

ROLES OF ATTITUDES IN INITIAL AND CONTINUED ICT USE: A LONGITUDINAL STUDY

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Abstract. *Attitude has been understudied in the information systems (IS) field. Research interest in attitude has gone through ups and downs due to the lack of predictability of attitude for behavioral intention on using ICT. In this paper, we first clarify both conceptual and operational confusions on attitudes that may have caused the inconsistent and inconclusive results. Two different types of attitudes, attitude toward object and attitude toward behavior, are defined and their structures are discussed. Then we propose a theoretical model that details the relationships among attitude toward object, attitude toward behavior, and behavioral intention both for initial ICT use stage and for continued ICT use stage. A longitudinal study with mandatory use of a course management system is conducted. Results show that attitude toward behavior is a strong predictor of intention; attitude toward object (ICT) influences intention indirectly through attitude toward behavior; and intention during initial use has a strong positive effect on intention during continued use. In addition, the roles of previous attitudes on current attitudes are dependent on whether the current attitudes are about initial use or continued use.*

Keywords: *attitudes, attitude change, ICT acceptance, initial use, continued use, empirical study.*

Introduction

Information and communication technology (ICT) has become one of the most important parts of organizations, businesses and communities. ICT is a broad term to include information technology and communication technology, and provides information processing and communication support to individuals, groups, organizations, and community of people. ICT adds values only if it is accepted, used and continuously used by intended users. Consequently, research studies on ICT acceptance and use, and correspondingly ICT design and development, has become more and more prolific in modern information systems (IS) literature (Venkatesh et al. 2003). Among the many competing theoretical foundations of such research efforts are the theory of reasoned action (TRA) and theory of planned behavior (TPB) (Ajzen 1991; Ajzen et al. 1980). In the past several decades, TRA and TPB have influenced the IS field on technology acceptance research, from the formation of the famous Technology Acceptance Model (Davis 1989), to a number of alternative models, to a recent attempt of a unified theory of technology acceptance (Venkatesh et al. 2003), and several studies on perfecting the models by consider moderating factors and other factors (Schepers et al. 2007; Sun et al. 2006). The convergence of research focus has been on the roles of an individual's beliefs and various antecedents of beliefs. Several salient behavioral beliefs include perceived usefulness, perceived ease of use and perceived enjoyment.

One importance concept in TRA and TPB, attitude, has not been always the focal interest in IS research on technology acceptance and continued use. Empirical studies find inconsistent and inconclusive results for the role of attitude on behavioral intention. Based on a survey of the literature, attitude toward using technology is theorized not to be a direct determinant of intention and thus is excluded from the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al. 2003, p447).

Our careful re-examination of the literature shows that attitudes should not be eliminated from technology acceptance and use research. In fact, attitudes can play important roles on behavioral intention if the concept is clearly understood and

carefully studied. We posit that there are conceptual and operational mis-conceptions of attitude toward behavior in the IS literature that can be the cause of inconsistent and inconclusive results. In addition, we postulate that depending on the stages of ICT acceptance and use (for example, initial use vs. extensive use of the same ICT), the roles of attitudes may change, which can add additional causes and complexity of the inconsistent and inconclusive literature.

In this paper, we investigate the theoretical underpinning of different attitude concepts, the structures of attitudes, the roles of different attitudes in forming technology use intention, and potential changes of attitude roles at different ICT use stages. To be focused, we only consider attitudes and behavioral intentions in our study. Specifically, we attempt to focus on three key points: (1) there are two types of attitudes that are conceptually different and thus have different effects on behavioral intention: attitude toward ICT as an object (ATO for short), and attitude toward using ICT as a behavior (ATB). Based on TRA and TPB, we hypothesize that ATB is a strong predictor of behavioral intention, while ATO's impact on intention is fully mediated by ATB. (2) One's ATO and ATB toward an early (or similar) version of ICT can have strong impacts on his or her current ATO and ATB during the initial use. (3) One's ATO, ATB and behavioral intention during the initial use can be carried over to the continued use of the ICT. A longitudinal empirical study is conducted to validate our theoretical positions. To the best of our knowledge, few studies provided a systematic examination of the two attitude concepts or have considered ATO and ATB together in same studies to distinguish them from each other, and few studies took a longitudinal perspective to study the changing roles of attitudes in different ICT use stages. Thus our study can offer insights into the theoretical basis and empirical evidence of the attitudes concepts and their roles. Such insights can provide guidance on ICT design and development, thus ICT's values can be better utilized once they are in use.

Literature Review on Attitudes in ICT Acceptance Research

To clarify the potential causes of inconsistent and inclusive results in the literature, we conducted a literature review on empirical studies in technology acceptance and use that included attitudes. The two threads we used for the literature review are (1) whether the attitude concept being studied is toward object (ATO) or toward behavior (ATB), and (2) how the attitude is measured in the study. Our review results show that most of the reviewed studies emphasized ATB. Some of these studies were actually the results of confusing attitudes toward objects with attitudes toward behaviors. The measures for attitude were also widely different. Some measured "global" attitudes, while others measured the informational base of the attitudes. For example, Harrison et al. (1992) and Sambamurthy et al. (1994) considered perceived ease of use and perceived usefulness as attitude measures. Yet in TAM and other models, these two were cognitive antecedents of attitude.

The mis-conception of the attitude construct has been noted by other researchers as well. For instance, in a recent study, Wixom and Todd clearly stated the difference between ATO and ATB, and included ATB in their research model (Wixom et al. 2005). Since we found no other ICT related studies that considered both ATO and ATB, and no ICT studies that considered longitudinal effects of attitudes, we decided to guide our discovery by theory-based speculations on the roles of attitudes during different ICT use stages but keep open mind to explore possible relationships among attitudes and behavioral intentions.

Toward this end, we first present a theoretically supported research model that outlines the roles of two types of attitudes on behavioral intentions at two different use stages. Then we provide the structures of the two types of attitudes that are supported by the theoretical understanding of the attitude concepts. In the empirical study, we test the psychometric property of the instruments and validate the theoretical model.

Conceptual Development

Two Types of Attitudes

Attitude studies have established a distinction between attitudes toward an object and attitudes toward a behavior on the object (Ajzen et al. 1980; Ajzen et al. 2005; Eagly et al. 1998; Forgas 2000). Attitude toward object (ATO) is defined as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (Eagly et al. 1998) or, as a combination of evaluative judgments about an object (Crites et al. 1994). Attitude toward behavior (ATB) is defined as "an individual's positive or negative feelings (evaluative affect) about performing the target behavior." (Fishbein et al. 1975) The attitude concept in TRA and TPB is about toward a particular behavior (Ajzen 1991; Ajzen et al. 1980; Fishbein et al. 1975). In a recent effort to clarify the roles of attitudes in behavior, Ajzen and Fishbein re-stated the difference between attitude toward object and toward behavior that are both theoretically and empirically established (Ajzen et al. 2005).

The two types of attitudes have different functions regarding behavior and behavioral intention. In particular, attitude toward behavior (ATB) has been stated to be a much better predictor of behavioral intention and behavior than attitude toward object (ATO) (Ajzen et al. 1980; Ajzen et al. 2005). Eagly and Chaiken pointed out that, although there are two broad theories of attitudes that are generally examined separately (i.e., either attitude toward the object or attitude toward the

behavior), it might be useful to examine both together to get good prediction of behavior. For example, once an attitude toward an object has been activated, there are likely still many options of appropriate behaviors to choose from. If a link is established between an ATO and an ATB (as a possible behavioral choice), then once an ATO has been activated, the attitude toward behavior (ATB) should also be activated; this leads to a good prediction of behavior (Eagly et al. 1998).

Attitude theories do not make a distinction between the different levels of experiences one may have with the object, such as in our case the initial and continued ICT use stages. Thus we anticipate that the hypotheses depicting the relationships among ATO, ATB and BI should hold true for both the initial and continued ICT use stages.

Ha1: Attitude toward using an ICT has a positive impact on behavioral intention of using the ICT during initial ICT use.

Hb1: Attitude toward an ICT has a positive impact on attitude toward using it during initial ICT use.

Hc1: Attitude toward an ICT does not have a direct effect on behavioral intention of using it during initial ICT use.

Ha2: Attitude toward using an ICT has a positive impact on behavioral intention of using the ICT during continued ICT use.

Hb2: Attitude toward an ICT has a positive impact on attitude toward using it during continued ICT use.

Hc2: Attitude toward an ICT does not have a direct effect on behavioral intention of using it during continued ICT use.

The Impacts of Previous Behavioral Intentions and Previous Attitudes

Research demonstrated that past behaviors, along with attitudes toward the behavior and subjective norms, predict behavioral intentions even when those past behaviors are not well-learned (Ouellette et al. 1998). In a study for travel mode choices, it found that decisions can be affected by interventions that produce change in attitudes, and that past behavior contributes to the prediction of later behavior when circumstances remain relatively stable (Bamberg et al. 2003). In our case, we consider the initial ICT use and continued ICT use situations that are relatively stable with little inventions introduced in between the two stages. We thus expect that past behavioral intention would also predict current behavioral intentions. This leads to the following hypothesis between behavioral intentions at two different use stages.

Hd: Behavioral intention during initial ICT use has a positive effect on behavioral intention during the continued ICT use.

Further, research examining relationships between previous and current attitudes and intentions has also found that attitudes toward a similar object and attitudes toward behavior with a similar object impact one's attitudes related to the current object. Participants taking part in a study of ICT use are likely to have previous experience with either a similar ICT, or even the same ICT but different use stage. Thus it is important to take these prior attitudes into account. In our study, when users are in the initial use stage of a target ICT (we name this as Time 1), their ATO and ATB on a similar product prior to (Time 0) contacting the target ICT should play roles on their current ATO and ATB. For the continued use of an ICT (Time 2), users' ATO and ATB during initial use should play a role on the current ATO and ATB. The consideration of previous ATO and ATB realizes the feedback loop idea of the impacts of formed attitudes on new interactions (Ajzen et al. 2005).

Because research in other disciplines examining these links has found conflicting results in terms of positive or negative effects, we decide to explore the roles of previous ATO and ATB without making specific predictions on the directions of these effects. Thus, we have the following hypotheses.

He1: During initial ICT use, previous attitude toward a similar ICT has an effect on attitude toward the target ICT. (ATO0->ATO1)

Hf1: During initial ICT use, previous attitude toward a similar ICT has an effect on attitude toward using the target ICT. (ATO0->ATB1)

Hg1: During initial ICT use, previous attitude toward using a similar ICT has an effect on attitude toward the target ICT. (ATB0->ATO1)

Hh1: During initial ICT use, previous attitude toward using a similar ICT has an effect on attitude toward using the target ICT. (ATB0->ATB1)

He2: During continued ICT use, previous attitude toward the ICT has an effect on attitude toward the ICT. (ATO1->ATO2)

Hf2: During continued ICT use, previous attitude toward the ICT has an effect on attitude toward using the ICT. (ATO1->ATB2)

Hg2: During continued ICT use, previous attitude toward using the ICT has an effect on attitude toward the ICT. (ATB1->ATO2)

Hh2: During continued ICT use, previous attitude toward using the ICT has an effect on attitude toward using the ICT. (ATB1->ATB2)

Attitude Structures

Attitude is considered a multidimensional construct comprised of cognitive, affective, and conative components. Yet, most attitude measurement techniques resulted in capturing only the affective side of the concept (Ajzen et al. 2005). IS research has widely accepted the attitude definition by Fishbein and Ajzen (Fishbein et al. 1975) in that attitude is “an individual’s positive or negative feelings (evaluative affect) about performing the target behavior” (Davis et al. 1989; Moon et al. 2001; Venkatesh et al. 2003). That is, attitudes are often considered overall affective evaluations (Ajzen et al. 1980).

The most recent theoretical understanding of the structure of attitude posits that attitude toward behavior contains instrumental (e.g., desirable-undesirable, valuable-worthless) as well as experiential (e.g., pleasant-unpleasant, interesting-boring) aspects; thus attitude measures should contain items representing these two sub-components (Ajzen et al. 2005). For attitude toward object, it has been well established that attitude should be measured by general evaluative terms such as positive/negative, good/bad, desirable/undesirable, and like/dislike (Crites et al. 1994).

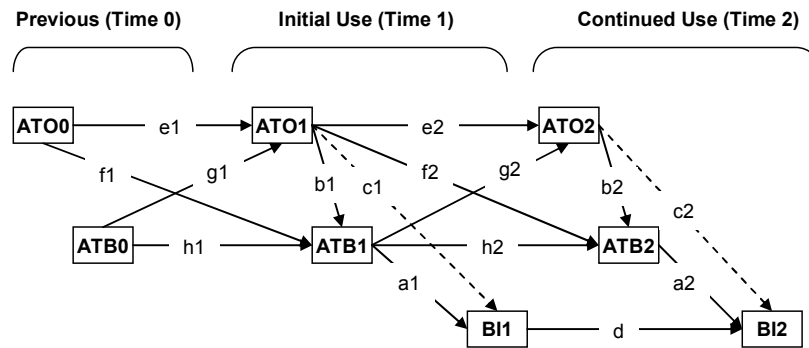


Figure 1. Theoretical Model

ATO0/ATB0: attitude toward (using) a similar ICT.
 ATO1/ATB1: attitude toward (using) the target ICT during initial use.
 BI1: behavioral intention of using the target ICT during initial use.
 ATO2/ATB2: attitude toward (using) the target ICT during continued use.
 BI2: behavioral intention of using the target ICT during continued use.

Study Design and Results

Two data sets were collected during the Fall 2006 semester to understand college student evaluations of a course management system WebCT at a major northeast university in the US. A new version, WebCT 6 was just implemented. It is significantly different from its previous version (WebCT 4) with new looks and new functions. Instructors and students in a class (either online or distance class) can share course related materials and communicate with each other by using WebCT 6. Only those classes that used WebCT 6 as part of the teaching were invited to participate in the study.

The first data set was collected during the 3rd and 4th weeks of the semester when students were getting settled in their courses. Participants were asked to rate their previous attitude toward WebCT 4 (ATO0) and previous attitude toward using WebCT 4 (ATB0), then attitude toward WebCT 6 (ATO1) and attitude toward using WebCT 6 (ATB1), and behavioral intention (BI1) of using WebCT 6 from this time on. The second data set was collected during the 11th and 12th weeks of the semester when the classes were toward being finished and all students should have had quite some extensive use of WebCT 6. Subjects from the first survey were sent an email invitation to participate in the second survey. Participants were asked to rate their current attitude toward WebCT 6 (ATO2) and toward using WebCT 6 (ATB2), and their behavioral intention (BI2) to continue using WebCT 6. A total of 145 participants filled both surveys that are usable.

The measures for behavioral intention and attitude toward objects were adopted from (Wixom et al. 2005) and (Crites et al. 1994) respectively. For attitude toward behavior, we constructed the measures based on the guideline by (Ajzen et al. 2005, p199). This measure of attitude toward behavior includes both instrumental and experiential aspects. Appendix A lists the instrument (in the surveys, tense was changed to reflect current and past attitudes). All constructs were measured using multiple items on 5-point Likert scales.

Data analyses consisted of two phases. The first phase was confirmatory factory analysis (CFA) to assess the measurement model. All constructs were modeled as reflective and by multiple indicators. The second phase was to test the research model using structural equation modeling technique. PLS was used for these analyses. Table 1 shows the descriptive statistics of the constructs' indicators.

The measurement model was examined for convergent and discriminant validity. Convergent validity was assessed by reliability of items, composite reliability of constructs and average variance extracted (AVE). Discriminant validity was

assessed by examining cross-loadings and the relationship between correlations among constructs and the square root of AVEs. Reliability of items was assessed by examining each item's loading on its corresponding construct. A common rule of thumb suggests that the item loading should exceed .70 (Barclay et al. 1995; Chin 1998). Confirmatory factor analysis results showed that all items exhibited loadings of more than .70 to their corresponding constructs, indicating adequate reliability of items.

Table 1. Descriptive Statistics of the Indicators of the Constructs

Time 0	Mean	Std.	Time 1	Mean	Std.	Time 2	Mean	Std.
ATO0.1	3.64	1.14	ATO1.1	3.53	1.09	ATO2.1	3.33	1.18
ATO0.2	3.50	1.17	ATO1.2	3.54	1.12	ATO2.2	3.37	1.22
ATO0.3	3.59	1.14	ATO1.3	3.78	1.09	ATO2.3	3.54	1.20
ATO0.4	3.54	1.09	ATO1.4	3.81	1.07	ATO2.4	3.51	1.20
ATB0.1	3.75	.96	ATB1.1	3.31	1.11	ATB2.1	3.23	1.16
ATB0.2	3.33	1.12	ATB1.2	3.82	1.10	ATB2.2	3.91	1.10
ATB0.3	3.31	1.12	ATB1.3	3.39	1.10	ATB2.3	3.29	1.10
ATB0.4	3.33	1.04	ATB1.4	3.49	1.13	ATB2.4	3.23	1.10
			BI1.1	3.36	1.19	BI2.1	3.00	1.22
			BI1.2	3.45	1.11	BI2.2	3.21	1.13

Table 2 shows composite reliability. AVE measures the amount of variance that a construct captures from its indicators relative to the amount due to measurement error (Chin 1998). It is recommended to exceed 0.5. All of the constructs met this guideline. AVE is also suggested to serve as a means of evaluating discriminant validity (Fornell et al. 1981). The square root of the AVEs should be greater than the correlations among the constructs, which indicates that more variance is shared between the construct and its indicators than with other constructs. In Table 2, the shaded numbers on the leading diagonals are the square roots of the AVEs. Off diagonal elements are the correlations among constructs. All diagonal numbers are greater than the off diagonal ones, indicating satisfactory discriminant validity of all the constructs. Another criterion for assessing discriminant validity is that no measurement item should load more highly on any construct other than the construct it intends to measure (Chin 1998). An examination of cross-factor loadings shows that all items satisfied this guideline. This indicates that ATO and ATB in general are different constructs confirmed by empirical evidence.

Table 2. Composite reliability & correlations of constructs

	Items #	Composite Reliability	AVE	ATO0	ATB0	ATO1	ATB1	BI1	ATO2	ATB2	BI2
ATO0	4	.97	.90	.95							
ATB0	4	.95	.82	.85	.91						
ATO1	4	.97	.88	.06	.19	.94					
ATB1	4	.93	.77	.05	.28	.79	.88				
BI1	2	.92	.85	.18	.39	.66	.81	.92			
ATO2	4	.98	.91	.14	.29	.73	.60	.54	.95		
ATB2	4	.95	.82	.18	.35	.68	.61	.54	.88	.91	
BI2	2	.95	.91	.08	.22	.08	.57	.63	.65	.72	.95

Results from Phase 2, the structural model, are shown in Figure 2. The model explains 60% of the variance in BI2, 79% in ATB2, 53% in ATO2, 65% in BI1, 69% in ATB1, and 8% in ATO1. There is support for some general relationships regardless the stage of use. For example, at any time, behavioral intention (BI) is positively determined by attitude toward behavior (ATB), not attitude toward object (ATO); and ATO has a strong positive impact on ATB. However, there are compelling differences on the roles of some constructs at different stage of use. For example, while all but one (ATO0->ATO1 is just a little shy from being significant at the .05 level) hypotheses related to Time 1 are supported by the data, it is not the case for Time 2. Specially, during Time 2 the continued use period, attitude toward behavior (ATB2) is solely determined by attitude toward the system (ATO2), while attitude toward the system (ATO2) is solely determined by the attitude toward the system during initial use (ATO1). In other words, the roles of attitudes are dependent on stages of use: (1) previous attitude on behavior does not always influence the current attitude on behavior (ATB0->ATB1, but ATB1 does not influence ATB2), and (2) previous ATB's role on attitude toward system (ATO) can be different (ATB0->ATO1, but ATB1 does not influence ATO2), and (3) previous ATO's on attitude toward behavior (ATB) can be different (ATO0->ATB1, but ATO1 does not influence ATB2). It is as expected that behavioral intention during initial use (BI1) has a positive effect on behavioral intention during the continued use (BI2).

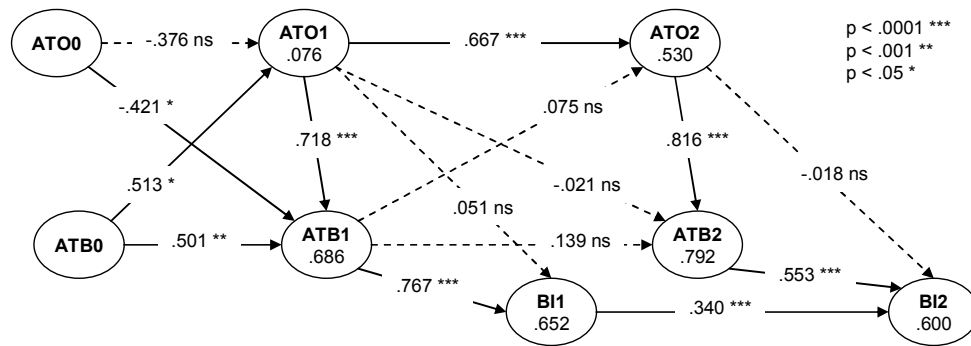


Figure 2. Empirical Model

To summarize, the empirical evidence supports most but not all the hypotheses. The data confirmed that ATB is a significant predictor of BI, while ATO's effect on BI is fully mediated by ATB. The data also supports to some extent the expectation that one's previous attitudes and behavioral intention can influence the current attitudes and intention. Specially, BI1 from initial ICT use has a positive impact on BI during continued use. The unsupported hypotheses (H_{e1}, H_{f2}, H_{g2}, H_{h2}) mostly have to do with attitudes in transitions: from previous attitudes to those in Time 1 during initial ICT use, or from the attitudes in Time 1 to those in Time 2 during continued ICT use. What is interesting is that the significances of the links of previous attitudes on current ones are just the opposite for Time 1 and Time 2: the significant links in Time 1 become insignificant in Time 2 and the insignificant links in Time 1 become significant in Time 2. One take-away message is that we should not always assume that previous attitudes (either toward a similar product or use of it or toward the same product or use of it during initial experience) would have impacts on current attitudes. Our study shows that it depends on whether current attitudes are based on initial IC use or continued ICT use.

Conclusion

In this paper, we clarify conceptual confusions regarding attitudes in the context of ICT acceptance and use. Specifically, we demonstrate that attitude toward what, object or behavior, is an important distinction. We claim that an attitude structure that incorporates both experiential and instrumental aspects shows good psychometric properties. Efforts to clarify conceptual confusions of attitude concepts are in great need due to the inconclusive and inconsistent empirical findings and the importance in studying ICT acceptance and use.

We also present a research model indicating the roles of ATO and ATB in predicting BI during users' initial and continued ICT use, as well as the roles of previous attitudes toward a similar ICT and use of it. A longitudinal study provided interesting evidence showing that the roles of attitudes can change as the users' use of the ICT increases. This finding, not all supported by theoretical reasoning from attitude studies begs for further theoretical and empirical investigation.

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Appendix A. Instrument

Attitude toward Object (ATO)

- ATO.1 I think ~ is desirable
- ATO.2 I like ~
- ATO.3 In general, ~ is good
- ATO.4 In general, I am positive about ~

Attitude toward Behavior (ATB)

- ATB.1 Using ~ is pleasant
- ATB.2 Using ~ is valuable
- ATB.3 Using ~ is desirable
- ATB.4 Using ~ is interesting

Behavioral Intention (BI)

- BI.1 I intend to use ~ at every opportunity in the future
- BI.2 I plan to increase my use of ~ to continue in the future