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INFLUENCE PROCESSES FOR INFORMATION TECHNOLOGY ACCEPTANCE: AN ELABORATION LIKELIHOOD MODEL[1]

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Abstract

This study examines how processes of external influence shape information technology acceptance among potential users, how such influence effects vary across a user population, and whether these effects are persistent over time. Drawing on the elaboration-likelihood model (ELM), we compared two alternative influence processes, the central and peripheral routes, in motivating IT acceptance. These processes were respectively operationalized using the argument quality and source credibility constructs, and linked to perceived usefulness and attitude, the core perceptual drivers of IT acceptance. We further examined how these influence processes were moderated by users' IT expertise and perceived job relevance and the temporal stability of such influence effects. Nine hypotheses thus developed were empirically validated using a field survey of document management system acceptance at an eastern European governmental agency. This study contributes to the IT acceptance literature by introducing ELM as a referent theory for acceptance research, by elaborating alternative modes of influence, and by specifying factors moderating their effects. For practitioners, this study introduces influence processes as policy tools that managers can employ to motivate IT acceptance within their organizations, benchmarks alternative influence strategies, and demonstrates the need for customizing influence strategies to the specific needs of a user population.

Motivation for the Study

Individual acceptance of information technology has been a central and recurrent theme in information systems research for more than two decades. Understanding IT acceptance is important because the expected benefits of IT usage, such as gains in efficiency, effectiveness, or productivity, cannot be realized if individual users do not accept these systems for task performance in the first place. Prior research in this area has identified several perceptions (e.g., perceived usefulness, perceived ease of use, and attitude) that are believed to impact potential users' IT acceptance and explored the causal nature of their effects on acceptance (e.g., Davis et al. 1989; Venkatesh et al. 2003). This research has also demonstrated that external sources, such as mass media, friends, family, and

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peers, can shape user perceptions regarding new technologies and thereby indirectly influence acceptance behavior (Venkatesh and Brown 2001; Venkatesh et al. 2003). Despite this research, our understanding of the nature, patterns, and outcomes of influence processes in the technology acceptance context still remains scant. For instance, we are not aware of any research that explains what types of information are most effective in influencing user perceptions and why, whether such influence applies equally or differentially across user populations, and whether these influence effects are temporally persistent.

One theoretical perspective that can help inform our understanding of influence processes in IT acceptance is the elaboration-likelihood model (ELM). The ELM classifies influence mechanisms or routes into central and peripheral types based on the type of information processed by a given user (e.g., task-relevant arguments or simple cues), explains circumstances under which that user may be more influenced by one route than the other, and discusses the long-term effects of each influence route (Petty and Cacioppo 1986). While there may be additional theories of influence, the ELM appears to be uniquely suited to our exploration of the "black box" of influence within the IT acceptance context, which until now has largely eluded the acceptance literature, and thereby fills an extant gap in IT acceptance research. Based on theoretical prescriptions from the ELM, three research questions were examined in this study.

RQ1.   Which influence processes shape user acceptance of new IT and how?

RQ2   Do the effects of these influence processes vary across a user population, and if so, how?

RQ3.   How persistent are the effects of these influence processes over time?

Understanding the dynamics of acceptance-related influence processes is important for theoretical as well as practical reasons. Theoretically, such research can enrich the IT acceptance literature by addressing a previously unexplored area of relevance, namely the processes of influence that can shape potential users' perceptions related to IT acceptance. Additionally, this research examines moderating factors that mitigate the effects of these influence processes on IT acceptance, variations in the effects of these processes across a user population, and the temporal nature of such influence processes. For practitioners, this research can help managers identify and benchmark alternative influence strategies to motivate IT acceptance in their organizations and customize these strategies to best fit the unique characteristics of their organizational users.

The rest of the paper proceeds as follows. In the next section, we present a brief overview of and identify gaps in prior research on influence in IT acceptance. Then, we describe key constructs and relationships in ELM and theorize nine research hypotheses related to our three research questions. The proposed hypotheses are then tested using empirical data collected from a field survey of a document management system (DMS) acceptance among departmental administrators and staff at L'viv City Hall in Ukraine. Finally, a discussion of our findings and their implications for IS research and practice are presented.

Prior Research

Prior research on individual IT acceptance has been informed by two dominant theoretical perspectives. The first perspective, centered on the theory of reasoned action (TRA [Fishbein and Ajzen 1975]) and the theory of planned behavior (TPB [Ajzen 1991]), has focused on individual perceptions as the primary drivers of acceptance intention and behavior. IT-specific variants of these theories include the technology acceptance model (TAM [Davis et al. 1989]), the decomposed theory of planned behavior (DTPB [Taylor and Todd 1995]), and the unified theory of acceptance and use of technology (UTAUT [Venkatesh et al. 2003]). Collectively, these theories suggest that users' IT acceptance intention and behavior are shaped by salient user cognitions related to the target IT such as its perceived usefulness and ease of use, users' attitude toward IT acceptance, social norms related to acceptance, and conditions enabling or constraining acceptance (for a summary, see Venkatesh et al. 2003).

Among the above determinants of IT acceptance, *social norm* is the only one related to external influence. Social norm (also called *subjective norm* or *social influence*) is defined as the extent to which members of a social network (e.g., peers, colleagues, family members, or other referents) influence one another's behavior to conform to the community's behavioral patterns (Venkatesh and Brown 2001). Davis et al. (1989) dropped social norms from TAM on grounds that it is empirically nonsignificant and probably less relevant in the IT acceptance context, but subsequent studies have added it back to the model (e.g., Venkatesh and Brown 2001; Venkatesh et al. 2003). More importantly, social norm suggests that community norms regarding a target behavior should exist before new users can be socialized into that behavior, and hence it cannot explain why new technologies, for which community norms may not yet exist, can be accepted by a user population. TAM's inclusion of "external variables" as predictors of user perceptions left open the possibility that external

influence from secondary sources, such as change agents or organizational managers, may still impact IT acceptance, albeit mediated by user perceptions. Nonetheless, TAM/TPB-based research does not explain why any such external influence may occur or explicate the sociological process of influence.

The above shortcoming is partially addressed by innovation diffusion theory (IDT [Rogers 1995]), the second theoretical perspective informing IT acceptance research. IDT suggests that IT acceptance (termed *adoption* within this perspective) patterns within a network of users is shaped by a process of communication and social influence, whereby later adopters are informed of the availability and utility of a new IT by earlier adopters within their social network (Rogers 1995). This communication is presumed to shape potential adopters' perceptions of key innovation attributes such as its relative advantage, complexity, and compatibility with existing work procedures, thereby motivating their acceptance decisions. Subsequent IDT research has examined a variety of mass-media channels (e.g., news media, experts) and interpersonal channels (e.g., colleagues, family members) that serve as the conduits of information and influence, and studied the impacts of these channels on perceived IT attributes (Brancheau and Wetherbe 1990; Moore and Benbasat 1991; Nilakanta and Scamell 1990). IDT also suggests that communication channels may have differential effects across the user population in that the more innovative early adopters are likely to be more motivated by mass media while the less innovative late adopters rely more on interpersonal channels.

The above research provides us with two key insights regarding influence processes: (1) external influence plays an important role in the formation of potential users' IT acceptance perceptions and ultimately in shaping their acceptance behaviors and (2) the same influence may engender differential effects across different user groups. Despite these insights, prior research still provides very limited understanding of the nature, patterns, and outcomes of influence process for at least three reasons. First, it does not explain what types of information are most effective in influencing user perceptions and why. IDT distinguishes between mass-media and interpersonal channels, but does not distinguish between the informational content communicated by those communication channels (e.g., how much IT-related detail is needed to convince a potential adopter) or information sources within each channel (e.g., the person writing the review). Presumably, not all informational content or information sources are equally effective in shaping users' perceptions about new technology. For instance, some tend to be influenced more by experts' suggestions, while others may rely more on the rationale or evidence provided. Hence,

information content and source may also be as important in motivating IT acceptance as the communication channel presenting such content.

Second, IDT observes that different user groups (early versus late adopters) respond differently to different channels (mass media or interpersonal), but does not explain why. The key distinction between early and late adopters is their innovativeness, which is defined as an outcome variable reflecting adopters' timing of adoption (i.e., more innovative users are early adopters), rather than a causal driver of their adoption behavior. Further, IDT cannot explain why some individuals may be early adopters of one IT but late adopters of others. Hence, IDT is of limited help in predicting *ex ante* how IT acceptance patterns may vary across a population of potential users based on the nature of external influence.

Third, prior research does not address the temporal dimension of influence effects. Some TAM/TPB studies have examined IT usage at multiple points in time, such as during and after initial acceptance (e.g., Davis et al. 1989; Venkatesh and Davis 2000), but cannot theoretically explain why usage patterns vary across time because of the cross-sectional nature of the underlying theories. Similarly, IDT research views adoption as a one-time decision, and has generally ignored post-adoptive or longitudinal effects.

In summary, prior research acknowledges that external influence may play a pivotal role in shaping users' perceptions related to IT acceptance, but does not delve into the dynamics of the influence process and is therefore of limited assistance in unraveling the complexities of influence patterns and effects. This study addresses the above gaps in the TAM/TPB and IDT literatures by elaborating two alternative means of influence, explaining which influence process is most effective for a given usage context, and presenting a simple yet useful theoretical model that can serve as the basis for further exploration of the role of influence in IT acceptance.

Theory and Research Hypotheses

Elaboration Likelihood Model

The role of influence processes in shaping human perceptions and behavior has been examined by dual-process theories in the social psychology literature.[2] Similar to IDT, dual-process

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[2]The term *influence* is often called *persuasion* in the referent literature. However, for purposes of clarity and consistency, we use influence throughout this paper.

theories suggest that external information is the primary driver of attitude change and consequent behavior change. Such information introduces people to new possibilities, causes them to reexamine their prior beliefs and attitudes, and potentially changes extant behaviors. However, unlike IDT, dual-process theories suggest that social judgments are not always based on effortful processing of judgment-relevant information, but can sometimes be based on less effortful processing of heuristic cues. These two alternative processes of attitude formation, namely more versus less effortful processing of information, form the core of all dual-process theories. Further, dual-process theories also specify conditions under which each of the two alternative processes is likely to be invoked. Interested readers are referred to Eagly and Chaiken (1993) and Chaiken and Trope (1999) for detailed discussions on the various dual processing theories in social psychology.

The specific dual process theory of interest to this study is the elaboration likelihood model (ELM). This theory was specifically chosen because (1) it relates directly to influence processes and their impacts on human perceptions and behavior and (2) it also explains why a given influence process may lead to differential outcomes across different users in a given usage setting. ELM posits that attitude change among individuals may be caused by two "routes" of influence, the central route and the peripheral route, which differ in the amount of thoughtful information processing or "elaboration" demanded of individual subjects (Petty and Cacioppo 1986; Petty et al. 1981). The central route requires a person to think critically about issue-related arguments in an informational message and scrutinize the relative merits and relevance of those arguments prior to forming an informed judgment about the target behavior. In IT acceptance contexts, such arguments may refer to the potential benefits of system acceptance, comparison of alternative systems, availability and quality of system support, and/or costs of and returns from system acceptance. The peripheral route involves less cognitive effort, where subjects rely on cues regarding the target behavior, such as number of prior users, endorsements from IT experts, and likeability of or affinity toward the endorser, rather than on the quality of arguments, in attitude formation. In the latter instance, attitude change results from peripheral processes such as identification with the source (Kelman 1961) or reliance on decision heuristics (Chaiken 1980). The central and peripheral routes of attitude change are typically operationalized in ELM research using the *argument quality* and *peripheral cues* constructs respectively, as shown in Figure 1.

The central and peripheral routes are distinct in at least three ways. First, the two routes process different types of information. The central route processes message-related arguments, while the peripheral route processes cues. Second, the cognitive effort involved in information processing is much higher in the central route than in the peripheral route. The central route requires thoughtful comprehension of the arguments presented, evaluation of the quality of those arguments, and combination of multiple and sometimes conflicting arguments into an overall evaluative judgment, while the peripheral route is less demanding in that it merely requires subjects' association with salient positive or negative cues related to the attitude object (Petty et al. 1981). Third, perception changes induced via the central route are generally more stable, more enduring, and more predictive of long-term behaviors since they are based on deliberate and thoughtful consideration of relevant arguments (Petty and Cacioppo 1986). In contrast, changes induced via peripheral cues tend to be less persistent, susceptible to counterinfluence, and less predictive of long-term behaviors.

According to ELM, information recipients can vary widely in their ability and motivation to elaborate on an argument's central merits, which in turn may constrain how a given influence process impacts their attitude formation or change. This ability and motivation to elaborate is captured in ELM by the *elaboration likelihood* construct. As Petty and Wegener (1999) note, "The term 'elaboration' is used to suggest that people add something of their own to the specific information provided in the communication…beyond mere verbatim encoding of the information provided" (p. 46). People in the high elaboration likelihood state are more likely to engage in careful scrutinization or thoughtful processing of an information message and, therefore, tend to be more persuaded by argument quality than by peripheral cues. In contrast, those in the low elaboration likelihood state, lacking the motivation or ability to deliberate thoughtfully, tend to be motivated by peripheral cues.

Note that ELM does not imply that people influenced via the central or peripheral routes will experience different outcomes. Surely, two individuals may arrive at the same conclusion (e.g., accept a given IT) even if such decision resulted from two entirely different (argument-based or cue-based) influence routes. Similarly, some may seek out message arguments in a given informational message, while others may be predisposed to searching for peripheral cues in that same message. In other words, ELM suggests that (1) a common influence process can engender very different responses across different individuals in a given population, (2) a common influence process may result in varying responses for the same individual if her elaboration likelihood fluctuates with technology, time, or situational contexts, and (3) different influence processes may generate similar responses among a diverse population. In short, elaboration likelihood moderates the effects of argument quality and peripheral cues on perception change (see Figure 1).
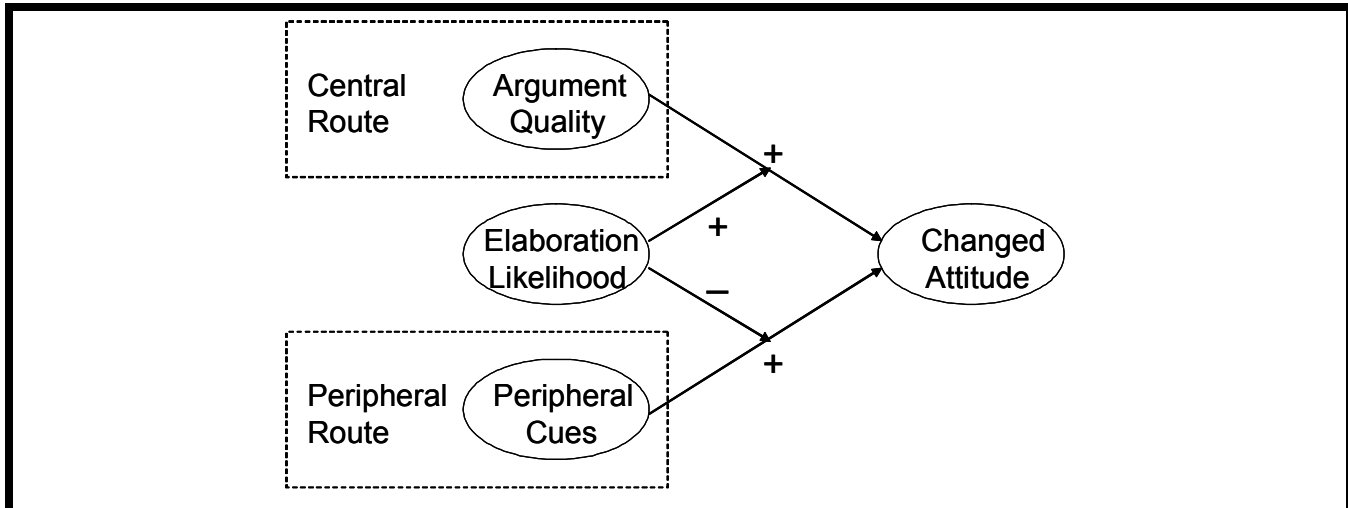
Figure 1. Elaboration Likelihood Model

ELM describes elaboration likelihood in terms of its two component dimensions, motivation and ability to elaborate, both of which should be present for extensive elaboration to occur (Petty and Cacioppo 1986). ELM researchers have typically operationalized motivation as recipients' *personal relevance* of the available information, and their ability as *prior expertise* or experience with the attitude object. If information recipients view a given message as being important and relevant to the target behavior, they are more likely to invest the necessary cognitive effort to adequately scrutinize its information content. In contrast, those that view the same message as having little personal relevance may not be willing to spend the time and effort in analyzing that message, but instead rely on cue-based heuristics for framing their perceptions. Likewise, experts in the target behavior are more likely to carefully consider the quality of arguments presented instead of relying on potentially incomplete or inaccurate peripheral cues. Nonexperts, in contrast, may have little choice but to depend on peripheral cues such as credibility of the information source. Hence, personal relevance and prior expertise are presumed to moderate the effects of argument quality and peripheral cues on perception changes.

It should be noted that elaboration likelihood is not a personality trait or an individual difference, but rather a temporal state that may fluctuate with situational contexts and time, even for the same individual. For instance, a physician may be an expert in diagnosing medical conditions but a novice in automotive repair. Hence, she may employ the central route for diagnosing and treating medical conditions among her patients, but rely on the peripheral route, such as

advice from an auto technician, for diagnosing and correcting automotive malfunctioning. Likewise, domain experts, who normally tend to rely on central route processing for deciding on a target behavior, may sometimes rely on the less demanding peripheral route if they lack the time or resources to adequately process all message-related arguments. Given its state representation, elaboration likelihood can be enhanced in the workplace by manipulating the message, the source, and the influence context, such as the amount of time available to process arguments, extent of message repetition, the number of distractions, and pre-message conditioning (e.g., telling subjects that they will be questioned on the message later). Indeed, ELM researchers like Petty, Haugtvedt, and Smith (1995) and others have manipulated this construct in laboratory tests of the theory.

ELM has enjoyed a rich tradition of empirical research in the social psychology (e.g., Petty and Cacioppo 1986; Petty et al. 1981; Petty et al. 1995) and marketing (e.g., Lord et al. 1995) literatures. However, to date, it has seen only limited use in information systems research. Among its early IS applications, Mak et al. (1997) conducted an experiment to examine how users' participation in designing an expert system, as a proxy for elaboration likelihood motivation, influenced their acceptance of the system's recommendations. Consistent with predictions from ELM, they observed two alternative routes of influence: users with low participation were primarily influenced by the perceived credibility of expert system developers (a peripheral cue), while those with high participation were influenced by the ambiguity of the decision setting (an argument quality). Dijkstra (1999) used ELM in

an experimental setting to examine why some users tend to agree with incorrect advice generated by expert systems, and found that student subjects who expended less mental effort, scored lower on recall questions, and perceived assigned cases as being easy (low elaboration likelihood) agreed with incorrect system advice more often than those spending more time and effort in analyzing the system recommendations. Sussman and Siegel (2003) employed ELM in a nonexperimental setting to study knowledge adoption via electronic mail by consultants at a public accounting firm. They found that argument quality and source credibility positively influenced consultants' perceived usefulness of information contained in those e-mails, indirectly motivating them to accept that information in their own tasks. Sussman and Siegel also reported that recipients' involvement (elaboration motivation) and expertise (elaboration ability) moderated the main effects of argument quality and source credibility on perceived information usefulness. Interestingly, while most ELM studies have used attitude as the dependent variable, Sussman and Siegal employed perceived usefulness as the dependent variable of interest and found that ELM's postulates still apply.

Although the above studies attest to the empirical validity of ELM in different IS contexts, none were concerned with the problem of IT acceptance. For instance, Mak et al.'s work examined expert system design, Dijkstra studied decision making, and Sussman and Siegal investigated knowledge adoption. Further, though these studies demonstrated the existence of the dual modes of information processing, none were originally intended to study influence processes in particular or the impact of such processes. Below, we employ ELM to explain the nature and impacts of different influence processes related to IT acceptance, while also elaborating some of the theoretical nuances (e.g., co-presence of central and peripheral route influences, temporal effects) of ELM for future research.

Research Model

ELM is relevant to understanding IT acceptance behaviors because, according to IDT, IT acceptance is fundamentally a problem of social influence (Rogers 1995). The notion of social influence is also acknowledged in part by TRA (Fishbein and Ajzen 1975) and TPB (Azjen 1991) via the social norm construct, although it has not been examined in depth in the technology acceptance literature. The ELM literature provides the theoretical basis and an empirical base for systematically studying alternative influence processes, their effects, and moderating factors.

In applying ELM to the IT acceptance context, we first expand the dependent variable in ELM (i.e., attitude) to include belief, affect, and intention regarding IT acceptance (see Figure 2). This is justifiable since social psychology research views attitude as a broad construct consisting of three related components: cognition, affect, and conation (Breckler 1984). While the affect dimension is commonly referred to as attitude in IT acceptance research, the cognition dimension is related to beliefs salient to the target behavior such as expected benefits from IT acceptance, and the conation dimension refers to intentions or behavioral dispositions regarding IT acceptance. A detailed discussion on the tripartite conceptualization of attitude and its empirical validation is available from Breckler (1984).

Extant attitude theories such as TRA and TPB hold that beliefs influence affect (attitude), which in turn influences intentions regarding a target behavior. Adapting TRA to the specific context of IT acceptance, TAM specified two acceptance-related beliefs, perceived usefulness, defined as the extent to which potential users expect using an IT system to benefit their task performance, and ease of use, defined as the extent to which they expect IT acceptance to be relatively free of effort (Davis et al. 1989). TAM also included a direct effect from perceived usefulness to IT acceptance intention, over and above the indirect effect via attitude, to suggest that utilitarian considerations such as perceived usefulness may sometimes override negative affect or attitude in motivating IT acceptance in the workplace.

Based on TAM, the two direct influences on users' IT acceptance intentions are therefore potential users' perceived usefulness from IT acceptance and attitude toward IT acceptance, respectively capturing utilitarian and affective motivations of IT acceptance (Davis et al. 1989, p. 985). Perceived usefulness is positively correlated to attitude, since users tend to develop a positive affect toward a system if they expect that system to benefit their task performance. Further, attitude and perceived usefulness have positive effects on users' IT acceptance intentions, given human tendencies to maintain beliefs, affect, and intentions that are mutually consistent with each other. These associations have been empirically validated across a wide range of technological and organizational contexts (e.g., Davis et al. 1989; Taylor and Todd 1995; Venkatesh and Davis 2000; Venkatesh et al. 2003).

Recent IT acceptance studies have found the link between attitude and intention to be somewhat tenuous, especially for organizational usage and long-term usage contexts (Venkatesh et al. 2003). Since users may be influenced by utilitarian considerations (perceived usefulness), affective considerations (attitude), or both in their IT acceptance decisions, per-
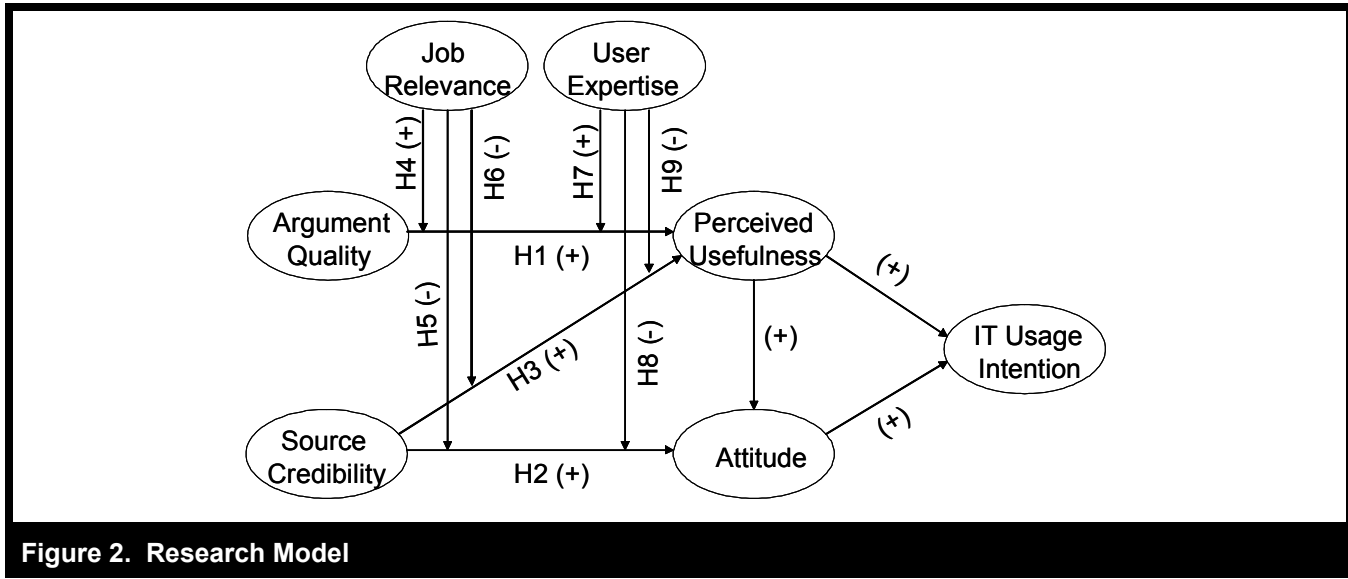
Figure 2. Research Model

ceived usefulness and attitude represent alternative motivations for IT acceptance. Although attitude may have an inconsistent effect in some specific settings, this effect may be more prominent in other contexts such as personal or home acceptance, early-stage acceptance, and so forth. In keeping with the semantic distinction between perceived usefulness and attitude and theoretical prescriptions from TAM, TRA, and TPB, we decided to retain both constructs in our study. The positive associations between perceived usefulness, attitude, and IT acceptance intentions, as suggested by the above theories, are depicted in Figure 2. However, these associations are not stated as formal hypotheses since they are not new in IT acceptance research and are also ancillary to our investigation of ELM-based influence processes.

ELM suggests that argument quality and peripheral cues are directly related to attitude and belief change. *Argument quality* refers to the persuasive strength of arguments embedded in an informational message, while *peripheral cues* relate to meta-information about the message (e.g., message source) but not its embedded arguments. Many peripheral cues have been suggested in the ELM literature, including the number of messages, number of message sources, source likeability, and source credibility. Of these, source credibility[3] appears to be one of the more frequently referenced cues. *Source credibility* is defined as the extent to which an information source is perceived to be believable, competent, and trustworthy by information recipients (Petty et al. 1981;

Sussman and Siegal 2003). This construct is relevant for IT acceptance because users, being unable to keep up with the rapid rate of technological change in this industry, often rely on expert advice to learn about the latest or the best technologies. Presumably, there may be other peripheral cues potentially relevant to IT acceptance that are not examined in this paper but may be the subject of future studies.

Although most prior ELM studies have focused on attitude as the dependent variable of interest (Lord et al. 1995; Petty et al. 1981), Sussman and Siegel (2003) demonstrated that perceived usefulness is also a relevant perception in the context of knowledge acceptance. Given that perceived usefulness and attitude are important and alternative drivers of IT acceptance, external influence in the acceptance context may be directed at informing potential users of the utility of IT acceptance (e.g., a third-party report comparing the target IT system with competing alternatives) or at enhancing users' affect toward IT acceptance (e.g., a celebrity endorsement), or both. Since message arguments are directed at users' rational judgment rather than their affect, argument quality is expected to influence perceived usefulness rather than attitude, by reinforcing or improving their extant beliefs about system acceptance. Likewise, peripheral cues such as source credibility are likely to influence attitude because such cues appeal to human affect rather than their rational judgment. These expectations lead us to propose

H1. The argument quality of informational messages has a positive effect on potential users' perceived usefulness of IT acceptance.

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[3]Petty et al. (1981) labeled this construct as *source expertise*.

H2. The source credibility of informational messages has a positive effect on potential users' attitude toward IT acceptance.

It is possible that argument quality may improve users' attitude toward IT acceptance. For instance, a well-articulated message, communicating useful arguments about system usage, may make one feel better about using a system. However, the effect on attitude is likely to be moderated by perceived usefulness, since high quality arguments may not change affect without first changing the users' usefulness beliefs. In other words, users feel better because they view the system as being more useful and not because the argument presented was strong enough. On the other hand, source credibility may sometimes directly influence users' perceived usefulness of IT acceptance, particularly if the recommendation for using the target system comes from a well-recognized or trusted IT expert. In this instance, potential users may substitute their own effortful thinking process with the expert's recommendation and employ a less effortful peripheral-route decision process to assess the potential usefulness of IT acceptance. Hence, we hypothesize

H3. The source credibility of informational messages has a positive effect on potential users' perceived usefulness of IT acceptance.

ELM also posits that the effects of argument quality and source credibility are moderated by potential users' motivation and ability to elaborate on informational messages (Petty and Cacioppo 1986). Drawing on prior ELM research, we operationalize the motivation dimension of elaboration as *job relevance*, defined as the message recipient's perceived relevance of an IT system to their work, and the ability dimension as *user expertise*, defined as the message recipient's ability to use IT in general. Potential users who view a new IT system as being highly relevant to their work performance are more motivated to engage in effortful scrutiny of all available information, thereby forming more informed and stable perceptions of usefulness based on message arguments. These users have less need for and are therefore less likely to consider peripheral cues. Conversely, users who perceive the same system as being less relevant to their work are less motivated to engage in extensive elaboration, and may instead rely on peripheral cues such as source credibility for shaping their personal attitudes and usefulness perceptions of IT acceptance. Hence, we propose

H4. Job relevance has a positive moderating effect on the association between argument quality and perceived usefulness of IT acceptance.

H5. Job relevance has a negative moderating effect on the association between source credibility and attitude toward IT acceptance.

H6. Job relevance has a negative moderating effect on the association between source credibility and perceived usefulness of IT acceptance.

Likewise, expert or computer-savvy IT users are more inclined to carefully scrutinize new messages about an IT to identify key acceptance-related arguments and form an informed judgment about IT acceptance. These users will rely less on peripheral cues, because they tend to be more aware of the possibility of inaccuracy, bias, and lack of realism in such cues. For instance, most advertisements tend to portray an overly positive and often unrealistic view of IT systems because such advertisements are intended to maximize IT sales. Hence, perceptions based on those cues are also likely to be biased. Further, expert users' superior IT expertise obviates their need to examine peripheral cues, since they can form more accurate perceptions by critically examining the message content. In contrast, novice or less expert users are forced to rely on peripheral cues such as source credibility, rather than embedded message arguments, in framing their attitude and perceived usefulness perceptions. Hence, we propose

H7. User expertise has a positive moderating effect on the association between argument quality and perceived usefulness of IT acceptance.

H8. User expertise has a negative moderating effect on the association between source credibility and attitude toward IT acceptance.

H9. User expertise has a negative moderating effect on the association between source credibility and perceived usefulness of IT acceptance.

Note that hypotheses H4 through H9 do not imply that high elaboration inspires IT acceptance or that low elaboration leads to nonacceptance. ELM indeed acknowledges that high and low elaboration processes may both lead to equivalent user perceptions and consequent intentions, irrespective of users' elaboration motivation or ability. Despite the fact that both high and low elaboration processes may lead to the same outcome, the influence paths for users in these groups are different in that the high elaboration process is influenced by argument quality, and the low elaboration process relies on source credibility and other peripheral cues. This difference in influence process is manifested in the strength of user

perceptions, leading to differential long-term persistence of influence effects.

According to ELM's *temporal persistence hypothesis*, user perceptions based on thoughtful elaboration tend to be temporally more stable, more persistent, and less susceptible to counter-persuasion than those based on less elaboration (Petty and Cacioppo 1986). This implies that if one's perceived usefulness and attitude toward IT usage are formed via the peripheral-route process, then such perceptions tend to decay significantly with time as the effects of the influence process wears off. In contrast, if the initial perceptions are based on the central-route process, as is typical for users in the high elaboration state, then such perceptions tend to remain persistent over time. Although users' initial elaboration state can be used as a proxy for central versus peripheral route processes, such elaboration may change over time. For instance, users who initially decide to accept a system based on detailed consideration of the pros and cons of system acceptance may not want to engage in such a similar thoughtful process later on while deciding whether or not to continue using the system. However, because we lacked data to adequately validate whether or not subjects' elaboration process changed during the course of our empirical study, we do not state the temporal persistence effects as formal hypotheses. Instead, we later describe an exploratory empirical test of these effects.

In summary, Hypotheses H1 through H3 depict the two alternative influence routes (main effects) in ELM, with H1 denoting a central-route influence process (based on argument quality) and H2 and H3 representing peripheral-route influence (based on source credibility). Hypotheses H4 through H9 represent the moderating effects of users' elaboration motivation (job relevance) and elaboration ability (user expertise) on ELM's two influence routes. Empirical testing of these hypotheses is described in the next section.

Research Method

Study Setting

The hypothesized ELM-based influence model of IT acceptance was tested empirically using a survey study of a document management system (DMS) acceptance by administrators and staff personnel at L'viv City Hall in Ukraine. The DMS was a custom application built using Lotus Notes, with the goal of improving the city's ability to record, track, and manage construction permits, business license applications, zoning clarifications, and other citizen or business requests.

The DMS was funded in part by a United States Agency for International Development (USAID) grant as part of a broader e-government initiative to promote governmental efficiency and transparency in developing countries.

The state of DMS acceptance at L'viv during the time of this study was as follows. The City of L'viv received an average of about 8,300 service requests, claims, and complaints per month, most of which were hand-delivered or mailed in by concerned citizens to the appropriate division at the city hall. Though city divisions were encouraged to record all correspondence in the DMS, this was not a strict mandate and was frequently ignored. About 20 percent of the incoming documents were forwarded to the city correspondence office for entry into the DMS system. The remaining 80 percent were retained in paper format for manual processing, even though over 90 percent of these manual documents were not processed within 30 days, as required by city covenants, and 30 to 40 percent of the documents were simply "lost in the system." Service requests entered in the DMS were registered and cataloged with an electronic control card, assigned to an appropriate administrator such as a division head, administrator, or secretariat, and sent to a staff member in the respective division for processing. Divisional staff electronically attached any investigational reports, their own comments, and draft responses to the control card, and sent it to the administrator for approval. If needed, administrators send relevant documents to the mayor's office or the city executive committee for further approval. Upon final disposition of each case, the official response was drafted by the assigned staff member and sent back to the city correspondence office, where it was printed and mailed to the filing citizen.

Most city administrators and staff members did not know much about the system, its purpose, or its potential impact on their work. Although the mayor wanted all city employees to use the DMS for all document processing, there was no explicit mandates, incentives, or training to facilitate its acceptance. The salary structure for governmental employees were set by the central Ukrainian government in Kyiv, and local governments had limited latitude to award bonuses or incentives for motivating desired employee behaviors, such as IT acceptance. Back in the Soviet days, citizens were too intimidated to request government services and government officials had little proclivity to respond to any such requests. This lack of customer service culture persisted among city hall employees even after Ukraine became independent in 1991. Further, many city employees did not have computer backgrounds and were simply intimidated by the new technology. Additionally, electronic documents were not officially recognized by Ukrainian courts or other governmental agencies such as finance or tax accounting and, hence, many

city employees preferred to work with paper documents instead. Given the above scenario, it was not surprising that DMS acceptance was practically nonexistent among L'viv city employees.

To improve service delivery to citizens, increase the productivity of city employees, and instill a culture of technology-enabled customer service, the mayor initiated a series of training sessions to introduce the city's administrative and staff personnel to the DMS and influence them to use it. One of this study's authors was commissioned to provide this training, with the goal of improving user beliefs and attitudes toward the system and ultimately facilitating their DMS acceptance. In total 87 city hall employees, including 30 administrators (senior executives or division heads) and 57 divisional staff members from a total of 130 such personnel, participated in the training program in four groups. Secretaries, aids, interns, and field personnel were excluded from the training, since they had no decision-making responsibility on citizen requests and did not directly interact with the DMS. Each group received three 8-hour days of training. The first 2 days were designed to bring participants up to speed on using the Windows operating system, word processing, spreadsheets, electronic mail, and web browsing. This was necessary given the lack of basic computer literacy among many city employees. The third day focused exclusively on Lotus Notes, its messaging, calendaring, and collaboration features, document generation, cataloging, and tracking, and using electronic control cards to move documents between city divisions. Training included both lectures and hands-on practice sessions. At the end of the 3-day training program, subjects were asked to complete a paper-based survey, intended to elicit their perceptions of each of the seven constructs of interest to this study. A second round of data collection followed 3 months later, when subjects' perceived usefulness and attitude regarding DMS usage was recaptured using the same instruments as in the first survey, and matched with responses from the first round using participants' self-reported home or cell telephone numbers. Note that data from the second round was intended for an exploratory test of ELM's temporal persistence hypotheses and not for testing any of the study's formally stated hypotheses.

The final sample consisted of 81 usable responses, from 28 administrators and 53 staff personnel, for an overall response rate of 62.3 percent. Nonresponse bias was not an issue, since a majority of the targeted population responded to our survey request, probably due to the overt support and involvement of the mayor. Additional comparison of means tests found that the respondent group did not differ significantly in age, years of formal education, or years of work experience from the average profile of L'viv city employees, alleviating any concerns of nonresponse bias.

Operationalization of Constructs

The seven constructs of interest to this study were perceived usefulness, attitude, acceptance intention, argument quality, source credibility, user expertise, and job relevance. All constructs were measured using multiple-item perceptual scales, using pre-validated instruments from prior research wherever possible, and reworded to relate specifically to the context of DMS acceptance. Individual scale items are listed in the appendix.

Perceived usefulness was measured using four Likert scaled items developed and validated by Davis et al. (1989) that tapped into subjects' perceptions of productivity, performance, and effectiveness gains from DMS acceptance, and overall usefulness. Attitude was measured using Taylor and Todd's (1995) four-item semantic differential scale anchored between "bad…good," "foolish…wise," "unpleasant… pleasant," and "like…dislike" adjective pairs. Intention to use IT was measured using an adapted version of Taylor and Todd's three-item Likert-scale that examined subjects' intent to use DMS within the next month, in the near future, and for more of their job responsibilities.

Source credibility was assessed using a modified version of Sussman and Siegal's (2003) four-item Likert scale. Three items from the original scale that tapped into subjects' perception of the source's knowledgeability, expertise, and trustworthiness were retained, while the reliability item was changed to credibility. The latter change was necessary since reliability perceptions are typically based on prior interaction history with the message source, which was justified for Sussman and Siegal's sample of consultants with a prior history of information sharing, but was less applicable in our case since the target users were not familiar with the trainer prior to this study.

Argument quality was measured using a Likert scale patterned after Sussman and Siegal's scale. The original scale examined completeness, consistency, and accuracy as dimensions of argument quality. While experienced consultants in the original study may be able to reasonably judge the above dimensions of an informational message, our sample of mostly inexperienced DMS users were not expected to do so. Hence, we replaced the above dimensions with the extent to which subjects believed that information provided during the DMS training was informative, helpful, valuable, and persuasive.

User expertise was assessed using three items that asked subjects to self-rate their prior knowledge of electronic mail, word processing, and computers on seven-point scales

anchored between "novice" and "expert," similar to the scale employed by Sussman and Siegal. These domains were specifically selected because DMS acceptance involves creating online documents, storing them on computers, and sharing them via e-mail. User expertise was cross-validated with a single-item fill-in measure of number of years of prior computer experience, which was positively correlated with each of the above three items.

Finally, job relevance was measured using two Likert-scaled items, proposed and validated by Venkatesh and Davis (2000), which examined the importance and relevance (appropriateness) of DMS in performing the subjects' job. Empirical validation of the above scales is described in the next section.

Data Analysis and Results

Data analysis proceeded in two stages. In the first stage, all measurement scales were tested for reliability and construct validity using confirmatory factor analysis (CFA). CFA is more appropriate than alternative statistical techniques such as exploratory factor analysis when there is strong *a priori* theory and the research employs mostly pre-validated measurement scales (Bagozzi and Phillips 1982), as was the case in this study. For purposes of CFA, all measured items were modeled as reflective indicators of their corresponding latent constructs, all constructs were allowed to covary freely in the measurement model, and each factor loading and inter-construct correlation was scrutinized individually. In the second stage, the associations between latent constructs in the CFA model were modified to match the theoretical causal structure specified in our hypotheses, and individual path effects and variance explained were examined. This two-stage approach to data analysis was preferred over an alternative one-stage approach, where measurement and structural models are examined simultaneously, because the former approach provides a more complete and robust test of measurement validity by examining potential associations between constructs that may not otherwise be theoretically specified in the one-stage structural model.

Scale Validation

Confirmatory factor analysis (CFA), used for assessing measurement scale validity, was performed using the partial least squares (PLS) approach. PLS-Graph Version 3.0 software (Chin and Frye 1994) was used for this purpose. The

variance-based PLS approach was preferred over covariance-based structural equation modeling approaches such as LISREL because PLS does not impose sample size restrictions and is distribution-free[4] (Chin et al. 2003). Raw data was used as input to the PLS program, and path significances were estimated using the bootstrapping resampling technique with 100 subsamples.

Scale validation proceeded in two phases: convergent validity and discriminant validity analyses. Convergent validity of scale items was assessed using three criteria suggested by Fornell and Larcker (1981): (1) all item factor loadings (λ) should be significant and exceed 0.70, (2) composite reliabilities (ρ_c) for each construct should exceed 0.80, and (3) average variance extracted (AVE) for each construct should exceed 0.50, or in other words, the square root of AVE should exceed 0.71. As seen from Table 1, standardized CFA loadings for all scale items in the CFA model were significant at $p < 0.001$ and exceeded the minimum loading criterion of 0.70, with the minimum loading being 0.81 for source credibility item SC4. From Table 2, we can see that composite reliabilities of all factors also exceeded the required minimum of 0.80, with the lowest value being 0.91 for the source credibility construct. Further, browsing the principal diagonal elements in Table 2, we can see that the smallest square root for AVE among all seven constructs in our CFA model was 0.85 for source credibility, which was greater than the desired minimum of 0.71. Hence, all three conditions for convergent validity were met.

Discriminant validity between constructs was assessed using Fornell and Larcker's recommendation that the square root of AVE for each construct should exceed the correlations between that and all other constructs.[5] From the data presented in Table 2, we can see that the highest correlation between any pair of constructs in the CFA model was 0.73 between perceived usefulness and attitude. This figure was lower than the lowest square root of AVE among all constructs, which was 0.85 for source credibility. Hence, the discriminant validity criterion was also met for our data sample.

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[4]The covariance-based PLS approach was preferred over covariance-based structural equation modeling approaches such as LISREL because PLS has fewer sample size and distribution restrictions than LISREL (Chin et al. 2003).

[5]This is supposedly a stronger test of discriminant validity than pair-wise comparison of χ^2 values of unconstrained and constrained CFA models often reported in the literature (Fornell and Larcker 1981).

Table 1. Confirmatory Factor Analysis Results

Scale Item[a]	Item Mean	Item S.D.	Item Loading[b]	Standard Error
IN1	4.30	1.48	0.93	0.014
IN2	4.31	1.35	0.94	0.015
IN3	4.06	1.34	0.88	0.033
PU1	4.85	1.71	0.97	0.008
PU2	4.73	1.73	0.94	0.021
PU3	4.86	1.66	0.96	0.010
PU4	4.81	1.78	0.94	0.015
AT1	4.37	1.50	0.94	0.011
AT2	4.32	1.44	0.93	0.023
AT3	4.40	1.39	0.90	0.039
AT4	4.31	1.53	0.94	0.011
AQ1	4.96	1.70	0.93	0.016
AQ2	4.90	1.65	0.89	0.032
AQ3	4.77	1.61	0.90	0.031
AQ4	5.09	1.64	0.89	0.019
SC1	4.48	1.30	0.89	0.030
SC2	4.43	1.37	0.83	0.069
SC3	4.42	1.41	0.87	0.033
SC4	4.40	1.19	0.81	0.058
UE2	4.40	1.54	0.94	0.014
UE2	4.16	1.61	0.91	0.022
UE3	4.20	1.58	0.92	0.022
JR1	4.41	1.55	0.94	0.015
JR2	4.38	1.60	0.93	0.015

[a]Item legend: IN: Intention; PU: Perceived usefulness; AT: Attitude; AQ: Argument quality; SC: Source credibility; UE: User expertise; JR: Job relevance.
[b]All item loadings were significant at $p < 0.001$ with t-statistic > 20.

Table 2. Scale Properties

Construct[a]	Mean	S.D.	ρ_c	Inter-Construct Correlations[b]						
				IN1	PU1	AT1	AQ1	SC1	UE1	JR1
IN	4.22	1.39	0.94	*0.91*						
PU	4.81	1.72	0.97	0.73	*0.95*					
AT	4.35	1.47	0.96	0.68	0.47	*0.92*				
AQ	4.93	1.65	0.94	0.47	0.60	0.32	*0.90*			
SC	4.43	1.32	0.91	0.58	0.47	0.67	0.32	*0.85*		
UE	4.25	1.58	0.94	0.35	0.40	0.30	-0.22	0.34	*0.92*	
JR	4.40	1.58	0.93	0.40	0.39	0.43	0.33	0.09	0.17	*0.93*

[a]Construct legend: IN: Intention; PU: Perceived usefulness; AT: Attitude; AQ: Argument quality; SC: Source credibility; UE: User expertise; JR: Job relevance.
[b]Diagonal elements (in italics) represent square root of AVE for that construct.
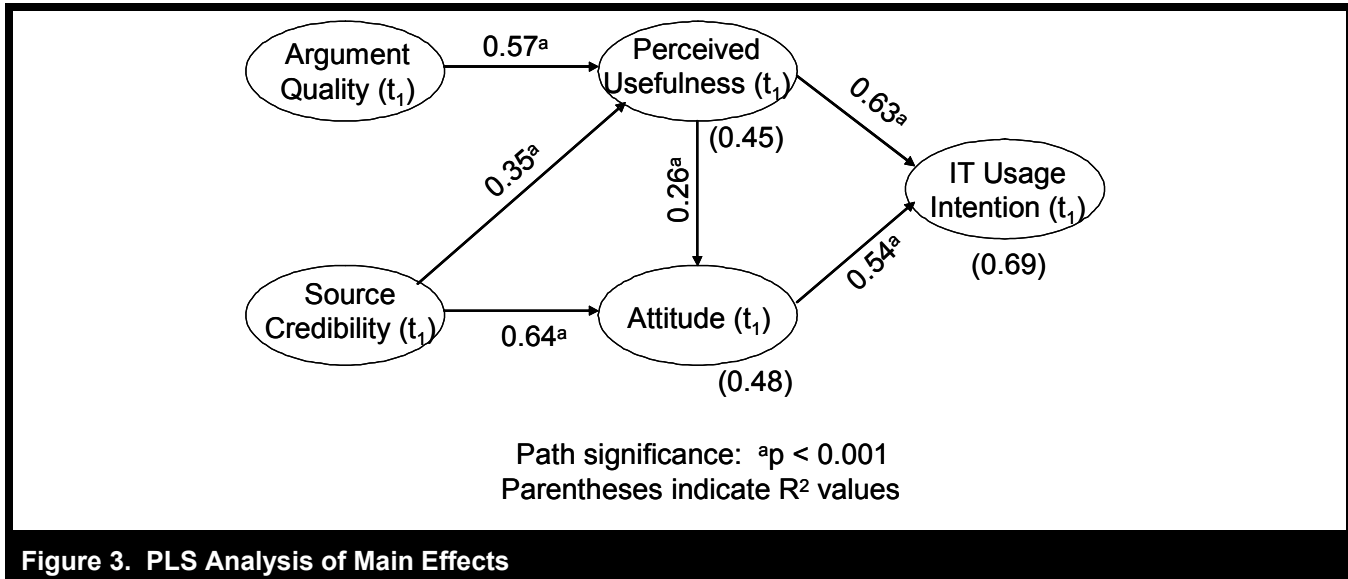
Figure 3. PLS Analysis of Main Effects

Hypotheses Testing

The next step in our data analysis was to examine the significance and strength of each of our hypothesized effects. This analysis was done using two PLS models. The first model examined the main effects specified in hypotheses H1 through H3, while the second model added the moderating effects stated in H4 through H9. Results of the analysis for each phase, including standardized path coefficients, path significances, and variance explained (R^2 value) for each dependent variable, are presented in Figures 3 and 4 respectively.

The main effects model (Figure 3) examined the effect of argument quality on perceived usefulness (H1) and that of source credibility on attitude (H2) and on perceived usefulness (H3), as well as three associations between perceived usefulness, attitude, and IT acceptance intention suggested by TAM. All six paths in this model were significant at $p < 0.01$. Consistent with ELM, argument quality had a strong and significant effect ($\beta = 0.57$; $p < 0.001$) on perceived usefulness, thereby supporting H1. Source credibility also had significant effects on attitude ($\beta = 0.64$; $p < 0.001$) and on perceived usefulness ($\beta = 0.35$; $p < 0.001$), demonstrating support for H2 and H3 respectively. Additionally, users' intention to use DMS was influenced significantly by both perceived usefulness ($\beta = 0.63$; $p < 0.001$) and attitude ($\beta = 0.54$; $p < 0.001$), as expected from TAM, and perceived usefulness had a significant effect on attitude ($\beta = 0.26$; $p < 0.001$). Argument quality and source credibility jointly explained 45 percent of the variance in perceived usefulness, with argument quality contributing a larger proportion to that

explanation. Source credibility and perceived usefulness jointly explained 48 percent of attitude, with source credibility having the dominant effect.

Collectively, the above results demonstrate that both central-route and peripheral-route processes are effective ways of influencing one's perceived usefulness and attitude toward IT acceptance, and that the central-route and peripheral-route influences are successfully captured using the argument quality and source credibility constructs respectively. Further, the effect of source credibility on perceived usefulness suggests that user perceptions may not necessarily be based entirely on a pure central-route or peripheral-route influence process, but may sometimes be formed jointly by both processes.

The moderating effects model (Figure 4) tested the extent to which job relevance and user expertise, representing elaboration motivation and ability, respectively, moderated the main effects hypothesized in H1 through H3. The interaction terms were modeled in PLS as products of each item belonging to the underlying scales, as recommended by Chin et al. (2003), and added to the main effects model in Figure 3. The main effects of the moderating constructs on IT acceptance perceptions were also included in this model in order to statistically separate the hypothesized moderating effects from all statistically possible main effects (these main effects are not reported here because of their lack of theoretical significance). As shown in Figure 4, including these moderating effects increased variance explained (R^2 value) in perceived usefulness from 45 percent in the main effects model to 75
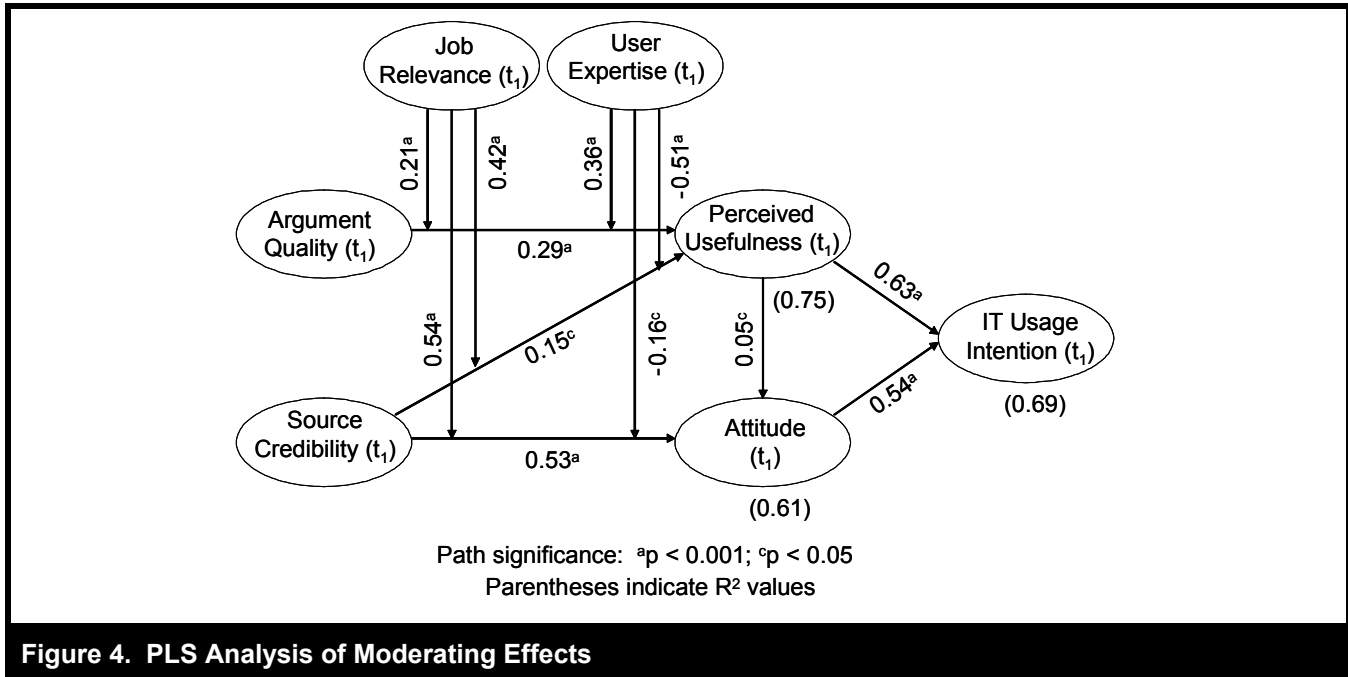
Figure 4. PLS Analysis of Moderating Effects

percent in the moderating effects model, and that in attitude from 48 percent to 61 percent. F-tests comparing the R^2 values for each dependent variable between the nested main and moderating effects models[6] found the increase in explanatory power to be statistically significant at $p < 0.001$ for both perceived usefulness and attitude. This confirmed our expectation that the hypothesized moderating effects indeed provide superior explanation of IT acceptance perceptions over and above their corresponding main effects.

Examining individual paths in the moderating effects model, we found that the job relevance had a significant positive moderating effect on the association between argument quality and perceived usefulness ($\beta = 0.21$; $p < 0.001$), as expected from H4. Further, job relevance positively moderated the effects of source credibility on attitude ($\beta = 0.54$; $p < 0.001$) and perceived usefulness ($\beta = 0.42$; $p < 0.001$), when these associations were expected to be *negative* from H5 and H6 respectively. Potential reasons for these unexpected effects are explored below. User expertise positively moderated the effect of argument quality on perceived usefulness ($\beta = 0.36$; $p < 0.001$), in accordance with H7, and negatively moderated the effects of source credibility and attitude ($\beta = -0.16$; $p < 0.05$) and perceived usefulness ($\beta = -0.51$; $p < 0.001$), consistent with H8 and H9 respectively.

The positive moderating effects of job relevance on the main effects of source credibility on attitude and perceived usefulness were perplexing, since H5 and H6 hypothesized these effects to be negative. While these discrepancies may be attributed to measurement errors, they may also be indicative of a deeper theoretical problem. To further investigate these counterintuitive results, we revisited the ELM literature and found similar unusual findings in other studies that used source credibility as a peripheral cue (e.g., Eagly and Chaiken 1993). In a recent overview of ELM, Petty and Wegener (1999) attempted to reconcile these conflicting findings by suggesting that a given variable can serve as either a cue or an argument, depending on the amount of thoughtful elaboration pursued by different subjects. This *multiple roles postulate* or multiplicity of influence patterns was described as follows:

> as people approach the high end of the elaboration continuum, they are more likely to scrutinize *all* available information in the immediate influence context in an attempt to evaluate the true merits of the argument *and position* advocated (Petty and Wegener 1999, p. 46).

Thus, users pursuing the high elaboration route may consider factors that are not only related to the arguments embedded in a message, but also peripheral cues related to the message source (e.g., is this source legitimate?) as an issue-relevant argument. Such thorough consideration of source credibility

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[6]Computed as $F = (R^2_{interaction} - R^2_{main}) / [(1 - R^2_{interaction})/df]$.

by high elaboration users as part of a broader decision process is distinct from the blind acceptance of a source's credentials by low elaboration users (Chaiken and Maheswaran 1994). If most users in our sample did follow the high elaboration route and viewed source credibility as an issue-relevant argument rather than as a peripheral cue, then the positive moderating effects of job relevance on the main effects of source credibility are indeed justified.

To empirically examine the plausibility of the above explanation, we conducted a follow-up analysis where we computed the overall elaboration level of each subject in our sample, based on a non-weighted average of their job relevance and user expertise scores. We then divided the entire sample into two groups based on whether their overall elaboration was above or below the sample median. If people in the high elaboration state indeed viewed source credibility differently from those in the low elaboration state, as Petty and Wegener suggested, then we should expect significant *positive* moderating effects of job relevance on the main effects of source credibility on perceived usefulness and attitude for the high elaboration group, but *negative* moderating effects for the low elaboration group. Separate PLS analysis for each group confirmed these expectations, demonstrating path coefficients of 0.41 ($p < 0.001$) and 0.63 ($p < 0.001$) for the high elaboration group, and –0.17 ($p < 0.05$) and –0.05 ($p > 0.05$) for the low elaboration group, providing partial support for the above explanation. These findings also demonstrate the complex and idiosyncratic nature of the source credibility construct that researchers should take into consideration while designing future ELM-based studies. In retrospect, it seems that source likeability or source affinity might have been a more appropriate peripheral cue for our study than source credibility.

Finally, as a preliminary test of ELM's temporal persistence hypotheses, we examined the stability of the ELM outcomes, perceived usefulness and attitude, between the time t_1 immediately following the DMS training and time t_2 three months later. For this purpose, we computed the change in perceived usefulness and attitude scores from t_1 to t_2 as dependent variables, and linked these difference scores to job relevance and argument quality as independent variables in our PLS model. Since high job relevance or high user expertise (i.e., high elaboration motivation and ability, respectively) was likely to cause minimum temporal change in perceived usefulness or attitude, we expected all four effects from the two independent variables to the two dependent variables to be negative. PLS analysis confirmed these expectations for the effects of user expertise on perceived usefulness change ($\beta = –0.14$, $p < 0.05$) and attitude change ($\beta = –0.13$, $p <$

0.05). Job relevance had a significant negative effect on attitude change ($\beta = –0.25$, $p < 0.001$), but a nonsignificant positive effect on perceived usefulness ($\beta = 0.16$, $p > 0.05$). It is possible that the latter nonsignificant effect may be due to the nonsignificant change in perceived usefulness mean from 4.81 at time t_1 to 4.83 at time t_2, while the attitude mean recorded a significant change from 4.35 to 4.11 during that period ($p < 0.01$). However, we caution readers against drawing any conclusive inferences from this exploratory analysis, given that we did not control for subjects' processing modes (central versus peripheral routes) during the 3-month course of this study. If subjects' influence modes changed from central to peripheral or vice versa, then that could invalidate our temporal persistence findings. Future research on ELM's temporal effects should be sensitive to such potential changes in subjects' elaboration patterns, and employ controlled laboratory experiments appropriately designed to control for subjects' modes of elaboration.

Conclusions

Discussion of Key Findings

This study started with the goal of addressing three research questions: (1) which influence processes shape user acceptance of new IT and how, (2) do the effects of these influence processes vary across users or situational contexts, and if so, how, and (3) how persistent are these effects over time? To answer these questions, we started with ELM, a dual-process theory of persuasion from social psychology, to identify the central and peripheral routes as two alternative ways of influencing IT users, postulated elaboration motivation and ability as moderating factors mitigating the two influence routes, and suggested that the central-route influence is more temporally stable than peripheral-route influence. We proposed nine hypotheses related to the first two research questions, of which seven were validated using a field survey of document management system (DMS) acceptance among governmental employees in Ukraine. The remaining two hypotheses, both moderating effects, were reconciled using *post hoc* subgroup analysis and found to be consistent with theoretical expectations. The third research question was examined via an exploratory test based on limited data.

Our empirical findings demonstrate that the central and peripheral routes are both viable ways of influencing users to accept a new IT. In the central route, users engage in thoughtful processing of issue-relevant arguments embedded in an informational message, while in the peripheral route, they

merely attend to cues about the message such as the credibility of the message source. These influence mechanisms shape users' IT acceptance intention by modifying key perceptions salient to acceptance such as perceived usefulness and attitude. Our results confirm that both influence routes are moderated by users' motivation and ability to elaborate or process issue-relevant arguments. Users with higher elaboration motivation and ability tend to be more influenced by the central route, while those with lower motivation and ability are influenced by the peripheral route. We also report that the central route results in more stable attitude and usefulness perceptions than the peripheral route, and hence is likely to have a longer-term impact on user acceptance decisions than the latter.

Based on prescriptions from the ELM literature, the central and peripheral routes were operationalized in this study using the argument quality and source credibility constructs respectively, while elaboration motivation and ability was captured using job relevance and user expertise constructs respectively. Although user expertise positively moderated the central route influence process involving argument quality and negatively moderated the peripheral route process involving source credibility, as theoretically expected, job relevance had positive moderating influences on both central and peripheral route processes. Additional follow-up analysis directed at resolving this anomaly revealed that while source credibility was a salient peripheral cue for low elaboration users, it was also viewed as an issue-relevant argument by high elaboration users. Combining high and low elaboration users in one group and testing their collective moderating influence on the impacts of source credibility therefore masked the differential nature of the effects for users in the two elaboration states. Future ELM researchers should be sensitive to such idiosyncratic impacts of source credibility, and may consider replacing this construct with a pure peripheral cue such as source likeability or affinity (Chaiken and Maheswaran 1994; Petty and Wegener 1999). Future researchers are also encouraged to examine other plausible peripheral cues, such as size of prior IT user base, and other elaborators beyond job relevance and user expertise, such as extent of distraction or time pressure in argument processing.

Our findings have some theoretical implications for ELM, especially as it applies to the IT acceptance problem. We observed that the central and peripheral routes to influence are not mutually exclusive in IT acceptance contexts, but that potential IT users may sometimes employ both processes simultaneously in forming perceptions related to IT acceptance. For instance, we noted that one's usefulness perceptions can be shaped by both argument quality and source credibility, resulting in a mixed-mode model. Further,

we split the attitude construct in ELM into perceived usefulness and attitude, respectively representing the cognitive and affective component of user attitudes. Extensions such as these may be necessary and appropriate if a theory is taken from one context and applied in an entirely different context. Such theoretical adaptations are useful ways of extending the core theory while simultaneously enhancing its explanatory ability across multiple research domains.

How does our elaboration likelihood model of informational influence inform core IT acceptance theories such as IDT and TAM/DTPB/UTAUT? While DTPB and UTAUT acknowledge that social norms may influence user perceptions related to IT acceptance, it provides no explanation of how and why influence could be exerted on potential users, prior to the development of community-based norms, as is often the case with a new IT. TAM admits the possibility that external variables may influence user perceptions of IT acceptance, but does not identify any specific external variable that may explain why they may be relevant. The ELM offers new insight into this unaddressed area by suggesting messages from external agents (e.g., IT change agents) as the primary external variables of interest and by indicating that the extent to which these messages influence user perceptions is moderated by users' elaboration state such as their motivation and ability to thoughtfully process issue-relevant arguments.

Likewise, IDT suggests that information communicated by mass media and interpersonal communication channels shapes users' awareness of and motivation to accept a new IT, but does not clarify what aspects of the communicated information influence users' acceptance decisions. The ELM posits argument quality and peripheral cues embedded in the communicated information as the key drivers of users' acceptance decisions. Further, IDT also indicates that these communication patterns have differential effects on different types of users (e.g., early versus later adopters), but does not elaborate why. The ELM bridges this gap by suggesting users' elaboration motivation and ability as moderating factors that impact the external informational message on user acceptance. In this sense, early adopters in IDT may be considered to be equivalent to users in the high elaboration state in ELM, and IDT's later adopters are similar to users in the low elaboration state.

Finally neither TAM/TPB nor IDT elaborate the long-term persistence of influence effects. Although our observations regarding ELM's persistence effects hypotheses should be considered preliminary, in light of our limited and non-controlled data, we found some evidence that the central route tends to result in influence effects that are more stable and persistent over the long-term than the peripheral route.

Limitations of the Study

Like most empirical research, this study is not without limitations. First, we did not actively manipulate central and peripheral routes to influence. We employed a common treatment in our research design whereby subjects did receive three days of formal, hands-on training on IT usage, but it was left to the subjects to decide whether they would follow the central or peripheral route. For practical constraints imposed by the field setting where data was collected, it was not possible for us to administer separate central-route and peripheral-route treatments to different subject groups, as would have been ideal for testing the hypothesized ELM effects. Although this lack of experimental controls may have hurt the internal validity of our findings, as a tradeoff, our field-based data collection helped improve our external validity or generalizability compared to most prior ELM studies conducted in laboratory settings. However, we encourage future researchers to employ controlled experimental designs to test the internal validity of our findings. Such designs should attempt to maintain the equivalence of central and peripheral route treatments by say, equating the number of message arguments and peripheral cues provided to treatment groups. Moreover, any test of attitude persistence should be conducted under conditions where initial attitude extremity is equivalent across central and peripheral route subject groups. This would help assure that any difference in attitude persistence is caused by differences in influence route rather than by initial differences in attitude extremity, and, additionally, minimize the potentially confounding effect of initial attitude differences on differential attitude decay over time (Petty et al. 1995).

Second, similar to many prior studies on IT acceptance, we used acceptance intention as a proxy for acceptance behavior. Prior research indicates that intention may be a weak proxy for behavior, with a correlation as low as 0.5 (for a meta-analysis of this effect size, see Sheppard et al. 1988). Further, additional factors, such as facilitating conditions, may confound the effect of intention on behavior. Objective data on acceptance behavior was not available in our study since the City of L'viv had no mechanism for storing such data on a centralized server. Although we would have certainly preferred to include objective data on actual acceptance, we do not believe that doing so would have substantively changed any of our reported findings since the focus of this study was on understanding informational influence effects on user perceptions and not on user behaviors *per se*.

Third, we examined one peripheral cue in this study, namely source credibility. Our choice of this cue was motivated by its prevalent use in the ELM literature (e.g., Petty et al. 1981; Sussman and Siegal 2003). However, as we realized following our empirical analysis, source credibility may be viewed differently by IT users depending on their extent of elaboration, resulting in idiosyncratic effects on the dual process model. We urge future researchers to consider alternative peripheral cues of potential relevance to the IT acceptance context, such as the number of users that have previously accepted the target IT, number of times an informational message is reiterated, and source likeability.

Implications for Practice

This study has several implications for IS practice, especially within the context of managing IT implementation within organizations. IT managers often invest millions of dollars in new IT with the goal of generating long-term organizational benefits such as improving worker productivity or decision quality. However, such investments are wasted if managers cannot influence organizational users to accept the implemented systems for their everyday work. IT managers can benefit from knowing what influence processes can be used to motivate organizational members' acceptance of IT and under what circumstances these processes are likely to succeed or fail.

Drawing from ELM, this research presents two alternative modes of influence, namely the central and peripheral routes, which managers can employ to encourage organizational members' acceptance of IT. The former technique involves educating users about the potential benefits of IT acceptance by providing them high-quality arguments about how the new IT can substantially improve their work, while the latter technique involves providing peripheral cues such as endorsements from reputable or preferred sources about the benefits and potential impacts of IT acceptance.

Second, IT managers should understand that a "one size fits all" approach to influence may not lead to the desired acceptance outcomes in organizations, given wide variation in organizational users' motivation and ability to elaborate issue-relevant arguments. Our study demonstrated that users who see high job relevance in IT usage and have relatively high IT expertise tend to follow the central route to influence and are influenced more by argument quality, while those with low perceptions of job relevance and expertise are more likely to rely on peripheral cues for their IT acceptance decisions. Targeting a user group with the wrong type of influence pro-

cess may be counterproductive and engender resistance within the target user group. Further, influence processes that worked in one organization may not work in equal effect in other organizations, due to intrinsic differences in the elaboration states of their users. Accordingly, IT managers should endeavor to assess users' elaboration motivation and ability before deciding which influence strategy to pursue in their organizations and should consider segmenting users into different groups, based on their elaboration states before administering influence strategies.

Finally, which of the two influence processes is better for changing user perceptions over the short and long terms? Our findings suggest that both the central and peripheral routes of influence are viable ways of shaping user perceptions over the short-term. However, our limited examination of ELM's temporal persistence hypotheses suggests the central route may be superior over the long-term because the perceptions created by this route are more stable over time and lead to persistent effects on long-term IT acceptance. Wherever possible, IT managers should therefore strive to employ the central route to influence in order to extract the most benefits from scarce IT implementation resources. Although the central route is less effective for users in the low elaboration state, managers should realize that elaboration likelihood is a temporary state and not a personality trait, and devise strategies to enhance users' elaboration such as by manipulating the message, the source, or the influence context, providing more time to users for processing arguments, reducing the number of distractions, and pre-message conditioning (such as by telling subjects that they will be questioned on the message later). Further, managers can directly influence job relevance by customizing the system to user or workgroup needs and user expertise via IT training programs.

Implications for Research

To the best of our knowledge, this is the first study to theoretically specify or empirically test the role of influence processes in IT acceptance. Prior IT acceptance studies started with individual perceptions such as usefulness and ease of use while attempting to understand acceptance, but did not specifically examine how those perceptions can be influenced in the first place. In that sense, our research addresses a gap in extant IT acceptance research by highlighting influence processes that can shape the formation of individual perceptions and eventual IT acceptance. As Markus and Robey (1988) observed, IT implementation is more than just technology deployment; it requires careful orchestration of the

social process of organizational change for overcoming users' resistance toward a new system and persuading them to use it. Overcoming user resistance requires deep-seated belief and attitude change on the part of target users, and hence it is important to study the influence processes by which such attitude change can be accomplished. By advancing the case for studying influence processes in IT acceptance research, this study may help stimulate future research on proactive modification of acceptance patterns within organizations.

Although IDT-based studies have suggested that informational influence drive technology acceptance among a user population, exactly what type of influence can achieve the desired change effectively over the short and long terms and under what circumstances is still largely unknown to IS scholars. User influence is a challenging task, as evident from Dennis' (1996) findings that even if users have access to critical information needed to perform certain tasks via the latest technologies such as group support systems, they may not necessarily utilize such information appropriately to make optimal decisions. Hence, it is incumbent upon researchers to identify viable ways of influencing users, compare the relative efficacy and long-term stability of such alternative processes, and describe conditions under which they are less effective, as was done in this study.

The final theoretical contribution of this study is its detailed exposition of the ELM and an illustration of its application to the problem of IT acceptance. Although a limited number of prior ELM-based studies had applied the theory within other contexts such as system design, decision making, or knowledge acceptance (e.g., Dijkstra 1999; Mak et al. 1997; Sussman and Siegel 2003), this study is the first to apply this theory to the IT acceptance area. Two major advantages of this theory, compared to prior theories of IT acceptance such as TAM and IDT, are (1) its focus on the processes by which user perceptions are formed and (2) its contextualized nature, which can explain not only how influence effects vary across individuals but also how such variation may occur within individuals as elaboration motivation and ability changes with time.[7] Indeed, ELM is a process theory that has the potential of opening the black box of the influence process as it unfolds over time, in contrast to most prior theories that were primarily factors-based. However, ELM also complements prior IT acceptance theories by emphasizing that IT system acceptance must be preceded and framed by acceptance of information about the system. Such information acceptance may occur in multiple ways, such as the central and peripheral

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[7]We thank an anonymous reviewer for making this observation.

routes, which have differential implications for eventual system acceptance. We also provide an exploratory test of ELM's temporal persistence hypothesis, based on our limited data, which may be the subject of future IT usage studies. We hope that this study will provide the foundation for building a comprehensive knowledge base of influence processes and inspire future researchers to investigate this ignored yet potentially fruitful area of IT acceptance research.

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Appendix

Measurement Items

Perceived Usefulness:
US1.   Using DMS in my job will increase my productivity (e.g., make my work faster).
US2.   Using DMS in my job will improve my performance (e.g., make my work better).
US3.   Using DMS in my job will make me more effective (e.g., help me make better decisions).
US4.   I find DMS to be useful in my job.

Attitude:
AT1.   Using DMS in my job is a (bad … good) idea.
AT2.   Using DMS in my job is a (foolish … wise) idea.
AT3.   Using DMS in my job will be (unpleasant … pleasant).
AT4.   Overall, I (dislike … like) the idea of using DMS in my job.

Intention:
IN1.   I intend to use DMS on my job within the next one month.
IN2.   I intend to use DMS on my job in the near future.
IN3.   I intend to use DMS for more of my job responsibilities.

Argument Quality:
AQ1.   The information provided during the DMS training session was informative.
AQ2.   The information provided during the DMS training session was helpful.
AQ3.   The information provided during the DMS training session was valuable.
AQ4.   The information provided during the DMS training session was persuasive.

Source Credibility:
SC1.   The person providing the DMS training was knowledgeable on this topic.
SC2.   The person providing the DMS training was trustworthy.
SC3.   The person providing the DMS training was credible.
SC4.   The person providing the DMS training appeared to be an expert on this topic.

User Expertise:
How knowledgeable are you on using the following technologies:
UE1.   Electronic mail (novice … expert).
UE2.   Word processing (novice … expert).
UE3.   Computers (novice … expert).

Job Relevance:
JR1.   Using DMS is important for my job.
JR2.   Using DMS is relevant (appropriate) for my job.

Note: Items for all constructs except attitude and user expertise were measured using seven-point Likert scales anchored between "strongly disagree" and "strongly agree." Scales for the attitude and user expertise items are shown above.