effect of external variables on each belief separately, as opposed to its effect on the summation of all of the beliefs. This enables an investigator to better formulate strategies for influencing user acceptance via controllable external factors, such as the design characteristics of the system (S_i), that have measurable influences on particular beliefs.

Evaluation Term

Whereas TRA multiplies each belief by a self-reported evaluation term (e_i), TAM employs no such evaluation term. Researchers have argued that to employ such a multiplication requires that the multiplied variables are scaled at the ratio level of measurement (Bagozzi, 1984; Ryan & Bonfield, 1975; Schmidt, 1973). However, measurements such as b_i and e_i are generally interval-scaled at best, and allowable linear

transformations "will change the relationship of the product term with the criterion...For example, a positive correlation can be made to be zero or negative merely through the addition of a constant to measurements of one of the variables in the product term." (Bagozzi, 1984, p. 296). Multiplying interval-scaled variables introduces an unknown amount of measurement error since, by definition, interval variables have no fixed zero point.

This scaling problem can be dealt with by including the main effects of each of the variables comprising the product in a regression along with the product itself. If the product explains a significant proportion of variance over and above these main effects, then there is evidence that subjects are indeed combining the variables multiplicatively. Using this strategy, recent studies have found that, quite often, subjects do not combine beliefs and evaluations in a multiplicative way (Bagozzi, 1984; Harrell & Stahl, 1986; Stahl & Harrell, 1981; however, c.f. Bagozzi, 1986).

Some argue that the evaluation term e_i is valuable because it provides a "self-reported" importance weight indicating differences between individuals in how they evaluate the same perceived consequence or attribute. Marketing researchers in particular have tended to use this approach (e.g., see reviews by Wilkie & Pessemier, 1973; Ryan & Bonfield, 1975; and Shocker & Srinivasan, 1979). However, researchers in organizational behavior (e.g., Stahl & Grigsby, 1987), behavioral decision theory (e.g., Shoemaker & Waid, 1982) and marketing (e.g., Bass & Wilkie, 1973) have found that statistically estimated weights predict as well as or better than their self-stated counterparts. Moreover, psychologists (e.g., Jaccard and Sheng, 1985) have found self-stated and regression weights to be unrelated to one another. Although the issue remains controversial, a frequent explanation is that people lack self-insight regarding the importance they attach to various

cues in forming judgments (Einhorn & Hogarth, 1981; Nisbett & Wilson, 1977; Slovic & Lichtenstein, 1971).

It has been pointed out that unit weights often predict dependent variables as accurately as regression-determined weights (e.g., Dawes & Corrigan, 1974; Wainer, 1976). However, this is apparently due more to the characteristics of linear models than to the phenomenological equality of importance among beliefs. Under conditions that obtain in most expectancy-value contexts (i.e., correlated independent variables monotonically related to the dependent variable), unit weights are capable of providing accurate predictions despite substantial deviations from the true causal parameters (Dawes & Corrigan, 1974; Einhorn & Hogarth, 1975; Wainer, 1976). Thus, it is erroneous to conclude that unit weights approximate the actual structural parameters simply because the explained variance is approximately the same.

The issues surrounding the evaluation weight (e_i) are complex and unresolved. However, some points are clear: they seldom add significant explanatory power; they introduce scaling problems that must be dealt with; they often don't combine multiplicatively with beliefs; and they have been found to be unrelated to statistical importance of beliefs. Since the evaluation weights introduce several problems and do not appear to add substantially to our ability to predict and explain behavior, in the interest of parsimony they are not included in TAM. The study presented below will allow us to more closely examine the role of evaluation terms in the context of user acceptance, however. Specifically, we will examine whether the evaluation terms interact multiplicatively with the beliefs elicited for TRA.

Relationships Between Beliefs

The technology acceptance model (TAM) posits a causal influence from perceived ease of use to perceived usefulness (equation 6) based on both theoretical considerations as well as

previous empirical results, whereas the theory of reasoned action (TRA) does not explicitly model beliefs as having an effect on one another. Numerous alternative theories provide a theoretical rationale for interrelationships among beliefs, however, including: impression formation (Asch, 1946), cue utilization (Slovic & Lichtenstein, 1971), information integration (Anderson, 1971), multiple-cue probability learning (Brunswik, 1955; Hammond & Summers, 1972), attribution (Heider, 1958; Kelley, 1973), and the subjective probability theories (Wyer & Goldberg, 1970).

Direct Belief-Intention Link

Although the theory of reasoned action (TRA) argues that beliefs (multiplied by the corresponding evaluations) influence intention only indirectly via their effect on attitude, TAM posits a direct effect of a belief, perceived usefulness, on intention, over and above it's indirect effect via attitude. The original specification of TAM, following TRA, hypothesized no direct usefulness-intention link (e.g., Davis 1987a). Several data sets have disconfirmed this hypothesis, revealing a consistent and strong usefulness-intention linkage (e.g., Davis, 1987a; Davis, 1987b; Davis & Olson, 1987). In fact, the usefulness-intention link has generally been greater in magnitude than the attitude-intention link!

This finding gave cause to review the empirical evidence concerning the direct effect of beliefs on intentions. Although numerous empirical studies have provided evidence of significant belief-attitude and attitude-intention links (e.g., see Ajzen & Fishbein, 1980), comparatively little attention has been paid to the presence or absence of a direct belief-intention link. Triandis (1977, p. 194) specified an alternative intention model that viewed beliefs, attitudes, and social influences as parallel determinants of intention. In comparative tests of TRA and Triandis's models, Brinberg (1979) observed a significant belief-

intention relationship but Jaccard and Davidson (1975) did not. Bagozzi (1982) observed both significant direct and indirect (via attitude) effects of beliefs on intentions. A direct link between beliefs and intentions is possible in cases where a person's attitude fails to integrate all of his or her beliefs. This may be apt to occur for instrumental acts which are not done for their own sake but are instead done in an effort to achieve some valued goal. A person may process such instrumental behaviors via cognitively-based causal schemata or scripts which associate the act with a salient goal without actually activating the affect associated with the goal (e.g., Triandis, 1977; Bagozzi, 1982). For example, an individual may process various organizational behaviors, including computer usage, by cognitively appraising the degree to which such acts are linked to performance gains (i.e., forming a perceived usefulness judgment). In such a scenario, performance becomes a highly cognitive, instrumental goal, and the second-order linkage between the performance gains and more affect-laden rewards such as pay increases and promotions (e.g., Vroom, 1964) need not be activated in order to form an intention toward the target behavior. Thus available theory and data suggest that a direct link between beliefs and intentions exist under at least some circumstances.

Subjective Norm

Subjective norm (SN) is one of the least understood parts of TRA. As formulated by Fishbein and Ajzen, it is difficult to disentangle direct effects of SN on intentions from indirect effects via attitudes. SN may influence intentions indirectly via attitudes due to internalization and identification processes or influence intentions directly via compliance (Kelman, 1969; Warshaw, 1980a). Conversely, attitudes may have a causal influence on subjective norm, for example due to the well-researched "false consensus" effect in which subjects erroneously project their own attitudes to others (e.g., Oliver & Bearden, 1985). The linkage

between nb_i and SN is also problematic, since "Very little research...has dealt with the formation of normative beliefs" (Fishbein & Ajzen, 1975, p. 304). Empirically, although the SN variable is often highly correlated with A, it often accounts for a significant amount of the variance in intention (I) over and above that explained by A alone (Ajzen & Fishbein, 1980). Because of its uncertain theoretical status, SN was not incorporated in the technology acceptance model (TAM). On the other hand, social influences may be an important mechanism by which such factors as top management support and user involvement in the design process influence usage intentions. Although it is generally thought that managerial computer use is voluntary (DeSanctis, 1983; Robey, 1979; Swanson, 1987), in some cases, people may use a particular system because it has been "mandated" by management, rather than due to their own feelings or beliefs about using it. Subjective norms, and particularly the compliance aspect, may account for this behavior. The present data allows us to begin to examine the role of SN in user acceptance processes.

Summary

TRA and TAM differ in several important respects. In TRA, BI is a function of A and SN, whereas in TAM, BI is a function of A and U. In applications of TRA outside the computer domain, SN usually has less influence on BI than A does. In several tests of TAM, U was found to be more influential than A. Due to the fact that the U-BI linkage is stronger than the SN-BI linkage, controlling for A, we expect TAM to account for more of BI's variance than TRA will. There are also several differences in the way beliefs are modeled in TRA versus TAM, including: (1) TAM identifies its beliefs, perceived usefulness and perceived ease of use, a priori based on numerous empirical MIS studies, whereas TRA uses a belief elicitation procedure whose validity has recently been called into question; (2) TRA multiplies its beliefs by a

self-reported evaluation term, which introduces error into its belief structure since beliefs and evaluations are not ratio-scaled, and since people often don't process beliefs and evaluations multiplicatively- TAM uses instead statistically-estimated weights which tend to yield accurate parameter estimates while avoiding the scaling problem; (3) TRA sums together its beliefs (times evaluations) prior to computing their effect on attitude, which may distort the estimate of the amount of explained variance in A, whereas TAM represents each belief as a separate independent variable explaining A; (4) TAM employs validated multi-item scales for operationalizing its belief constructs whereas TRA does not; and (5) TAM posits a causal relationship between two beliefs (perceived ease of use and perceived usefulness) whereas TRA does not explicitly consider relationships between beliefs. Because of these various shortcomings in the way it handles beliefs, TRA is likely to obscure the interpretability of the belief-attitude relationship.

5. Experiment

In order to empirically compare the two competing models, we gathered data from 107 full-time MBA students during their first of four semesters in the MBA program at the University of Michigan. A word processing program, WriteOne, is available for use by these students in two public computer laboratories located at the Michigan Business School. Word processing was selected as a test application because: (1) it is a voluntarily used package, unlike spreadsheets and statistical programs that students are required to use for one or more courses, (2) students would face opportunities to use a word processor throughout the MBA program for memos, letters, reports, resumes, and the like, and (3) word processors are among the most frequently used categories of software among practicing managers (Benson, 1983; Honan, 1986; Lee, 1986).

At the beginning of the semester, MBA students are given a one-hour introduction to the WriteOne software as part of a computer orientation. At the end of this introduction, we administered the first wave of a questionnaire containing measures of the TRA and TAM variables. A second questionnaire, administered at the end of the semester 14 weeks later, contained measures of the TAM and TRA variables as well as a 2-item measure of self-reported usage.

Hypotheses

Both models predict behavior from behavioral intention (BI). We expect BI, measured both at the beginning and end of the semester, to be significantly correlated with usage frequency at the end of the semester. Further, we expect BI at the end of the semester to correlate more strongly with usage at the end of the semester than will BI at the beginning of the semester. We expect this pattern for two reasons. First, it has widely been observed that the intention-behavior relationship attenuates as the time between the measurements of intention and behavior increases (e.g., Fishbein & Ajzen, 1975, p 369). This is because during the intervening time period, intentions may change and other events may occur which may impede following through on intentions. Second, intentions measured after a 1-hour introduction are based on much less information and experience than those measured after months of experience with the behavior in question, which tends to make the earlier intentions less stable. Since intention is theorized to causally mediate between beliefs, attitude and subjective norm on the one hand and usage on the other, we do not expect any of the other variables in either TAM or TRA to have a direct effect on usage behavior over and above intentions.

We hypothesize that TRA and TAM will both explain a significant proportion of the variance in one's behavioral intention to use WriteOne (BI), but that TAM will explain

significantly more of BI's variance than TRA will due to the greater expected influence of perceived usefulness (U) on BI as compared to SN. Both TRA and TAM specify indirect effects on intention as well. According to TRA, the belief structure $\Sigma b_i e_i$ should not have any direct effect on BI over and above A and SN. Similarly, TAM posits that perceived ease of use (E) does not have a significant direct effect on BI over and above A and U.

Both TRA and TAM are expected to explain a significant proportion of the variance in one's attitude toward using WriteOne (A). According to TRA, we would not expect perceived usefulness (U) or perceived ease of use (E) to explain any variance in A beyond that already accounted for by $\Sigma b_i e_i$. According to TAM, we would not expect TRA's belief summation term ($\Sigma b_i e_i$) to add any additional explained variance in A beyond that already accounted for by TAM's perceived usefulness (U) and perceived ease of use (E) constructs.

Pretest

To determine the modal salient beliefs for usage of the WriteOne software, telephone interviews were conducted with 40 MBA students who were about to enter their second year of the MBA program. During the prior year, these interview subjects had been given an indoctrination to the WriteOne system equivalent to that given the subjects of the present study. Interviewees were asked to list separately the advantages, disadvantages, and anything else they associate with becoming a user of WriteOne (This procedure is recommended by Ajzen and Fishbein (1980, p. 68).). Beliefs referring to nearly identical outcomes using alternative wording were classified as the same item, and the most common wording was utilized. The seven most frequently mentioned outcomes were chosen. This belief set was mentioned by more than 20% of the sample and contained more than 75% of the beliefs emitted. The seven resulting belief items, in order of frequency of mention, are:

1. I'd save time in creating and editing documents.
2. I'd find it easier to create and edit documents.
3. My documents would be of a better quality.
4. I would not use alternative word processing packages.
5. I'd experience problems gaining access to the computing center due to crowdedness.
6. I'd become dependent on WriteOne.
7. I would not use WriteOne after I leave the MBA program.

Questionnaire

Both TRA and TAM are being used to explain a specific behavior (usage) toward a specific target (WriteOne) within a specific context (the MBA program). The time period of usage is non-specific. The definition and measurement of model constructs correspond in specificity to these characteristics of the behavioral criterion, so that the measures of intentions, attitudes, and beliefs are worded in reference to the specific target, action and context elements, but are non-specific with respect to time frame (for further discussion of the correspondence issue, see Ajzen & Fishbein, 1977; 1980). The intention measures use a standard format, recommended by Ajzen and Fishbein (1980, Appendix A). It should be pointed out that intention, as defined and measured by Ajzen and Fishbein (1980), and as used in the present research, is actually closer to the behavioral expectation (BE) construct introduced by Warshaw and Davis (1984), which is a self-prediction of behavioral performance. (Intention, or one's conscious behavioral decision to perform a behavior, appears to require the development of new measurement scales to measure it in isolation from BE (Davis & Warshaw, 1987).) BE generally predicts future behavior better than BI, and is considered to be the best single predictor of future behavior (Warshaw & Davis, 1985; Sheppard, Hartwick and Warshaw, 1987). Attitude toward using WriteOne is measured with standard, multi-item scales composed of

semantic differential adjective pairs. Subjective Norm uses the single-item scale recommended by Ajzen and Fishbein (1980, Appendix A). TRA's belief constructs are each operationalized with single-item, seven-point likely-unlikely measures.

TAM's perceived usefulness and perceived ease of use constructs are each operationalized with 4-item likelihood scales resulting from a systematic measure development and validation procedure. As described in Davis (1987b), the measure development process consisted of: stating conceptual definitions of the constructs; generating 14 candidate items for each construct from prior MIS literature; pre-testing the items to refine their wording and to pare the item pools down to 10 items per construct, and assessing the reliability (using Cronbach alpha) and validity (using the multitrait-multimethod approach) of the 10-item scales. High levels of convergent and discriminant validity of the 10-item scales were observed, and Cronbach alpha reliabilities were .97 for perceived usefulness and .91 for perceived ease of use. Item analyses were used to streamline the scales to 6-items per construct, and new data (Davis, 1987c) again found high validity and reliability (alpha of .97 and .93 respectively for usefulness and ease of use). Further item analyses were performed to arrive at the 4-item scales used in the present research (Appendix). System usage is measured using 2 questions regarding the frequency with which the subject currently uses WriteOne. These are typical of the kinds of self-reported measures often used to operationalize system usage, particular in cases where objective usage metrics are not available. Objective usage logs were not practical in the present context since the word processing software was located on personal computers and subjects use different computers, as well as different applications, from one session to the next. Self-reported frequency measures should not be regarded as ratio-scaled measures of actual usage frequency, although previous research

suggests they are appropriate as interval measures (Blair & Burton, 1987; Hartley, et al., 1977).

Results

Scale Reliabilities

The two-item behavioral intention scale obtained a Cronbach alpha reliability of .84 at time 1 (beginning of the semester) and .90 at time 2 (end of the semester). The four-item attitude scale obtained reliabiliies of .85 and .82 at times 1 and 2 respectively. The four-item perceived usefulness scale achieved a reliability of .95 and .92 for the two points in time, and the four-item perceived ease of use scale obtained reliability coefficients of .91 and .90 for time 1 and time 2. SN, the b_is and the e_is, were each operationalized with single item scales, per TRA, and hence no internal consistency assessments of reliability are possible. The two-item usage scale administered in the second questionnaire achieved an alpha of .79.

Explaining Usage

As hypothesized, BI was significantly correlated with usage. Intentions measured right after the WriteOne introduction were correlated .35 ($p<.001$) with usage frequency 14 weeks later (Table 1). Intentions and usage measured contemporanneously at the end of the semester correlated .63 ($p<.001$). The "proximal" intentions measured at the end of the semester significantly out-predicted the "distal" intentions measured at the beginning of the semester ($F_{1,93,2}=49.0$, $p<.001$), as expected. Also consistent with our hypotheses, none of the other TRA or TAM variables (A, SN, $\Sigma b_i e_i$, U, or E) had a significant effect on usage over and above intentions at either time 1 ($F_{1,92,5} = 1.76$, n.s.) or time 2 ($F_{1,92,5} = 1.46$, n.s.), which suggests that intentions fully mediated the effects of these other variables on usage.

Explaining Behavioral Intention (BI)

As hypothesized, TRA and TAM both explained a significant proportion of the variance in behavioral intention (Table 1). TRA accounted for 32% of the variance at time 1 ($p<.001$) and 26% of the variance at time 2 ($p<.001$). TAM explained 47% ($p<.001$) and 51% ($P<.001$) of BI's variance at times 1 and 2 respectively. TAM explained significantly more of BI's variance than TRA in both time period 1 ($F_{104,1}=27.3$, $p<.001$) and time period 2 ($F_{104,1}=51.3$, $p<.001$), as anticipated.

Looking at the independent variables, within TRA, attitude had a strong significant influence on BI ($\beta=.55$, time 1; $\beta=.48$, time 2), whereas SN had no significant effect in either time period ($\beta=.07$ and .10, respectively). Within TAM, perceived usefulness has a very strong effect in both time periods ($\beta=.48$ and .61, respectively, both significant at the .001 level), and attitude had a smaller effect in time 1 ($\beta=.27$, $p<.01$) and a non-significant effect in time 2 ($\beta=.16$, n.s.). Equation 1b, Table 2, shows that U adds significant explanatory power beyond A and SN, at both time 1 ($\beta=.48$, $p<.001$) and time 2 ($\beta=.63$, $p<.001$), underscoring the influential role of the perceived usefulness construct.

Counter to TRA, the belief summation term, $\Sigma bi ei$, had a significant direct effect on intention over and above A and SN in time period 2 ($\beta=.21$, $P<.05$) but not in time period 1 ($\beta=.08$, n.s.) (Table 2, equation 1a). Counter to TAM, perceived ease of use (E) had a significant direct effect on BI over and above A and U in time period 1 ($\beta=.20$, $p<.01$) but not time period 2 ($\beta=-.11$, n.s.) (Table 2, equation 3c).

Insert Tables 1 and 2 about here

Explaining Attitude

As hypothesized, both TAM and TRA explain a significant percentage of variance in attitude toward using (Table 1). TRA

explained 7% ($p<.001$) of A's variance at time 1 and 30% ($P<.001$) at time 2. TAM explained 37% ($p<.001$) and 36% ($p<.001$) at times 1 and 2 respectively. TAM accounts for significantly more of A's variance than TRA does both at time 1 ($F_{1,04,2}=26.0$, $p<.001$) and time 2 ($F_{1,04,2}=13.0$, $p<.001$). Perceived usefulness has a strong significant effect on A in both time periods ($\beta=.61$ and .50, respectively, both significant at .001), although perceived ease of use is significant at time 2 only ($\beta=.24$; $p<.01$). Whereas at time 1 ease of use appears to have a direct effect on BI ($\beta=.20$, $p<.01$, equation 1c, Table 2), with no indirect effect through attitude ($\beta=.02$, n.s., equation 3b, Table 1), at time 2 its effect is entirely indirect via attitude ($\beta=.24$, $p<.001$, equation 3b, Table 1), with no direct effect on intention ($\beta=-.11$, n.s., equation 1c, Table 2). TRA's belief summation term, $\Sigma b_i e_i$, explains a significant proportion of A's variance beyond that accounted for by usefulness and ease of use in time period 2 ($\beta=.32$, $p<.001$) but not in time period 1 ($\beta=.10$, n.s.) (Table 2, equation 2).

Futher Analysis of TRA Beliefs

As discussed above, there are several controversial points regarding the manner in which TRA handles beliefs, including its assertion that (a) each belief item corresponds to a conceptually distinct belief construct, (b) beliefs and evaluations interact in a multiplicative way, (c) beliefs (times evaluations) should be summed together before computing their impact on attitude, (d) the belief elicitation process identifies a complete listing of the most important beliefs determining behavior and (e) beliefs influence intention only indirectly via attitude. We now look at whether modifying the way of representing TRA's beliefs in accordance with such concerns improves the ability to interpret the effect of beliefs on A and BI.

Table 3 shows a varimax rotated factor analysis of the seven originally-elicited modal belief items. The beliefs factored into

three distinct dimensions. Beliefs 1, 2 and 3 load on a common factor. These three beliefs can be seen as tapping aspects of "expected performance gains," i.e., perceived usefulness (U). Beliefs 4 and 6 comprise factor 2, which has to do with becoming dependent on WriteOne. Factor 3 consists of items 5 and 7, which are concerned with access to WriteOne, both while in the MBA program (item 5), and after leaving the program (item 7). Hence, factors 2 and 3 represent beliefs which are beyond the scope of the technology acceptance model (TAM). Notationally, we refer to these three belief factors as F_1, F_2 and F_3. Consistent with our interpretation of F_1, it correlates highly with U (r= .41 and .69 for time 1 and time 2, respectively, both significant at the .001 level, see Table 4). Factor F_2, "dependency," correlates significantly with both F_1 (r=.33 and .45 for time 1 and time 2) and U (r=.26, p<.01, at time 1 and .46, p<.001 at time 2). Apparently, the more one perceives WriteOne to be useful, the more one anticipates becoming dependent on it. F_3, "accessibility" is correlated negatively with U (r=-.22, p>.05, in both time periods). Thus, it appears doubtful that the 7 elicited beliefs correspond to 7 distinct constructs. Instead, evidence indicates the existence of three distinct constructs (perceived usefulness, dependency, and accessibility).

Insert Tables 3 and 4 about here.

In light of the conceptual similarity between F_1 and perceived usefulness, as well as their high correlation at time 2 (.69), there is evidence to suggest that F_1 and U may be tapping the same underlying conceptual variable. A second factor analysis which includes the 4 perceived usefulness items and four perceived ease of use items from TAM was conducted to address this possibility (Table 5). For time period 1, a five factor solution was obtained,

consisting of: the four usefulness items, the four ease of use items, and the original factors F_1 - F_3. At time 2, however, a four-factor solution was obtained, with the usefulness items and F_1 items loading on a common factor, and the remaining 3 factors corresponding to ease of use, F_2 and F_3. Hence, during the time period between questionnaires 1 and 2, TRA belief items 1,2 and 3 converged to perceived usefulness. At time period 2, it appears appropriate to regard these three items as alternative measures of perceived usefulness.

In order to test for the interaction between beliefs and evaluations, a hierarchical regression was performed. A regression with all the individual TRA belief and evaluation terms entered as main effects was compared with a second which included these main effects plus the products of beliefs and evaluations. The product terms added no significant explained variance in A at either time 1 ($F_{86,7}$ = .01, n.s.) or time 2 ($F_{86,7}$ = .70, n.s.). The analysis was repeated at the factor level. The F_i's were entered into a regression along with their corresponding summed evaluation terms. The addition of product terms had no significant effect on R^2 at time 1 ($F_{96,3}$ = 1.32, n.s.) or time 2 ($F_{96,7}$ = .12, n.s.). Thus, in the present situation, beliefs and evaluations do not appear to interact multiplicatively.

Table 6 reports alternative formulations of TRA's belief structure. Omitting the evaluation weights, and using a simple sum of beliefs (equation 1) leads to a drop in R^2 from .07 ($p<.01$) to .03 (n.s.) for time 1, and from .30 ($p<.001$) to .23 ($p<.001$) for time 2. In order to treat each of the F_is as separate independent variables, we used belief items 1,2 and 3 as a summed scale for F_1, items 4 and 6 as a scale for F_2 and items 5 and 7 as a summed scale for F_3. Representing F_1, F_2 and F_3 as separate independent variables increases the explained variance substantially, up to .18 ($p<.001$) for time 1 and .41 ($p<.001$) for time 2. F_1 has a

significant effect on A which increases from .31 ($p<.01$) at time 1 to .63 ($p<.001$) at time 2. The convergence of F_1 toward usefulness, discussed above, may explain the increased importance of F_1 at time 2, and also may account for the rather dramatic increase in the effect of $\Sigma b_i e_i$ on A between time 1 and 2 (Table 1). F_2 has no significant effect on A at either time 1 ($\beta=.09$, n.s.) or time 2 ($\beta=-.02$, n.s.). F_3 has a significant negative effect on A at time period 1 ($\beta=-.21$, $p<.05$) but not at time 2 ($\beta=-.10$, n.s.). The negative influence of F_3 on A seemingly counteracted the positive effects of F_1 and F_2, causing a downward distortion in R^2 when all beliefs were summed together. When usefulness and ease of use are added to the equation (Table 6, equation 3) we find that, over and above the F_is, ease of use has a significant effect at time 2 ($\beta=.23$, $p<.01$) but not time 1 ($\beta=.02$, n.s.). Perceived usefulness has a much stronger effect than F_1 at time 1 (.53, $p<.001$ vs. .13, n.s.) but is overshadowed by F_1 at time 2 (.18, n.s., vs. .46, $p<.001$). As table 4 shows, the correlation between A and F_1 increased substantially from time 1 (.36) to time 2 (.63). This is very consistent with the convergence of F_1 to usefulness. It appears that F_1 is tapping aspects of usefulness that are more strongly linked to attitude at time 2.

Beliefs have a significant impact on intention over and above A and SN whether they are treated as the original TRA belief summation term ($\Sigma b_i e_i$) (Table 1, equation 3a), as a simple sum of beliefs (Σb_i) (Table 7, equation 1), or as three factors F_i each entering the regression separately (Table 7, equation 2). Perceived usefulness adds significant explained variance in BI above and beyond A, SN and the F_i's, ($b=.41$, $p<.001$ in time 1; $b=.36$, $p<.001$ in time 2) (see Table 7, equation 3). The magnitude of the direct effects of both F_2 and F_3 on BI increase from time 1 to 2. F_2 has a non-significant effect ($\beta=.06$) at time 1 and a significant effect ($\beta=.21$, $p<.01$) at time 2. F_3 has a non-

significant effect at time 1 (β=-.08) and a significant negative effect at time 2 (β=-.21, $p<.01$). Perceived usefulness (U) (equation 3) has a strong direct effect on BI above and beyond A, SN and the F_i's at both time 1 (β= .41, $p<.001$) and time 2 (β=.36, $p<.001$).

Insert Tables 5, 6 and 7 about here.

Summarizing our analysis of beliefs: (a) each belief does not appear to correspond to a distinct construct; instead the beliefs factored into 3 underlying dimensions; (b) beliefs and evaluations do not interact multiplicatively, (c) in order to avoid bias, beliefs should not be summed together prior to regressing them on attitude (d) since TAM's perceived ease of use (E) had a significant effect on attitude beyond the effects of the TRA beliefs, the TRA elicitation procedure did not appear to reveal a complete set of the most important beliefs driving behavior, and (e) contrary to TRA, beliefs appear to systematically influence BI above and beyond A and SN.

The Role of Subjective Norm (SN)

Recall from our theoretical discussion that some researchers have argued that SN may influence BI both directly (compliance) and indirectly via one's attitude (internalization and identification) (e.g., Kelman, 1958; Warshaw, 1980a). The present data allows us to address these two roles played by SN. As Table 1 (equation 1) shows, SN has no significant direct effect on BI in our data (β=.07, time 1; β=.10, time 2). Further, note that SN is about as highly correlated with A ($r=.27$, $p<.01$, time 1; $r=.19$, $p<.05$ time 2) as it is with BI ($r=.22$, $p<.05$, time 1; $r=.20$, $p<.05$, time 2) (Table 4), which is quite consistent with previous experience using TRA. Together, these two observations are consistent with Oliver and Bearden's (1985) suggestion that SN may, in part, operate

through one's attitude. As shown in Table 8, SN has a significant direct impact on A over and above the impact of TRA beliefs in time period 1 (β=.22, $p<.05$) but not at time 2 (β=.07, n.s.) (equations 1, table 8). The same pattern holds when beliefs are represented as a simple sum or as three factors (equations 2 and 3, Table 8). It is interesting to speculate about why the role of SN diminishes over time. Perhaps one's attitude is initially based more on social cues and later from actual experience interacting with the system. This would agree with theories from the diffusion of innovations which stress the role of opinion leadership in early product trial (e.g., Rogers & Shoemaker, 1971). Note that SN has no significant effect on A above and beyond TAM's usefulness and ease of use in either time period (equation 4, Table 8).

Insert Table 8 about here.

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6. Discussion

Our results yield several important insights concerning the determinants of managerial computer use. First, we have been able to significantly predict peoples' frequency of usage, 14 weeks in advance, based on a limited, one-hour introduction using a measure of their intention to use the system (correlation=.35). In addition, using the technology acceptance model (TAM) we have been able to account for about half of the variance in their intentions with only two variables: perceived usefulness and attitude toward using. Overall, our efforts at explaining the underlying determinants of user acceptance have been quite successful.

Comparing the two particular theoretical models, TAM received more empirical support than TRA. TAM explained significantly more variance in both intentions and attitudes at both the beginning and end of the 14 week period. The vast majority of this explanatory advantage is attributable to the perceived usefulness construct.

Indeed, perceived usefulness has consistently been the single most influential variable determining attitudes and intentions, as observed both in the present study as well as in previous tests of TAM (Davis, 1987a; 1987c; Davis & Olson, 1986).

It is interesting to observe that, although perceived usefulness was identified for TAM by analyzing many MIS studies which did not use TRA, the first three belief items elicited by TRA were strongly related to usefulness. Their content related to "expected performance gains," they loaded together on a common factor ("F_1"), and converged to perceived usefulness by the end of the 14-week test period. But why was it the case that usefulness became influential right after the one-hour introduction, whereas F_1 did not become influential until some time later? One possibility relates to the concreteness-abstractness distinction from psychology (e.g., Mervis & Rosch, 1981). Perceived usefulness within TAM is fairly abstract and general, referring to "performance gains" and the like, whereas factor F_1 from TRA is more concrete and specific, referring directly to the quality of documents and the time savings in using WriteOne for creating and editing them. As Bettman and Sujan (1987) point out, novice consumers are more apt to process choice alternatives using abstract, general criteria, since they have not undergone the learning needed to understand and make judgments about more concrete, specific criteria. This phenomenon would account for the increased importance of F_1 over time, as well as its convergence to TAM's usefulness variable, as the subjects in our study gained additional expertise and knowledge about the use of WriteOne over the 14-week period following the initial introduction.

Perceived ease of use also exhibited an interesting pattern over time. Just after the initial introduction, ease of use had a significant direct effect on intentions above and beyond attitude and usefulness (β=.20), but no effect on attitude. Fourteen weeks

later, this direct effect was supplanted by an entirely indirect effect via attitude. Conceivably, the initial formation of attitude was not influenced by perceived ease of use, whereas after more experience using the system attitudes became more influenced by ease of use, and then mediated the ease of use-intention linkage.

Thus, TAM appears to provide a parsimonious, robust model of user acceptance that captures most of the variance of attitude and intention with a small number of fundamental contruucts.

TRA fared much less well in the present study, however, explaining significantly less variance in intention and attitude than TAM. Moreover, many of TRA's structural hypotheses were not supported by our data. Specifically, subjective norm did not have a significant effect on intentions, beliefs had a direct effect on intentions over and above attitude, and beliefs and evaluations did not interact multiplicatively. In addition, the TRA belief elicitation method failed to produce a complete set of determining belief items, since although TAM's "perceived ease of use" explained additional variance in attitude and intention beyond that accounted for by TRA, this belief was not elicited using the TRA procedure.

Additional insight, as well as explanatory power, was obtained by moving away from TRA's summation of beliefs times evaluations toward the use of factor analysis to identify basic belief dimensions to be used as separate independent variables. As discussed above, the first factor was quite similar to perceived usefulness. This procedure identified two additional beliefs which are not part of TAM: dependence (F_2) and accessibility (F_3). Dependence was not able to explain any variance in attitude, intention or usage beyond that accounted for by TAM.

Accessibility, however, had a significant negative effect on intention (β=-.18) over and above A, SN and usefulness at time 2.

The increased importance of this belief from time 1 to time 2 is likely a result of increasingly crowded conditions at the computing center toward the end of the semester. It also makes sense that accessibility would not operate indirectly through attitude, since one may have a positive attitude toward a behavior yet still not possess an intention to do it in recognition of the lack of opportunity, in this case, due to lack of access to needed resources. Other researchers have also identified a link between accessibility and usage of information and information technology (Allen, 1977; Culnan, 1983; O'Reilly, 1982). Further research on the impact of accessibility on computer usage certainly appears warranted.

Managerial Implications

What do our results imply for managerial practice? When planning a new system, MIS practitioners would like to be able to predict whether the new system will be acceptable to users, diagnose the reasons why a planned system may not be fully acceptable to users, and to take corrective action to increase the acceptability of the system in order to enhance the business impact resulting from the large investments in time and money associated with introducing new information technologies into organizations. The present research is relevant to all of these concerns.

As Ginzberg (1981) articulated in his discussion of "early-warning" techniques for anticipating potential user acceptance problems, at the initial design stages of a system development effort, a relatively small fraction of a projects resources has been expended, and yet, many of the design decisions concerning the functional and interface features of the new system are made. Moreover, at this early point in the process, there is greatest flexibility in altering the proposed design since little if any actual programming or equipment procurement has occurred. Hence, this would appear to represent an ideal time to measure user

beliefs and attitudes toward a proposed system in order to get a reading on its acceptability. Better still would be an approach which allows users to perform a comparative evaluation of multiple system alternatives (e.g., Davis, 1987a; 1987c). Standing in the way, however, has been the lack of a theoretical model, and associated measures, of the key beliefs and attitudes that determine user behavior. The present research contributes to the solution of this dilemma by helping to identify and provide valid measures of key belief and attitude variables that are linked to user behavior.

A second challenge facing "user acceptance testing" early in the development process is the difficulty of conveying to users in a realistic way what a proposed system will consist of. The "paper designs" that typify the status of a system at the initial design stage may not be an adequate stimulus for users to form accurate assessments. However, several techniques can be used to overcome this shortcoming. Rapid prototypers, screen prototypers, user interface management systems, and videotape mockups are increasingly being used to create realistic "facades" of what a system will consist of, at a fraction of the cost of building the complete system. This raises the question whether a brief exposure (e.g., less than an hour) to a proposed new system is adequate to permit the potential user to acquire stable, well-formed beliefs. Especially relevant here is our finding that TAM's perceived usefulness variable formed rapidly after a one hour training session, showing a strong effect on attitudes and intentions. In contrast, the TRA belief structure required additional time before exhibiting an influential effect. The ability to take robust, well-formed measures of the determinants of user acceptance early in the development process is undoubtedly going to have an impact on our ability to weed out bad systems, refine the rest, and

generally cut the risk of implementing finished systems which get rejected by the users.

Measurements of this kind can be used not only to project the likely degree of user acceptance, but also to diagnose the reasons underlying user acceptance or rejection of a new system. This could be valuable for identifying alterations to the existing system or support environment aimed at increasing user acceptance. For example, many designers believe that the key barrier to user acceptance is the lack of user friendliness of current systems, and that adding user interfaces that increase usability is the key to success (e.g., Branscomb & Thomas, 1985). Yet our data indicates that, although ease of use is clearly important, the usefulness of the system is even more important and should not be overlooked. Managers may be willing to tolerate a difficult interface in order to access functionality that is very important, while no amount of ease of use will be able to compensate for a system that doesn't do a useful task. Diagnostic measurements of the kind we're proposing may help designers avoid barking up the wrong tree.

With models such as the technology acceptance model, researchers and practitioners may be able to begin systematically analyzing and cataloging the kinds of design features that have the greatest impact on acceptability for various classes of managers. There may be a core set of features that fit the needs of many managers, and variations on the core features unique to particular management levels, functional areas or industries. This kind of research stream could yield a set of design guidelines for practitioners to use in making more informed choices of new systems.

The two beliefs suggested by TRA but not part of TAM: dependency and accessibility, have implications for management too. Users may resist a system to the extent that they feel that becoming a user ould lead to a loss of control over their work.

For example, a user may feel that going from a paper to an on-line data management system may make it difficult to return to the paper system if the on-line system proves unacceptable. In addition, the user may feel uncomfortable not having a paper-based system to fall back on if the system should break down, or if they have trouble operating the system, and they have an urgent need to access the information for a key meeting or decision deadline. These are all concerns that can obviously be overcome through the design of a paper-based backup system, but, if overlooked, could undermine the successful implementation of a system that would otherwise enhance performance.

Accessibility is another determinant of acceptance suggested by the present research which is often overlooked in systems design and implementation. Although in the eyes of IS management, the establishment of a PC room in which several PCs are available for use on a shared basis may seem to be a cost-effective approach for providing an adequate service level to the end-users, from the user's perspective there is apt to be a world of difference between a PC room and having a dedicated PC in one's own office. To use a shared PC implies the need to gather and take all the necessary materials from one's office to the shared facility, be away from the phone, be subject to interruptions, noise and lack of privacy in the shared facility, and not be guaranteed access to the same machine each time, or any machine at all during busy times. To the extent that becoming a user implies a high level of dependency on a system, any of these reductions of access may be unacceptable for a user. Access to manuals, consultants, printer output and other resources should similarly be taken into account.

There are a number of more subtle access issues involved as well. Given that many management decisions are made in the context of meetings, access to one's computing applications from a conference room, coupled with the ability to display information

reports on a large screen, could be a major determinant of acceptance. Such design considerations are evident in contemporary executive information systems and group decision support systems (e.g., Richman, 1987). System developers often overlook the fact that many executives spend a majority of their time traveling. A system "anchored" at the office has some obvious access problems for the traveling manager. Portable computers are rapidly improving, and may help overcome this barrier to accessibility by allowing executives to take key files and applications along on trips, or use the portable computer to connect to the office computer or corporate mainframe. Another strategy for enhancing access is to provide a high level of integration between computing at the manager's home and corporate systems. Indeed, many Fortune 500 CEO's already make extensive use of PCs at home (Honan, 1986; Rockart & Treacy, 1982). Offsite access to corporate systems and networks places a premium on establishing effective security measures in order to manage the increased risks of computer abuse that are introduced.

Our results have implications for training and support activities too. In presenting a new system to users, it is important to distinguish two kinds of learning: learning what the system does (its usefulness) and learning how to operate the system (its ease of use). Training activites have tended to emphasize the latter, and yet it is the former that appears to have a greater impact on acceptance. Indeed, these two kinds of training may be somewhat in conflict with one another. By exposing the potential user to the wide range of tasks that can be supported by a system, the user may become overwhelmed and feel that the system would be quite hard to use. Conversely, by attempting to teach the new user how easy it is to master a small number of tasks on a system, concealing the breadth of functionality, the user may erroneously conclude that the system is too limited to be of value to them.

Feedback regarding the impact of the system on one's task performance may be a particularly powerful method for promoting user acceptance. New users often misjudge a system's usefulness, underestimating how much it can influence the effectiveness with which they carry out their tasks. A good example of this is the study by Alavi and Henderson (1981) in which users who were unwilling to use a "bootstrap" DSS model became much more willing to use it after being shown, via a comparison of their own performance versus that of the model, the performance advantages of using the model. Indeed, training strategies are a potentially powerful, and largely overlooked, mechanism for enhancing user acceptance. One dissertation underway (Olfman, 1986) is comparing training strategies that emphasize how to operate the software (construct-based training) against those that emphasize how to tackle a relevant business problem (application-based training) for their relative effects on perceived usefulness, perceived ease of use, attitudes and self-predicted use. A research program on the impact of training on user acceptance is likely to generate important implications for MIS management.

Thus, our data provides numerous insights into practical strategies that can be used to increase user acceptance of management support systems. Further research along these lines is likely to yield additional insights and to sharpen our understanding of the interplay between the myriad of decisions facing the MIS practitioner and user acceptance. The theoretical models and measurements contributed by the present work contribute toward establishing a foundation for this future research.

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Figure 1. Theory of Reasoned Action (TRA)

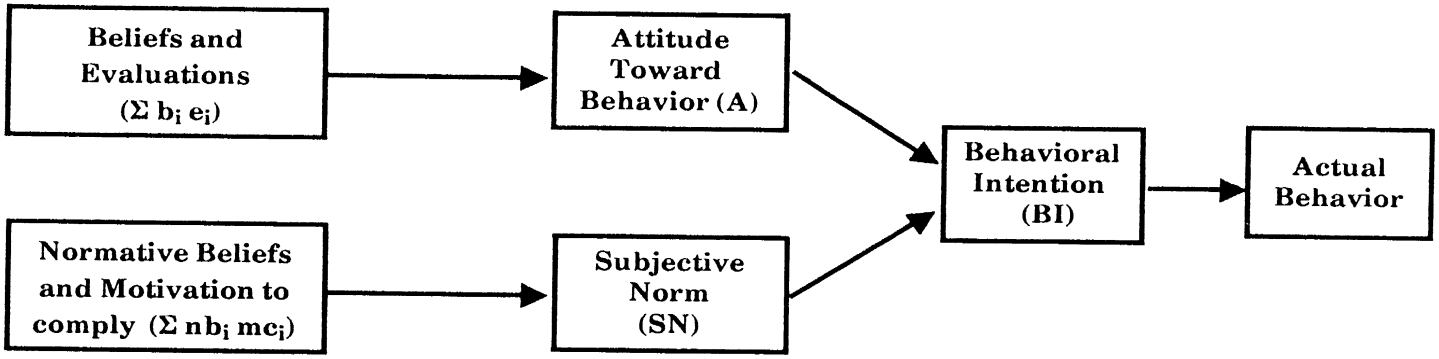

Figure 2. Technology Acceptance Model (TAM)

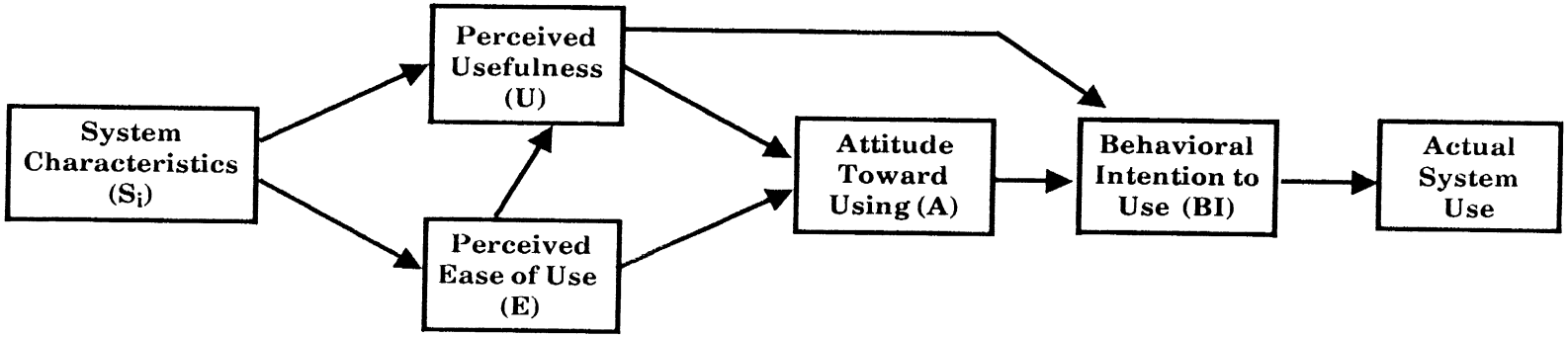

Table 1. Empirical Comparison: Theory of Reasoned Action (TRA) Versus Technology Acceptance Model (TAM)

Equation	Time 1 Immediately After Demo R^2	Time 1 Immediately After Demo Beta	Time 2 14 Weeks After Demo R^2	Time 2 14 Weeks After Demo Beta
(1) Explaining Usage at Time 2 From Intentions Measured at Times 1 and 2 (Common to both Models)				
Usage (Time2) = BI	.12***		.40***	
BI		.35***		.63***
(2) Explaining Behavioral Intention: TRA vs. TAM				
(a) TRA				
BI = A + SN	.32***		.26***	
A		.55***		.48***
SN		.07		.10
(b) TAM				
BI = A + U	.47***		.51***	
A		.27**		.16
U		.48***		.61***
(3) Explaining Attitude: TRA vs. TAM				
(a) TRA				
$A = \Sigma b_i e_i$	.07**		.30***	
$\Sigma b_i e_i$		.27**		.55***
(b) TAM				
A = U + E	.37***		.36***	
U		.61***		.50***
E		.02		.24**

* P < .05 ** p <.01 *** p<.001

Note: BI = Behavioral Intention
A = Attitude Toward Using
SN = Subjective Norm
U = Perceived Usefulness
$\Sigma b_i e_i$ = Sum of Beliefs Times Evaluations
E = Perceived Ease of Use

Table 2. Hierarchical Regression Tests

Equation	Time 1 R^2	Time 1 Beta	Time 2 R^2	Time 2 Beta
(1) Behavioral Intention (BI)				
(a) BI = A + SN + $\Sigma b_i e_i$	.33***		.30***	
A		.53***		.37***
SN		.06		.08
$\Sigma b_i e_i$		.08		.21*
(b) BI = A + U + SN	.47***		.51***	
A		.27**		.16
U		.48***		.63***
SN		.02		-.04
(c) BI = A + U + E	.51***		.52***	
A		.26**		.19*
U		.47***		.62***
E		.20**		-.11
(2) Attitude (A)				
A = U + E + $\Sigma b_i e_i$	.38***		.44***	
U		.58***		.35***
E		.01		.18*
$\Sigma b_i e_i$		.10		.32***

* P < .05 ** p <.01 *** p<.001

Note: BI = Behavioral Intention to Use
A = Attitude Toward Using
SN = Subjective Norm
U = Perceived Usefulness
E = Perceived Ease of Use
$\Sigma b_i e_i$= Sum of Beliefs Times Evaluations

Table 3. Factor Analysis of TRA Belief Items- Varimax Rotated

Belief Item	Time 1			Time 2		
	F_1	F_2	F_3	F_1	F_2	F_3
1. I'd save time in creating and editing documents.	.93	.12	-.04	.92	.17	.02
2. I'd find it easier to create and edit documents.	.93	.11	-.03	.95	.14	.03
3. My documents would be of a better quality.	.81	.13	-.01	.86	.24	.09
4. I would not use alternative word processing packages.	.10	.83	-.06	.08	.86	-.05
5. I'd experience problems gaining access to the computing center due to crowdedness.	.10	.22	.82	.15	.12	.91
6. I'd become dependent WriteOne.	.14	.81	.05	.31	.74	.19
7. I would not use WriteOne after I leave the MBA Program.	-.19	-.33	.69	-.38	-.35	.39
Eigenvalues	2.78	1.26	1.16	3.28	1.03	1.01
% of Variance Explained	39.7	18.0	16.5	46.9	14.6	14.4
Cumulative % of Variance	39.7	57.7	74.2	46.9	61.6	76.0

Table 4. Intercorrelations Between TRA and TAM Variables

	BI	A	SN	F_1	F_2	F_3	U	E
Time 1								
BI	--							
A	.57	--						
SN	.22	.27	--					
F_1	.45	.36	.17	--				
F_2	.26	.20	.13	.33	--			
F_3	-.20	-.23	-.09	-.06	.01	--		
U	.65	.61	.26	.41	.26	-.22	--	
E	.27	.08	-.06	.13	-.12	.08	.10	--
Time 2								
BI	--							
A	.50	--						
SN	.20	.19	--					
F_1	.69	.63	.29	--				
F_2	.48	.27	.22	.45	--			
F_3	-.28	-.17	-.25	-.10	-.09	--		
U	.70	.56	.34	.69	.46	-.22	--	
E	.12	.35	-.02	.24	.01	.20	.23	--

Table 5. Combined Factor Analysis of TAM and TRA Belief Items.

Belief Item	Time 1 Factors 1	2	3	4	5	Time 2 Factors 1	2	3	4
(a) TRA Items									
TRA1	.28	.05	**.89**	.10	-.01	**.82**	.08	.08	.34
TRA2	.27	.13	**.88**	.11	-.02	**.84**	.13	.05	.34
TRA3	.18	.03	**.80**	.13	-.01	**.74**	.12	.14	.42
TRA4	.17	-.11	.09	**.81**	-.04	.20	.01	**.88**	-.02
TRA5	.02	.09	.06	.24	**.83**	-.02	.05	.10	**.82**
TRA6	.08	-.09	.17	**.79**	.07	.32	-.06	**.69**	.30
TRA7	-.26	.00	-.12	-.34	**.66**	-.45	.32	-.07	-.06
(b) TAM Usefulness (U) Items									
TAM/U1	**.90**	-.03	.18	.06	-.02	**.79**	.11	.31	-.15
TAM/U2	**.90**	-.03	.26	.14	-.04	**.82**	.07	.22	-.16
TAM/U3	**.91**	.01	.16	.06	-.05	**.84**	.08	.12	-.24
TAM/U4	**.85**	.03	.24	.17	-.13	**.85**	.17	.18	-.07
(c) TAM Ease of Use (E) Items									
TAM/E1	-.08	**.84**	.08	-.12	.08	-.09	**.88**	-.06	.07
TAM/E2	.01	**.90**	.03	-.05	.01	.15	**.85**	.12	-.05
TAM/E3	-.05	**.91**	.03	-.09	.03	.05	**.89**	-.04	.07
TAM/E4	.10	**.91**	.07	.00	-.01	.30	**.84**	-.02	.03
Eigen.	4.83	3.35	1.51	1.14	1.06	5.87	2.99	1.27	1.01
% Var	32.3	22.3	10.1	7.6	7.0	39.2	19.9	8.5	6.7
Cum %	32.3	54.6	64.7	72.3	79.3	39.2	59.1	67.6	74.3

Table 6. Alternative Representations of the Impact of TRA's Belief Structure on Attitude (A)

Equation	Time 1		Time 2	
	R^2	Beta	R^2	Beta
(1) $A = \Sigma b_i$	.03		.23***	
Σb_i		.18		.49***
(2) $A = F_1 + F_2 + F_3$	.18***		.41***	
F_1		.31**		.63***
F_2		.09		-.02
F_3		-.21*		-.10
(3) $A = F_1 + F_2 + F_3 + U + E$	.40***		.48***	
F_1		.13		.46***
F_2		.02		-.03
F_3		-.11		-.13
U		.53***		.18
E		.02		.23**

* P < .05 ** p< .01 *** p<.001

Note: A = Attitude Toward Using
b_i = original beliefs
F_i = belief factors from factor analysis
U = Perceived Usefulness
E = Perceived Ease of Use

Table 7. Testing for Direct Effects of TRA's Beliefs on Behavioral Intention (BI)

Equation	Time 1 R^2	Time 1 Beta	Time 2 R^2	Time 2 Beta
(1) $BI = A + SN + \Sigma b_i$	.35***		.41***	
A		.52***		.28**
SN		.05		.05
Σb_i		.17*		.44***
(2) $BI = A + SN + F_1 + F_2 + F_3$	.41***		.57***	
A		.41***		.08
SN		.05		-.07
F_1		.29**		.55***
F_2		.06		.21**
F_3		-.08		-.21**
(3) $BI = A + SN + F_1 + F_2 + F_3 + U$	.50***		.62***	
A		.21*		.01
SN		.01		-.11
F_1		.21*		.39***
F_2		.01		.14
F_3		-.06		-.18**
U		.41***		.36***

* P < .05 ** p< .01 *** p<.001

Note: A = Attitude Toward Using
SN= Subjective Norm
b_i= Original TRA beliefs items
Fi= TRA belief dimensions from factor analysis
U = Perceived Usefulness
E = Perceived Ease of Use

Table 8. Testing the Impact of TRA's Subjective Norm (SN) on Attitude (A)

Equation	Time 1 R^2	Time 1 Beta	Time 2 R^2	Time 2 Beta
(1) $A = \Sigma b_i e_i + SN$	.12**		.31***	
$\Sigma b_i e_i$		.22*		.54***
SN		.22*		.07
(2) $A = \Sigma b_i + SN$	.09**		.25***	
Σb_i		.15		.47***
SN		.25**		.10
(3) $A = F_1 + F_2 + F_3 + SN$	.22***		.41***	
F_1		.29**		.64***
F_2		.08		-.02
F_3		-.20**		-.10
SN		.19*		-.01
(4) $A = U + E + SN$	.39***		.36***	
U		.58***		.49***
E		.02		.24**
SN		.12		.03

* P < .05 ** p< .01 *** p<.001

Note: A = Attitude Toward Using
SN= Subjective Norm
$\Sigma b_i e_i$= beliefs times evaluations
F_i = TRA beliefs from factor analysis
U = Perceived Usefulness
E = Perceived Ease of Use

Appendix. Measurement Scales Used for TRA and TAM Variables

Present Intention to Regularly Use WriteOne

Assuming I learned to use it, I presently intend to actually use WriteOne regularly in the MBA Program.

A. likely | extremely | quite | slightly | neither | slightly | quite | extremely | unlikely

B. definitely no | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | definitely yes

Attitude Toward Using WriteOne

Assuming I learned to use it, my actually using WriteOne regularly in the MBA program would be:

A. pleasant | extremely | quite | slightly | neither | slightly | quite | extremely | unpleasant

B. foolish | extremely | quite | slightly | neither | slightly | quite | extremely | wise

C. pleasureable | extremely | quite | slightly | neither | slightly | quite | extremely | painful

D. harmful | extremely | quite | slightly | neither | slightly | quite | extremely | beneficial

Social Norms Toward Using WriteOne

Most people who are important to me think I should use WriteOne regularly in the MBA Program.

likely | extremely | quite | slightly | neither | slightly | quite | extremely | unlikely

Beliefs About Actually Using WriteOne

Assuming you actually become a continuing user of WriteOne, how likely or unlikely is it that each of the following consequences would occur for you personally as a result of your actually using WriteOne regularly in the MBA program:

	likely			neither			unlikely
1. I'd save time in creating and editing documents.	1	2	3	4	5	6	7
2. I'd find it easier to create and edit documents.	1	2	3	4	5	6	7
3. My documents would be of a better quality.	1	2	3	4	5	6	7
4. I would not use alternative word processing packages.	1	2	3	4	5	6	7
5. I'd experience problems in gaining access to the computing center due to crowdedness.	1	2	3	4	5	6	7
6. I'd become dependent on WriteOne	1	2	3	4	5	6	7
7. I would not use WriteOne after I leave the MBA program.	1	2	3	4	5	6	7

Evaluations of Belief Consequences

How good or bad are each of the following consequences for you personally:

	good			neutral			bad
My saving time in creating and editing documents.	1	2	3	4	5	6	7
My finding it easier to create and edit documents.	1	2	3	4	5	6	7
My documents being of a better quality.	1	2	3	4	5	6	7
My not using alternative word processing packages.	1	2	3	4	5	6	7
My experiencing problems in gaining access to the computing center due to crowdedness.	1	2	3	4	5	6	7
My becoming dependent on WriteOne.	1	2	3	4	5	6	7
My not using WriteOne after I leave the MBA program.	1	2	3	4	5	6	7

Present Computer Usage

At the present time, I consider myself to be a

frequent								infrequent
	extremely	quite	slightly	neither	slightly	quite	extremely	

user of WriteOne.

I currently use WriteOne (select most accurate answer):

[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
not at all	less than once a week	about once a week	2 or 3 times a week	4 to 6 times a week	about once a day	several times a day

Perceived Ease of Use

1. Learning to operate WriteOne would be easy for me.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

2. I would find it easy to get WriteOne to do what I want it to do.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

3. It would be easy for me to become skillful at using WriteOne.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

4. I would find WriteOne easy to use.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

Perceived Usefulness

1. Using WriteOne would improve my performance in the MBA program.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

2. Using WriteOne in the MBA program would increase my productivity.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

3. Using WriteOne would enhance my effectiveness in the MBA progam.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

4. I would find WriteOne useful in the MBA program.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely