What Determines User Attitudes in IS Research? A Meta-analytic Structural Equation Modeling Approach

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Abstract:

While research in general has extensively studied the coherence between attitude and behavior, Information Systems (IS) research has paid little attention to the antecedents of attitude. Using the elaboration likelihood model (ELM) as theoretical basis, we focus on the factors that determine attitudes in IS research. We apply a meta-analytic structural equation model based on major IS-adoption models that focuses on classifying the antecedents of attitude in the studies of our meta-analysis according to the central and peripheral route of information processing proposed by the ELM. The results indicate that affect and cognition as representatives for the central route are less important as attitudinal antecedents in the IS context compared to external factors that represent the peripheral route of information processing.

Keywords: Attitude, Meta-analytical Structural Equation Modeling, Antecedents, Elaboration Likelihood.

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1   Introduction

Researchers generally assume that attitudes exert a conclusive influence on behavior and determine human action (Ajzen, 1988). Implied in this assumption is the thought that people behave in a manner consistent with their beliefs (Eagly & Chaiken, 1998). Researchers have frequently applied theoretical frameworks on the relationship between attitudes and behavior, such as the theory of reasoned action (Fishbein & Ajzen, 1975) and the theory of planned behavior (Ajzen, 1991,) in the information systems (IS) discipline (i.e., Davis, Bagozzi, & Warshaw, 1989; Hsieh, Rai, & Keil, 2008; Taylor & Todd, 1995; Venkatesh, Morris, Davis, & Davis, 2003) to explain user behavior and the effect of its related determinants. However, although attitudes as antecedents of user behavior are among the top three most applied independent variables used to predict behavior in IS-adoption models (Jeyaraj, Rottman, & Lacity, 2006), the insignificance rate of the attitude construct in studies in the context of individual IS-adoption research is about 20 percent according to Kroenung and Eckhardt's (2011) meta-analysis. Moreover, attitude is inconsistent in the extent of predictive validity when compared to other behavior-predicting constructs such as perceived usefulness (Venkatesh et al., 2003). Various researchers have addressed this imbalance in the IS-adoption discipline (e.g., Venkatesh et al., 2003; Yang & Yoo, 2004; Zhang, Aikman, & Sun, 2008), and their studies have all provided valuable but also partly divergent ideas and approaches to explain this case. Classifying these approaches with regards to research on attitudes in social psychology, we can group them into two major perspectives: the intra-attitudinal perspective and the inter-attitudinal (and/or external perspective) with three subcategories each. As we show in this paper, attitudes do not predict user behavior to the extent that they should do in the IS discipline because we have not yet captured the whole attitude concept and neglected important aspects that decisively impact the predictive validity of attitude on behavior. Prior IS research has mostly focused on issues of attitude measurement (e.g., item operationalization) or interrelation with other constructs in order to address the phenomenon of low and inconsistent predictive validity of attitude on user behavior in the IS context (e.g., Yang & Yoo, 2004). Beside situational factors and the interrelation with competing internal attitudes that research has not yet considered in the IS context, another important indicator for the predictive validity of attitude is its formation by its preceding antecedents. Attitude formation considers the temporary state of attitude, its formation, and its impact on behavior (Eagly & Chaiken, 1993). Social psychology literature holds evidence that, with respect to the formation of attitudes, attitude formation's antecedents are likewise meaningful with respect to the relationship between attitude and behavior. The elaboration likelihood model (ELM), for instance, proclaims that when individuals consciously form an attitude based on affective and cognitive responses to a stimulus (central route), it is relatively enduring and resistant towards persuasive influences and, thus, more predictive of behavior than in the case when individuals form attitudes based on low cognitive effort and heuristic information processing (peripheral route) (Petty & Cacioppo, 1986). In the central route, individuals are motivated and can think about the given information; thus, their attitude "results from thinking about the issue or arguments under consideration" (Petty & Cacioppo, 1981, p. 262). This consideration or evaluation also involves emotions that occur in relation to the attitude object. In contrast, information processed via the peripheral route does not cause individuals to think about the information due to a lack of motivation or ability; their attitude "results from non-issue relevant concerns" (Petty & Cacioppo, 1981, p. 263). That is, exclusion of the central route defines the peripheral route; it is the "non-central" route (Hamilton, Hunter, & Boster, 2009).

Contribution:

This paper provides a unique perspective on user attitudes in information systems (IS) research with respect to theoretical scope and method. From a theoretical perspective, although user attitude is a frequently applied construct in IS research, its formation process and the impact of this process on the predictive validity of the construct attitude on behavior has not been investigated so far. Therefore, we contribute to the body of knowledge in this area by extending the perspective from the attitude-behavior relationship to the attitude-formation process and stress its importance with respect to the predictive validity of attitude on behavior, which has been questioned multiple times in the IS context. Therefore, we provide a classification of prior research on attitudes in IS, exemplify the link between attitude formation and behavioral responding and its relevance for behavioral predictions in IS models. Since the applied techniques allow for categorizing attitudinal determinants into groups, we can show that the antecedent category of external factors has the highest impact on attitude and thus, the largest predictive validity for the impact of attitude on behavior. In the individual antecedent groups, inter-attitudinal/system-related factors and performance expectancy are most important for the formation of user attitudes. From a methodological standpoint, we contribute to the IS discipline by applying a meta-analytic structural equation modeling technique that enable us to derive implications on a meta level across a large amount of studies.

In other research disciplines such as consumer research, researchers have already focused on the antecedents of attitudes and discerned their significance with respect to attitude persistence and strength (i.e., Brown & Stayman, 1992; Tavassoli & Fitzsimons, 2006). However, in the IS discipline, researchers have not yet addressed the theoretical perspective of attitudinal antecedents based on attitude formation and their implications as to the attitude behavior relationship.

The strong effect of attitudinal antecedents on attitude and its efficiency in indirectly predicting behavior or persisting persuasive influences represents an important research stream in attitude research (Eagly & Chaiken, 1993). Thus, we acknowledge this importance of attitudinal antecedents for attitude's persistence and predictive validity and transfer this knowledge into the IS-adoption discipline to better understand the relationship between attitudes and user behavior. In particular, by analyzing attitudinal antecedents in the IS-adoption literature on a meta-analytical basis using the theoretical foundation of the ELM (Petty & Cacioppo, 1981), we apply a meta-analytic structural equation modeling (MASEM) technique to address the following two research questions:

RQ1: Which antecedent categories have the highest importance on the construct of attitude in the IS-adoption discipline?

RQ2: Which route of information processing (i.e., central versus peripheral route) has IS researchers predominantly assumed in order to model the attitude behavior relationship?

This paper proceeds as follows: in Section 2, we summarize the attitude concept and its antecedents from a social psychological standpoint. In Section 3, we focus on prior research on attitudes in the IS discipline. In Section 4, we discuss the ELM as theoretical basis and its applicability for the process of attitude formation. In Section 5, we describe the methodology we used to review the literature and conduct our meta-analysis. In Section 6, following the example of Joseph, Ng, Koh, and Ang (2007), we explain the MASEM approach we conducted. In Section 7, we present the results of the meta-analytic structural equation model. Finally, in Sections 8, we discuss our study's limitations and, in Section 9, our findings' implications for IS-adoption research.

2   Attitude in Social Psychology Literature: Concept and Definition

Eagly and Chaiken (1993, 2007) provide a conceptual and holistic definition of attitude: "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (Eagly & Chaiken, 1993, p. 1). Importantly, the definition explicitly stresses that evaluation comprises all classes of attitudinal responding: affect, cognition, and behavior. These classes of responses are essential to the attitude concept because an attitude develops based on responses (Bagozzi, Tybout, Craig, & Sternthal, 1979; Breckler, 1984). This tripartite view of attitudinal responses has a very long history in social psychology, McGuire (1969, 1985) claims that it goes as far back as classical Greek philosophy. In line with the concept that we can categorize attitudinal responses into three classes is the assumption that attitudes have three types of determinants.

The formation of attitudes based on cognitive processes is inherent in most of the research done on attitudes (Ajzen, 1991; Albarracín, Zanna, Johnson, & Kumkale, 2005; Eagly & Chaiken, 1993; Fishbein & Ajzen, 1975). A cognitive learning process is assumed to occur when a person gains information about an attitude object, and thereby forms beliefs. This process can proceed directly (through experience) or indirectly (through external information). As to affective determinants of attitude, Zajonc (1984) and Zajonc (2000) state that preferences (e.g., evaluations) often arise immediately in line with the first contact an individual has with the attitude object without being mediated by cognitive activities (see also Barrett, Mesquita, Ochsner, & Gross, 2007). An example of this phenomenon is the feeling of immediate compassion when we are confronted with a tragic event. Eagly and Chaiken (1993) define affective determinants as "feelings, moods, emotions, and sympathetic nervous system activity that people experience in relation to attitude objects" (p. 11). In this sense, affective attitudinal determinants, which we call "affect" (analogous to "cognition" in "cognitive attitudinal determinants") in this paper, holds a different conceptualization than, for instance, "core affect" as per Zhang (2013).

Further, according to Eagly and Chaiken (1993), we need to conceptualize affective and cognitive determinants always in relation to one another. In this sense, affective determinants are by definition non-cognitive, and cognitive determinants by definition involve cognitive activities (e.g., thinking) and exclude affect. In this paper, we also adapt this delineation of affect and cognition for reasons of definitional clarity.

The assumption that attitudes form based on past behavior rests on the premise that people tend to infer attitudes that are consistent with their behaviors. While theories such as cognitive dissonance (Festinger, 1957) and the concept of attitudes as representations in memory (Bohner & Dickel, 2011) outline that behavioral processes (e.g., direct or indirect behavioral experience with the attitude object) precede attitude change and reformation, the formation of an initial attitude represents a special case. Just as it seems quite intuitive that cognitive and/or affective processes antecede the development of an initial attitude, it is counterintuitive that behavior precedes the initial formation of attitude because attitude itself is assumed to be a behavioral antecedent. As to this question, literature provides various viewpoints, too. Some authors (Zanna & Rempel, 1988) claim that simple behavioral processes can precede initial attitudes. In contrast, others argue that an initial attitude is constructed on the spot and determined only by affect and/or cognition and moderating situational factors (Fazio, 2007). Figure 1 summarizes the definitions of attitudes on the continuum of the concepts "stored in memory" and "constructed on the spot".
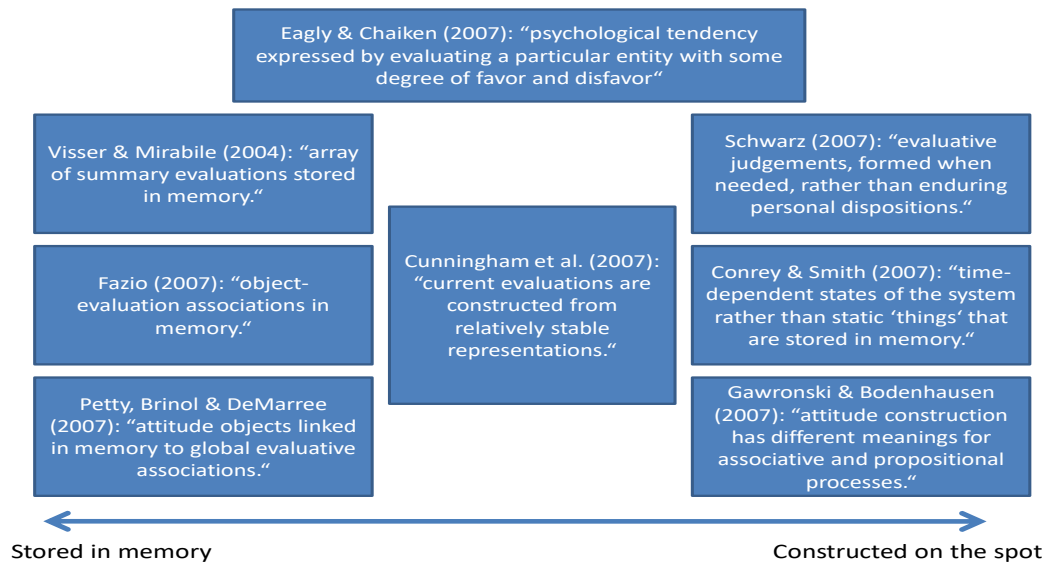
Figure 1. Attitude Definitions Ordered According to Their Stable vs. Temporary Constructions (Bohner & Dickel, 2011 p. 393)

Apart from the question of how individuals form attitudes (research on "attitude formation"), research on attitudes comprises a second stream (known as "attitude change"). This latter stream focuses on the transformation of attitudes over time and under certain conditions (persuasive influences) (Albarracin et al., 2005). The social psychology literature distinguishes between these two streams of research on attitudes (e.g., Ajzen, 2001; Bohner & Dickel, 2011; Crano & Prislin, 2006; Eagly & Chaiken, 1993), and journals such as the *Annual Review of Psychology* have classified the distinction (Ajzen, 2001). However, in the beginning, attitude research did not differentiate between the two research streams. Rather, the two streams represented different focal points. While such research focused mainly on attitudes' nature and structure in the late 1920s and 1930s, research in the 1950s and 1960s addressed issues that affect attitude change (Crano & Prislin, 2006). Later research predominantly focused on attitude's content and functions and the central issue of persuasion. Fundamental discussions among researchers led to a generally accepted division in two separate research streams in attitude research (Bohner & Dickel, 2011). Thus, the difference in attitude formation and attitude change represents not a distinction of totally different subjects but other perspectives on the same subject. As a result, the theoretical and conceptual intersections in the research streams also inevitably arise and benefit each stream.

3   Classification of Research on Attitudes in IS Research

Despite the rich body of research on individual attitudes in the social psychology discipline (for an overview, see Albarracín et al., 2005; Eagly & Chaiken, 1993), little research has examined the role of attitude in IS research. As our scientometric literature review that builds the data basis of this research revealed, many studies have incorporated attitude as exogenous variable in their models, but only a handful of studies have specifically focused on attitude as a construct.

Given the need to further investigate the role and importance of individual attitudes in relation to IS adoption (see Venkatesh et al., 2003) and the reported concern about unusually high insignificance rates of the construct in predicting the endogenous variable (Kroenung & Eckhardt, 2011; Kroenung & Eckhardt, 2015), we review and classify the prior literature on attitudes in the IS discipline and their research foci to reveal further research gaps and outline our own focus here.

In general, one can classify research on and around attitudes into two broad perspectives (Albarracín et al., 2005; Eagly & Chaiken, 1993): 1) the intra-attitudinal perspective that focuses on attitude measurement, operationalization, and processes of attitude formation, and 2) the inter-attitudinal (and/or external) perspective that addresses the relationship between attitude and other constructs (e.g., habit or subjective norm), different attitudes towards different attitude objects, and the impact of external influences on attitude (e.g., situational factors). Sometimes, researchers regard these external influences as a separate perspective on attitude (see Eagly & Chaiken, 1993, p. vi-ix), but, following the argument that other constructs also affect a single attitude from "outside" and not within the attitudinal structure itself, we classify "external influences" into two perspectives.

Table 1 overviews the different research focuses on attitudes and their respective outcome in the IS literature classified by influencing factor. Given the challenging attitude-behavior relationship in IS-adoption literature, the second column in Table 1 shows the influencing factors from the intra- and inter-attitudinal perspective that have the potential to substantially influence the predictive validity of attitude on behavior. Regarding the intra-attitudinal perspective, these influencing factors are "attitude operationalization", "attitude measurement", and "attitude formation". Yang and Yoo (2004), Zhang et al. (2008), and Zhang and Sun (2009) have addressed attitude operationalization, which relates to how one models attitude as a construct and deducts it into single items in a questionnaire. Applying a deductive research approach using empirical data, Yang and Yoo (2004) state that researchers should operationalize attitude as two separate constructs: one that captures affect and one that captures cognition. Zhang et al. (2008) and Zhang and Sun (2009) reviewed the literature for different operationalizations of attitude and extracted two different types of used operationalization: "attitude towards the object" and "attitude towards the behavior". Out of these two operationalizations, they found attitude towards the behavior to be more predictive.

Attitude measurement as a term certainly comprises aspects of attitude operationalization, but it also comprises more methodological approaches than questionnaire items and holds a broader view that includes the antecedents and the relation to the attitude object. Although attitude measurement in the IS context is predominantly based on empirical surveys and perceptive questionnaires (which makes attitude measurement basically equal to attitude operationalization), we wanted to explicitly separate those approaches where measurement does not equal operationalization and that make use of other methodological approaches and perspectives on attitude in order to provide a more granular picture.

As to this understanding of attitude measurement, Kroenung and Eckhardt (2011) focus on the issue of attitude measurement in relation to the respective IS artifact. In line with Yang and Yoo (2004), they show that cognition or an affect-based measurement of attitude alone does not increase attitude's predictive power: they can only do so in relation with the IT's characteristics (hedonic or utilitarian). Since this approach was not based on perceptive questionnaire items, we clustered it to the category of "attitude measurement" instead of "attitude operationalization".

We also adopt the intra-attitudinal perspective; namely, the process of attitude formation. This perspective generally posits that the structure of attitudinal antecedents is an indicator for attitude strength, which is again essential for the predictive validity of attitude on behavior (Eagly & Chaiken, 1995). Based on the ELM (Petty & Cacioppo, 1981, 1986), we theoretically elaborate whether IS researchers in specific papers have modeled the attitude-formation process in a way that assumes the process follows central, cognitive, and rational routes and, therefore, should strongly and highly predict behavior or whether they have

modeled the process in a way that assumes it follows a peripheral route and does not rely on conscious thought and, thus, that attitude should more weakly predict behavior.

Table 1. Classification of Prior Research on Attitudes in the IS Discipline

| Prsp.	Influence factor	Research focus	Authors in IS domain	Research approach	Outcome
Intra-attitudinal perspective	Attitude operationalization	Addresses the operationalization of the attitude construct and the question of whether attitude should be separated in two constructs in order to increase its predictive validity.	Yang & Yoo (2004), Zhang et al. (2008), Zhang & Sun (2009).	Empirical, deductive, SEM.	Separation of attitude in two constructs: 1) *Affective attitude* and *cognitive attitude* (Yang & Yoo, 2004) 2) *Attitude towards the object* and *attitude towards the behavior* (Zhang et al., 2008; Zhang & Sun, 2009).
	Attitude formation	**Addresses the antecedents of attitude and the process of attitude formation with reference to implications on the predictive validity of attitude.**	**Focus of this research.**	**Deductive, meta-analytical-SEM.**	
	Attitude measurement	Focuses on the measurement of attitude and its impact on the attitude behavior relationship.	Kroenung & Eckhardt (2011).	Deductive, meta-analytic ANOVA.	The measurement of attitude (affect or cognition-based) should match the type of IT artifact (hedonic or utilitarian) in order to increase the predictive validity of attitude on behavior.
Inter-attitudinal and external perspective	Interrelation with other constructs	Addresses the interrelation of attitude with other constructs (perceived usefulness/subjective norm/habit) and their implications on the predictive validity of attitude.	Venkatesh et al. (2003), Titah & Barki (2009), Kroenung et al. (2013).	Deductive, meta-analytic ANOVA.	Perceived usefulness is more powerful than attitude in explaining individual adoption behavior. Attitude and subjective norm have a non-linear relationship. The predictive validity of attitude varies depending on habitual strength of an individual.
	Interrelation with an attitude towards a competing artifact	Focuses on the interrelation of two attitudes towards different attitude objects that are related with respect to functionality or purpose (e.g., Outlook and Lotus Notes) (Heider, 1946; Eagly & Chaiken, 1993).			
	Situational factors	Addresses the influence of situational characteristics on the attitude behavior relationship (e.g., Glasman & Albarracín, 2006).			

Prior research on the inter-attitudinal and external perspective has predominantly focused the interrelation with attitude and other constructs (e.g., perceived usefulness or subjective norm). Venkatesh et al. (2003) discuss the relationship between attitude and perceived usefulness and state that the predictive validity of attitude on behavior seems to be limited if one integrates cognitive constructs (e.g., perceived usefulness) in the adoption model. Further, Titah and Barki (2009) found that attitude and subjective norms hold a non-linear and substitutional relationship. For instance, if normative pressures to use a system are high (assuming an individual has volitional control over using the system), increases in individual attitude have a decreasing marginal impact on user behavior (Titah & Barki, 2009, p. 839). Thus, attitude's predictive

power depends on the presence of subjective norms. One can observe a similar dependency between attitude and habit, which Triandis (1971, 1977, 1980) has noted and Verplanken and Aarts (2011) described. Focusing on attitude, Kroenung, Eckhardt, and Bernius (2013) describe this dependency and note that the degree to which attitude influences habit varies depending on the strength of an individual's habit.

Beside the outcomes we mention above, we also derive two research gaps with respect to the role and impact of attitude in IS-adoption research (see Table 1). One can classify both gaps into the inter-attitudinal and external perspectives. The first gap concerns the impact an attitude has on a competing attitude. For instance, consider a situation in which an individual's adoption behavior towards a certain stimulus (stimulus A) represents the endogenous variable (e.g., adoption of Lotus Notes). However, the individual has moreover also developed a strong attitude towards another stimulus (stimulus B—e.g., MS Outlook). Then, the individual's attitude towards stimulus B will affect their attitude and adoption behavior towards stimulus A. Research on social psychology has found evidence that this sort of attitudinal interrelationship exists and influences the impact single attitudes have on behavior (see Eagly & Chaiken, 1993) if the attitude objects (e.g., Outlook and Lotus Notes) have a relationship with each other in the sense that they are two options fulfilling the same purpose.

Situational factors represent another important factor that presumably influences attitude as a construct and that IS researchers have not yet investigated. According to Glasman and Albarracín's (2006) meta-analysis, the circumstances under which individuals form attitudes and perform corresponding behaviors are important for the relationship between attitude and behavior because attitudes that individuals form from using much cognitive energy and considering much relevant information are assumed to be stronger and more predictive of behavior than those not formed under the aforementioned conditions.

While Table 1 indicates that some researchers have investigated attitudes in the IS context to some degree, as exemplified above, we still lack important parts of the puzzle. In order to fill this gap, we investigate attitude formation to derive insights about attitude's predictive power as measured and reported in IS-adoption studies. Figure 2 outlines this research focus by illustrating the coherence between a determinant-based view and its impact on behavioral responding. Figure 2 suggests that, by analyzing the antecedents of attitudes (and, thus, the attitude-formation process), one can draw implications about attitude strength or attitude's potential impact on behavior (highlighted arrow). We explain the details about how and why the attitude formation process provides information for the predictive power of attitude in detail in the following section.
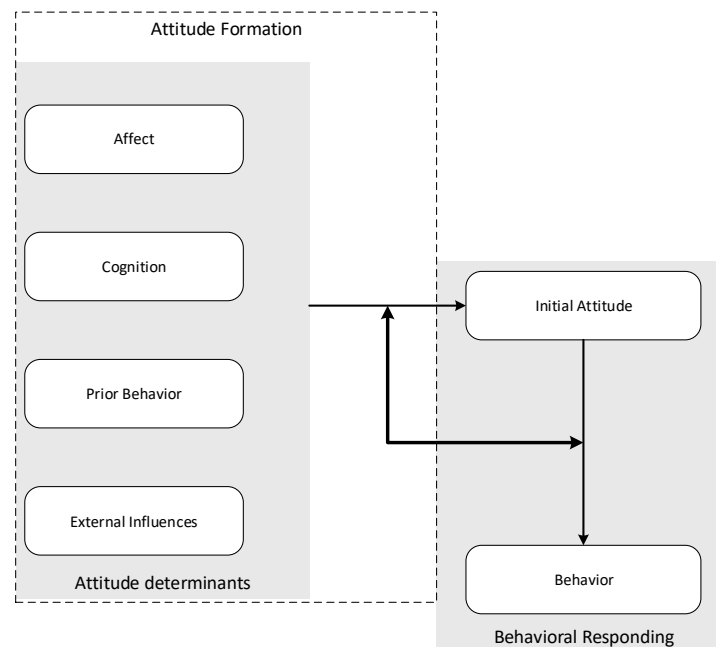
Figure 2. Coherence Between Attitude Formation and Attitude Responding

4 Attitude and Information Processing: The Elaboration Likelihood Model

The ELM, which Petty and Cacioppo (1981, 1986) propose, represents a theory that can affect both attitude formation and change. One can categorize the ELM as one of the dual-process theories in the social psychology literature that examine information processes that shape human perceptions and behavioral states (Eagly & Chaiken, 1993). Originally part of the literature stream of attitude change theories, dual-process theories state that attitude adjustments or changes and their resulting behavioral changes are primarily driven by external information that causes individuals to re-examine their beliefs (Chaiken & Trope, 1999).

Specifically, the ELM posits that two "routes" of influence—the central route and the peripheral route—cause an individual's attitude change or attitude adjustment (Petty & Cacioppo, 1981, 1986; Petty, Cacioppo, & Goldman, 1981). In the central route, individuals are motivated and can think about information; their attitude "results from thinking about the issue or arguments under consideration" (Petty & Cacioppo, 1981, p. 262). This consideration or evaluation also involves emotions that occur in relation to the attitude object. In contrast, information processed via the peripheral route does not cause individuals to think about the information due to a lack of motivation or ability; their attitude "results from non-issue relevant concerns" (Petty & Cacioppo, 1981, p. 263). That is, negation defines the peripheral route because it is "not the central" route (Hamilton et al., 2009).

In simple terms, the central route requires an individual to think thoroughly about issue-related information and weigh up the relative merits and relevance of the information to evaluate it, whereas the peripheral route involves less cognitive effort and the reliance on external cues and heuristics (i.e., the number of a systems' prior users as an indicator for its quality) (Bhattacherjee & Sanford, 2006).

The central and peripheral routes differ in three aspects. First, the central route processes message-related information, whereas the peripheral route processes external cues, which suggests that the central route covers all processes that lead to internal evaluation in terms of the tripartite model (but predominantly cognition and affect). In contrast, the peripheral route comprises external cues (i.e., overhearing people talk about the attitude object). Second, the cognitive effort of information processing is much more extensive in the central route than in the peripheral route. The central route requires thoughtful evaluation in contrast to the peripheral route that only requires an individual's association with related cues (Petty & Cacioppo, 1986). Third, attitudes or changed attitudes predominantly built based on information processed via central route are generally stronger and more stable compared to those built based on the peripheral route (Chaiken & Trope, 1999).

Originally designed as a theory to explain attitude change as a consequence of persuasion, research has begun to value the ELM's applicability to attitude formation and attitudinal antecedents (Hamilton et al., 2009). In particular, following the concept of attitude's temporary constructions (see the right side of Figure 1), differentiating attitudinal antecedents based on the central and peripheral route combines the traditional internal perspective of attitude formation based on the tripartite model with an external perspective of information sources and peripheral cues to create a more integrative and dynamic view on attitude formation. To illustrate how an individual might follow either route, consider an individual evaluating a product based on information about it. If the information is more associative (i.e., an advertising poster that uses nothing but pictures) than informative (i.e., an informative flyer about the product), the individual will likely build an attitude about the product based on the peripheral route (MacKenzie & Lutz, 1989). If the information requires more intensive evaluation in terms of affect and cognition, then the individual will likely build an attitude about the product based on the central route. According to theory, the latter attitude would be stronger and more resistant with respect to persuasive influence (Chaiken & Trope, 1999); however, the latter attitude presumes the individual has paid attention and has the motivation to think about the product, which, at least in the advertising example, is harder to achieve.

5   Research Model and Hypotheses

Combing the theoretical implications from the prior sections, we depict our research model that addresses the impact of antecedents for attitude formation in Figure 3. The model combines the perspectives of the 1) tripartite model (see Eagly & Chaiken, 1993, 2007) that assumes that individuals build attitude based on affect, cognition, and (if present) prior behavior in relation to the attitude object; and 2) the ELM, which postulates that individuals process information in relation to the attitude object via two different routes (see Petty & Cacioppo, 1981). As Figure 3 illustrates, the attitudinal antecedents of affect and cognition are subordinate to the central route since they presumably require more internal cognitive effort compared to prior behavior and external factors. Thus, the latter are subordinate to the peripheral route.
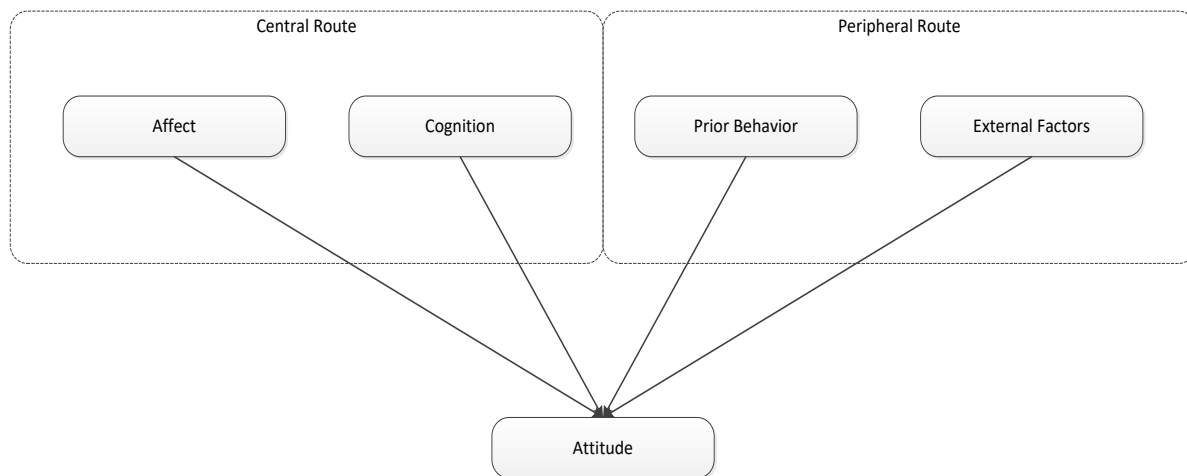

Figure 3. Research Model: Conceptual

In order to make the research model in Figure 3 applicable to the IS-adoption context and to the methodological meta-analytic structural equation modeling approach, we had to further refine the categories in Figure 3. We started with the central route. We disaggregated the category cognition into performance expectancy and effort expectancy based on UTAUT's categories (Venkatesh et al., 2003). In order to define subcategories of affect, we referred to Beaudry and Pinsonneault (2005, 2010) and broadly classified it into "positive" and "negative" emotions.

In order to match the peripheral route to constructs used in IS-adoption research, we used the category "external factors" (Jeyaraj et al., 2006; Venkatesh et al., 2003). External factors are clearly not internal to an individual, which would again be the central route, and are clearly neither cognition nor affect. As subcategories of "external factors", we defined "social factors" that covered all antecedents related to any kind of social influence or interaction (i.e., subjective norm). With respect to the second subcategory, the lablling turned out to be more complex. Experience and/or prior behavior did not cover trust, habit, or monetary resources, whereas facilitating conditions did not cover all the remaining antecedents. Thus, referring to the ELM and the peripheral route, we labeled the remaining group "inter-attitudinal/system-related factors". Antecedents in this group had to fulfill two conditions: 1) they could not belong to one of the other groups and 2) they had to be external in the sense that they do not represent any class of attitudinal antecedents. The classification of variables is illustrated in the following Figure 4.

However, we note that the ELM literature contains diverse opinions about categorizing variables into the central and peripheral routes (see, e.g., Petty & Cacioppo, 1986; Petty & Wegener, 1999). For instance, in the IS discipline, Angst and Agarwal (2009, p. 344) do not specifically categorize cue types because of "the considerable debate surrounding the validity of categorizing a variable as acting through a central or peripheral route rather than recognizing the multiple roles for variables", which, in line with Fazio and Williams (2004), implies that attitudes that one builds based on these activities are more accessible and, thus, central to the individual because the individual can consciously retrieve these reactions faster compared to less-accessible factors (e.g., based on prior behavior) (Verplanken & Aart, 2011). Thus, our argument for classifying affect and cognition into the central route mainly rests on accessibility (Fazio & Williams, 2004) and on consciousness about these reactions (Verplanken & Aarts, 2011). The latter argument further conceptually justifies why we had to subordinate past behavior and external factors under the peripheral route. Prior behavior represents an antecedent of habits (see Verplanken & Aarts,

2011), which, by definition, is a variable that, from a behavioral standpoint, belongs to the behavioral paradigm of goal-directed automaticity. For this reason, behaviors (and attitudes) based on prior behavior require much less mental capacity, and attitudes based on prior experience should be weaker (Bargh & Ferguson, 2000; Fazio & Williams, 2004; Verplanken & Aarts, 2011). The same holds true for external factors, which mainly comprise social influences. Thus, they are not central but peripheral (e.g., external) to the individual.
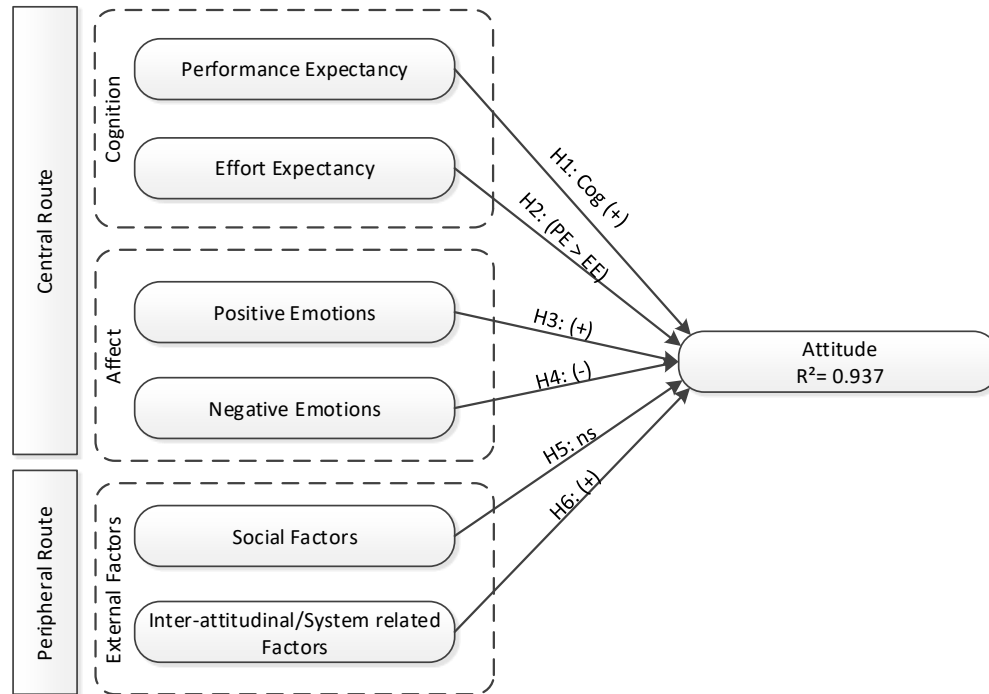

Figure 4. Research Model With Hypotheses

5.1   Research Hypotheses

We structure the way we present our hypotheses based on the higher-level categories cognition, affect, and external factors (see Figure 4). According to the ELM, the first two categories, affect and cognition, represent the central route of information processing, whereas the third category, external factors, represents the peripheral route of information processing.

5.1.1   Cognition

IS-adoption research has made significant strides toward understanding the determinants of user behavior through cognitive-based models such as the TAM (Davis et al., 1989) or the UTAUT (Venkatesh et al., 2003; Beaudry & Pinsonneault, 2005, 2010). Based on theories such as the theory of reasoned action (Fishbein & Ajzen, 1975) and the theory of planned behavior, much IS research has posited that individuals form intention based on beliefs. Considering the tripartite model of attitude antecedents in combination with the findings of van der Heijden (2004) and the implication that cognition is more important than affect for whether individuals will adopt utilitarian technologies, we hypothesize that cognition will have a strong and positive impact on attitude for the following reason: the major part of the studies included in the analyses examined utilitarian technologies (63.3%), which should result in a formation of attitude primarily based on cognition (Eagly & Chaiken, 2007; Kroenung & Eckhardt, 2011; Van der Heijden, 2004). As to the subconstructs performance expectancy and effort expectancy, Venkatesh et al. (2003) state that the construct performance expectancy is the strongest predictor of intention. They also refer to Davis et al. (1989) who modeled a direct link between usefulness and intention, but they did not model one for ease of use. Schepers and Wetzels (2007) provide another strong indication for a stronger effect of performance expectancy on attitude in comparison with effort expectancy: they report in their meta-analysis that the significance rate of the relationship between perceived usefulness and attitude was at a 100 percent level and the correlation coefficient was 55.4 compared to 46.4 for ease use. Therefore, we posit:

H1: Cognitive determinants have a positive impact on attitude.

H2: Performance expectancy has a stronger effect on attitude than effort expectancy

5.1.2 Affect

Based on the classification in Table 2, we created two emotion constructs: one that captures positive emotions and one that captures negative emotions. Research has hypothesized that affect has a major impact on attitude formation (Eagly & Chaiken, 1993; Zajonc, 1984). Analogous to cognition, negative affect is likely to result in negative attitudes and positive affect in positive attitudes (Eagly & Chaiken, 1993). Therefore, in line with Beaudry and Pinsonneault (2010), we posit:

H3: Positive emotions have a positive impact on attitude.

**H4:** Negative emotions have a negative impact on attitude.

5.1.3 External Factors

We include two constructs under external factors: "social factors" and "inter-attitudinal/system-related factors". Both categories neither represent affect nor cognition, and external forces (which individuals cannot themselves influence) drive them both. As such, social factors represent an interesting case. According to the theories of reasoned action (Fishbein & Ajzen, 1975) and planned behavior (Ajzen, 1985, 1991), subjective norms, the construct that captures perceived peer influences in both theories (Eckhardt, Laumer, & Weitzel, 2009), is a direct determinant of behavioral intention rather than attitude. Further, Titah and Barki (2009) found that the relationship between the two constructs was substitutive in nature. Nevertheless, in our literature sample, we tracked several cases where social influence was a determinant of attitude (e.g., Li, Hess, & Valacich, 2008). With reference to Titah and Barki's (2009), Fishbein and Ajzen's (1975), and Ajzen's (1985, 1991) findings, we posit:

H5: Social factors do not have a significant influence on attitude.

As for the antecedents that we included in the group of inter-attitudinal/system-related factors, we assumed them to be by definition generally supportive and facilitating. Importantly, we put all constructs that referred to experience or prior behavior in this group. Due to the low total number of constructs that referred to any kind of prior behavior (experience 2, familiarity 1), the implementation of a separate group referring to prior behavior was inappropriate from a methodological standpoint. Therefore, we posit:

H6: Inter-attitudinal/system-related factors have a positive influence on attitude.
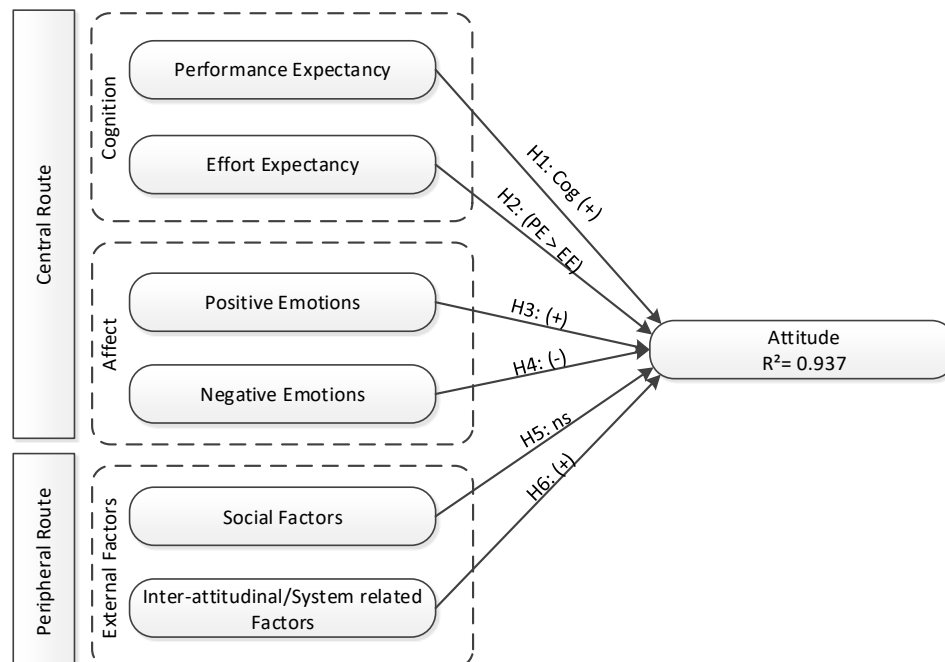
Figure 5. Research Model and Hypotheses

6   Methodological Approach

In this section, we describe how we collected data via a scientometric literature review (Eckhardt, 2009) and analyzed it via meta-analytic structural equation modeling (MASEM). In general, MASEM is a methodological approach that combines meta-analysis and structural equation modeling. This procedure has emerged over the last 20 years and has proven to be advantageous especially with respect to theory testing where each primary study does not include all the relationships that the authors of the papers hypothesize (Viswesvaran & Ones, 1995; Cheung & Chan, 2005; Joseph et al., 2007). If, for instance, ten studies report a relationship between two constructs (A and B), ten other studies report relationships between B and C, and five other studies report correlations between A and D, B and D, and C and D, then one can estimate the relationships between all constructs meta-analytically and use them to test a theory that involves all four constructs (Viswesvaran & Ones, 1995).

The methodological procedure resembles the two-step approach of general structural equation modeling, with the important difference that one takes the measures by which the latent variables are estimated from scientometric data (Eckhardt, 2009) instead of single or longitudinal survey data (Cheung & Chan, 2005). Thus, the difference basically lies in the measurement model. Because the measurement model specifies how indicators/observations measure the variables (Hair, Hult, Ringle, & Sarstedt, 2014), the process of defining these indicators out of a dataset based on scientometric data represents the basic difference of MASEM compared to SEM where the indicator data stems from primary data sources (e.g., surveys, interviews, or observations). To estimate the structural model, one uses the correlations between the constructs or, in this case, the beta values of empirical studies to test the hypotheses (Viswesvaran & Ones, 1995). So the procedure of MASEM basically comprises the three steps in Figure 6.
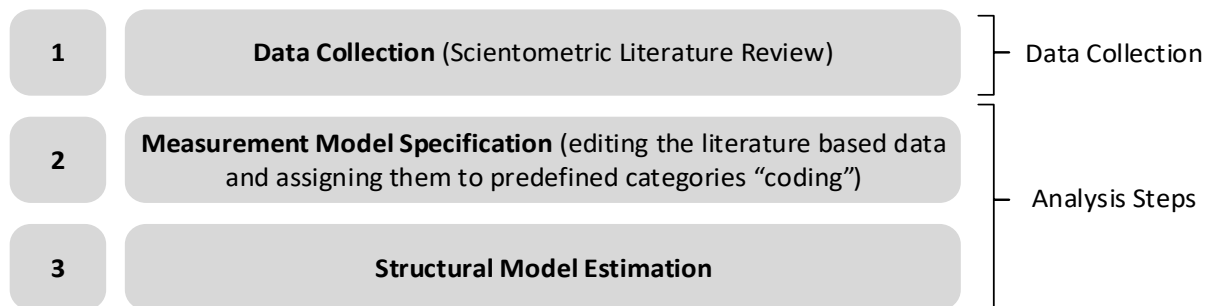
1	**Data Collection** (Scientometric Literature Review)	Data Collection
2	**Measurement Model Specification** (editing the literature based data and assigning them to predefined categories "coding")	Analysis Steps
3	**Structural Model Estimation**	

Figure 6. MASEM Procedure

Some studies across social sciences have applied MASEM in order to test theories from a higher level of abstraction. For instance, Hom, Caranikas, Prussia, and Griffeth (1992) used this methodology to test alternate models of withdrawal behavior. Brown and Peterson (1993) used it to test antecedents and consequences of job satisfaction in sales personnel. Further, Visweswaran and Ones (1995) applied MASEM to test a theory of job performance. In the IS discipline, Joseph et al. (2007) introduced MASEM by modeling turnover of information technology professionals. For this research, we chose MASEM in order to estimate the influence of different antecedent groups of attitude that different IS studies used as attitude determinants on the explained variance of attitude. By means of this technique, we could examine whether affect, cognition, or external factors such as social influence predominantly determine attitude as a variable in an IS context.

6.1   Data Collection Procedure: Scientometric Literature Review

To gather the data for our meta-analytic structural equation model, we conducted a scientometric literature review. We used the TAM's introduction in 1989 as our starting point and 2010 as our ending point.

In order to ensure the meaningfulness of the results and an appropriate sample size, we included 12 top peer-reviewed journals of the IS discipline (*Management Information Systems Quarterly* (*MISQ*), *Information Systems Research* (*ISR*), *European Journal of Information Systems* (*EJIS*), *Journal of the Association for Information Systems* (*JAIS*), *Journal of Information Technology* (*JIT*), *Journal of Management Information Systems* (*JMIS*), *Journal of Strategic Information Systems* (*JSIS*), *Information Systems Journal* (*ISJ*), *Communications of the AIS* (*CAIS*), *Decision Support Systems* (*DSS*), *Communications of the ACM* (*CACM*), and *Information and Management (I&M)*) and two general

management research journals with high importance for the IS discipline (*Decision Sciences* (*DS*) and *Management Science* (*MS*)). Besides including in the AIS journal basket (Saunders et al., 2006), we chose the journals because of their topical relevance and their appearance among the top-ten ranked journals according to Peffers and Tang's (2003) ranking.

We searched through every single issue of the journals selected between August, 1989, and December, 2010. In total, we accessed more than 19,500 papers via Business Source Complete by EBSCOhost.

Specifically, to feature in our study, papers had to fulfill the following inclusion criteria:

1. They had to be published in one of the selected journals.
2. The study had to be published between the introduction of the technology acceptance model in August 1989 (Davis et al., 1989) and December 2010.
3. They had to contain an operationalization of attitude toward an object or behavior or affiliated terms already found in literature (Ajzen, 1991; Eagly & Chaiken, 1993; Fishbein, 1963; Fishbein & Ajzen, 1975).
4. They had to be empirical and based on survey data. We excluded conceptual models or research approaches that used other research methods (e.g., Dennis & Garfield, 2003; Doll & Torkzadeh, 1991; Ortiz de Guinea & Markus, 2009).
5. They had to at least hypothesize an effect of or on attitude in some way.

After filtering out papers that did not meet the above criteria, we searched for "attitude" in the body of the text, abstract, or title of the remaining papers. As a result, we obtained 427 papers. We then manually cross-checked these papers for their relevance and to avoid any duplicates. We categorized the remaining papers based on their title, author(s), year of publication, outlet, research subject, context, place and point of time of data collection, type of technology, adoption context, and voluntariness of usage. We also observed the individual role of the attitude construct as it concerned item measurement, determinants, methodological approach, beta value, significance (t-value), theoretical underpinning, construct definition, and impact on other exogenous and endogenous variables. We stored and coded the results in an excel sheet.

To avoid biased findings and to ensure the results' validity, we independently cross-checked and coded each identified paper. After the coding process, 147 papers that contained empirical evaluated research models comprised the final sample. Since we specifically focused on attitude, we excluded studies on TAM or TAM 2 that did not include attitude as a construct. Further, we also considered if any single paper measured attitude more than once with different datasets. For instance, Hsieh et al. (2008) calculated their model that included attitude with two different samples (socio-economic advantaged vs. disadvantaged); therefore, we recorded two different measurements of attitude. We conducted this time-consuming process to ensure we collected as many different measurements of attitude as possible to strengthen the meaningfulness of the results. The application of this procedure yielded 378 single measurements of attitude in total.

In Section 6.2, we describe how we coded the data and classified determinants in order to develop a meta-analytic structural equation model that models how different determinant groups affect the explained variance of attitude in the IS-adoption literature.

6.2 Measurement Model Specification

MASEM involves two analysis steps. In the first, one codes the literature and, thus, links the data to predefined categories that later represent the constructs in the structural model. Based on Joseph et al.'s (2007) approach to coding data, we identified a total of 47 distinct determinants of attitude in our sample.

Thus, in the first step, we defined the categories according to the research model depicted in Figure 4. In the second step, we assigned the 47 distinct determinants to the categories cognition (performance expectancy, effort expectancy), affect (positive emotions, negative emotions), and external factors (social factors, inter-attitudinal/system-related factors).

As to the antecedents of attitude identified in the scientometric literature review, we subordinated the 47 determinants according to their definition to six determinant groups. We built the first two groups based on the UTAUT categories (Venkatesh et al., 2003) covering the cognition category with reference to Figure 3.

To build the second category affect, we referred to the emotion categories that Beaudry and Pinsonneault (2010) define and chose to label the two emotion categories in a more general way.

The two groups that referred to the category of external factors and, thus, the peripheral route of information processing covered the remainder of variables, which we grouped in social factors: these factors covered all constructs that represented social interaction to a certain extent. Note that the kind and source of social interaction was of minor interest to the classification procedure since we primarily focused on capturing external influences on attitude that one could account to some sort of social interaction and from their nature to the peripheral instead of the central route. We labeled the second subgroup of external factors that we further split into two categories: inter-attitudinal factors and system-related factors. The inter-attitudinal factors category comprised psychological constructs that researchers have hypothesized to affect attitude to some extent (e.g., trust and habit) but not accounted to attitude or attitude determinants per definition (Eagly & Chaiken, 1993; Verplanken & Aarts, 2011; Balliet & Van Lange, 2013). So, these variables are latent psychological constructs internal to an individual but external (not internal as cognition or affect) with regards to their impact on the individual's attitude. We labeled the second subcategory system-related factors, which captured constructs related to an individual's perceptions with regards to the system. Again, here the essence with respect to the research model is that these perceptions are neither affective nor cognitive and external to attitude, a necessary precondition to be accounted to the peripheral route.

Table 2 lists the final allocation and the occurrences (numbers in the columns) of the respective constructs. In order to obtain a classification result as robust as possible, we classified independently within our two-headed team and subsequently discussed discrepancies. We further consulted senior scholars in the DIGIT workshop of the Special Interest Group for Adoption and Diffusion of IT (SIGADIT) to control for the validity of our coding scheme.

In order to obtain estimates for the defined categories, referring to Petter and McLean (2009), we extracted the following information from the studies: sample size, beta values of the determinants listed in Table 2, and R^2's from attitude. As the categories in Table 2 represent only direct determinants of an endogenous attitude, we regarded the beta values as equivalents to correlations that Cheung and Chan (2005) and Joseph et al. (2007) used. We sorted out determinants that were not significant beforehand.

We then copied the beta values of the determinants from the single studies and transferred them into an excel sheet. If a single study had more than one determinant related to one classification, we took the mean value of the betas. We needed to perform this procedure to avoid biases resulting from a high number of studies that used the respective determinant (i.e., perceived ease of use has been applied 37 times). In each study, as the previous section outlined, we recorded every single measurement of attitude and the respective determinant, so with regards to the case of two different samples in one paper (e.g., Hsieh et al., 2008), we treated both samples as single cases. Regarding longitudinal data, we referred to the procedure by Sabherwal et al. (2006) and reported the results of each period in order to be consistent to our single measurement-based procedure.

For attitude as endogenous variable, we used the R^2 values from the studies as indicator because it represents the amount of explained variance, which we aimed to explain. After that, the complete data sheet was weighted by the proportion of study sample size divided by the total sample size of all studies.

Table 2. Classification of Attitude Determinants

Cognition				External factors				Affect			
Performance expectancy		Effort expectancy		Social factors		Inter-attitudinal/system-related factors		Positive emotions		Negative emotions	
Perceived usefulness	40	Perceived ease of use	E	Social norms	2	**Inter-attitudinal factors**		Perceived enjoyment	5	Perceived risk	3
Satisfaction	8	Time saving	2	Collaboration quality	2	Trust	19	Sense of self-worth	1	Anxiety	1
Perceived diagnosticity	3	Download delay	1	External PLOC	2	Experience	2	Playfulness	1	Security concerns	1
Time	3	Cost of compliance	1	Internal PLOC	2	Habit	1	Personal innovativeness	1	Security breach concern level	1
Utilitarian outcomes	2	Cost of non-compliance	1	Introjected PLOC	2	Familiarity	1				
Hedonic outcomes	2			Subjective norm	1	Attitude-based preference	1				
Information quality	2			Punishment severity	1	**System-related factors**					
System quality	2			Identification	1	Compatibility	6				
Process quality	2			Self-efficacy	1	Management support	2				
Anticipated extrinsic rewards	1			Volunteering behavior	1	Service quality	2				
Perceived product value	1			Punishment certainty	1	Source	2				
Benefits of compliance	1			General computer-self-efficacy	1	Security awareness	2				
Accuracy	1			Anticipated reciprocal relationships	1	Infrastructure	1				
Perceived relative advantage	1			Subjective norm	1	Trustworthiness	1				
Perceived visibility	1			Peer influence	1	Switching costs	1				
Settlement performance	1			Subjective norm	1	Switching benefits	1				
Perceived reputation	1					Style	1				
Self-evaluating outcome expectations	1					Content	1				
Software costs	1					Context	1				
Perceived need	1					Critical mass	1				
Privacy	1					Monetary resources	1				
Response efficacy	1										
Response cost	1										
Perceived result demonstrability	1										

7   Results of the Meta-analytic Structural Equation Model of Attitude Determinants

According to Figure 4, we used the six categories for an attitude's determinants (i.e., cognition: performance expectancy, effort expectancy; affect: positive emotions and negative emotions; external factors: social factors, inter-attitudinal/system-related factors) to empirically evaluate the research model with our meta-analytic data. To validate our hypotheses, we transferred the research model into a meta-analytic structural equation model (Viswesvaran & Ones, 1995). In approaches that combine psychometric meta-analysis and structural equation modeling for theory testing, each study does not need to include all the relationships a theory specifies (Viswesvaran & Ones, 1995), which perfectly suited our approach. Furthermore, we could include several differing relationships between attitude and the 47 distinct determinants. While several researchers from organization science have applied this meta-analytic method to observe individual job satisfaction, job performance, or leadership (e.g., Hom et al., 1992; Premack & Hunter, 1988), researchers have not applied it often in IS the discipline. According to the best of our knowledge, only four IS studies have applied MASEM thus far (Joseph et al., 2007; Petter & McLean, 2009; Sabherwal et al., 2006; Schepers & Wetzels, 2007), and only one dealt with individual IS adoption (Schepers & Wetzels, 2007).

We used a correlation matrix as input for SmartPLS (Ringle et al., 2005) and corrected the correlation matrix for attenuation. Therefore, we used James, Mulaik, and Brett's (1982) procedure: they suggest setting the relationship between latent variable and (single) indicator to the square root of the reliability coefficient and setting the error term of the indicator to one minus the reliability coefficient. Many multivariate analyses and meta-analysts have not yet developed effect-size statistics that adequately represent such research findings. Furthermore, as apparent in some relationships between attitude and its determinants in our model, low coefficient betas can result in nontrivial overestimation of the corrected correlations. The availability of more data would, of course, cancel out potential attenuation effects.

Figure 7 depicts the results of our meta-analytic structural equation model and its related path coefficients and coefficients of determination. As one can see, except for effort expectancy, positive and negative emotions, and social factors, all other cumulative constructs in our MASEM were significant determinants for an individual's attitude. This finding concurs with the majority of our hypotheses that include positive effects for performance expectancy and inter-attitudinal/system-related factors. Positive and negative emotions and social factors did not significantly predict attitude. Looking at the path coefficients, one can see that inter-attitudinal/system-related factors had the highest coefficient (0.521). The remaining significant path coefficient performance expectancy was significant at $p < 0.001$. At 93.7 percent, cognition, affect, and external factors almost completely explained the R^2 of attitude. Thus, our research model leads to a better understanding of the theoretical underlying relationships between attitude and its predictors.

In order to answer our research questions, we need to observe the effect sizes of both the determinant categories and the individual subcategories of our research model. Therefore, in Table 3, we depict the effect sizes (f^2) for the three determinant categories and the individual determinant subcategories. As one can see, we found several interesting differences regarding the effect sizes between the six determinant subcategories in our research model. The Inter-attitudinal/system-related factors subcategory had the highest effect size with 2.37. The performance expectancy subcategory had the second largest effect size with 1.05. All other subcategories had a weak or no effect on attitude (effort expectancy, positive and negative emotions). Although the effect size of social factors was pretty large, its effect was non-significant.

With regard to the determinant categories, one can see that the cognition category ($f^2 = 1.35$) and the external factors category ($f^2 = 3.73$) both had a strong effect on attitude. Interestingly, the affect category (which included the positive emotion and negative emotion groups) did not seem to have impact on individuals' attitude in the IS-adoption context.
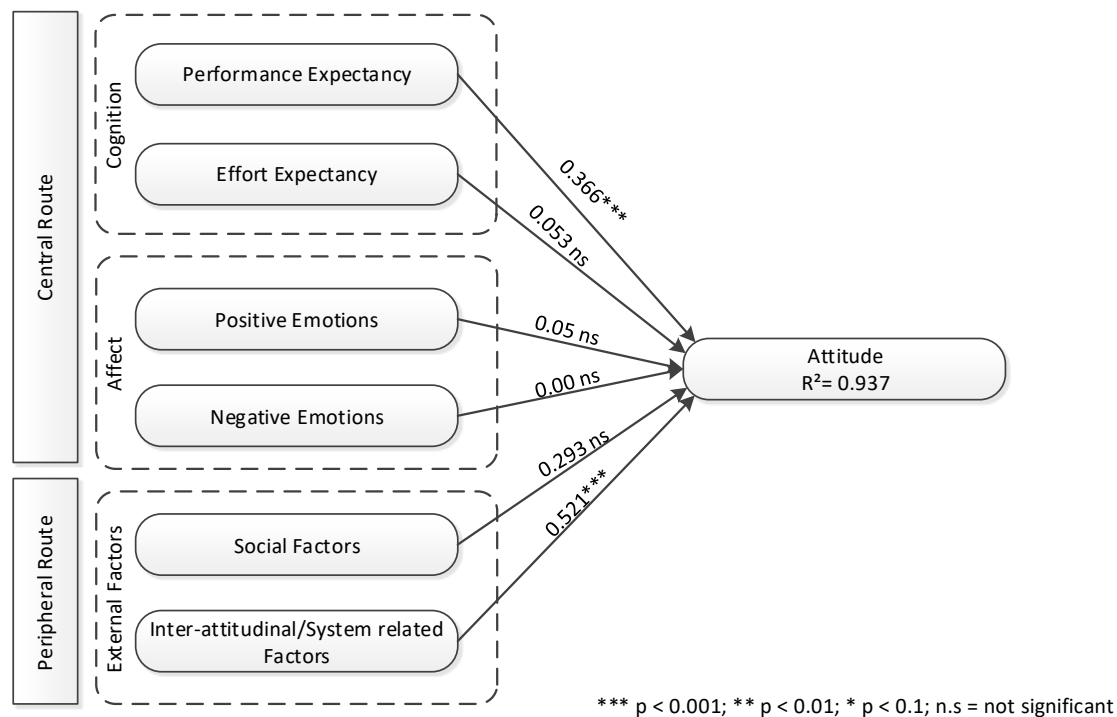
Figure 7. Structural Model Evaluation

*** p < 0.001; ** p < 0.01; * p < 0.1; n.s = not significant

Table 3. Effect Sizes

Determinant subcategories	f^2
Performance expectancy	1.05
Effort expectancy	0.03
Social factors	1.03
Inter-attitudinal/system-related factors	2.37
Positive emotions	0.03
Negative emotions	0.00
Determinant categories	
Cognition	1.35
Affect	0.03
External factors	3.73

To summarize, after analyzing the path coefficients and effect sizes in our research model, we found partial support for H1 because performance expectancy had a positive impact on attitude but effort expectancy was not a significant predictor. The higher path coefficient for performance expectancy in comparison to effort expectancy supports H2. Due to the insignificant path coefficients for positive/negative emotions' impact on attitude, we did not find support for H3 and H4. Because the external factor social factors was an insignificant determinant of attitude and inter-attitudinal/system-related factors was a significant determinant for attitude, we found support for H5 and H6. The results with regards to the hypotheses are summarized in the following Table 4.

Table 4 Hypotheses-testing Results

H1	Cognitive determinants have a positive impact on attitude.	Partially supported
H2	Performance expectancy has a stronger effect on attitude then effort expectancy.	Supported
H3	Positive emotions have a positive influence on attitude.	Rejected
H4	Negative emotions have a negative influence on attitude.	Rejected
H5	Social factors do not have a significant influence on attitude.	Supported
H6	Inter-attitudinal/system-related factors have a positive influence on attitude.	Supported

8   Limitations

Before we discuss our results and their implications, we note our study's limitations. We used the MASEM technique to analyze the reported statistical results from a large number of prior empirical studies. As in similar approaches in IS research (Petter & McLean, 2009; Sabherwal et al., 2006; Schepers & Wetzels, 2007), with such an approach, one has to combine results based on different variables and measures across studies. Additionally, the quality of our approach depends heavily on the quality of the prior studies. In order to ensure as meaningful results as possible, we took several precautions recommended for meta-analyses in general and MASEM in particular.

Because we did not have access to the original data sets from each approach included in our MASEM, we did not include moderating effects in the model. As such, we could not examine how the determinants and attitude in the model might vary across different situations, differing technologies, and differing adoption contexts. Due to the requirements of the meta-analysis, we had to exclude case studies and laboratory experiments. We also had to exclude conference proceedings and working papers that represent current work in progress due to the difficulty associated in estimating their quality compared to work published in the 14 top-journals of the IS and management disciplines as we mention above.

As to the longitudinal studies in our sample, we integrated the results for all individual periods. Thus, the studies could be assigned to the pre-implementation period and others to the post-implementation phase. Overall 23.9 percent of the studies were studies in the pre-implementation stage, and the rest were in the post-implementation stage. We excluded all cases that did not clearly indicate voluntary or mandatory use, adoption context, type of technology, and implementation stage beforehand. Thus, in total, 83.1 percent of the cases in the overall sample clearly involved voluntary use, whereas only 16.9 percent of the sample clearly involved mandatory use.

Further, another limitation might concern the timeframe (i.e., from 1989 to 2010) we considered when collecting data. Hence, we did not include studies on technology adoption that included any kind of attitude variables published before 1989 and after 2010.

The authors of the studies in our sample conducted their research in varying contexts such as the traditional organizational context (56.3%) and the household context (43.7%). Regarding the type of technology, 63.3 percent of the studies included or dealt with utilitarian systems. In contrast, 36.7 percent of the studies investigated hedonic systems.

Hence, the emergent MASEM applies best to a post-implementation stage that features a high degree of voluntary use of utilitarian systems in the organizational context.

9   Discussion and Further Research

Given the inconsistent picture of attitude's predictive validity for user behavior in the IS-adoption context, this research provides an attitude formation-based perspective in order to identify attitudinal determinant categories with the largest impact on the construct of attitude. This information can be further interpreted as information on the predictive validity of attitude on behavior since attitudes formed under some circumstances (i.e., central route) are more predictive of behavior than those formed under different conditions (i.e., peripheral route). We classified all determinants used to determine attitude as belonging to one of these two routes (central and peripheral) in order to detect whether the consistently weak predictive validity in the IS discipline is grounded on different assumptions of attitude formation. In doing so, we contribute to IS-adoption literature in several ways. First, we provide a detailed view on attitude as

psychological construct by consolidating and classifying prior research on it in the IS-adoption discipline. Second, we provide a new focus on the process of attitude formation in this context and explain attitude's predictive validity on endogenous variables such as user behavior. Third, by using MASEM and the ELM, we report important findings with respect to the routes of information processing that IS researchers have implicitly assumed and their consequences on attitude's predictive validity.

We found that external factors—those we considered as belonging to the peripheral route of information processing—had the strongest effect on attitude in IS-adoption studies. More specifically, we found that inter-attitudinal/system-related factors such as trust, monetary resources, security awareness, habit, experience, familiarity, trustworthiness of the system, infrastructure, information quality, management support, service quality, and compatibility seem to influence user attitude even more than cognition. This result is quite surprising since the majority of IS-adoption models assume that cognitive beliefs are the primary driver of user attitude and user behavior (Beaudry & Pinsoneault, 2010; Davis et al., 1989; Fishbein & Ajzen, 1975; Venkatesh et al., 2003). With regards to information processing and the implicit attitude strength, this result suggests two things. First, it suggests that external forces that are not native determinants of attitude such as affect, cognition, or prior behavior have predominantly determined attitude as a construct in IS-adoption studies (Eagly & Chaiken, 1993). Investigating this interesting aspect represents a promising avenue for further research. A restructuring of the variables that we grouped into the external factors category and measuring their impact on attitude could provide more and important insights as to how and by which means individual attitudes determine user behaviors. Second, and closely related to attitude's low predictive validity on behavior in the IS context, our results show that external factors—in particular, inter-attitudinal and system-related factors—determined attitude to the largest extent. According to the ELM, this finding implies that attitude is weaker and less predictive of behavior because attitude is formed on the basis of the peripheral route. Thus, shifting the focus from the attitude-behavior relationship to the attitude-formation process, our results add to prior results on measurement and operationalization (e.g., Yang & Yoo, 2004) and identify low strength as another major reason for attitude's low predictive validity in the IS context. The results indicate that, in the IS-adoption literature, attitude formation is to a high extent assumed to proceed according to the peripheral route of information processing. The implication of this result for the attitude-behavior relationship in the IS-adoption context is that attitudes built on peripheral information processing are less strong, less stable, and, thus, less predictive of behavior compared to those built on the basis of the central route. Given that the attitude-behavior relationship has shown irregularities throughout IS-adoption literature (see, e.g., Davis et al., 1989; Venkatesh et al., 2003; Yang & Yoo, 2004; Zhang et al., 2008; Zhang & Sun; 2009), our research contributes to this stream by explaining why attitude is not as persistent and predictive as it could be due to its formation predominantly based on the peripheral route.

For further research, our results imply that measuring attitude strength also with respect to its formation and relation to other constructs (e.g., habit) has the potential to reveal important insights with respect to the attitude-behavior relationship. In particular, when it comes to an internal competition between automatic and conscious processes (see, e.g., Verplanken & Aarts, 2011; Kroenung et al., 2013), attitude strength, which research has barely measured in the IS context, is a factor of high relevance with regards to predicting behavior.

Moreover, our results also indicate that social factors actually are an insignificant predictor of attitude. This finding confirms the debate around prominent theories, such as the theories of reasoned action and planned behavior, and in research such as Titah and Barki (2009). Nevertheless, future research needs to investigate whether attitude and social influence are the main determinants of behavioral intention without or with a distinct hierarchical relationship. Research needs to extend the focus from the bidirectional relationship between attitude and subjective norm and extend the perspective into the direction of factors such as habit or trust that research has also found to impact the predictive validity of attitude. Extracting the separate effects from the interaction effects of these constructs remains an important challenge.

With regard to the cognition cluster, our results suggest that performance expectancy is, as we expected, a major determinant for an individual user's attitude but that effort expectancy has no significant effect. While research on attitude outlines that users need to perceive a system as useful before they develop a positive attitude toward it, the perceived cognitive effort to learn to use the system is not an important predictor for users' attitude in the IS-adoption context. This finding might be explained not only by maturing technologies but also maturing users. More than twenty years ago, while Davis (1989) developed the TAM, the diffusion of personal computers in society was far from today's diffusion rates. Thus, with the increasing diffusion of technologies and the Internet globally, individuals started to use and

become more familiar with technologies in every part of their daily life. Although the results of the scientometric literature review do not significantly support this argument, our research holds slight evidence that, apart from generation-related factors, users may have more skills in using technologies (Thomas & Bostrom, 2010). Apart from the focus on psychological constructs internal to the user, the question of whether an improvement in users' skills leads to the declining importance of constructs related to effort expectancy to learn or adapt to a new system remains a very interesting question for further research.

Finally, as for the affect category, we found that both performance expectancy and effort expectancy had no significant impact on the formation and development of a user's attitude according to the ELM. Considering the methodology and the number of studies that actually reported emotional determinants for attitude, this insignificance could be due to methodological limitations in the sense that the number of studies was too small. Therefore, we cannot interpret any implications based on the structural model for the affect categories. However, the fact that few studies have modeled affective determinants as predictive for attitude indicates that researchers have defined attitude as a construct predominantly as "evaluative affect" with reference to Davis et al. (1989) and operationalized it accordingly and have not defined it as a construct formed of affective and cognitive determinants with reference to the social psychology literature (Eagly & Chaiken, 1993). Kroenung and Eckhardt (2011) have also proven that this affect-based definition on the one hand and the absence of affect-based attitudinal determinants on the other creates distortion with respect to the predictive validity of attitude on behavior. Combined with the theoretical implications of the ELM and the formation of weaker attitudes on the basis of peripheral routes, we recommend that future research base the formation of attitude constructs on its core determinants— affect and cognition.

Our results emphasize that, with respect to individual attitudes towards IS and their implications regarding system-relevant user behaviors, we have just looked only slightly below the surface. Assuming a situation under volitional control, attitudes are one of the major determinants of behavior (Ajzen, 2001) and remain essential for predicting behavior.

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Appendix A: Paper Overview

Table 4. Paper Overview

No	Paper
1	Hsieh, J., Rai, A., & Keil, M. (2008). Understanding digital inequality. *MIS Quarterly*, *32*(1), 97-126.
2	Pavlou, P. A., & Fygenson, M. (2006). Understanding and predicting electronic commerce adoption: An extension of the theory of planned behavior. *MIS Quarterly*, *30*(1), 115-143.
3	Anderson, C. L., & Agarwal, R. (2010). Practicing safe computing: A multimedia empirical examination of home computer user security behavioral intentions. *MIS Quarterly*, *34*(3), 613-643.
4	Angst, C., & Agarwal, R. (2009). Adoption of electronic health records in the presence of privacy concerns: The elaboration likelihood model and individual persuasion. *MIS Quarterly*, *33*(2), 339-370.
5	Bock, G. W., Zmud, R. W., Kim, Y. G., & Lee, J. N. (2005). Behavioral intention formation in knowledge sharing: Examining the roles of extrinsic motivators, social-psychological forces, and organizational climate. *MIS Quarterly*, *29*(1), 87-111.
6	Bhattacherjee, A., & Premkumar, G. (2004). Understanding changes in belief and attitude toward information technology usage: A theoretical model and longitudinal test. *MIS Quarterly*, *28*(2), 229-254.
7	Bhattacherjee, A., & Sanford, C. (2006). Influence processes for information technology acceptance: An elaboration likelihood model. *MIS Quarterly*, *30*(4), 805-825.
8	Banerjee, D., Cronan, T., & Jones, T. (1998). Modeling IT ethics: A study in situational ethics. *MIS Quarterly*, *22*(1), 31-60.
9	Venkatesh, V., & Brown, S. (2001). A longitudinal investigation of personal computers in homes: Adoption determinants and emerging challenges. *MIS Quarterly*, *25*(1), 71-102.
10	Venkatesh, V., & Goyal, S. (2010). Expectation disconfirmation and technology adoption: Polynomial modeling and response surface analysis. *MIS Quarterly*, *34*(2), 281-303.
11	Bulgurcu, B., Cavusoglu, H., & Benbasat, I. (2010). Information security policy compliance: An empirical study of rationality-based beliefs and information security awareness. *MIS Quarterly*, *34*(3), 523-548.
12	Sia, C. L., Lim, K. H., Leung, K., Lee, M. K., Huang, W. W., & Benbasat, I. (2009). Web strategies to promote internet shopping: Is cultural-customization needed? *MIS Quarterly*, *33*(3), 491-512.
13	Titah, R., & Barki, H. (2009). Nonlinearities between attitude and subjective norms in information technology acceptance: A negative synergy? *MIS Quarterly*, *33*(4), 827-844.
14	Venkatesh, V., Morris, M., Davis, G., & Davis, F. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, *27*(3), 425-478.
15	Barki, H., & Hartwick, J. (1994). Measuring user participation, user involvement and user attitude. *MIS Quarterly*, *18*(1), 59-82.
16	Kim, S. (2009). The integrative framework of technology use: An extension and test. *MIS Quarterly*, *33*(3), 513-537.
17	Kim, H., & Kankanhalli, A. (2009). Investigating user resistance to information systems implementation: A status quo bias perspective. *MIS Quarterly*, *33*(3), 567-582.
18	Komiak, S., & Benbasat, I. (2006).The effects of personalization and familiarity on trust and adoption of recommendation agents. *MIS Quarterly*, *30*(4), 941-960.
19	Suh, K., & Lee, Y. (2005).The effects of virtual reality on consumer learning: An empirical investigation. *MIS Quarterly*, *29*(4), 673-697.
20	Igbaria, M., Parasuraman, S., & Badawy, M. (1994). Work experiences, job involvement and quality of work life among information systems personnel. *MIS Quarterly*, *18*(2), 175-201.
21	Barcki, H., & Hartwick, J. (2001). Interpersonal conflict and its management in information systems development. *MIS Quarterly*, *25*(2), 195-228.
22	Taylor, S., & Todd, P. (1995). Assessing IT usage: The role of prior experience. *MIS Quarterly*, *19*(4), 561-570.
23	Feeny, D., Edwards, B., & Simpson, K. (1992). Understanding the CEO/CIO relationship. *MIS Quarterly*, *16*(4), 435-448.
24	Karahanna, E., Straub, D., & Chervany, N. (1999). Information technology adoption across time: A cross-sectional comparison of pre-adoption and post-adoption beliefs. *MIS Quarterly*, *23*(2), 183-213.

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25	Culnan, M. (1993). "How did they get my name?": An exploratory investigation of consumer attitudes toward secondary information use. *MIS Quarterly*, *17*(3), 341-363.
26	Hunton, J., & Beeler, J. (1997). Effects of user participation in systems development: A longitudinal field experiment. *MIS Quarterly*, *21*(4), 359-388.
27	Johnston, A., & Warkentin, M. (2010). Fear appeals and information security behaviors: an empirical study. *MIS Quarterly*, *34*(3), 549-566.
28	Sarker, S., & Valacich, J. (2010). An alternative to methodological individualism: A non-reductionist approach to studying technology adoption by groups. *MIS Quarterly*, *34*(4), 779-808.
29	Wixom, B., & Todd, P. (2005). A theoretical integration of user satisfaction and technology acceptance. *Information Systems Research*, *16*(1), 85-102.
30	Taylor, S., & Todd, P. (1995). Understanding information technology usage: A test of competing models. *Information Systems Research*, *6*(2), 144-176.
31	Mathieson, K. (1991). Predicting user intentions: Comparing the technology acceptance model with the theory of planned behavior. *Information Systems Research*, *2*(3), 173-191.
32	Jiang, Z., & Benbasat, I. (2007). Research note – Investigating the influence of the functional mechanisms of online product presentations. *Information Systems Research*, *18*(4), 454-470.
33	Hong, W., Thong, J., & Tam, K. (2004). Does animation attract online users' attention? The effects of flash on information search performance and perceptions. *Information Systems Research*, 15(1), 60-86.
34	Harrison, D., Mykytyn, P., & Riemenschneider, C. (1997). Executive decisions about adoption of information technology in small business: Theory and empirical tests. *Information Systems Research*, *8*(2), 171-195.
35	Galletta, D. F., Henry, R. M., McCoy, S., & Polak, P. (2006). When the wait isn't so bad: The interacting effects of website delay, familiarity, and breadth. *Information Systems Research*, *17*(2), 20-37.
36	Constant, D., Kiesler, S., & Sproull, L. (1994). What's mine is ours, or is it? A study of attitudes about information sharing. *Information Systems Research*, *5*(4), 400-421.
37	Kwan, S., So, M., & Tam, K. (2010). Applying the randomized response technique to elicit truthful responses to sensitive questions in IS research: The case of software piracy behavior. Information Systems Research, 21(4), 941-959.
38	Song, J., & Zahedi, F. (2005). A theoretical approach to Web design in e-commerce: A belief reinforcement model. *Management Science*, *51*(8), 1219-1235.
39	Davis, F., Bagozzi, R., & Warshaw, P. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, *35*(8), 982-1003.
40	Bagozzi, R., & Dholakia, U. (2006). Open source software user communities: A study of participation in Linux user groups. *Management Science*, *52*(7), 1099-1115.
41	Iscan, O., & Natiyok, A. (2005). Attitudes towards telecommunicating: The Turkish case. *Journal of Information Technology*, *20*(1), 52-63.
42	Oh, S., Ahn, J., & Kim, B. (2003). Adoption of broadband Internet in Korea: The role of experience in building attitudes. *Journal of Information Technology*, *18*(4), 267-280.
43	Dinev, T., Hu, Q., & Nam, K. (2009). User behaviour towards protective information technologies: The role of national cultural differences. *Information Systems Journal*, *19*(4), 391-412.
44	Lin, C., & Bhattacherjee, A. (2010). Extending technology usage models to interactive hedonic technologies: A theoretical model and empirical test. *Information Systems Journal*, *20*(2), 163-181.
45	Townsend, A., Demarie, S., & Hendrickson, A. (2001). Desktop video conferencing in virtual workgroups: Anticipation, system evaluation and performance. *Information Systems Journal*, *11*(3), 213-227.
46	Day, D. (2000). Behavioural effects of attitudes toward constraint in CASE: The impact of development task and project phase. *Information Systems Journal*, *10*(2), 151-163.
47	Wang, Y. (2008). Assessing e-commerce systems success: A respecification and validation of the DeLone and McLean model of IS success. *Information Systems Journal*, *18*(5), 529-557.
48	Nysveen, H., & Pedersen, P. (2004). An exploratory study of customers' perception of company web sites offering various interactive applications: Moderating effects of customers' Internet experience. *Decision Support Systems*, *37*(1), 137-150.

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49	Xu, D., Liao, S., & Li, Q. (2008). Combining empirical experimentation and modeling techniques: A design research approach for personalized mobile advertising applications. *Decision Support Systems*, *44*(3), 710-724.
50	Yang, H., & Yoo, Y. (2004). It's all about attitude: Revisiting the technology acceptance model. *Decision Support Systems*, *38*(1), 19-31.
51	Kumar, N., Mohan, K., & Holowczak, R. (2008). Locking the door but leaving the computer vulnerable: Factors inhibiting home users' adoption of software firewalls. *Decision Support Systems*, *46*(1), 254-264.
52	Wang, J., Chen, R., Herath, T., & Rao, H. R. (2009). Visual e-mail authentication and identification services: An investigation of the effects on e-mail use. *Decision Support Systems*, *48*(1), 92-102.
53	Cheng, F., & Wu, C. (2010). Debiasing the framing effect: The effect of warning and involvement. *Decision Support Systems*, *49*(3), 328-334.
54	Kang, Y., & Kim, Y. (2006). Do visitors' interest level and perceived quantity of web page content matter in shaping the attitude toward a web site? *Decision Support Systems*, *42*(2), 1187-1202.
55	Cheng, E., Lam, D., & Yeung, A. (2006). Adoption of internet banking: An empirical study in Hong Kong. *Decision Support Systems*, *42*(3), 1558-1572.
56	Forshay, N., Mukherjee, A., & Taylor, A. (2007). Does data warehouse end-user metadata add value? *Communications of the ACM*, *50*(11), 70-77.
57	Nill, A., Schibrowsky, J., & Peltier, J. (2010). Factors that influence software piracy: A view from Germany. *Communications of the ACM*, *53*(6), 131-134.
58	Mann, F., von Walter, B., Hess, T., & Wigand, R. T. (2009). Open access publishing in science. *Communications of the ACM*, *52*(3), 135-139.
59	Cannoy, S., & Salam, A. (2010). A framework for health care information assurance policy and compliance. *Communications of the ACM*, *53*(3), 126-131.
60	Malhorta, Y., & Galletta, D. (2004). Building systems that users want to use. *Communications of the ACM*, *47*(12), 2004, 88-94.
61	Lee, Y., & Kozar, K. (2005). Investigating factors affecting adoption of antispyware. *Communications of the ACM*, *48*(8), 72-77.
62	Sambamurthy, V., & Chin, W. (1994). The effects of group attitudes toward alternative GDSS designs on the decision-making performance of computer-supported groups. *Decision Sciences*, *25*(2), 215-241.
63	Jackson, C., Chow, S., & Leitch, R. (1997). Toward an understanding of the behavioral intention to use an information system. *Decision Sciences*, *28*(2), 357-389.
64	Muthitcharoen, A., Palvia, P., & Grover, V. (2011). Building a model of technology preference: The case of channel choices. *Decision Sciences*, *42*(1), 205-237.
65	Agarwal, R., & Prasad, J. (1999). Are individual differences germane to the acceptance of new information technologies? *Decision Sciences*, *30*(2), 361-391.
66	Brown, S.A., Massey, A.P., Montoya-Weiss, M.M., & Burkman, J.R. (2002). Do I really have to? User acceptance of mandated technology. *European Journal of Information Systems*, *11*(4), 283-295.
67	Van der Heijden, H., Verhagen, T., & Creemers, M. (2003). Understanding online purchase intentions: Contributions from technology and trust perspectives. *European Journal of Information Systems*, *12*(1), 41-48.
68	Bagchi, S., Kanungo, S., & Dasgupta, S. (2003). Modeling use of enterprise resource planning systems: A path analytic study. *European Journal of Information Systems*, *12*(2), 142-158.
69	Singh, S., Dalai, N., & Spears, N. (2005). Understanding web home page perception. *European Journal of Information Systems*, *14*(3), 288-302.
70	Verhagen, T., Meents, S., & Tan, Y. (2006). Perceived risk and trust associated with purchasing at electronic marketplaces. *European Journal of Information Systems*, *15*(6), 542-555.
71	van Slyke, C., Ilie, V., Lou, H., & Stafford, T. (2007). Perceived critical mass and the adoption of a communication technology. *European Journal of Information Systems*, *16*(3), 270-283.
72	Quaddus, M., & Hofmeyer, G. (2007). An investigation into the factors influencing the adoption of B2B trading exchanges in small businesses. *European Journal of Information Systems*, *16*(3), 202-215.
73	Dickinger, A., Arami, M., & Meyer, D. (2008). The role of perceived enjoyment and social norm in the adoption of technology with network externalities. *European Journal of Information Systems*, *17*(1), 4-11.

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74	Herath, T., & Rao, H. (2009). Protection motivation and deterrence: A framework for security policy compliance in organisations. *European Journal of Information Systems*, *18*(2), 106-125.
75	Theotokis, A., Viachos, P., & Pramatari, K. (2008). The moderating role of customer-technology contact on attitude towards technology-based services. *European Journal of Information Systems*, *17*(4), 343-351.
76	Heinze, N., & Hu, Q. (2009). Why college undergraduates choose IT: A multi-theoretical perspective. *European Journal of Information Systems*, *18*(5), 462-475.
77	Pramatari, K., & Theotokis, A. (2009). Consumer acceptance of RFID-enabled services: A model of multiple attitudes, perceived system characteristics and individual traits. *European Journal of Information Systems*, *18*(6), 541-552.
78	Khalifa, M., & Liu, V. (2008). Online consumer retention: Contingent effects of online shopping habit and online shopping experience. *European Journal of Information Systems*, *16*(6), 780-792.
79	Chau, P. (1994). Selection of packaged software in small businesses. *European Journal of Information Systems*, *3*(4), 292-302.
80	Udo, G., & Guimarares, T. (1994). Empirically assessing factors related to DSS benefits. *European Journal of Information Systems*, *3*(3), 218-227.
81	Deng, L., Turner, D. E., Gehling, R., & Prince, B. (2010). User experience, satisfaction, and continual usage intention of IT. *European Journal of Information Systems*, *19*(1), 60-75.
82	Tojib, D., Sugianto, L., & Sendjaya, S. (2008). User satisfaction with business-to-employee portals: Conceptualization and scale development. *European Journal of Information Systems*, *17*(6), 649-667.
83	Jahng, J., Jain, H., & Ramamurthy, K. (2007). Effects of interaction richness on consumer attitudes and behavioral intentions in e-commerce: Some experimental results. *European Journal of Information Systems*, *16*(3), 254-269.
84	Dinev, T., & Hu, Q. (2007). The centrality of awareness in the formation of user behavioral intention toward protective information technologies. *Journal of the Association for Information Systems*, *8*(7), 386-408.
85	Brown, S., Fuller, R., & Vician, Ch. (2004). Who's afraid of the virtual world? Anxiety and computer-mediated communication. *Journal of the Association for Information Systems*, *5*(2), 79-107.
86	Galletta, D. F., Henry, R. M., McCoy, S., & Polak, P. (2004) Web site delays: How tolerant are users? *Journal of the Association for Information Systems*, *5*(1), 1-28.
87	Limayem, M., & Hirt, S. (2003). Force of habit and information systems usage: Theory and initial validation. *Journal of the Association for Information Systems*, *4*, 65-97.
88	Tan, M., & Teo, T. (2000). Factors influencing the adoption of Internet banking. *Journal of the Association for Information Systems*, *1*(5), 1-42.
89	Chan, F. K. Y., Thong, J. Y. L., Venkatesh, V., & Brown, S. A. (2010). Modelling citizen satisfaction with mandatory adoption of an e-goverment technology. *Journal of the Association for Information Systems*, *11*(10), 519-549.
90	Leonard, L., & Cronan, T. (2001). Illegal, inappropriate, and unethical behavior in an information technology context: A study to explain influences. *Journal of the Association for Information Systems*, *2*(1), 1-31.
91	Sherif, K., & Menon, N. (2004). Managing technology and administration innovations: Four case studies on software reuse. *Journal of the Association for Information Systems*, *5*(7), 247-281.
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