The Journal of Korean
Institute of CALS/EC
Vol. 5, No. 1, June 2000

정보 시스템 사용의 전제로서의 태도에 대한 연구: 약30년간의 실증연구에 대한 메타분석

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ATTITUDE IS AN ANTECEDENT TO INFORMATION SYSTEMS USE: A META-ANALYSIS OF NEARLY THIRTY YEARS OF EMPIRICAL RESEARCH

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Abstract

In spite of seemingly conflicting findings, a meta-analysis of studies published between 1971 and 1998 demonstrates an unambiguous relationship between attitude and IS use. The apparent contradictions arise principally because of methodological inconsistencies in the way that attitude was measured (belief or affect) and the timing of the measurement of attitude vis-à-vis the use of the technology. We found that the affective dimension of attitude is more powerful than the cognitive dimension for explaining IS use. However, neither is particularly strong in predicting future use.

Keywords: Attitudes, IS Use, Theory of Reasoned Action
ISRL Categories: AA0102, AA05, EI0208, GB02

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Attitude has a long history as a construct used to explain and predict information systems (IS) use. Theoretical justification comes principally from the theory of reasoned action in which attitude leads to behavior directly or indirectly through behavioral intention. For example, Lucas (1975, 1978) reported a strong correlation between attitude and IS use, and Davis, Bagozzi & Warshaw (1989) argued that attitude is a strong predictor of behavioral intention. Nevertheless, there have been many critics of attitude as a useful measure and many attempts to find an appropriate replacement.

Swanson (1982) regarded attitude as an affective construct, and complained of its lack of usage-relevant components. To overcome this limitation, he introduced the channel disposition model. Goodhue (1988) also criticized the use of attitude as a factor influencing IS success, arguing that attitude (affect) is a surrogate for general satisfaction which is an emotion unrelated to task. According to him, a positive attitude does not necessarily lead to increased performance; only improvements in tasks do. By defining attitude as purely affective, Davis (1989) found that perceived usefulness, a cognitive belief, that presumably influences attitude, has a more direct relationship to IS use than affect does. Schewe (1976) conceptualized attitude as belief about the outcome of IS, and found nonsignificant regression coefficients between belief and IS use. Ginzberg (1981), Sambamurthy & Chin (1994), and Zigurs, DeSanctis & Billingsley (1991) reported insignificant correlations between attitude and IS use as well.

Gutek, Winter & Chudoba (1992) argued that the inconsistency between computer attitudes and use may stem from inattention to conditions that moderate the relationship between attitudes and behavior: i.e., controls over use, access to computers, computer knowledge, specificity of the target information system, and the particular aspect of attitude being explored. We undertook a meta analysis to determine the explanatory and predictive power of the attitude construct under various operationalizations to bring order and clarification to the results found to-date.

We begin by exploring the attitude construct in the psychology literature. This leads to a framework for classifying the ways in which attitude has been operationalized in the IS context. Next, we review the IS literature to understand the relationship between attitude and IS use. We conclude by providing suggestions based on our findings.

THE ATTITUDE CONSTRUCT

Three dimensions in various configurations comprise the attitude construct in the psychology literature. The affective dimension of attitude refers to how much the person likes the object of thought (McGuire, 1985) and measures the degree of emotional attraction toward an object (Bagozzi & Burnkrant, 1979). This dimension is a direct measure of attitude because assessing it places few cognitive demands on respondents

(Bagozzi & Burnkrant, 1985). Respondents can be asked to express their overall attitude toward the object directly.

Attitude can also be measured by asking about specific beliefs related to the object (Bagozzi & Burnkrant, 1979, 1985). The cognitive aspect of attitude consists of evaluation, judgment, reception, or perception of the object of thought based on values (Chaiken & Stangor, 1987). The cognitive approach to measuring attitude is indirect because it measures the evaluations of other concepts, objects, and events associated with the object, entailing deeper thought processes.

The conative approach uses the person's behavior measured by his or her verbal report of intended acts toward the object (McGuire, 1985).

The theory of reasoned action (Fishbein & Ajzen, 1975) has been used widely in IS research. It views attitude as a unidimensional construct denoting one's affect or feeling toward an object. In the theory, the relationship of affect to behaviour is mediated by intention. While much less popular in the IS literature, there are three other important views of attitude in the psychology literature: affect directly antecedent to behavior, the dyadic view and the tripartite view (see figure 1).

Affect Directly Antecedent to Behavior Although the Theory of Reasoned Action has robust predictive power (Olson & Zanna, 1993; Tesser & Shaffer, 1990), empirical research shows that attitude also has a more direct relationship to behavior. A series of studies (Bagozzi & Yi, 1989; Bagozzi, Yi & Baumgartner, 1990; Yi, 1990) identified the direct influence on behavior of attitude measured as the perceived effort required for that behavior. In addition, individuals' affect (or liking) for particular behaviors can, under some circumstances, exert a strong influence on their actions. Choice of television programs, for example, is almost solely based on affect (Bandura, 1986). In fact, many consumer choices are often made on the basis of affective reactions (Engle, Blackwell & Miniard, 1986). Barki and Hartwick (1994) and Hartwick and Barki (1994) found that users have varying affect toward information systems depending upon their experiences with them, implying that the relationship between affect and behavior may be recursive.

Dyadic View. The dyadic view presumes affective and cognitive components to be independent variables that are antecedents to behavioral intention. In this view, affective and cognitive components are understood as alternative ways of measuring an individual's attitude (Bagozzi & Burnkrant, 1979, 1985). Weiss & Cropanzano (1996) identified four empirical studies that identified independent influences of the affective and cognitive components of attitude. Similarly, Triandis (1980) argued for precision in the relationship between attitude and behavior through

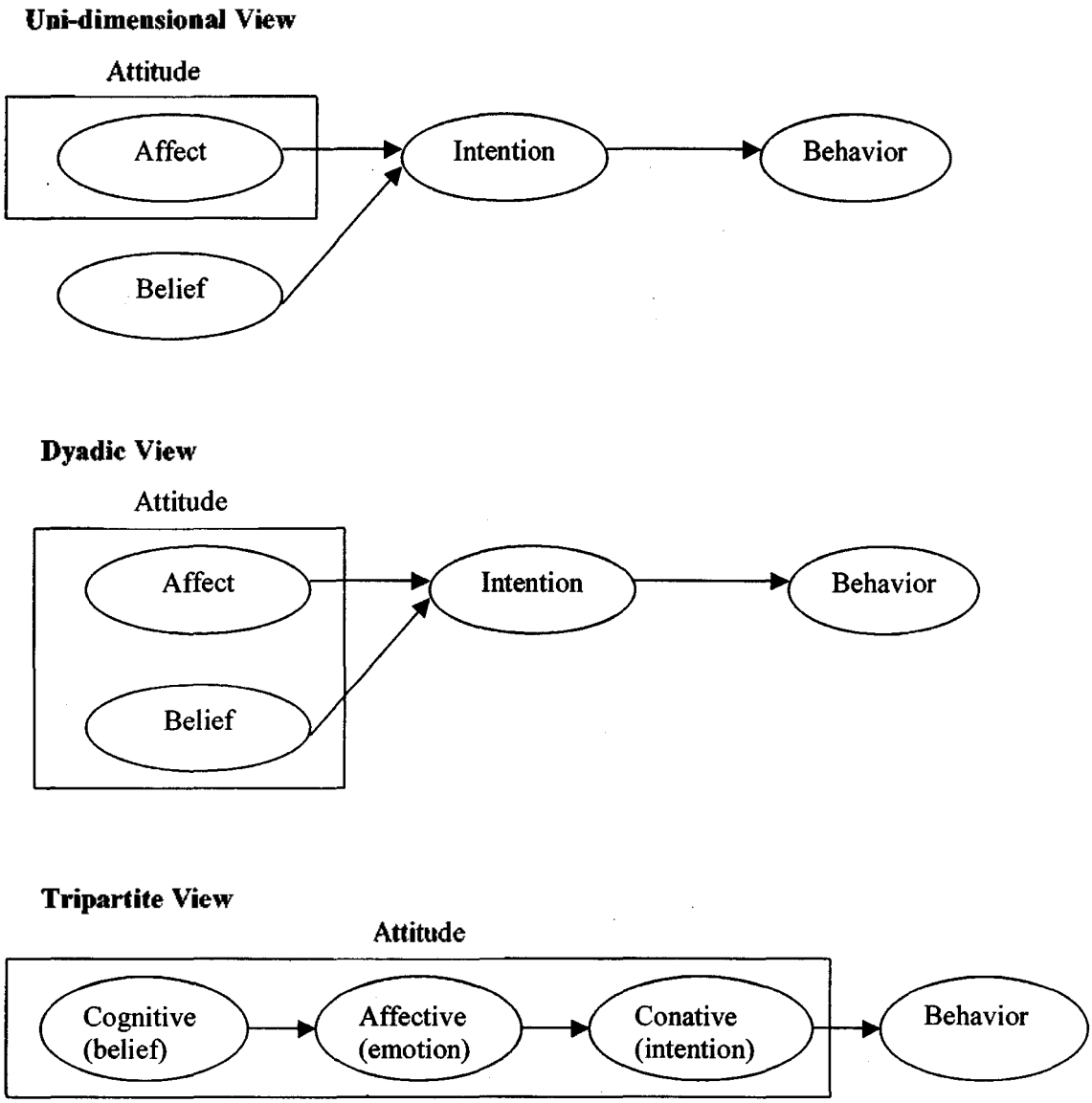

Figure-1 Theories of Attitude

the separation of the affective and cognitive components.

Tripartite View. The tripartite view distinguishes affective, cognitive, and conative components of attitude (e.g., Katz & Stotland, 1959). It assumes that cognitive belief influences affective emotion, which in turn leads to the conative dimension. All

three components are considered part of the attitude construct.

It seems probable that the specific component of attitude being investigated may affect a study's outcome. An evaluative disposition toward an object or a behavior might be different depending on whether it is inferred from an affective, cognitive or behavioral response (Melone, 1990). Hence, the complexity associated with the construct precludes it from consideration as a useful term to explain or predict IS use without dimensional clarification.

In order to be accurately measured, attitude should be tested in relation to a specific behavioral objective (Millar & Tesser, 1986), context, action, target, and time (Ajzen & Fishbein, 1977), and must be strong and accessible - evoked automatically without the individual's intending it to be or being aware of its influence (Fazio, 1990). The distinction between attitude toward the object and attitude toward the behavior must be maintained. Attitude toward the behavior relates more strongly to a specific behavior than does attitude toward the object (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980). In the IS area, Hartwick & Barki (1994) argued that the attitude toward "using" computers needs to be measured as an antecedent to IS use, rather than attitude toward computers.

Psychology's research into attitude provides the following insights: the attitude dimension needs to be clear; for high attitude-behavior consistency, the attitude should be matched to the behavior, not the object; and attitude can have a direct effect on behavior. In the IS context, these findings imply that the attitude dimension to be investigated needs to be identified; that to see the real influence of attitude on IS use, we have to ask about the attitude toward IS use, not just IS generally; and that the affective dimension of attitude may affect use more directly than the theory of reasoned action predicts. Furthermore, users have different attitudes depending upon their experiences with information systems. Hence, the direct effect of attitude on IS use may be influenced by the timing of the measurement of both attitude and use.

ISSUES IN OPERATIONALIZING TESTS OF THE RELATIONSHIPS BETWEEN ATTITUDE AND USE IN IS RESEARCH

To understand the relationship between attitude and IS use, it is necessary to carefully define and operationalize both. Igbaria & Parasuraman (1991) recognized that, "the problems of attitude research in MIS derive from differences in the conceptualization and operationalization of attitude, lack of specificity of the attitude measures, and failure to establish their construct validity (p. 554)." In this section we discuss issues relating to three concerns: the dimension of attitude studied (affective, cognitive, conative), the attitude target, and the timing of the measurement of both attitude and use.

Dimension of Attitude

There has been little consistency in the specification of attitude in the IS literature. Hence, the relative appropriateness of each of the dimensions of attitude in the IS context is not obvious. For example, Davis (1989), Goodhue (1988), and Swanson (1982) define attitude as affect, whereas Igbaria & Parasuraman (1991) and Thompson, Higgins & Howell (1991) include both affective and cognitive dimensions. Early on, Schewe (1976) considered attitude to be synonymous with belief. The technology acceptance model has also found strong relationships between beliefs (perceived usefulness and ease of use) and IS use (e.g., Davis, 1989, 1993; Davis, Bagozzi & Warshaw, 1989). It may be that the inconsistent results regarding the attitude-IS use relationship are attributable to the variations in the attitude dimensions being investigated.

The tripartite perspective has little support in the IS literature. Bagozzi & Burnkrant (1979) criticized the tripartite model because it obscures the attitude-behavior relation. Many studies (e.g., Bagozzi & Yi, 1989; Bagozzi, Yi & Baumgartner, 1990; Yi, 1990) have labeled the conative dimension behavioral intention. Its influence on IS use (i.e., the relationship between behavioral intention and IS use) has been found robust (e.g., Davis, Bagozzi & Warshaw, 1989; Taylor & Todd, 1995).

The theory of reasoned action and the dyadic view support the notion that attitudes provide the justification (i.e., affective or cognitive reasons) for intention. Goodhue (1988) and Swanson (1982) both recognized that the distinction between affect and belief has been frequently overlooked in MIS attitude research. A meta-analysis of the attitude research in IS should provide a perspective about which of the two dimensions (affective or cognitive) is more powerful in explaining and predicting IS use.

Attitude Targets

It is well recognized in the IS literature that attitude toward system use should be measured, not just the attitude toward the system (e.g., Davis, 1993; Hartwick & Barki, 1994; Mathieson, 1991; Moore & Benbasat, 1991). Early attitude research investigated a myriad of attitude targets. These include the computer's potential and the system's staff (Lucas, 1975; Maish, 1979); the implementation of a computerized IS (Lucas, 1978); the effect of MIS on the individual and the organization (Schewe, 1976); MIS as a whole (Schultz & Slevin, 1975); and even society in general (Lee, 1970; Morrison, 1983). All are problematic since measured attitudes must be specific and match behavior-objectives for strong behavioral predictability (Ajzen & Fishbein, 1977; Millar & Tesser, 1986).

How can we discriminate the attitude toward IS use from that toward the IS itself? Hartwick & Barki (1994) recommend use of the word "use" in questionnaire items (for example, "My using the new system is great" is better than "The new system is great"). However, the problem of IS use is not the issue of wording expression, but of the situation. If we ask heavy users about their

attitude toward their specific IS without necessarily using the expression "use", they will respond with their use experiences. Therefore, in selecting appropriate studies to include in the meta-analysis, we assume that questions about the experiences with or the specificity of information systems are as valid as those using the word "use".

Measurement Timing

Measurement timing enables us to determine whether attitude is useful for prediction, explanation or both. Given the strong relationship between intention and IS use, high correlations between attitude and intention may imply future use. Hence, attitude may be considered predictive if there is a high correlation when it is measured first and IS use is measured at a later time. Attitude may be useful as an explanation of behavior if there is a high correlation between post-use attitude and IS use, when both are measured simultaneously. These relationships are made more complex since the status of IS use is very fragile and its patterns are constantly changing (Zigurs, DeSanctis & Billingsley, 1991).

Hence, in order to understand the explanatory and predictive power of attitude vis-a-vis IS use, we must investigate two aspects of attitude measurement: dimension (cognitive or affective) and measurement timing (pre-use attitude and post-use attitude) (see figure 2). The simultaneous consideration of these aspects responds to Barki & Hartwick's (1994) request for future research regarding the relative influence of differentiated and undifferentiated attitude on IS use.

We categorized the IS attitude literature in terms of these aspects in order to explain the inconsistencies that seem to exist.

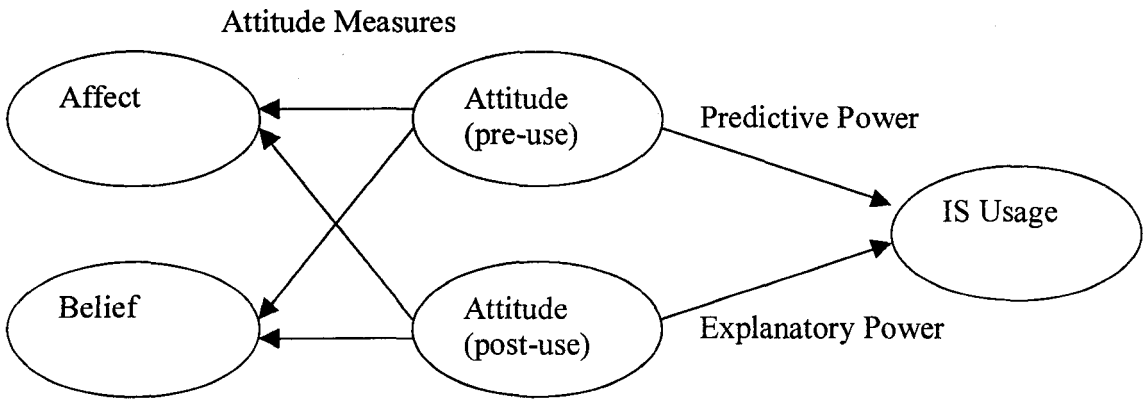

Figure-2 Research Models

ATTITUDE STUDIES IN THE IS LITERATURE

Empirical studies between 1971 and 1998 that researched the attitude construct in the context of IS were collected from the CALGARY SURVEY DATABASE®[1] and ABI/INFORM™[2]. Additional studies not captured by these two databases were collected through references and recommendations by experts as recommended by Hunter & Schmidt (1990). We excluded all but seventy-four studies because they did not describe empirical data. Those eliminated include conceptual studies (e.g., Goodhue, 1988; Swanson, 1982), instrument development (e.g., Amoroso & Cheney, 1991; Heckman & King, 1994), and surveys for description or the comparison of attitudes (e.g., Jiang, Klein, Motwani & Balloun, 1997; O'Brien & Wilde, 1996; Paradice, 1990; Power, Meyeraan & Aldag, 1994).

Four additional filters were applied to these seventy-four studies to narrow our focus to the research that investigated the impact of users' attitude toward IS use on that use. The studies that each filter eliminated are listed in Appendix 1, sections 1-4.

1. We deleted studies that used attitude as a dependent construct. Twenty-four studies investigating factors influencing attitude were eliminated (Appendix I-1).

2. We dropped studies in which the subjects holding the attitudes were not users themselves. For example, Dutton & Kraemer (1978) measured the impact of top managements' attitude toward IS on the IS use of middle management. Six studies were eliminated (Appendix I-2).

3. We eliminated studies in which the dependent variable was not IS use. These studies, for example, looked at the impact of attitude on satisfaction (Bruwer, 1984; Hiltz & Johnson, 1990; King, Premkumar & Ramamurthy, 1988; Rivard & Huff, 1988), on participation (Barki & Hartwick, 1994), and on computer anxiety (Webster, Heian & Mechelman, 1990). Twenty studies were eliminated (Appendix I-3).

4. Finally, we eliminated studies in which the target of the attitude was other than a specific IS. Even though these studies used IS use as a surrogate for IS success, the target of the attitude was not a specific IS, but rather general IS such as PCs, mainframes, etc.. For example, Brock & Sulsky (1994) measured the attitude toward IS in general. Larsen (1993) studied the impact of attitude toward organizational and task change on IS use. Zigurs, DeSanctis & Billingsley (1991) measured attitude toward a group-decision-making-meeting rather than the use of a GDSS. Five studies were eliminated by this filter (Appendix I-4).

[1] An annotated collection of data acquisition instruments in MIS produced by the University of Calgary. For more details, refer to Newsted, Munro & Huff (1991).

[2] An index to journal literature in the areas of business, management and related fields. ABI/INFORM™ is a registered trademark of Data Courier.

In sum, fifty-five studies were eliminated, leaving nineteen studies that satisfied all our requirements. These studies investigated the impact of users' attitude toward IS use on IS use, and reported empirical evidence about the relationship. Appendix II summarizes each.

PRELIMINARY ANALYSIS

Our research questions were answered by reinterpreting previous empirical reports about the relationship between the attitude toward IS use and the IS use behavior. The first issue in reinterpreting previous work is which rules to use to define the affective and cognitive aspects of attitude. We use the approach described by Crites, Fabrigar & Petty (1994). The affective scales are defined as the position that best describes respondents' feelings toward the object, while the cognitive scales indicate the position that best describes the traits or characteristics of the object. Therefore, twelve affective word pairs (love/hateful, delighted/sad, happy/annoyed, calm/tense, excited/bored, relaxed/angry, acceptance/disgusted, joy/sorrow, positive /negative, like/dislike, good/bad, and desirable/undesirable) and seven cognitive word pairs (useful/useless, wise/foolish, safe/unsafe, beneficial/harmful, valuable/worthless, p erfect/imperfect, and wholesome/unhealthy) constitute affective and cognitive scales respectively (Crites, Fabrigar & Petty, 1994)[3].

Based on these guidelines, we categorized the nineteen studies into those that measured the affective dimension of attitude and those that measured the cognitive dimension. Eight studies tested the influence of attitude measured as affect and twelve tested the influence of attitude measured cognitively. Sambamurthy & Chin (1994) is included in both categories because perceived ease of use was measured as an affective dimension using expressions such as "frustrated, fun, enjoy, and comfortable", and perceived usefulness was measured cognitively using such words as "depersonalization, good idea, hindrance to meeting, and making interesting meeting boring".

Table I provides an overview of the eight studies in which the affective attitude is measured.

[3] Crites, Fabrigar & Petty (1994) distinguished between affective antecedent of attitude and attitude itself. They identified eight word pairs for the affective antecedent and four word pairs for the attitude itself. However, we believe this distinction is not robust because the word expressions are very alike between those two groups. In addition, this kind of distinction goes against many attitude-related theories (such as theory of reasoned action, technology acceptance model, and theory of planned control).

Table 1 Relationship between affect and IS use

Author(s)	Findings	Target System
Compeau & Higgins (1991)	Attitude is an explanatory factor for IS use (self-report).	Neither individually specific nor shared
Davis (1993)	Attitude is an explanatory factor for IS use (self-report).	Individually specific and shared (e-mail, text editor)
Davis, Bagozzi & Warshaw (1989)	Attitude is neither a predictive nor an explanatory factor for IS use (self-report).	Individually specific and shared (WriteOne)
Gutek, Winter & Chudoba (1992)	Attitude is an explanatory factor for IS use (self-report).	Neither individually specific nor shared
Hartwick & Barki (1994)	Attitude is neither a predictive nor an explanatory factor for IS use (self-report).	Individually specific but not shared
Popovich, Hyde, Zakrajsek & Blumer (1987)	In general, attitude is an explanatory factor for IS use (self-report).	Neither individually specific nor shared
Sambamurthy & Chin (1994)	Attitude is both an explanatory and predictive factor for IS use (self-report).	Individually specific and shared (SAMM)
Thompson, Higgins & Howell (1991)	Attitude is NOT an explanatory factor for IS use (self-report).	Neither individually specific nor shared

All eight studies measured the explanatory power of affect: i.e., attitude was measured at the same time as IS use. Three of them also measured the predictive power of attitude: i.e., attitude was measured first and IS use was measured at a later time. The studies reported conflicting conclusions. Five studies reported a significant positive correlation between affect and IS use when measured simultaneously and three studies did not. As for the predictive power of affect, two studies were positive, and one was not.

Table 2 summarizes the results of the studies testing the relationship between attitude toward IS use and actual IS usage behavior, when attitude was measured cognitively.

Eleven of the studies measured the explanatory power of cognitive attitude. Only two measured its predictive power. These studies also reported conflicting conclusions. In terms of the explanatory power of cognitive attitude, nine studies reported positive results, and two reported no relationship. As for its predictive power, only one of the two studies was positive.

While suggestive, this brief review of correlations between attitude and IS use does not allow us to draw incontrovertible conclusions about the explanatory or predictive power of attitude. To further resolve the ambiguity, we conducted a meta-analysis.

Table 2 Relationship between belief and IS use

Author(s)	Findings	Target System
Amoroso & Cheney (1991)	Attitude is NOT an explanatory factor for IS use (self-report).	Neither individually specific nor shared
Ginzberg (1981)	Attitude is NOT a predictor factor for IS use (archival).	Individually specific and shared (OLPM)
Igbaria (1990)	Attitude is an explanatory factor for IS use (self-report).	Neither individually specific nor shared
Igbaria (1992)	Attitude is an explanatory factor for IS use (self-report).	Neither individually specific nor shared
Igbaria & Parasuraman (1991)	Attitude is an explanatory factor for IS use (self-report).	Neither individually specific nor shared
Lucas (1975)	Attitude is an explanatory factor for IS use (self-report).	Individually specific and shared (sales IS)
Lucas (1978)	Attitude is an explanatory factor for IS use (mixed).	Individually specific and shared (Medical research IS)
Moore & Benbasat (1995)	Attitude is an explanatory factor for IS use (self-report).	Neither individually specific nor shared
Robey (1979)	Attitude is an explanatory factor for IS use (archival).	Individually specific and shared (sales IS)
Sambamurthy & Chin (1994)	Attitude is both an explanatory and predictive factor for IS use (self-report).	Individually specific and shared (SAMM)
Schewe (1976)	Attitude is NOT an explanatory factor for IS use (self-report).	Individually specific but not shared
Schiffman, Meile & Igbaria (1992)	Attitude is an explanatory factor for IS use (self-report)	Neither individually specific nor shared

META-ANALYSIS

We based our meta-analysis on Hunter & Schmidt (1990). Two features characterize their method. First, only correlation can be used for cumulation. Regression weights (coefficients) cannot be cumulated because beta weights are relative to the set of predictors considered and will only replicate across studies if the exact set of predictors is considered in each. For the same reason, factor loadings cannot be cumulated either. Second, a number of corrections to meta-analytic data that compensate for a variety of statistical artifacts can be made. By artifacts, we mean the errors in study results produced by study imperfections that are artifactual or man-made and not properties of nature. When error is not controlled, correlations will be underestimated and standard deviations will be overestimated (Hunter & Schmidt, 1990: 198).

Artifact Attenuation

Eleven types of artifact can affect the size of correlation coefficients: i.e., sampling error; measurement error in the (in)dependent variable;

dichotomization of a continuous (in)dependent variable; range variation in the (in)dependent variable; deviation from perfect construct validity in the (in)dependent variable; reporting or transcriptional error; and variance due to extraneous factors[4]. Meta-analysis enables the determination of the real relationship between the variables of interest by canceling out the attenuation effects of all artifacts except for reporting and transcriptional error.

Among the artifacts that need to be controlled in meta-analysis, we assumed that only sampling error and measurement error in both dependent and independent variables relate to our study. Other extraneous factors may be investigated later as moderating variables in the relationship between independent and dependent variables. Sampling error is assumed unsystematic (random), so it affects only the true variance between two constructs, but not the true correlation (Hunter & Schmidt, 1990: 44). Meanwhile, measurement error is assumed systematic, so it affects both the true correlation and variance between two constructs. This approach is quite conservative since adjusting the artifact multiplier, which is always smaller than 1, can increase the study mean correlation. However, if this conservative approach can identify a positive correlation between attitude and IS use, a positive relationship between these two variables probably exists.

Table 3 provides the details of the results of the meta analysis. The measurement error-corrected correlations between attitude and use are high when measured at the same time (.69 for affect with the 95% credible interval of .2906 ≤ ≤ `1., and .58 for belief with the 95% credible interval of .0097 ≤ ≤ `1.). However, the impact of moderators is large (68.6% of variance for affect and 87.1% for belief). Both the affective and cognitive dimensions of attitude correlate poorly with use when use is measured at a later time than attitude (.35 for affect and .19 for belief) with all studies reporting non-significant results. Appendix III contains the meta-analysis worksheets.

[4] Sampling error implies that the samples may not represent the population well. Variable dichotomization means arbitrarily choosing a dichotomous interval for a continuous variable. Range restriction means suggesting wrong ranges for each variable. Construct validity matters if a surrogate measure is used for a construct of interest. Reporting or transcriptional error includes inaccuracy in coding data, computational errors, and errors in reading computer output. Extraneous factors are the uncontrolled influential factors that are not the focus of interest..

Table 3 Meta Analysis Results

	Number of studies	Average sample size	Mean correlation	Variance	Reliability of attitude	Reliability of use
Explanatory power of affect	8	264	.43	.0236	.84	.74
Predictive power of affect	3	83	.24	.0001	.88	.77
Explanatory power of belief	11	193	.39	.0440	.81	.83
Predictive power of belief	2[5]	36	.19	.0062	N/A	N/A

Note: For details, refer to Appendix III. Meta-analysis Worksheets.

Table 3 continued

	Measurement error corrected correlation	Standard deviation adjusted for artifacts	Sampling error variance	Variance due to variation of reliability	Residual variance
Explanatory power of affect [6]	.692	.205	.0025 (10.6%)	.0049 (20.8%)	.0162 (68.6%)
Predictive power of affect [7]	.354	`0	`0	0.0004	`0
Explanatory power of belief [8]	.580	.291	.0037 (8.4%)	.0020 (4.5%)	.0383 (87.1%)
Predictive power of belief [9]	N/A	`0	0.0266	N/A	N/A

[5] Only one study provides reliability information, so variation of reliabilities cannot be calculated.

[6] The attenuation factor by measurement error (A) = Average ($Reliability_{attitude}$) * Average ($Reliability_{IS\ use}$) = 0.84 * 0.74 = 0.6216. Thus, the measurement error corrected correlation (ρ) = Average (r)/A = 0.43/0.6216 = 0.6918. Sampling error, $\sigma_e^2 = (1 - [\text{Average } (\rho_{xy})]^2)^2/(N-1) = (1 - 0.43^2)^2/263 = 0.0025$ (Formula is explained in Hunter & Schmidt, 1990: 108). The variance due to measurement error is $S_2^2 = \rho^2A^2V$, whereas $V = [\text{StDev } (Reliability_{attitude})]^2 /[\text{Average } (Reliability_{attitude})]^2 + [\text{StDev } (Reliability_{IS\ use})]^2 /[\text{Average } (Reliability_{IS\ use})]^2 = 0.11276^2/0.84^2 + 0.06907^2/0.74^2 = 0.0267$ (Hunter & Schmidt, 1990: 163-169). Therefore, $S_2^2 = 0.6918^2 * 0.6216^2 * 0.0267 = 0.0049$. The residual variance is thus 0.0162 (0.0236-0.0025-0.0049). The sampling error corrected variation of study correlations, $Var(\rho_{xy}) = \sigma_r^2 - \sigma_e^2 = 0.0236 - 0.0025 = 0.0211$. The variance in true correlation is $Var(\rho) = [Var(\rho_{xy}) - S_2^2]/A^2 = [0.0211 - 0.0049]/0.6216^2 = 0.0419$ (Hunter & Schmidt, 1990: 163-169). Thus, standard deviation adjusted for artifacts is 0.205.

[7] The attenuation factor by measurement error (A) = 0.88 * 0.77 = 0.6776. Thus, measurement error corrected correlation is $\rho = 0.24/0.6776 = 0.3542$. The sample error is $\sigma_e^2 = (1 - 0.24^2)^2/82 = 0.0108$. Therefore, the sampling error corrected variation of correlations across studies is $Var(\rho_{xy}) = -0.01075$ (0.00005 - 0.0108). In meta-analysis, variance of population sometimes ends up with a negative value because it is computed as the difference between the given variance of observed correlations and the statistically given sampling error variance. The fact that the difference is negative shows that there is some second-order sampling error, which occurs due to the

DISCUSSION

We found that affect -- although generally regarded as changeable, weak, and undifferentiated, and assumed to be hardly related to IS use (Hartwick & Barki 1994) -- is just as robust as cognitive measures for explaining IS use. In fact, the explanatory power of attitude was greater when attitude was measured as affect than as belief (0.69 versus 0.58). In addition, the amount of unspecified variance after adjusting artifact attenuation was less for affect (68.6% versus 87.1%). Affect was also superior to cognitive measures in predicting IS use behavior (0.35 versus 0.19). However, the predictive power of both affective and cognitive attitude is marginal, no matter how it is measured. This finding refutes the presumption held by Davis, Bagozzi & Warshaw (1989) that attitude is a useful construct to predict future IS use parsimoniously.

Why are affective measures of attitude better than cognitive measures in explaining IS use? Perhaps because it is difficult to identify beliefs comprehensively enough to tap the appropriate cognitive responses. Mathieson (1991) argued that the cognitive dimensions of attitude are situation specific: i.e., general questions may not have enough construct validity or reliability. Actually, our findings could have been anticipated given Wilson et al.'s (1989, 1990) "reasons analysis" that showed the diminishing relationship between attitudes and behavior when people are encouraged to think about their attitudes (Wilson, 1990; Wilson, Dunn, Kraft & Lisle, 1989). The cognitive dimensions may provide the right reasons for the use of information systems if we could identify all of them, but it seems difficult to pinpoint the cognitive reasons which affect IS use.

Another interesting finding is the dynamics of the influence of attitude throughout the IS life cycle (i.e., pre-use and post-use). It is not surprising that both affective and cognitive measures correlated better with use when

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small number of studies considered in meta-analysis. The corresponding estimate of the standard deviation is 0 (Hunter & Schmidt, 1990: 289). This means there is no variation in the study population effect sizes. When the variance of population correlations is zero, the difference will be negative half the time (Hunter & Schmidt, 1990: 412-413). $V = 0.06928^2/0.88^2 + 0.02828^2/0.77^2 = 0.0075$. Therefore, the variance due to measurement error is $S_2^2 = 0.3542^2 * 0.6776^2 * 0.0075 = 0.0004$. The variance in true correlation is thus Var $(\rho) = [0 - 0.0004]/0.6776^2 = -0.0009$, which means 0.

[8] The attenuation factor by measurement error (A) = 0.81 * 0.83 = 0.6723. Thus, measurement error corrected correlation is $\rho = 0.39/0.6723 = 0.5801$. The sample error is $\sigma_e^2 = (1 - 0.39^2)^2/192 = 0.0037$. $V = 0.05090^2/0.81^2 + 0.08016^2/0.83^2 = 0.0133$. Therefore, the variance due to measurement error is $S_2^2 = 0.5801^2 * 0.6723^2 * 0.0133 = 0.0020$. The residual variance is thus 0.0383 (0.0440-0.0037-0.0020). The sampling error corrected variation of study correlations is Var $(\rho_{xy}) = 0.0403$ (0.0440 - 0.0037). The variance in true correlation is thus Var $(\rho) = [0.0403 - 0.0020]/0.6723^2 = 0.0847$.

[9] Only one study provides reliability information, so the attenuation effect caused by measurement error cannot be adjusted. The sample error is $\sigma_e^2 = (1 - 0.185^2)^2/35 = 0.0266$. Therefore, the sampling error corrected variation of correlations across studies is Var $(\rho_{xy}) = -0.0204$ (0.0062 - 0.0266), which means 0.

explaining than when predicting. However, the difference between predictive power and explanatory power was far bigger for the cognitive measure than for the affective measure: 3.14 times versus 1.95 times. This phenomenon can be interpreted to signify that the influence of the cognitive dimension of attitude grows as users gain more experience with their information systems.

We would also like to call attention to the fact that we focused only on the direct relationship between attitude and IS use by combining correlations of previous studies. We are interested in comparing the influence of affective and cognitive dimensions of attitude, not on investigating and criticizing previous studies. Most research uses the attitude construct as part of a comprehensive model to explain IS use and includes many constructs in addition to attitude. Strong correlations between other constructs and IS use can partial out the strength of attitude upon IS use. In fact, Amoroso & Cheney (1991), Davis, Bagozzi & Warshaw (1989), Hartwick & Barki (1994), Schewe (1976), and Thompson, Higgins & Howell (1991) denounced the explanatory power of attitude on IS use as a consequence of their analyses.

These findings are consistent with those of the psychology literature as several derivative models of the theory for reasoned action adding new components have been developed. For example, Ajzen's (1985) theory of planned behavior includes perceived control as a third predictor of intentions. Other variations include non-volitional factors and behaviors. Eagly & Chaiken (1992) include habit, self-identity, attitude toward objects, and attitude toward behavior.

Perhaps one of our most interesting findings is that even though attitude seems to be widely debated in the IS literature, there are few empirical studies, in fact far too few to investigate moderating factors. Given the large amount of variance unexplained by sampling error and measurement error (68.6% of variance between affect and IS use, and 87.1% between belief and IS use), there are probably several important moderating factors. For example, Schiffman, Meile & Igbaria (1992) argued that end user type might moderate the cause-effect relationship among IS success factors. Igbaria & Parasuraman (1991) complained about heavy dependence on high school and college student samples because heavy reliance on attentive and verbally skilled collegians in attitude research may underestimate the motivational issues of attitude such as selective exposure and retention (Chaiken & Stangor, 1987).

IS specificity and the way that use was measured may also moderate the relationship between attitude and use. Gutek, Winter & Chudoba (1992) argue that specificity of the target information system could be a moderating factor between attitude and IS use. The history of investigations into measures of use and their efficacy also points to potential moderating relationships. Trice & Treacy (1986) identify three classes of use measures: the degree of MIS

institutionalization (user ownership of, dependency on, and participation in MIS), a binary measure of use vs. non-use, and unobtrusive utilization measures such as connect time and frequency of computer access. These measures can be obtained from self-report and/or archival records. Self-report and archived methods are not neatly related to each other and bring forth different results (Chin, 1996; Collopy, 1996; Straub, Limayem & Karahanna-Evaristo, 1995). IS researchers typically use perceived rather than objective measures of IS use (Melone, 1990; Robey, 1979). Nevertheless, there is some evidence that archive measures are more useful than perceptual, retrospective measures (Collopy, 1996; Melone, 1990; Straub, Limayem & Karahanna-Evaristo, 1995).

Even though we could identify the existence of moderating factors between attitude and IS use, we could not pinpoint what they are. We tapped the possibility of the moderating role of IS specificity and IS use measurement method, but in vain mainly due to the lack of studies. No studies in our sample measured IS use archivally and attitude as affect simultaneously. Three studies measured attitude as affect under specific IS, but only one study (Sambamurthy & Chin, 1994) reported correlation. Many more studies would have to be undertaken to explore the potential of these moderators.

We collected the studies that actually used the word "attitude". There are many affective and cognitive constructs that impact on IS use such as anxiety, ease of use, usefulness, cognitive absorption, and self-efficacy. That we did not explore them is a limitation of our work.

CONCLUSION

Based on our meta-analysis, we conclude that affect is better than the cognitive dimension of attitude for explaining IS use. Neither is a particularly good predictor of future use. The value of our study comes from clarifying these relationships and refuting those suspicious of any relationship (e.g., Davis, 1989; Goodhue, 1988; Schewe, 1976; Swanson, 1982). We have found that IS researchers have repeatedly delivered empirical data supporting the explanatory relationship between affective and cognitive components of attitude and IS use. Let's move on.

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Appendix I

Studies failing filters

1. Attitude as Dependent Variable (Influential Factors on Attitude)

Study	The Independent Variables(s)
Aydin & Rice (1991)	Social word, individual differences, involvement, and use
Compeau & Higgins (1991a)	Computer self-efficacy
Davis & Bostrom (1993)	Training methods & interfaces
Delaney, Foroughi & Perkins (1997)	Attitudes after using a computerized negotiation support system
Doll & Torkzadeh (1989)	Involvement
Doll & Torkzadeh (1991)	User involvement congruence
Galletta, Ahuja, Hartman, Peace & Teo (1994)	Positive word of mouth
George & Theis (1991)	Training
Hauptmann & Rudnicky (1988)	Communication interface (speech-to-computer mode, speech-to-human mode & typing-to-computer mode)
Joshi (1990)	Equity
Joshi (1992)	Equity, EDP staff & service, user's knowledge & involvement, quality of information products, role ambiguity & role conflict
Kappelman & McLean (1992)	Participation → involvement → satisfaction (attitude)
Kraut, Dumais & Koch (1989)	The computerized-record system
Lockwood (1991)	The computer-aided instruction
Mykytyn, Green (1992)	Computer experience, task complexity
Olson (1989)	Telecommuting
Parasuraman & Igbaria (1990)	Gender, age, education, organizational level, trait anxiety, locus of control, math anxiety, cognitive style
Power, Meyeraan & Aldag (1994)	The computerized decision-aid
Pullman & Parsegian (1990)	Gender & computer experience
Silk (1990)	Individual demographic factors
Smith (1989)	How power influences attitudes of users and DP managers toward each other
Srinivasan & Kaiser (1987)	Organizational resources & external influences
Szajna & Scamell (1993)	The realism of expectation
Yap & Tng (1990)	Factors influencing on the attitude toward telecommuting

: 24 studies

2. Attitude Subject other than IS User Himself/Herself

Study	Attitude Subject
Baronas & Louis (1988)	Users' ratings about managers' attitude toward implementation
Culnan (1993)	Customers' attitude toward the secondary use of personal information for direct marketing
Dos Santos & Hawk (1988)	Systems analysts' attitude
Dutton & Kraemer (1978)	The impact of top managements' attitude toward computing on usage
Edwards (1993)	Systems analysts' attitude
Yavas, Luqmani & Quraeshi (1992)	Opinion-leader's (change agent) attitude

: 6 studies

3. The Dependent Variable other than IS Use

Study	The Dependent Variable(s)	Findings
Barki & Hartwick (1994)	Participation, involvement	Positive correlation
Bruwer (1984)	Satisfaction	Positive correlation
Divine, Kocakulah & Bell (1989)	Learning achievement in accounting	Weak to moderate positive relationship
Farley, Kahn, Lehmann & Moore (1987)	Intention to automate	Strong positive relation
Gatian (1994)	Decision performance, efficiency	Positive covariance
Gopal, Bostrom & Chin (1992-1993)	Perceived outcome, satisfaction with outcome, satisfaction with process.	Positive path coefficients
Harrison, Mykytyn & Riemenschneider (1997)	Intention to adopt an IT for a competitive advantage	Significant regression
Harrison & Rainer (1992)	Computer skill	Negative attitude is significant, but positive attitude did not have significant relationship
Hiltz & Johnson (1990)	Satisfaction on interface, performance, inexpressive, mode problems	Mixed correlation
Hiltz (1988)	Productivity	Not strong correlation
Howard & Mendelow (1991)	Usefulness	Unstable factor loadings
Igbaria & Nachman (1990)	End-user satisfaction	Positive correlation
Jackson, Chow & Leitch (1997)	Behavioral intention	Non-significant path
Mathieson (1991)	Behavioral intention	Significant regression coefficients to intention to use
King, Premkumar & Ramamurthy (1988)	Satisfaction on computer-assisted instruction	Nonsignificant correlation
Rivard & Huff (1988)	User satisfaction	Positive correlation
Schewe (1976)	The number of times for more information requirement	Nonsignificant regression
Tait & Vessey (1988)	User involvement, user satisfaction	Positive path coefficient
Taylor & Todd (1995)	Behavioral intention	Significant path coefficients to intention to use
Webster, Heian & Michelman (1990)	Computer anxiety	Negative correlation

: 20 studies

4. Attitude Targets other than IS Use

Study	The Targets of Attitude	Findings
Barki & Huff (1985)	Work-related change	Positive correlation
Brock & Sulsky (1994)	General IS (Not IS use)	Positive attitudes were more significant than negative ones
Larsen (1993)	Change	Positive path coefficient
Nabali (1991)	User involvement	Positive correlation
Zigurs, DeSanctis & Billingsley (1991)	Overall group decision making outcomes & process (Not confined to GDSS use)	No strong correlation

: 5 studies

Appendix II
Study Summaries

Amoroso & Cheney (1991):

1. Attitude measure: **Cognitive**; No items, just descriptions available ($\alpha = 0.87$)
- Expectations of EUC benefits
- Top management encouragement of EUC
- Perceptions of organizational environment
- Beliefs about usefulness of EUC
2. Dependent variable measure: Self-report ($\alpha = 0.85$), 12 measures of application utilization.
3. The specificity of target systems: Neither individually specific nor shared (general end-user computing).
4. Usage experience of samples (N=506): Various levels of end-user computing (less than 1 year - more than 10 years).
5. Correlation result: Attitude is tested as an explanatory factor (cross-sectional study): "User attitude toward end-user development" to "Applications utilization": 0.19 ($p<0.01$)

Compeau & Higgins (1991):

1. Attitude measure: **Affective**; No items, just descriptions available ($\alpha = 0.87$)

Affect was measured by five items, such as "I like working with computers," and "Once I get working on the computer, I find it hard to stop".

2. Dependent variable measure: Self-report ($\alpha = 0.81$)

Computer use was measured by four items, reflecting the duration and frequency of use of computers at work, and the duration of use of computers at home on weekdays and weekends.

3. The specificity of target systems: Neither individually specific nor shared.
4. Usage experience of samples (N = 1020): Various levels. The target population for the study was knowledge workers such as most managers, insurance adjusters, financial analysts, researchers, consultants and accountants.
5. Correlation result: Attitude is tested as an explanatory factors (cross-sectional study): 0.52 (significant)

Davis (1993):

1. Attitude measure: **Affective** ($\alpha = 0.96$)

All things considered, my using electronic mail in my job is: Good-Bad; Wise-Foolish; Favorable-Unfavorable; Beneficial-Harmful; and Positive-Negative.

2. Dependent variable measure: Self-report, two items ($\alpha = 0.70$)

- The frequency of use of the system: On the average, I use electronic mail: Don't use at all; Use less than once a week; Use about once a week; Use several times each week; Use about once each day; Use several times each day.
- How many hours users normally spend each week using the target system.

3. The specificity of target systems: Individually specific and shared. Two different software systems, an electronic mail system and a text editor, which are widely available in an organization.
4. Usage experience of samples (N = 112): Maybe pretty good. Subjects were 112 professional and managerial employees of a large North American corporation. The questionnaire screened respondents to make sure they had previously used the target systems so that the attitudes and beliefs measured were formed based on direct behavioral experience with the attitude object.
5. Correlation result: Attitude is tested as an explanatory factor (cross-sectional study), but the correlations are not available. The regression coefficient from "Attitude toward using" to "Actual system use": 0.21 ($p<0.05$)

Davis, Bagozzi & Warshaw (1989):

1. Attitude measure: **Affective**; No items, just descriptions available ($\alpha = 0.85, 0.82$: average $\alpha = 0.835$)

Attitude is defined as an individual's positive or negative feelings (evaluative affect) about performing the target behavior. Four items were used to measure attitude, but not available in the paper.

2. Dependent variable measure: Self-report ($\alpha = 0.79$): 2 items for system usage frequency
3. The specificity of target systems: Individually specific and shared. A word processing program, WriteOne, in two public computer laboratories located at the Michigan Business School.
4. Usage experience of samples (N = 107): One semester (14 weeks)
5. Correlation result: Attitude is tested as an explanatory and predictive factor as well, but the correlations are not available. By the regression coefficients, attitude at time 1 did not have a significant effect on use (time 2), and attitude at time 2 did not have a significant effect on use (time 2) either.

Ginzberg (1981):

1. Attitude measure: **Cognitive**

- IMPORT: All ion all, how important do you believe it is for the Trust Department to have a system like OLPM available to Portfolio Managers?
- VAL: How valuable do you expect OLPM to be to you?
- PROBS: How would you characterize the likelihood of OLPM being a success?

2. Dependent variable measure: Archival

- CONNECT: Average number of minutes per month of on-line use of OLPM (connect time)
- SESSIONS: Average number of OLPM terminal sessions per month
- FREQUENCY: Average number of OLPM functions executed per month (executing a function wither produces a report which is displayed on the CRT terminal, or performs some sort of data transformation preparatory to producing a report)
- USEIND: The sum of the normalized values of the three use measures; that is, each measure was first divided by the mean value on that measure for all system users and included in the sample.

3. The specificity of target systems: Individually specific and shared (OLPM: On-Line Portfolio Management).
4. Usage experience of samples (N = 35): Each portfolio manager's average monthly use collected for a five month period – July to November 1978.

5. Correlation results: Attitude is tested as a predictor factor (longitudinal study): Average 0.129

	CONNECT	SESSIONS	FREQUENCY	USEIND
Attitude (IMPORT)	0.069 (NS)	0.282 ($p<0.05$)	0.188 (NS)	0.174 (NS)
Attitude (VAL)	0.158 (NS)	0.062 (NS)	0.094 (NS)	0.104 (NS)
Attitude (PROBS)	0.063 (NS)	0.108 (NS)	0.116 (NS)	0.132 (NS)

NS: Non-significant

Gutek, Winter & Chudoba (1992):

1. Attitude measure: **Affective**
- Global satisfaction with the computer system (coded 1 = not too satisfied to 3 = very satisfied).
- A question asking if workers would choose to avoid the computer in doing their work.
- A question asking if they would prefer to computerize more tasks.
2. Dependent variable measure: Self-report
- How many hours per week respondents used the computer.
- The extensiveness of computer use: The percent of tasks performed in respondents' jobs that required the use of a computer.
3. The specificity of target systems: neither individually specific nor shared.
4. Usage experience of samples (N = 168): NA.
5. Correlation results: Attitude is tested as an explanatory factor (cross-sectional study): Average 0.275.

	Hours	Extent
Avoid computers	0.34 ($p<0.01$)	0.26 ($p<0.01$)
More computer tasks	0.30 ($p<0.01$)	0.25 ($p<0.01$)
Satisfaction	0.28 ($p<0.01$)	0.22 ($p<0.01$)

Hartwick & Barki (1994):

1. Attitude measure: **Affective** ($\alpha = 0.96$ at time 1) ($\alpha = 0.93$ at time 2)
- My frequently using the system ...: (good/bad; terrible/terrific/ useful/useless; worthless/valuable)
- My being a heavy user of the new system ...: (good/bad; terrible/terrific; useful/useless; worthless/valuable)
2. Dependent variable measure: Self-report
- Are you currently a heavy or light user of the system
- How often do you use the new system?
3. The specificity of target systems: Individually specific but not shared. Respondents were selected when their organizations had plans to develop a new application.
4. Usage experience of samples (N = 105): Three to six months of use.
5. Correlation results: Attitude is tested as an explanatory and predictive factor as well:
- Explanatory function:

	Post-use Attitude 1	Post-use Attitude 2
System Use 1	0.668 ($p<0.000$)	0.670 ($p<0.000$)
System Use 2	0.612 ($p<0.000$)	0.653 ($p<0.000$)

* Average Correlation: 0.6508

- Predictive function:

	Pre-use Attitude 1	Pre-use Attitude 2

System Use 1	0.224 (p<0.03)	0.270 (p<0.01)
System Use 2	0.167 (p<0.11)	0.244 (p<0.02)

* Average Correlation: 0.2263

Igbaria (1990):

1. Attitude measure: **Cognitive** ($\alpha = 0.82$)

We would like to find out what you believe are the advantages and disadvantages of your using computers in your job.

- Using a computer could provide me with information that would lead to better decisions.
- Using a computer allows me to be more innovative by providing the opportunities for more creative analysis outputs.
- Using a computer can take up too much of my time performing many tasks.
- Using a computer would involve too much time doing mechanical operations (e.g., programming, inputting data) to allow sufficient time for managerial analysis.
- Using a computer improves my productivity on the job.
- I'd hesitate to use a computer because of the difficulty of integrating it with existing information systems in my work.
- Using a computer gives me the opportunity to enhance my managerial image.
- Using a computer allows me to be more independent of my subordinates and secretaries.
- Using a computer allows me to access, store and retrieve information easily without difficulties.
- Using a computer exposes me to vulnerability of computer breakdown and loss of data.

2. Dependent variable measure: *Self-report* ($\alpha = 0.78$)
- Actual daily use of the computer: The amount of time spent on the system per day.
- Frequency of use: Measured on a six-point scale ranging from "less than once a month" to "several times a day".

3. The specificity of target systems: neither individually specific nor shared. Part-time MBA students at an urban university on the East coast were invited to participate in a survey of end-user computing.
4. Usage experience of samples (N = 187): Maybe pretty good. The participants are managers and professionals who have access to computers on a daily basis for their job.
5. Correlation results: Attitude is tested as an explanatory factor (cross-sectional study): 0.40 (significant at 0.05 level).

Igbaria (1992):

1. Attitude measure: **Cognitive** ($\alpha = 0.79$): The same as Igbaria (1990).
2. Dependent variable measure: Self-report
- Actual daily use of the computer: the amount of time spent on the system per day
- Frequency of use
- The number of packages used by the participants
- The number of tasks the system is used for

3. The specificity of target systems: neither individually specific nor shared. Taiwan managers and professionals who had microcomputers on their desks or had easy access to a microcomputer.
4. Usage experience of samples (N = 86): Various levels.
5. Correlation results: Attitude is tested as an explanatory factor (cross-sectional study): Average 0.2825

	Number of tasks	Number of SW packages	Frequency of use	Time of use
Attitudes	0.40 (p<0.001)	0.24 (p<0.05)	0.18 (p<0.05)	0.31 (p<0.01)

Igbaria & Parasuraman (1991):

1. Attitude measure: **Cognitive** ($\alpha = 0.86$)

- Perceived utility:
  1. Using a microcomputer could provide me with information that would lead to better decisions.
  2. I'd like to learn about ways that microcomputers can be used as aids in management tasks.
  3. A microcomputer would give me more opportunities to obtain the information that I need.
  4. Using a microcomputer would give me much greater control over important information.
- Limited hardware/software capacity
  5. A microcomputer would be of no use to me because of its limited computing power.
  6. I'd discourage my company from acquiring microcomputers because most application packages would need to be modified before they could be useful in our specific situation.
  7. A microcomputer would be of no use to me because of the limited availability of application program packages.
  8. A microcomputer would be of no use to me because of its small storage capacity.
- Problems in use:
  9. Using a microcomputer would result in a tendency to overdesign simple tasks.
  10. I wouldn't want to have a microcomputer at work because it would distract me from my normal job duties.
  11. I wouldn't favor using a microcomputer because there would be a tendency to use it when it was more time consuming than manual methods.
  12. I'd hesitate to acquire a microcomputer for my use at work because of the difficulty of integrating it with existing information systems.
- Time requirements:
  13. I wouldn't use a microcomputer because programming it would take too much time.
  14. I wouldn't use a microcomputer because it is too much time consuming.
  15. Using a microcomputer would take too much time away from my normal duties.
  16. Using a microcomputer would involve too much time doing mechanical operations (e.g., programming, inputting data) to allow sufficient time for managerial analysis.
- User friendliness:
  17. I'd like to have a microcomputer because it is so easy to use.
  18. I'd like to use a microcomputer because it is oriented to user needs.
  19. It is easy to access and store data in a microcomputer.
  20. It is easy to retrieve or store information from/to a microcomputer.

2. Dependent variable measure: Self-report
- System use: The amount of time spent on the system per day, and frequency of use.
- Utilization categories: The measure of tasks supported by computers, and number of applications.

3. The specificity of target systems: neither individually specific nor shared. Part-time MBA students at an eastern urban university was invited to participate in the study.
4. Usage experience of samples (N = 126): Various levels.
5. Correlation results: Attitude is tested as an explanatory factor (cross-sectional study): Average 0.394

	Attitudes toward microcomputers
Frequency of use	0.36 ($p<0.001$)
Extent of use	0.45 ($p<0.001$)
Number of tasks	0.38 ($p<0.001$)
Number of applications	0.40 ($p<0.001$)

Lucas (1975):

1. Attitude measure: **Cognitive**; No items, just descriptions available
- Quality of output: A scale constructed from a series of questions about computer output in general, including its timeliness, accuracy and the usefulness of the information provided.
- Computer potential: A scale formed from two questions dealing with the respondent's perceptions of the potential for the use of computer in sales work.
- Management computer support: A scale formed from questions on the respondent's perception of the degree to which both general management and his immediate superior support more use of the computer in sales work.
2. Dependent variable measure: Self-report
- Working with customer in store: A scale that describes the respondent using the sales report in the store with customers.
- Detailed analysis of buying entity/account: Items dealing with the detailed examination of data for a buying entity.
- Planning: Questions, which relate to planning and general problem finding, such as planning calls and subdividing a territory for travel purpose.
- Overall progress: The use of information on bookings versus target and shipments for this year and last year.
- Summary this year versus last: A general summary scale includes items comparing this year's and last year's performance for actual bookings and percentage changes.
- Cancellations: The use of sections of the report describing returns and allowances.
3. The specificity of target systems: Individually specific and shared (sales information systems).
4. Usage experience of samples (N = 104): Maybe have used the system pretty long. The system was originally implemented in the 1960's and has evolved over time.
5. Correlation results: Attitude is tested as an explanatory factor (cross-sectional study), but the correlations are not available.

Regression:

	Output quality	Computer potential	Management support
Working with customer in store	0.31 ($p<0.001$)	Non-significant	Non-significant
Detailed analysis of buying entity	0.25 ($p<0.01$)	0.31 ($p<0.001$)	0.14 ($p<0.05$)
Overall progress	0.38 ($p<0.001$)	0.18 ($p<0.05$)	Non-significant
Summary this year vs. Last	Non-significant	Non-significant	0.22 ($p<0.01$)
Planning	0.34 ($p<0.001$)	0.21 ($p<0.01$)	Non-significant
Cancellations	0.24 ($p<0.01$)	Non-significant	0.18 ($p<0.05$)

Lucas (1978):

1. Attitude measure: **Cognitive**; No items, just descriptions available
- Rating of the system
- Few impediments to system use
- Quality of information
- Success using system
- Percentage completeness of file
- Percent of file relevant
- File is up-to-date.
2. Dependent variable measure: Originally, there were 15 usage variables. For the sake of consistency with other studies, only direct usage measures were chosen.

Have used system (binary [0, 1] variable)	Questionnaire
Frequency of use	Questionnaire

Number of sessions by researcher	Monitor
Number of searches by researcher	Monitor
Number of displays by researcher	Monitor
Number of printed reports by researcher	Monitor
Extent of use by researcher	Questionnaire
General use of system	Questionnaire

3. The specificity of target systems: Individually specific and shared (an interactive Medical information storage and retrieval system in medical research).
4. Usage experience of samples (N = 180): Maybe substantial. Most researchers in the firm make heavy use of the library during all phases of a research project.
5. Correlation results: Attitude is tested as an explanatory factor (cross-sectional study): Average 0.3013: Favorable attitudes are related to the use of the information storage and retrieval system.

	Frequency	Res. Sessions	Res. Search	Res. Print	Gen. Use. Sys.
System rating	0.21*	NA	NA	NA	0.29**
Few impediments	0.35***	NA	NA	NA	0.31***
Quality of information	NA	NA	NA	NA	NA
Success	0.44***	0.18**	0.17*	0.25*	0.39***
% File complete	0.38***	NA	NA	NA	0.21**
% File relevant	0.42***	NA	NA	0.23**	0.45***
% File up-to-date	NA	NA	NA	NA	0.24**

* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Moore & Benbasat (1995):

1. Attitude measure: **Cognitive**; No items, just descriptions available. 50 items in the following 8 factors.
- Relative advantage: the degree to which using a PWS is perceived as being better than using its precursor.
- Compatibility: the degree to which using a PWS is perceived as being consistent with the existing values, and past experiences of the potential adopter.
- Ease of use: the degree to which a PWS is perceived as being easy to use.
- Trialability: the degree to which a PWS may be a experimented with before adoption.
- Image: the degree to which using a PWS is perceived to enhance one's image or status in one's social system.
- Visibility: the degree to which a PWS is apparent to the sense of sight.
- Computer avoidance: respondent's potential aversion to avoidance reactions to IT.
2. Dependent variable measure: Self-report ($\alpha = 0.88, 0.98$: average $\alpha = 0.93$)
- Diversity of use: The number of hours an individual uses the PWS (personal workstations).
- Intensity: The number of different functions that an individual uses on the PWS (i.e., word processing, spreadsheet, graphics, database, computer modeling, information retrieval, e-mail, etc.).
3. The specificity of target systems: neither individually specific nor shared. An individual defines personal workstation (PWS) as a set of computerized hardware and software tools designed for personal use. Data were gathered from both users and non-users of PWS in seven organizations.
4. Usage experience of samples (N = 540): Various levels.
5. Correlation result: Attitude is tested as an explanatory factor (cross-sectional study), but the correlations are not available. Also, attitude has a significant positive path coefficient on use (0.52: $p<0.001$).

Popovich, Hyde, Zakrajsek & Blumer (1987):

1. Attitude measure: **Affective** ($\alpha = 0.84$)

- Factor 1: Negative reactions to computers:
  - Whenever I use something that is computerized, I am afraid I will break it.
  - I know that I will not understand how to use computers.
  - Using a computer is too much time consuming.
  - I have had bad experiences with computers.
  - I do not like using computers because I cannot see how the work is being done.
  - I do not feel I have control over what I do when I use a computer.
  - I do not like to program computerized items such as VCR's and microwave.
- Factor 2: Positive reactions to computers:
  - I would prefer to type a paper on a word processor than on a typewriter.
  - I feel that having a computer at work would help me with my job.
  - I prefer not to learn how to use a computer.
  - I would like to own, or I do own a computer.
  - I like to play video games.
- Factor 3: Computers and children/education:
  - I like to keep up with technological advances.
  - I feel that the use of computers in schools will help children to learn mathematics.
  - If I had children, I would not buy them computerized toys.
  - I feel that the use of computers in schools will negatively affect children's reading and writing abilities.
  - I think that computers and other technological advances have helped to improve our lives.
- Factor 4: Reactions to (familiar) computer-related mechanisms:
  - I prefer to use an automatic teller for most of my banking.
  - I wold prefer to order items in a store through a computer than wait for a store clerk.
  - I would prefer to go to a store that uses computerized price-scanners than go where the clerks enter each price into the cash register.

2. Dependent variable measure: Self-report. Hours per week on a computer.
3. The specificity of target systems: neither individually specific nor shared.
4. Usage experience of samples (N = 351): Various levels. 351 undergraduate students enrolled in general psychology courses at a medium-sized mid-western university participated in this study.
5. Correlational results: Attitude is tested as an explanatory factor (cross-sectional study)

	Factor 1	Factor 2	Factor 3	Factor 4	Total
Hours per week on a computer	-0.26**	-0.32**	-0.16	-0.05	-0.30**

** $p<0.001$.

Robey (1979):

1. Attitude measure: **Cognitive**; No items, just descriptions available (average $\alpha = 0.73$)

- Performance (13 items): Effect of system on manager's job performance and performance visibility ($\alpha = 0.81$).
- Goals (9 items): Goals which occur in organization structure and people dealt with ($\alpha = 0.58$)
- Support/resistance (11 items): System has implementation support; adequate top management, technical, and organizational support and does not have undue resistance ($\alpha = 0.76$)
- Client/researcher (3 items): Researchers understand management problems and work well with their clients ($\alpha = 0.74$)

- Urgency (12 items): Need for results, even with costs involved; importance to self, boss, top management (α = 0.76).

2. Dependent variable measure: Archival
- The percentage of customer records that had to be updated annually: If a large number of accounts required annual updating, it was assumed that the salesperson was not a continual user of the system.
- The number of customer records maintained on the system per account.

3. The specificity of target systems: Individually specific and shared (sales information systems).
4. Usage experience of samples (N = 66): The system had been in use for 15 months prior to this study.
5. Correlation results: Attitude is tested as an explanatory factor (cross-sectional study): Average 0.652

Spearman rank correlations		
	Accounts kept	Annual updating
Performance	0.79	0.76
Goals	0.42	0.42
Support/resistance	0.78	0.75
Client/researcher	0.63	0.59
Urgency	0.71	0.67

* All the correlations were significant at alpha = 0.001

Sambamurthy & Chin (1994)

1. Attitude measure:

Perceived ease of use: **Affective** (α = 0.84)
- I felt frustrated by the SAMM system (reverse scale).
- Using the SAMM system was fun.
- While using the SAMM system, I felt comfortable.
- I enjoyed using the SAMM system.
- On the while, I felt very comfortable with the SAMM system and would be willing to use it again.

Perceived usefulness: **Cognitive** (α = 0.76)
- I am not in favor of computer-aided meetings, because it is just another step toward depersonalization of meetings (reverse).
- Using a computer system for meetings seems like a good idea.
- Even otherwise interesting meeting might be boring when conducted with computer-mediated support (reverse scaled).
- The SAMM system was more of a hindrance in the process of our meeting.

2. Dependent variable measure: Self-report (α = 0.75)
- I did not feel that the SAMM system played a major role in our meeting activities.
- On the whole, I learned enough the SAMM system and used it extensively during the meeting.
- I think that the SAMM system enabled us to gain a better perspective on various issues than would have been possible without the use of the system.
- Most members of my group used the SAMM system extensively to support various phases of the meeting.

3. The specificity of target systems: Individually specific and shared (A group decision support system named SAMM: Software Aided Meeting Management)
4. Usage experience of samples (N = 36): Two and a half hours to solve a strategy simulation game.
5. Correlation results: Attitude is tested as an explanatory and predictive factor as well

	Meeting 1		Meeting 2	
	Perceived usefulness	Perceived ease of use	Perceived usefulness	Perceived ease of use

Extensiveness of GDSS use	0.24 (non-significant)	0.51 ($p<0.05$)	0.74 ($p<0.05$)	0.53 ($p<0.05$)

Schewe (1976):

1. Attitude measure: **Cognitive**

- Decision making effectiveness: The effect of the MIS on the user's ability to make decisions.
- Managerial capabilities: The effect on the user's opportunities to use his managerial talents.
- Job productivity: The effect on the manager's own productivity
- Personal prestige: The effect of the computer on the user's prestige within his division
- Management control: The effect of the system on general management's ability to control its operation
- Information usefulness: The effect of the information system on the overall usefulness of information in the company
- Quality of information: The effect on the general quality of the information in the company
- Corporate costs: The effect of the system on operating costs
- Clerical costs: The effect on clerical costs
- Corporate procedures: The effect on the company's policies and procedures

2. Dependent variable measure: Self-reported

Out of two types of IS use - routinely generated computer reports and personally initiated requests for additional information not ordinarily provided in routine reports, the latter one was taken in this study.

3. The specificity of target systems: Individually specific but not shared. Ten food processing firms in three Midwestern states cooperated in the study. Two independent but comparable samples were obtained – a sample of 41 batch system users and a sample of 38 interactive system users.
4. Usage experience of samples (N = 79): Various levels.
5. Correlation results: Attitude is tested as an explanatory factor (cross-sectional study): Not available. But, based on regression coefficients, attitudes do not appear to have any real influence on behavior.

Schiffman, Meile & Igbaria (1992):

1. Attitude measure: **Cognitive** ($\alpha = 0.82$).

- Because of EUC, I get a greater amount of work accomplished.
- EUC helps me do what I do faster.
- EUC increases the quality of what I do.
- Because of EUC, I do what I do more accurately.
- EUC is extremely useful.
- Although EUC may be useful, learning how to use computers takes excessive amounts of my time.
- Although EUC may be useful, dealing with the things I have to do to run computers take excessive amounts of time.
- Mishaps such as losing data occasionally reduce my productivity.

2. Dependent variable measure: Self-report

- Number of business tasks: Participants were asked to describe all business tasks they accomplish with the help of EUC.
- Number of packages used by the participants: Respondents were asked to list all the software packages they use.
- Frequency of use (year)
- Time of use (year)

3. The specificity of target systems: Not clear. A regional engineering company was chosen for this study. EUC had been used by this firm for several years and was continuing to grow.

4. Usage experience of samples (N = 209): Various levels
5. Correlation results: Attitude is tested as an explanatory factor (cross-sectional study): Average 0.1525

	Business tasks	S/W applications	Frequency of use	Time of use
Attitudes toward EUC	0.21 ($p<0.01$)	0.16 ($p<0.01$)	0.11 ($p<0.05$)	0.13 ($p<0.05$)

Thompson, Higgins & Howell (1991):

1. Attitude measure: **Affective** ($\alpha = 0.61$)
- PCs made work more interesting
- Working with PCs was fun
- PCs were all right for some jobs but not the kind of job wanted (reverse scored).
2. Dependent variable measure: Self-report ($\alpha = 0.64$)
- The intensity of job-related PC use (minutes per day, at work): ranging from less than 15 minutes to more than 120 minutes.
- The frequency of PC use: ranging from less than once per week to several times a day.
- The diversity of software packages used for work (number of packages): by counting those software packages for which the response for extent of use was "to some extent" or greater.
3. The specificity of target systems: neither individually specific nor shared. The population of interest was knowledge workers (e.g., managers or professionals) who used a PC in their jobs of a large multinational manufacturing organization.
4. Usage experience of samples (N = 212): Various levels.
5. Correlation results: Attitude is tested as an explanatory factor (cross-sectional study): 0.32 (significant).

Appendix III
Meta-analysis worksheets

Explanatory power of affect

	Sample Size	Reliability (attitude)	Reliability (IS use)	Correlation
Compeau & Higgins (1991)	1020	0.87	0.81	0.52
Davis (1993)	112	0.96	0.7	NA
Davis, Bagozzi & Warshaw (1989)	107	0.84*	0.79	NA
Gutek, Winter & Chudoba (1992)	168	NA	NA	0.28*
Hartwick & Barki (1994)	105	0.93*	NA	0.65*
Popovich et al. (1987)	351	0.84	NA	0.3
Sambamurthy & Chin (1994)	36	0.84[10]	0.75	0.53[11]

[10] Sambamurthy & Chin (1994) report two different reliabilities for each of attitude and IS usage. The reliability of perceived ease of use is 0.84, and that of perceived usefulness is 0.76.

[11] Sambamurthy & Chin (1994) report four different correlations between attitude and IS usage. Use (time 2) vs. perceived usefulness (time 1) is 0.24, and use (time 2) vs. perceived ease of use (time 1) is 0.51. Use (time 2) vs. perceived usefulness (time 2) is 0.74, and use (time 2) and perceived ease of use

Thompson et al. (1991)	212	0.61	0.64	0.32
Average	264	0.84	0.74	0.43
Standard Deviation		0.11276	0.06907	0.15358

* An average of multiple values.[12]

Predictive power of affect

	Sample Size	Reliability (attitude)	Reliability (IS use)	Correlation
Davis, Bagozzi & Warshaw (1989)	107	0.84*	0.79	NA
Hartwick & Barki (1994)	105	0.96*	NA	0.23*
Sambamurthy & Chin (1994)	36	0.84	0.75	0.24
Average	83	0.88	0.77	0.24
Standard Deviation		0.06928	0.02828	0.00707

* An average of multiple values.

Eplanatory power of belief

	Sample size	Reliability (attitude)	Reliability (IS use)	Correlation
Amoroso & Cheney (1991)	506	0.87	0.85	0.19
Igbaria (1990)	187	0.82	0.78	0.4
Igbaria (1992)	86	0.79	NA	0.28*
Igbaria & Parasuraman (1991)	126	0.86	NA	0.39*
Lucas (1975)	104	NA	NA	NA
Lucas (1978)	180	NA	NA	0.3*
Moore & Benbasat (1995)	540	NA	0.93*	NA
Robey (1979)	66	0.73*	NA	0.65*
Sambamurthy & Chin (1994)	36	0.76	0.75	0.74
Schewe (1976)	79	NA	NA	NA
Schiffman, Meile & Igbaria (1992)	209	0.82	NA	0.15*
Average	193	0.81	0.83	0.39
Standard Deviation		0.05090	0.08016	0.20974

* An average of multiple values.

Predictive power of belief

(time 2) is 0.53. Therefore, the explanatory power of affect is 0.53, the explanatory power of belief is 0.74, the predictive power of affect is 0.51, and the predictive power of belief is 0.24.

[12] To come up with a single-outcome measure, the measurements can be combined and averaged. If the average correlation is used to represent the study, then there is no violation of the independence assumption. The simple sample size can be used for this average correlation (Hunter & Schmidt, 1990: 453-454).

	Sample size	Reliability (attitude)	Reliability (IS use)	Correlation
Ginzberg (1981)	35	NA	NA	0.129*
Sambamurthy & Chin (1994)	36	0.76	0.75	0.24*
Average	36			0.1845
Standard Deviation				0.07849

* Both correlations were not significant.