A Comprehensive Review and Conceptualization of the Post-Adoptive Behaviors Associated with IT Applications

Abstract

For the last 25 years, organizations have invested heavily in information technology (IT) to support their work processes. In today’s organizations, intra- and inter-organizational work systems are increasingly IT-enabled. Available evidence, however, suggests the functional potential of these installed IT applications is underutilized. Most IT users apply a narrow band of features, operate at low levels of feature use, and rarely initiate extensions of the available features. We argue that aggressive organizational tactics are needed to encourage users to expand their use of installed IT-enabled work systems.

This article strives to accomplish two primary research objectives. First, we offer a comprehensive research model aimed both at coalescing existing research on post-adoptive IT use behaviors and at directing future research on those factors that influence users to (continuously) exploit and extend the functionality built into IT applications. Second, in developing this comprehensive research model, we provide a window (for researchers across a variety of scientific disciplines interested in technology management) into the rich body of research regarding IT adoption, use, and diffusion. Finally, we discuss implications and recommend guidelines for research and practice.

Keywords: IT adoption, IT use, post-adoptive behavior, IT value

ISRL Categories: AA01, GB01, GB03
A Comprehensive Review and Conceptualization of the
Post-Adoptive Behaviors Associated with IT Applications

Organizations have made huge investments in information technology (IT) over
the last twenty-five years, resulting in many, if not most, intra-organizational work
systems being IT-enabled. Further, many, if not most, organizations increasingly
depend on IT-enabled inter-organizational value chains as the backbone of their
commerce with both clients and customers (Davenport 1998; Mabert, Soni, and
Venkataramanan 2000, 2001). However, existing evidence (Davenport 1998; Lyytinen
and Hirschheim 1987; Mabert et al. 2001; Osterland 2000; Rigby, Reichheld, and
Schefter 2002; Ross and Weill 2002) strongly suggests that organizations underutilize
the functional potential of this mass of installed IT applications (i.e., in a majority of IT-
enabled work systems, users employ quite narrow feature breadths, operate at low
levels of feature use, and rarely initiate technology- or task-related extensions of the
available features). For example, Iivari (1996, p. 94) reports that one year after
implementation, approximately 5% of CASE tools are widely used, 25% are used by a
single group, and about 70% are not used. Organizations may achieve considerable
economic benefits by successfully inducing and enabling users to enrich their
(appropriate) use of already-installed IT-enabled work systems. In other words,
organizations need to focus their attention on encouraging and facilitating the IT-related
post-adoptive behaviors of their members.

The overarching goals of this paper are to conceptualize the post-adoptive
behavior construct (at an individual level of analysis), to understand and to explain the
underlying factors that influence post-adoptive behavior, and to situate these factors
within a nomological net to facilitate future research in this domain. To guide this effort,
we focus on the overarching research question: What influences users of installed IT applications to continuously exploit and extend the functionality built into these technologies? As will be seen, our review and analysis of what is currently known about post-adoptive behavior produced a two-level conceptualization of post-adoptive IT behaviors: one level representing individual cognitions regarding post-adoptive behavior and the other level representing the organizational context in which these individual cognitions are situated. The subsequent discussion of this two-level conceptualization and its implications provides direction for future research on post-adoptive behaviors.

We organize the remainder of the paper as follows. First, we present a view of post-adoptive behavior (at the individual level of analysis) within the larger context of IT adoption and use. Then, we develop the two-level conceptualization of post-adoptive behavior. Finally, we conclude with implications of this conceptualization for future research.

THE PHENOMENON OF POST-ADOPTIVE BEHAVIOR

The research stream examining the adoption and use of new IT has evolved into one of the richest and most mature research streams in the information systems (IS) field (Hu et al. 1999; Venkatesh et al. 2003). In order to understand what this body of research has discovered regarding post-adoptive behavior, we reviewed relevant research investigating adoptive and post-adoptive behavior (defined broadly as use beyond initial acceptance) at the individual level of analysis. From this review, we identified three major shortcomings of previous work.

First, although prior researchers have examined individual post-adoptive behavior in a variety of technology contexts (see Table 1), for the most part,
researchers have examined these technologies as a whole (i.e., as a ‘black box’) rather than focusing on the specific feature sets that comprise each application’s functionality. Because more productive use of information technology typically occurs as more functions of the technology are used, Trice and Treacy (1988) suggest that when researchers apply theories to predict IT use they should work at a ‘feature’ level of analysis. In our review, we found five studies which examined post-adoptive behavior at this feature level of analysis (Bhattacherjee 1998; Ginzberg 1981; Hiltz and Turoff 1981; Kay and Thomas 1995; Straub, Limayem, and Karahanna-Evaristo 1995). In each of these studies, researchers found variation in the number of technology features used by the individuals they studied. In addition, two studies found that feature selection and use varied over time. For example, Kay and Thomas (1995) found that over a three-year period, users of a Unix-based text editor (sam) adopted an increasing number of commands as their use became more sophisticated. In this study, the later-adopted features tended to be more complex and powerful than early-adopted features. Hiltz and Turoff (1981) studied individual use of an electronic information exchange system for three and one-half years and found that the number of features considered “extremely valuable” or “fairly useful” increased corresponding to length of time on the system. These results imply that by examining use of technology as a whole, researchers may be overlooking important -- in our view, the most important -- aspects of individual post-adoptive behavior. Recently, other scholars have also noticed this failing (DeSanctis and Poole 1994; Griffith 1999). In our proposed reconceptualization of post-adoptive behaviors, we recommend that post-adoptive research incorporate a feature level of analysis.
Second, previous researchers have tended to employ very simplistic measures of use. Table 2 contains a summary of use measures employed by post-adoptive researchers. As can be seen, in many cases, researchers have conceptualized or measured use as frequency or length of use. While these two measures (frequency and length of use) represent relatively “popular” proxies of use behaviors, we believe that more robust measures need to be developed (i.e., measures that allow researchers to capture different levels and patterns of use). In our proposed reconceptualization of post-adoptive behaviors, we address this shortcoming by suggesting that post-adoptive behavior is a multi-dimensional construct representing the many feature adoption decisions, feature use behaviors, and feature extension behaviors undertaken by the individual user.

Third, the majority of empirical studies either only examine IT application use immediately after adoption or do not control for a user’s prior history of using the focal, or a similar, IT application. The examples in Table 3 illustrate the length of time after adoption typically studied by researchers who examine IT use behaviors. As indicated, only nine studies explicitly indicate that the time after adoption is greater than one year. In addition, as shown in Table 4, only eight studies have considered the direct impact of prior use history on post-adoptive behaviors. Research directly incorporating prior use behaviors has observed that: computer experience (measured as extent of experience
using various types of applications and systems) predicts computer usage (Igbaria 1990, 1993; Igbaria, Guimaraes, and Davis 1995; Igbaria, Parasuraman, and Baroudi 1996); personal computer (PC) experience (measured as length of time using PC and overall rating of PC skills) directly and indirectly predicts PC use (measured as intensity, frequency, and diversity of use) (Thompson, Higgins, and Howell 1994); prior use of email (measured as length of use in months) predicts the extent to which email was used to communicate regarding work tasks (Kettinger and Grover 1997); and system use at time-one (measured as frequency of use (Venkatesh, Morris, and Ackerman 2000) and actual use (Venkatesh, Speier, and Morris 2002)) predicts system use at time-two (Venkatesh et al. 2000; Venkatesh et al. 2002). Interestingly, in the latter two studies, prior use was the best and only significant predictor of later use even though behavioral intention was also included in the analysis model (Venkatesh et al. 2000; Venkatesh et al. 2002). In our reconceptualization of post-adoptive behaviors, we propose that individual use history is a critically important predictor of post-adoptive behaviors.

In summary, despite more than twenty years of research examining IT adoption and use, we believe our collective understanding of post-adoptive behavior is at an early stage of development. Further, the three shortcomings just identified resonate through the existing literature and impede the intellectual development of the post-
adoptive behavior construct. Because of these shortcomings, prior research on post-adoptive IT behavior has, for the most part, inhibited penetrating examinations of how individuals selectively adopt and apply, and then exploit and extend the feature sets of IT applications introduced to enable organizational work systems. Recognition of these three deficiencies has greatly influenced the lens applied here in developing a fresh conceptualization of post-adoptive behavior.

A Definition of Post-Adoptive Behavior

Previous researchers have tended to define post-adoptive behavior very simply as ‘continued use’ and have generally (explicitly or implicitly) conceptualized that the set of factors that lead to initial acceptance and use of a technology will impact/direct its continued use (Bhattacherjee 2001; Kettinger and Grover 1997; Thompson et al. 1994; Venkatesh et al. 2000; Venkatesh et al. 2003). To the extent that limited windows of opportunity exist for users to create their initial conceptualizations of new technologies and that individuals resist changing these initial conceptualizations (Tyre and Orlikowski 1994), we agree that the cumulative tradition of research on technology acceptance and initial use should be used to enrich our understanding of individual post-adoptive behaviors. However, our purpose is to reconceptualize the post-adoptive behavior construct and, specifically, to move beyond the initial or early use post-adoptive context. Therefore, we define post-adoptive behavior as the myriad feature adoption decisions, feature use behaviors, and feature extension behaviors made by an individual user after an IT application has been installed, made accessible to the user, and applied by the user within his/her work activities. Because of the path-dependent nature of IT adoption and use processes in general (Gersick 1991; Rogers 1995) -- and post-adoptive IT
behaviors in particular -- post-adoptive behavior must be framed within the larger context of IT adoption and use. In this section, we present key concepts from the IT adoption and use literature relevant to our reconceptualization of post-adoptive behavior.

**IT Adoption and Use**

Most researchers use stage models to represent adoption and diffusion processes associated with IT applications (c.f., Cooper and Zmud 1990; Kwon and Zmud 1987; Rogers 1995). Typically, these researchers identify three adoption stages: pre-adoption activities, the adoption decision, and post-adoption activities (Rogers 1995). However, studies of IT application adoption and use behaviors typically do not represent the reality that all IT applications consist of a hierarchy of subsystems, whose functionality can be (but rarely is) abstracted to the feature level.

A technology’s features are defined as the building blocks or components of the technology (Griffith 1999; Griffith and Northcraft 1994). Some of these features reflect the core of the technology by collectively representing the identity or purpose of the technology. Other, more tangential features, however, are not defining components and their use may be optional (DeSanctis and Poole 1994; Griffith 1999). Features may also be concrete or abstract in terms of the difficulty in describing them. Concrete features can be described in a direct, specific manner as opposed to abstract features, which can only be described more indirectly and/or generally (Griffith 1999).

Previous literature postulates two approaches to conceptualizing features (DeSanctis and Poole 1994; Griffith 1999; Orlikowski 2000). The appropriation conceptualization focuses on the structures inherently defined by a technology’s
features and examines how users appropriate these structures (DeSanctis and Poole 1994; Orlikowski 2000). A second approach, the emergent conceptualization, focuses instead on the enactment by the user of technology structures through the user’s recurrent interactions with a technology (Griffith 1999; Orlikowski 2000). In practice, both perspectives likely operate simultaneously, with the relative influence of each perspective varying for different individuals in similar situations and for the same individual at different points in time. Our conceptualization of post-adoptive behavior incorporates both perspectives.

Figure 1 presents a three-stage model, which incorporates a feature-centric view of technology adoption and use at the individual level of analysis. Stage one reflects an organization’s decision to adopt a technology. This decision might be voluntary or mandatory, with a mandatory decision reflecting situations where regulators, competitors, and/or partners induce the organization to adopt a technology and to ‘force’ organization members to apply the technology to accomplish work tasks and work processes (Hartwick and Barki 1994). At some point in time after the organization has adopted (and installed) the IT application, stage two occurs when intended (as well as, perhaps, unintended) users make individual decisions to adopt the technology (Leonard-Barton and Deschamps 1988). This “secondary” adoption decision may also occur as a voluntary or mandatory decision. A mandatory decision reflects situations where the organization formally embeds the IT application within the work system and hence the user must adopt the application to complete his/her work assignments. The

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1Some researchers have applied the terms discretionary/non-discretionary use (c.f., Howard and Mendelow 1991) to represent the same idea represented by our use of the terms voluntary/mandatory use.
secondary adoption reflects an explicit commitment by an individual to use a technology; however, by itself, secondary adoption does not represent usage behaviors.

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Insert Figure 1 Here
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After an individual commits to adopt the IT application, stage three occurs when an individual user adopts, uses, and/or extends one or more of the application's features. Feature adoption decisions may occur voluntarily or as the result of an organizational mandate, with a mandatory decision reflecting situations where the organization requires the individual to use one or more specific features to accomplish an assigned work task. Typically, however, most IT applications have many more features than those mandated for work accomplishment. Even when an organization mandates IT application adoption, normally only a few of these feature adoption decisions are mandated. Once an individual commits himself/herself to using a specific feature, their use of that feature commences. Finally, individuals may discover new uses for an existing feature or suggest new features to add to the IT application, thereby engaging in the behaviors we define as feature extension. Feature extension may result from an individual’s use of and experimentation with one or more features, or feature extension may occur when a user, not aware of the “limitations” of a feature, employs the feature in a new and innovative manner (Griffith 1999). By definition, feature extensions are always voluntary. In our conceptualization, then, feature adoption, use, and extension all fall within the realm of post-adoptive behaviors.

2In general, we believe that feature extensions are always voluntary; however, we recognize that after one individual’s voluntary feature extension, the organization may realize the value of the extension and subsequently mandate use of the extension for all other individual users. In such situations, we
While the stage-models often applied to characterize IT application adoption and use phenomena would generally suggest that feature adoption, use, and extension occur in that order, we posit that these sub-stages may occur in any order given the ongoing nature of post-adoptive behavior. For example, a user may experiment with a feature (i.e., use it) as a trial before committing to use (i.e., adopt) the feature. Or, as noted previously, a user may ‘accidentally’ extend a feature immediately after the feature adoption decision.

As described above, post-adoptive behaviors might be voluntary or mandatory. While the majority of the prior IT adoption and use literature has focused on voluntary use contexts, the conceptualization developed here applies to both of these contexts. Even when organizations mandate the use of an IT application, individual users have considerable discretion in their use behaviors:

“Mandatory use is also under one’s control ... Mandatory users can also choose the extent to which they will use the system. For example, some users will defy their superiors and not use the system at all. Others will use the system selectively, using it when they personally feel it is effective or when they think they are being monitored. And, of course, there will be many who will use the system all the time.” (Hartwick and Barki 1994, p. 454)

From a feature-centric view (as introduced earlier), the individuals mandated to use an IT application might find that their use of many, if not most, of the IT application’s features are in fact voluntary. Even with mandated features, distinct levels of feature use typically exist, with higher levels of use being voluntary rather than mandatory (Saga and Zmud 1994). As a consequence, although post-adoptive behavior can reflect
situations of both voluntary and mandatory behaviors, post-adoptive behavior is largely voluntary phenomena by nature.

Post-Adoptive Behavior

The IS and consumer behavior literatures make empirically founded distinctions between pre-adoption and post-adoption user beliefs and behaviors (Agarwal and Karahanna 2000; Karahanna, Straub, and Chervany 1999; Oliver 1980). Both literatures posit that an individual’s perceptions, attitudes, and needs with respect to use after an IT application (product) has been adopted (purchased) may differ from their original state prior to adoption (purchase) as a result of IT application (product) use experience. Further, the IS literature argues that political and learning models better explain post-adoptive behaviors, whereas rational task-technology fit models better explain pre-adopter and adoption behaviors (Cooper and Zmud 1989, 1990; Kling and Iacono 1984; Markus 1983).

We defined post-adoptive behavior to include an individual user’s decisions and actions regarding IT application feature adoption, use, and extension. Typically, post-adoptive behaviors are framed within an individual learning context, with post-adoptive behaviors increasing with an individual’s greater exposure to an IT application. In reality, post-adoptive behaviors both intensify or diminish over time, as the various features of an IT application are resisted, treated with indifference, used in a limited fashion, routinized within on-going work activities, championed, or extended (Hartwick and Barki 1994; Thompson, Higgins, and Howell 1991; Thompson et al. 1994). Individuals may actively or passively resist post-adoptive behavior for a variety of reasons (the
technology “just gets in the way,” “is too difficult to learn,” or may represent a personal loss of prestige or of power (Markus 1983)).

On the other hand, after an individual commits herself/himself to using an IT application’s features within her/his work context, such usage, over time, imprints these feature-use behaviors within the cognitive and organizational scripts that direct the individual (or, the individual’s work unit) in task accomplishment (Bargh 1989; Logan 1989; Louis and Sutton 1991). Accordingly, much post-adoptive behavior, over time, likely reflects a habitualization or automaticity of action where the decision to use a feature occurs more or less automatically via a subconscious response to a work situation (Bargh 1989, 1994; Eagly and Chaiken 1993; Limayem, Hirt, and Chin 2001; Logan 1989; Ouellette and Wood 1998; Thompson et al. 1994; Venkatesh et al. 2000).

In some mandatory use environments, such routinized behaviors may develop through the “mindless” following of policy, procedures, methodologies, or other codified, organizational scripts (Langer, Blank, and Chanowitz 1978). In voluntary and most mandatory use environments, however, such routinized behaviors instead reflect a series of active decision processes in which selected features were adopted, applied and, eventually, scripted (Bargh 1989, 1994; Langer et al. 1978; Langer and Piper 1987; Logan 1989; Louis and Sutton 1991; Ouellette and Wood 1998).

Occasionally, individuals engage in post-adoptive feature extension behavior. Here, one or more features have been so richly infused within the work context that an individual recognizes benefits of the IT application that extend beyond those envisioned by the application’s developers and/or implementers (Cooper and Zmud 1990; Kwon and Zmud 1987; Morrison, Roberts, and von Hippel 2000; Saga and Zmud 1994). Or,
not knowing the normatively defined feature limitations of an IT application, a user may
make sense of the IT application by acknowledging or discovering one or more features
in a manner that extends those features beyond the expectations of the application’s
designers (Griffith 1999). Thus users discover new uses for a feature (or, more likely, for
a set of features) and suggest feature extensions (e.g., enhancements of existing
features or development of new features) (Morrison et al. 2000).

CONCEPTUAL MODEL OF POST-ADOPTIVE BEHAVIOR

The developed conceptualization of post-adoptive behavior involves two levels of
analysis: one operates at the level of an individual’s cognitions regarding feature
 adoption, use, and extension; and, the other operates at the level of the organizational
context within which these individual cognitions are situated. By modeling individual
cognition and organizational action separately but interdependently, the exercise of
accommodating the multiple threads of behavior involved becomes conceptually less
complex.

Central to our conceptualization is the position, raised earlier, that post-adoptive
behaviors tend to become habitualized, with time, unless interventions occur to disrupt
the formation of these deep, non-reflective mental scripts. As shown in Figure 2, such
interventions occur during a period of ‘substantive technology use.’ We define
substantive technology use as a state in which an individual attentively and reflectively
engages with one or more features of an IT application. Interventions -- individual
learning, technology changes, work task/process changes, and/or work system social
structure changes -- trigger these substantive technology use periods. Individual
learning refers to the knowledge and understandings an individual gains about a
technology (i.e., changes in individual cognitions) through self-learning, through the
dynamic interaction between individual cognition and use behaviors, and through the
dynamic interactions between individual cognition and organizational actions (e.g.,
formal or informal training, peer-group or co-worker interaction, technical support, etc.).
Technology, work task/process, and social system changes may reflect purposive
change initiatives to compensate for misalignments or may emerge from ongoing
organizational action. In either case, these changes result in the mutual adaptation of
organizational structures, task structures, and technology structures and may lead to
unintended consequences (DeSanctis and Poole 1994; Leonard-Barton 1995;

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Insert Figure 2 Here
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The theory of punctuated equilibrium (Gersick 1991) provides the basis for the
just-described dynamic posited as the basis of post-adoptive behaviors. Three concepts
from punctuated equilibrium theory are particularly important: deep structures,
equilibrium periods, and revolutionary periods. Deep structures refer to a “… set of
fundamental ‘choices’ a system has made of (1) the basic parts into which its units will
be organized and (2) the basic activity patterns that will maintain its existence” (Gersick
1991, p. 14). Deep structures (i.e., deep, less-reflective mental scripts) remain relatively
stable because of path dependency (i.e., choices made in the past limit future options)
and feedback loops. This stability contributes to equilibrium periods, where patterns of
activity essentially stay the same. Changes or adjustments may occur within the
system, but if deep structures are not altered the organization remains in equilibrium.
Revolutionary periods, however, occur when organizations dismantle and reconstruct deep structures (Gersick 1991; Tushman and Romanelli 1985). Support for this view within a technology context (i.e., that technology use often reflects patterns of routine use punctuated by episodes of change activity) has been observed (Lassila and Branchaud 1999; Majchrzak et al. 2000; Tyre and Orlikowski 1994).

In addition to punctuated equilibrium theory, the post-adoptive behavior dynamic illustrated in Figure 2 draws from previous work in psychology. Psychologists argue that cognitive scripts (derived from prior cognitions) drive habitualized individual behavior (Bargh 1989, 1994; Logan 1989; Ouellette and Wood 1998; Triandis 1971, 1980).

Individuals may alter habitual behavior in situations in which the individual deliberates her/his actions (Louis and Sutton 1991). Such deliberations lead to changes in cognitions which in turn lead to novel behaviors (Ajzen 2002; Louis and Sutton 1991).

Over time, the new behaviors become routine and the individual returns to a new state of habitual behavior (Bargh 1989, 1994). If individuals do not encounter situations which induce them to significantly alter their cognitions, the inherent cognitive structure will continually reinforce these habitual behaviors (Bargh 1989; Logan 1989; Louis and Sutton 1991; Ouellette and Wood 1998).

Figure 2 depicts that individuals bring their prior use cognitions, based on prior experiences with the focal technology (as well as related technologies), into a period of substantive technology use. Often, these prior use cognitions have evolved into cognitive scripts that have, to varying degrees, habitualized these technology use behaviors. Habitualized post-adoptive behavior represents use of technology features in an equilibrium state (i.e., non-reflective) based on deep structure. During a period of
substantive use, an individual’s use cognitions change (either incrementally or more substantially) producing a new set of cognitions that result in new use behaviors. Eventually, these new behaviors become routinized and the individual returns to a state of habitualized post-adoptive behavior. Unless substantive changes occur within the individual’s use cognitions, the deep structures inherent in them will be sustained, thus reinforcing the routinization (i.e., habitualization) of post-adoptive behaviors.

The Individual Cognition Model of Post-Adoptive Behavior

The individual cognition model (presented as Figure 3) draws from the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al. 2003), a theory which integrates previous research applying eight different acceptance and use theories, and from expectancy-confirmation theory (ECT) (Oliver 1980), which was recently introduced and validated within an IT context (Bhattacherjee 2001). The underlying premise of UTAUT (when applied to post-adoptive behavior) suggests that given a particular time and context, an individual’s intentions to engage in post-adoptive behavior are the best predictors of that individual’s actual post-adoptive behaviors. An individual’s collective cognitions (i.e., beliefs and knowledge) about the feature to be used determine the individual’s post-adoptive intentions. In the post-adoptive behavior context, these cognitions are largely reflective of prior (long-term as well as more recent) use experiences (Venkatesh et al. 2003). According to ECT (in the context of post-adoptive behavior), an individual forms expectations regarding an IT application feature as she/he learns about the feature. Upon the adoption and use of the feature, 

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3 The collective results of research which has applied eight different theories to explain both intention to use and actual use behavior was reviewed and incorporated into the development of UTAUT. We refer the reader Venkatesh et al (2003) for a more comprehensive discussion of these other theories.
these expectations are confirmed (or disconfirmed) resulting in a level of satisfaction with the feature and a refined expectation (i.e., cognition) regarding future use of the feature. Over time these evolving satisfaction levels and use expectations determine continuance intentions and, hence, post-adoptive behaviors (Bhattacherjee 2001).

The individual cognition model of post-adoptive behavior largely follows UTAUT and involves the sequential set of relationships posited to exist amongst cognition, post-adoptive intention, and post-adoptive behavior; however, we propose three modifications to UTAUT. First, in accordance with ECT, we propose that confirmation plays a significant role in the feedback loop between behavior and cognitions (Bhattacherjee 2001; Oliver 1980). Thus, the individual cognition model proposes a sequential set of relationships among cognition, post-adoptive intention, post-adoptive behavior, confirmation and, then again, cognition. As a second addition to UTAUT, based on evidence from previous psychology and IS research, we suggest that the impact of use history (i.e., past behavior) on post-adoptive behavior has been overlooked and should be included in models of post-adoptive behavior (Conner and Armitage 1998; Igbaria 1990, 1993; Igbaria et al. 1995; Igbaria et al. 1996; Kettinger and Grover 1997; Ouellette and Wood 1998; Thompson et al. 1994; Venkatesh et al. 2000; Venkatesh et al. 2002). Finally, as argued earlier, we recognize that post-adoptive behavior becomes habitual. As a result, future behaviors often occur in the absence of conscious thought. Figure 3 depicts this non-reflective post-adoptive behavior with dashed line relationships.
In this conceptualization, instances of post-adoptive behavior relate to single IT features. An individual develops cognitions about an IT feature when she/he is exposed to the feature. These cognitions, along with the individual's use history, induce the individual to develop intentions about adopting, using, or extending the feature. Individuals act on their intentions to adopt, use, or extend the feature in their work. An adoption, use, or extension experience provides the opportunity to confirm (disconfirm) the earlier cognitions regarding the feature; if the confirmation (disconfirmation) is sufficiently strong, the individual modifies earlier cognitions. An individual's post-adoptive behavior consists of the entire collection of post-adoptive behavior instances (i.e., post-adoptive behavior represents the set of features adopted, used, and extended by the individual). Thus, each individual has a unique pattern of post-adoptive behavior defined by the collection of technology features adopted, used, and extended. The model in Figure 3 applies both to explaining a single instance of post-adoptive behavior (e.g., cognitions, intentions, behavior, confirmation, and use history relative to a specific IT application feature) and to understanding individual post-adoptive behavior as a collection of technology features (e.g., the rich portfolio of cognitions, intentions, behavior, confirmation, and use history relative to an IT application).

The model presented in Figure 3 contains two distinctly different feedback loops relative to post-adoptive behavior. One loop (characterized by reflective thought represented by the solid line relationships in Figure 3) contains the series of relationships from individual cognitions to confirmation and back. This feedback loop is founded in reflexive consideration in which the user mindfully considers and processes surrounding informational cues regarding IT application features (Langer 1989; Langer
et al. 1978; Langer and Piper 1987; Louis and Sutton 1991). If the newly developed
cognitions are significantly favorable, the individual develops post-adoptive intentions
and elects to engage in post-adoptive behavior. Subsequent to the behavior, the
individual again engages in reflection (i.e., confirmation/disconfirmation) regarding the
post-adoptive behavior experience and adjusts cognitions accordingly. Such series of
active cognitive processing play an important role during periods of substantive
technology use.

The second feedback loop (characterized by non-reflective use and represented
by the dashed line relationships in Figure 3) consists of the direct relationships between
use history and post-adoptive behavior. In this loop, reflective consideration does not
drive post-adoptive behavior. Instead, habitual behavior (i.e., captured in use history)
determines post-adoptive behavior. In this mode of IT application use, individuals use
only those IT application features that they have previously used (Bargh 1989, 1994;
Conner and Armitage 1998; Logan 1989; Ouellette and Wood 1998). This subconscious
feedback loop represents the behaviors that characterize use behaviors prior to and
after a period of substantive technology use. And, in the absence of a period of
substantive technology use, this non-reflective loop becomes the primary driver of an
individual’s post adoptive behavior. In the remainder of this section, we discuss the
theoretical/empirical logic behind the individual cognition model of post-adoptive
behavior and develop associated research propositions.

Cognitions and Individual Differences

Individual cognition can be broken into two domains: cognitive process and
cognitive content (Blumenthal 1977). Cognitive process involves both the mental
processes used in perceiving, learning, remembering, thinking, and understanding and
the mental activity of applying those processes (Ashcraft 1998). Cognitive content
consists of the collection of mental structures formed as a result of cognitive processing
-- we refer to instances of cognitive content as individual “cognitions.”

When initially made aware of a new IT application feature, an individual begins to
construct a set of mental notions (cognitions) regarding the feature. In the absence of
congruent experiences with the feature, the individual will form an initial set of beliefs
about the feature (Price 1967; Prichard 1967; Yolton 1965), and this initial set of beliefs
frames both the evolution of the individual’s cognitions regarding the technology feature
and the individual’s initial experiences with the feature (Churchman 1971). Because
experiences are fabricated from existing cognitions, these initial beliefs form the basis of
knowledge (Locke 1965). Individuals confirm/disconfirm and modify these beliefs about
the application feature as they gain experience with the feature. Learning about and
understanding the IT application feature occurs through this confirmation
(disconfirmation) process. An individual’s post-adoptive cognitions about the IT
application feature exist initially as a set of beliefs, then become a mix of beliefs and
knowledge, and finally represent mostly knowledge.

But what exactly is the nature of these cognitions with regard to post-adoptive
behavior? Previous research (see Table 5) examines numerous cognitions believed to
play a role in post-adoptive behavior. Recently, researchers synthesized and integrated
these cognitions into a single set of cognitions which predict post-adoptive intentions
(Venkatesh et al. 2003): performance expectancy, effort expectancy, social influence,
and facilitating conditions. In the current study, we draw from the logical reasoning of UTAUT and suggest these four cognitions as the instrumental cognitions most likely to influence post-adoptive intentions. UTAUT proposes various individual differences as moderator of the relationship between cognition and intention (Venkatesh et al. 2003).

Table 6 contains an overview of the many individual difference factors considered by IT adoption/use researchers. Following the logic of UTAUT, the individual cognition model includes cognitions as a predictor of post-adoptive intentions and individual differences as a moderator of this relationship. Thus, we offer the following propositions:

**Proposition 1**
An individual with current favorable cognitions regarding post-adoptive behavior will be more likely to sustain or increase post-adoptive intentions than would an individual lacking such cognitions.

**Proposition 2**
Individual differences will moderate the relationship between cognitions and post-adoptive intentions.

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*Post-Adoptive Intentions*

In the individual cognition model, post-adoptive intention refers to an individual's intent to adopt, extend, or continue/discontinue or increase/decrease the use of an IT application feature. A consistent finding of previous research reflects the strong

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4Venkatesh et al (2003) define facilitating conditions as cognitions regarding the technical and organizational infrastructure which supports system use.

5UTAUT proposes a direct relationship (moderated by age and experience) between the facilitating conditions cognition and use. Because we have grouped all four cognitions proposed by Venkatesh et al (2003) into a single construct, we have not modeled this relationship in Figure 3.
association between intention to use and use behavior (Davis, Bagozzi, and Warshaw 1989; Szajna 1996; Taylor and Todd 1995b; Venkatesh et al. 2000; Venkatesh et al. 2003). This fundamental observation leads to a further proposition:

**Proposition 3**
An individual’s post-adoptive intentions will positively influence the individual’s post-adoptive behaviors.

**Confirmation**

We define confirmation (disconfirmation) as the extent to which post-adoptive behavior substantiates (undermines) prior-held cognitions (i.e., cognitions developed prior to a post-adoptive behavior episode). Drawing from ECT, we postulate that during a substantive period of technology use, an individual making active, rather than habitual, use of an IT application feature implicitly triggers confirmation (disconfirmation) of the cognitions that existed prior to the active use experience (Bhattacherjee 2001). Thus, confirmation occurs as an evaluative cognitive process that transpires when an individual contrasts the outcomes of a post-adoptive behavior episode with those expected from pre-episode cognitions. If the confirmation (disconfirmation) outcome is sufficiently strong, the individual modifies prior-held cognitions accordingly. This leads to the following proposition:

**Proposition 4**
Post-adoptive behaviors that confirm (disconfirm) prior-held cognitions will reinforce (destabilize) these cognitions.

**Use History**

As discussed earlier, a key facet of post-adoptive behavior is the strong influence of an individual’s IT application use history on post-adoptive intentions and on post-adoptive behavior (encompassing both reflective thought and the deep mental scripting that results in and from habitual use). We define an individual’s use history as the
collective, systematic account of the individual’s prior use of an IT application. Use
history generally produces a tendency to act in a particular manner given a particular
context. Regarding IT post-adoptive behavior, such behavioral tendencies develop as
part of the repetition and practice of applying the same IT application feature to address
a particular work task (Eagly and Chaiken 1993; Ouellette and Wood 1998; Triandis
1971, 1980). The first few times that an individual uses an IT feature, she/he engages in
the cognitive processing that influences post-adoptive intentions and, hence, post-
adoptive behavior; however, through repetition, this reflective cognitive processing
dissipates and becomes automatic and routinized (Bargh 1989, 1994; Logan 1989;
Ouellette and Wood 1998).
Psychologists have been studying the role of habit in individual behavior for
many years (c.f., Bargh 1989; Eagly and Chaiken 1993; James 1890; Ouellette and
review of previous research on the role of habit (defined as frequency of performing the
behavior) in predicting future intentions and behavior. In this review, the authors find
substantial empirical evidence to support a direct relationship between past behavior
and intentions regarding future behavior. In addition, in stable contexts (i.e., “behavioral
domains conducive to habit formation”), past behavior has a direct effect on future
behavior over and above the effect of intention (Ouellette and Wood 1998). Ouellette
and Wood argue that due to habit formation, individuals do not engage in active
deliberation regarding behavior or conscious decision-making; thus, past behavior (or
habit) becomes the best predictor of future behavior. In another review of research
applying the theory of planned behavior (TPB), Connor and Armitage (1998) also find
empirical evidence of a direct relationship between past behavior and intentions, as well as between past behavior and future behavior and propose that future research applying TPB in the context of frequently performed behaviors should include past behavior as a predictor of both intention and of future behavior. As mentioned previously, recently IS researchers have also found that past use behavior and experience are significant predictors of later use behavior (Igbaria 1990, 1993; Igbaria et al. 1995; Igbaria et al. 1996; Kettinger and Grover 1997; Thompson et al. 1994; Venkatesh et al. 2000; Venkatesh et al. 2002). Thus, we propose:

Proposition 5 An individual’s use history will influence the individual’s current post-adoptive behavior.

And, in a tautological feedback effect, an individual’s post-adoptive behaviors are obviously incorporated within the individual’s use history on an on-going basis. At this point, we return again to our discussion of the two feedback loops represented in Figure 3. Ouellette and Wood (1998, p. 66) indicate that “when behavior is a function of conscious decision making and deliberation, intentions directly predict behavior performance, and the effects of past behavior are likely to be mediated through conscious intents.” Louis and Sutton (1991) suggest that conscious processing occurs based on three types of stimuli: when a situation is novel; when an individual senses a discrepancy between reality and expectation; and when individuals are induced to deliberate regarding their behavior. In these situations, as the individual

Ajzen (2002) and his colleagues (Ajzen and Fishbein 2000; Bamberg, Ajzen, and Schmidt 2003) discuss, discount, and dismiss previous work that suggests habit should be added to TPB. “...[T]he observed correlation between frequency of prior and later behavior is no more (or less) than an indication that the behavior in question is stable over time...Thus, behavioral stability may be attributable not to habituation but to the influence of cognitive and motivational factors that remain unchanged and are present every time the behavior is observed...” (Ajzen 2002, p. 110). We echo Ajzen’s (2002) call for future research which establishes a measure of habit that is independent of prior behavior frequency.
deliberates her/his intentions, both cognitions and use history will influence these deliberations. Except in cases when new intentions alter or change behavior (e.g., to overcome or change a previous use habit), we expect that use history will have a positive relationship with intentions (Conner and Armitage 1998; Louis and Sutton 1991; Ouellette and Wood 1998). Therefore, we propose the following:

**Proposition 6** An individual’s use history will influence the individual’s current post-adoptive intentions.

When an individual engages in a state of habitual use (i.e., non-reflective use), the mechanics of use become second nature and more or less automatic (Bargh 1989, 1994; Bennett 1972; Conner and Armitage 1998; Logan 1989; Ouellette and Wood 1998). Therefore, an individual in a habitual state of post-adoptive behavior will likely not cognitively consider her/his behavioral intentions to determine post-adoptive behaviors. These observations have received empirical support from IS researchers. In separate studies examining post-adoptive behavior, tests of research models which included both intentions and past behavior as predictors of later behavior indicate that prior behavior was the only significant predictor of later behavior (Venkatesh et al. 2000; Venkatesh et al. 2002). Thus, we posit that individuals will rely on the scripted past behaviors embedded in their use history to determine future post-adoptive behaviors (see non-reflective feedback loop represented by dashed relationships in Figure 3).

Such habitualized behavior will likely continue until an intervention triggers a substantive technology use period and activates cognitive processing related to post-adoptive behavior (Louis and Sutton 1991).

As an example of such an intervention effect, consider a study in which researchers examined individual choice of travel mode among college students
(Bamberg et al. 2003). The researchers studied whether introduction of an intervention (i.e., a program to allow university students to use their student IDs as a “pre-paid” ticket for an unlimited number of bus rides during the semester) would increase the number of students who ride the bus to campus. The researchers found that prior to the intervention, past behavior (with intention) was a significant predictor of later behavior and contributed to additional explained variance (change in $R^2$ from 47% to 64%) in later behavior (i.e., past bus riding behavior predicted future bus riding behavior). However, after the intervention, although past behavior was a significant predictor of later behavior, past behavior did not contribute to additional explained variance (change in $R^2$ was negligible). This example lends support to our argument that during a habitual state of post-adoptive behavior, use history dominates the individual cognition model and that this habitual state can be interrupted by means of intervention. As a result, we propose:

**Proposition 7** When in a state of habitual post-adoptive behavior, an individual’s use history and post-adoptive behaviors will recursively reinforce each other until an intervention(s) prompts reflective cognitive processing related to post-adoptive behavior.

Support for such a proposition is provided by Tyre and Orlikowski (1994), who show that following relatively short “windows of opportunity” users discontinue making modifications to their IT application use patterns and their use stabilizes. In addition, they suggest that the windows of opportunity occur relatively seldom and that very little change in user adaptations to their initial use of an IT occur after the first window of opportunity. Other opportunities may occur following discrepant events in which users discover misalignments between their conceptualizations of the technology and their
use of the technology (Leonard-Barton 1988; Tyre and Orlikowski 1994). Although Tyre and Orlikowski conclude that discrepant events occur relatively infrequently, other researchers have found evidence that discrepant events may occur continuously over the post-adoption period and that individuals strive to correct the misalignments that arise based on the discrepant events (Lassila and Brancheau 1999; Majchrzak et al. 2000). In the next section, we describe an organizational action model of post-adoptive behavior that is useful in understanding how organizations may introduce discrepant events (or interventions) during the post-adoption period that induce users to engage in reflective post-adoptive behavior.

**Organizational Action Model of Post-Adoptive Behavior**

As argued in the previous section, in the absence of substantive technology use periods, post-adoptive behavior represented in the individual cognition model likely transitions to a state of stabilized cognition where habitual behavior (i.e., use history) largely determines an individual’s use of an IT application’s features (Bargh 1989, 1994; Conner and Armitage 1998; Edmondson, Bohmer, and Pisano 2001; Limayem et al. 2001; Logan 1989; Ouellette and Wood 1998; Venkatesh et al. 2000; Venkatesh et al. 2002). When these habitual use behaviors lead to satisfactory outcomes and when the work context is stable, such behaviors might very well be viewed as appropriate. Often, however, these two conditions do not jointly hold (Edmondson et al. 2001).

To modify individual cognitions and, hence, motivate an individual to engage in differentiated IT application feature adoption, use, and extension behaviors (i.e., post-adoptive behavior), organizations often introduce interventions to either challenge existing cognitions or to stimulate learning processes with respect to these cognitions.
In essence, such interventions induce, or perhaps mandate, the individual to apply unused features, to apply already-used features at higher levels of use, to discover new uses of existing features, or to identify the need to incorporate new features into the IT application.

Structuration theory (Giddens 1984) applied within a technological context (Orlikowski 1992) provides a basis for understanding the dynamic interactions that occur during substantive technology use periods. Human agents (i.e., individual users, peers, experts, and managers) initiate interventions to modify technology structures (applied feature sets of implemented IT applications) and organizational structures (i.e., task structures, work processes, social structures) during periods of substantive technology use as both objective and subjective aspects of social reality (Giddens 1979, 1984; Orlikowski 1992, 2000). Within this two-level conceptualization of post-adoptive behavior, the subjective aspects dominate at the individual cognition level while the objective aspects (i.e., interventions) dominate at the organizational action level. In other words, at the organizational action level, human agents either introduce interventions expected to have certain effects or engage in interactions that result in emergent interventions. However, at the individual cognition level, individual users will make sense of these interventions in idiosyncratic ways to enact the cognitions that determine post-adoptive behaviors (Orlikowski 1992, 2000; Orlikowski et al. 1995; Yates, Orlikowski, and Okamura 1999). These post-adoptive behaviors then determine - both immediately through the construction of new structural entities and in a more protracted fashion through the routinization of behaviors induced by the new structural
entities -- the constitution of organizational and technology structures (Orlikowski and Robey 1991).

Figure 4 presents the organizational action model of post-adoptive behavior, which situates an individual's use of an IT application's features within a complex set of organizational actions intended to promote episodes of substantive technology use. The logic that underlies the organizational action model of post-adoptive behavior begins with an observation of a work system outcome expectation gap (as perceived by a user, by a peer of the user, by an expert, or by a manager). This expectation gap represents the difference between desired and perceived work system outcomes. These expectation gaps might be performance-related, personal-related, or both, and, if sufficiently large, trigger a need to resolve the dissonance caused by the expectation-outcome conflict. To resolve expectation gaps, interventions are engendered that induce work system changes, which in turn directly influence work system outcomes. Work system outcomes, in turn, recursively influence both future desired and perceived work system outcomes.

Work System

The work system consists of the context within which the individual user performs work (Gibson, Ivancevich, and Donnelly 1994; Schippmann 1999). Thus, the work system includes organizational members, the work tasks undertaken by members, work processes, technologies that enable work tasks and processes, and social structures that direct organizational members both in their work-related behaviors and in their
interactions with each other. Social structures, thus, include performance-related (e.g., performance evaluation and feedback, promotion, merit pay, bonuses, etc.) and personal-related (social recognition, reputation, social interaction, etc.) incentives and disincentives (Ba, Stallaert, and Whinston 2001; Bhattacherjee 1998; Eisenhardt 1989; Howard and Mendelow 1991; Stajkovic and Luthans 2001) that prior research suggests are likely to influence individual IT use (Bhattacherjee 1998; Howard and Mendelow 1991). An organization’s members are obviously core elements of the work system, both in performing work-related roles and as users of work-enabling technologies. Most important, given that an organization’s members continuously interpret their work context (Brousseau 1983; Dunham, Aldag, and Brief 1977; Gibson et al. 1994; Orlikowski 2000), their learning processes become an especially critical subcomponent of the work system.

**Work System Outcomes**

Organizations and their members introduce new IT applications with the expectation that certain benefits will accrue as work system outcomes (Zuboff 1988). Although various types of work outcomes exist (Gibson et al. 1994), in the context of post-adoptive behavior we are concerned with work system outcomes that arise, either intentionally or unintentionally, as a result of using IT application features in the conduct of organizational work, such as performing a task in a more effective and/or efficient manner, enhancing an individual’s (or group’s) power through the control of a critical information resource, etc.
Post-Adoptive Interventions

Post-adoptive interventions, hereafter referred to as ‘interventions,’ consist of either purposeful actions directed at disrupting established patterns of technology use (or nonuse) (Orlikowski et al. 1995; Yates et al. 1999) and/or emergent outcomes that arise from users’ self reflections as well as users’ interactions with others, the technology, or work tasks/processes (Feldman 2000; Weick 1979a). Importantly, interventions trigger or activate periods of substantive technology use. As shown in Figure 4, these interventions are devised or emerge because (1) a gap in work system outcome expectations has become sufficiently large and (2) someone believes that this gap may potentially be resolved by disrupting current technology use behaviors (Edmondson et al. 2001; Feldman 2000; Gersick and Hackman 1990). Interventions may be aimed at promoting specific post-adoptive behaviors or may be more opportunistic in that the intent may simply be to create the potential for differentiated post-adoptive behaviors to emerge (Yates et al. 1999). We thus postulate:

Proposition 8  The greater the gaps in work system outcome expectations, the more likely interventions will be introduced (or emerge) to induce work system changes.

Further, while no assumptions are necessarily required regarding the level at which work system outcomes are conceptualized and measured, prior research demonstrates that the closer a work system outcome to the specific work tasks and processes directly facilitated by an IT application’s feature, the more likely the observable work system outcomes can be attributed to the use of the IT application feature (Goodhue 1995; Goodhue and Thompson 1995; McKersie and Walton 1991). This leads to the following proposition:
Proposition 9  The greater the likelihood that gaps in work system outcome expectations can be ameliorated through the use of enabling technologies, the more likely interventions will be introduced (or emerge) to induce work system changes.

Before an intervention can influence an individual user, the user must attend to and/or reflect upon the intervention (i.e., the intervention must first get the attention of the individual) (Yi and Davis 2003). Individuals may ignore or not recognize an intervention, even when the intervention targets them directly. “People find noninteresting those propositions that affirm their assumption ground (that’s obvious), that do not speak to their assumption ground (that’s irrelevant), or deny their assumption ground (that’s absurd)” (Weick 1979b, p. 51). Therefore, we propose:

Proposition 10  The greater the likelihood that individuals attend to an intervention, the more likely the intervention will induce work system changes (and, hence, work system outcomes).

Interventions, by interrupting (i.e., making changes to) the work system context, focuses users' attention (Weick 1995) on their cognitions regarding IT application features. Therefore, the salience to users (based on their own values, goals, and plans) of the work system changes likely induced by an intervention also play a critical role in influencing an individual's decisions to (or not to) respond to the intervention (Beach 1997). As a result, when individuals anticipate that interventions will result in work system changes aligned with their own values and preferences or will facilitate their personal goals and plans, the salience of those changes will likely motivate individuals to engage with, participate in, or heed the interventions and their outcomes (Beach 1997; March 1994). This leads to two related propositions:

Proposition 11  The greater the salience to individuals of the work system elements likely affected by an intervention, the more likely the intervention will induce work system changes.
Proposition 12 The greater the number of salient interventions introduced during a period of substantive technology use, the more likely it is that work system changes will occur.

The Nature of Post-Adoptive Interventions

During a period of substantive technology use, one or more interventions are initiated or emerge, which induce changes in the work system. For the sake of simplicity, we do not attempt to develop a complete taxonomy of possible interventions or to model the complex relationships that might exist between and among interventions and their outcomes. We leave such important but complex tasks for future research. Instead, we limit our focus to providing a conceptual framework (see Figure 5) for such future research by identifying the sources (the individual user, the user’s peers, experts, and managers) and targets (the user, the technology, work tasks and processes, and social structures) of these interventions. Note that each of the intervention sources may design and implement interventions aimed at each of the intervention targets.

We indicated previously that interventions have greater likelihood of inducing work system changes when targeted individuals recognize and reflect on the interventions. In addition, we proposed that the salience (from the perspective of the targeted individuals) of the work system elements associated with an intervention to be positively related to likelihood that work system changes will occur. A third important factor influencing the impact of interventions is the power of the intervention source, as the intervention source’s power plays a crucial role in whether or not an individual recognizes and responds to an intervention. Power is commonly defined as an
individual’s or collective’s ability to influence another individual or collective to think or to act (Frost 1987; Hall 1999). Furthermore, Emerson suggests that “the dependence of Actor A upon Actor B is 1) directly proportional to A’s motivational investment in goals mediated by B and 2) inversely proportional to the availability of these goals to A outside the A-B relationship” (Emerson 1962, p. 32). Thus, we propose:

**Proposition 13**  The greater the power of the intervention source in relation to targeted work system elements, the more likely it is that work system changes will occur.

In the remainder of this section, we discuss each of the intervention sources shown in Figure 5 and provide examples of possible interventions undertaken by these sources (summarized as Table 7).

**Users as Intervention Sources**

User-initiated interventions affect the individual's post-adoptive behaviors by influencing their interpretations of and interactions with work system elements (Orlikowski et al. 1995). One might argue that the interventions taken by individual users represent the primary operative link in explanations of post-adoptive behaviors. Before post-adoptive behavior can occur, individual users must not only understand how to use an IT application's features, but also how these features work in relationship to other work system elements (Swanson 1974). Thus, self-orchestrated learning about the IT application’s features, the potential use of those features, and the work system within which the IT application is situated constitute crucially important means by which individuals modify their use cognitions. Examples of such learning interventions
undertaken by an individual user include: taking advantage of formal or informal training opportunities (Fuerst and Cheney 1982), accessing external documentation (Brancheau and Wetherbe 1990), observing others (Bandura 1986; Gioia and Manz 1985), and experimenting with IT application features (DeSanctis and Poole 1994) and/or new approaches for handling work assignments (McKersie and Walton 1991). In the case of self-orchestrated learning, the target of the intervention is obviously the individual’s cognitions (i.e., knowledge and understanding) about the IT application and the work system.

User interventions can also directly target other elements of the work system (i.e., other users, the IT application, work tasks and processes, and social structures) through actions to modify or to influence the modification of one or more of these elements. Active participation (i.e., input into or influence regarding) in IT application or work task/process (re)design has been reported to affect subsequent use behaviors (Hartwick and Barki 1994; Igbaria and Guimaraes 1994; King and Rodriguez 1981; McKersie and Walton 1991). And, of course, users directly change work system elements by their choices regarding how best to carry out assigned tasks. Typically, such user-initiated interventions occur as new needs emerge over time (Morrison et al. 2000). Alternatively, users may modify their use of technology and/or the work system in ways that go against organizational intentions. For example, in many cities, police officers receive cellular phones for use in their patrol activities. However, in addition to using the cellular phones for official police business, officers alter their work routine to use the phones instead of their two-way radios -- thus avoiding recording devices used to monitor patrol activities and the sequence of decisions made by officers in the field.
Furthermore, as an extreme unintended intervention, some police officers use the cellular phone to avoid work altogether (Manning 1996)!

**Peers as Intervention Sources**

Individuals spend much of their organizational life interacting with peers, defined here to include co-workers from the same or different work units and workers in other organizations. Peer-induced interventions often target others' use cognitions via the informal work-related training and support (i.e., coaching, helping, etc.) that regularly occurs as a normal part of organizational life. Additionally, when peers display new post-adoptive behaviors, these behaviors often promote others to rethink the nature and role of technology within a work system. Such peer behaviors are particularly potent when they involve either shared work processes or shared technology platforms (Contractor, Seibold, and Heller 1996; Fulk 1993; Fulk, Schmitz, and Steinfield 1990; Kraut et al. 1998; Lucas and Spitler 1999; Markus 1990).

As with user-induced interventions, peer-induced interventions can also directly modify elements of the work system. Often, such modifications occur not through singular actions but rather through joint-actions with others, such as episodes of joint problem solving activity (DeSanctis and Poole 1994). Such episodes of joint interaction essentially result in the construction (or, evolution) of shared meaning regarding one or more work system elements (Burkhardt 1994; DeSanctis and Poole 1994; Fulk 1993; Fulk et al. 1990; Kim 1993; McKersie and Walton 1991; Prasad 1993).

**Experts as Intervention Sources**

Work and technology experts, including both internal and external professionals (i.e., consultants, contractors, or technologists in partner-firms) housed in central or
distributed work units, may have a strong influence on the work system. The most
obvious of these interventions occur through these professionals’ involvement in IT
application (Markus and Bjørn-Andersen 1987) or work system design, development,
implementation and support activities.

Experts target user learning though the delivery of formal/informal training and
end-user support (Nelson and Cheney 1987; Venkatesh and Speier 1999; Venkatesh et
al. 2002; Xia and Lee 2000). Alternatively, experts educate users through involvement
in strategic and tactical planning as well as coordination processes and informally
through day-to-day interactions (Boynton and Zmud 1987; Earl 1993). Experts target
other elements of the work system by taking direct actions in designing, building, or
modifying IT applications, associated work tasks/processes, and policies/procedures
associated with the work system (Yates et al. 1999). As with peer-induced interventions,
the expert-induced interventions that occur in the context of (work or IT) system design
and development efforts often involve collaborative efforts with users.

**Managers as Intervention Sources**

Direct supervisors, middle managers, and senior managers can exert profound
influences on post-adoptive behaviors by directly or indirectly targeting work system
elements. Typical manager-induced interventions include direct involvement with and
providing support (sponsorship, resources, associated social structures, etc.) for an IT
application (Igbaria and Iivari 1995) or an IT-enabled work system (Orlikowski 2000;
Yates et al. 1999). Such interventions strongly influence both the learning and actions of
affected individuals (users, their peers, and experts) through the images, descriptions,
rhetoric, and ideologies they represent and the institutional momentum produced
Prior research indicates that manager-initiated interventions are particularly important to organizational members disinclined toward technology use (Leonard-Barton and Deschamps 1988). Other research has investigated the impact of interventions in which managers themselves incorporate technology use within their personal behavioral routines (e.g., e-mail use) (Fulk et al. 1990; Schmitz and Fulk 1991). Incentive structure changes also serve, at times, as the target of manager interventions (Ba et al. 2001; Bhattacherjee 1998; Howard and Mendelow 1991; Stajkovic and Luthans 2001).

Managers may perform indirect interventions directed at all of the targets mentioned above. Indirect management interventions include sponsorship, championship, resource provision, directives, and mandates (Igbaria and Iivari 1995). Manager support in the form of encouragement, communicated support, and allocating resources has been found to positively influence technology use and infusion (Guimaraes and Igbaria 1997; Igbaria 1990, 1993; Igbaria and Guimaraes 1994; Igbaria et al. 1996). Finally, in contrast to other intervention sources, managers can target other intervention sources (i.e., managers often engage in actions to induce others to initiate interventions aimed at shaping work system changes).

**Synthesizing the Individual Cognition and Organizational Action Models**

Organizations are “social systems of collective action that structure and regulate the actions and cognitions of organizational participants through rules, resources, and social relations” (Oscasio 2000, p. 42). As such, the rich and dynamic interplay that occurs within collective action shape and influence both the cognitive processing and the cognitive content of individuals situated within larger systems of collective action.
(i.e., the organizational context) (Bandura 1986, 1995; Weick 1979a, 1979b, 1995). This idea represents the key to the synthesis of the individual cognition and organizational action models (see Figure 6): intervention (i.e., components of organizational collective action) brings about work system changes, which then directly or indirectly produce changes in individual cognitions. The individual sense making triggered by these interventions drives the learning processes associated with adaptive structuration (DeSanctis and Poole 1994; Griffith 1999; Prasad 1993; Weick 1990, 1995). We discuss this interplay across the organizational action and individual cognition models in more detail below.

The post-adoptive behaviors of organizational members engaged within an IT-enabled work system result in work system outcomes. If work system outcomes, as assessed by members of the work system (i.e., users, peers, experts, managers), exhibit a sufficiently large gap between desired and perceived work system outcomes, one or more organizational members (users, peers, experts, or managers) undertake post-adoptive interventions targeted at work system elements. Individual users are then impacted by effected work system changes, resulting in cognition changes, which in turn motivate individual post-adoptive intentions. These post-adoptive intentions, influenced also by the individual’s use history, impact subsequent post-adoptive behaviors. The post-adoptive behaviors engaged in by the individual and work system outcomes from the organizational action level are inputs to an evaluative assessment by the individual of the adequacy of his/her cognitions. If the adequacy of the cognitions is
not confirmed, then the individual appropriately revises these cognitions raising the potential for differentiated post-adoptive behaviors.

There is one exceptional case to the synthesis model depicted in Figure 6 and described above. When the individual user is the source and the target of post-adoptive interventions (see Figure 7), the user induces a post-adoptive intervention as an instance of post-adoptive behavior. Because the user is also the target of the intervention, the post-adoptive intervention/behavior affects work system outcomes directly as a post-adoptive behavior and indirectly through individual learning. The exceptional case outlined in Figure 7 represents a direct relationship between work system outcome expectation gap and individual cognitions.

DIRECTIONS FOR FUTURE RESEARCH

Given the complexity of the factors and processes involved in post-adoptive behavior, as modeled in Figure 6 and Figure 7, a literal plethora of research directions exist that researchers might fruitfully pursue to better understand post-adoptive behaviors. Due to space limitations, however, we focus on the methodological and theoretical implications we believe most critical to the future development of this research domain.

Methodological Implications

Implication #1: Feature Level of Analysis. As discussed throughout this paper, we believe that previous researchers have overlooked a significant source of variation in individual post-adoptive behavior by ignoring the distinct features of an IT application.
Researchers attempting to collect data at the feature level of analysis face decisions not usually encountered when collecting data at the IT application level of analysis. First, the researcher must decide which features to include as part of the study. Second, the researcher must decide whether to use discreet features as the unit of analysis, to use bundles of features, or both. For example, several distinct features might collectively make a feature bundle (e.g., discreet features such as “Generate Balance Sheet,” “Generate Income Statement,” and “Generate Statement of Cash Flows” may also exist as a feature bundle called “Generate Financial Statements”). We advocate that research studies be designed at the level of the IT feature and that researchers select the users’ (subject/respondent) view of an IT application’s features when deciding on which features to focus.

Implication #2: Measures of Individual Post-Adoptive Behavior. An issue for researchers collecting data at the feature level of analysis concerns whether to collect data from one individual for multiple features or for a single feature. From a sample size perspective, the researcher obtains a larger sample by asking respondents about their post-adoptive behavior with respect to multiple features (e.g., a sample size of 100 could be obtained from 25 individuals for each of 4 features). In addition, important path-dependences may very well exist within a set of features; thus, being able to capture and analyze the interdependencies within feature portfolios has important implications to the understanding of post-adoptive behaviors. However, a respondent’s willingness to answer the same set of questions multiple times (the only difference being the specific IT feature addressed in the question) then becomes an important factor to consider as the researcher makes a determination whether to ask the
respondent about his/her use of multiple features. As future researchers examine the propositions presented in our paper, we encourage them to include multiple features within their research designs but to carefully consider the pros and cons associated with asking a single respondent about multiple features.

**Implication #3: Measures of Use History.** Given the importance of path-dependency in explaining post-adoptive behaviors, studies of post-adoptive behavior must capture individuals’ use histories with regard to an IT application's features. As such, longitudinal studies of post-adoptive behavior, or the collection of multiple waves of cross-sectional data, are required. The line of research pursued by Venkatesh and his colleagues (Venkatesh 2000; Venkatesh and Davis 2000; Venkatesh and Morris 2000; Venkatesh et al. 2000; Venkatesh et al. 2003; Venkatesh et al. 2002) provides a good example of research efforts that have begun to explore post-adoptive behavior across multiple waves of data collection. Furthermore, we encourage future researchers to develop robust measures of use history that go beyond measures of past behavior frequency. In practice, different intervention strategies will likely be most beneficial for users exhibiting distinctive use patterns. Recognizing and categorizing recurrent patterns of use (for IT applications in general and for specific IT application features) and then identifying effectual intervention strategies both within and across use history categories are a strongly advocated direction for future research.

**Theoretical Implications**

**Implication #4: Work System Changes.** Scholarly efforts to understand variation within and across individuals’ post-adoptive behavior regarding an IT application must account (control) for changes in the IT application as well as the work
system(s) enabled by the IT application. For both research and practice, assessments of the efficacy of interventions are perhaps best undertaken during periods of relative stability with the IT application and the work system(s) being enabled through the IT application. Further, as pointed out earlier, the efficacy of post-adoptive interventions should account for IT application use history as well as an individual's history of salient work task behavior.

**Implication #5: Incentive Changes.** Efforts to understand variation within and across individuals’ post-adoptive behavior regarding an IT application must account (control) for changes in organizational incentive structures that might otherwise influence (or be influenced by) work system outcomes. Regarding practice, organizational incentive structures must be recognized as an ever-present (and often overlooked) lever for management intervention. Likewise, when an organization makes substantive changes to an IT-enabled work system, the organization should carefully examine the implications of these changes on incentive structures.

**Implication #6: Substantive Technology Use Periods.** Clearly much of the benefit derived from installed IT applications comes during periods of equilibrium rather than during periods of dramatic change. Much remains to be learned, consequently, about managing a technology’s post-adoption life cycle. What are the dysfunctionalities associated with substantive periods of technology use? Here, we have ignored these dysfunctionalities. When should periods of substantive technology use proliferate and when should they be minimized? Is it advisable to constrain (to specific users, to specific technology features, etc.) periods of substantive technology use? Currently, researchers know very little regarding such issues. Consequently, while the current
work has focused at the level of the individual user, much value also exists in research that examines, more broadly, the dynamics of an IT application’s evolution and use along with associated organizational outcomes associated with this use.

**Implication #7: Post-Adoptive Interventions.** While prior literature has discussed post-adoptive interventions (Orlikowski et al. 1995; Yates et al. 1999), this important domain of IT implementation research merits more systematic study. What are the important contextual factors to account for when initiating different interventions? Do certain interventions complement or inhibit others? Do path-dependencies exist across specific sets of interventions? Should certain interventions be introduced early (or late) in the post-implementation life cycle? Again, researchers know very little about such issues. Most importantly, it is paramount for all researchers studying post-adoptive behaviors to discover and identify the salient interventions directed at the focal IT application as well as the salient interventions directed at the work systems associated with the focal IT application. Research studies that fail to account for such interventions will likely observe considerable unexplained variance in research models.

**CONCLUSION**

We have reviewed the IT adoption and use literature and synthesized the results of this review with our own understanding of post-adoptive behaviors to create a two-level conceptualization that we believe significantly advances our collective understanding of IT post-adoptive behavior at the individual level of analysis. While many, if not most, of the posited relationships have received empirical support in prior research, the complete model has no such support. We encourage future research that
examines subsets of the model as well as the model as a whole, and we heartedly anticipate the modifications and extensions that such testing will engender.

Deep, systematic explorations of post-adoptive behaviors have not yet attracted the attention of either the research or practice communities. It is admittedly difficult to undertake such research, given that these efforts are likely tightly bound to an IT application (its features and their evolution over time), the work system (its features and their evolution over time), and the organizational context (its features and their evolution over time). Still, the capability of organizations to fully leverage their current (and future) investments in installed IT are inextricably bound to the collective knowledge that exists regarding post-adoptive behaviors. We hope that our ideas stimulate others to commit themselves to the more intensive study of this important facet of organizational life.
Figure 1 Feature-Centric View of IT Adoption and Use

Organizational Application Adoption Decision (voluntary or mandatory)

Individual Application Adoption Decision (voluntary or mandatory)

POST-ADOPTIVE BEHAVIORS

Individual Feature Adoption Decision (voluntary or mandatory)

Individual Feature Use (voluntary or mandatory)

Individual Feature Extension (voluntary)
Figure 2 Contextual Overview Of Substantive Technology Use Period

*Clearly, individuals working within an organization experience their own individual context and the greater organizational context simultaneously. Here, however, a distinction is made between an individual situated within the context of her/his own history and beliefs and within the larger organizational context to facilitate the conceptualization of post-adoptive behavior.*
Figure 3 Individual Cognition Model of Post-Adoptive Behavior

NOTE: The solid line relationships represent an individual’s reflective use of IT application features. The dashed line relationships represent an individual’s non-reflective use of IT application features. We include two relationships between post-adoptive intentions and post-adoptive behaviors for completeness to illustrate that this relationships is part of both reflective and non-reflective use.
**Figure 4** Organizational Action Model of Post-Adoptive Behavior

- **Desired Work System Outcomes**
- **Work System Outcome Expectation Gap**
- **Perceived Work System Outcomes**
- **Post-Adoptive Interventions**
- **Work System Changes**
- **Work System Outcomes**
Figure 5 Intervention Sources and Targets
Figure 6 Synthesis of Individual Cognition and Organizational Action Models
Figure 7 Synthesis Model -- Individual as Intervention Source and Intervention Target

- Intervention as an Instance of Post-Adoptive Behavior
  - Individual Cognitions
  - Post-Adoptive Intentions
  - Post-Adoptive Behavior

- Work System Outcome Expectation Gap
  - Desired Work System Outcomes
  - Perceived Work System Outcomes

- Confirmation
  - Work System Outcomes
### Table 1 Technologies Studied by IT Adoption/Use Researchers

<table>
<thead>
<tr>
<th><strong>Business Process Applications</strong></th>
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<tbody>
<tr>
<td>Account management system -- Venkatesh and Davis 2000</td>
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<tr>
<td>Accounting system -- Venkatesh et al. 2003</td>
<td></td>
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<tr>
<td>Activity report system -- Swanson 1974</td>
<td></td>
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<tr>
<td>Banking system -- Bhattacherjee 2001</td>
<td></td>
</tr>
<tr>
<td>Batch report system -- Schewe 1976</td>
<td></td>
</tr>
<tr>
<td>CASE tool -- livari 1996; Tyre and Orlikowski 1994; Xia and Lee 2000</td>
<td></td>
</tr>
<tr>
<td>Computer systems -- Goodhue and Thompson 1995; Hartwick and Barki 1994</td>
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<tr>
<td>Customer service management system -- Venkatesh et al. 2003</td>
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<tr>
<td>Data retrieval system -- Venkatesh and Morris 2000; Venkatesh et al. 2000; Venkatesh et al. 2002</td>
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<tr>
<td>Database of product standards -- Venkatesh et al. 2003</td>
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<tr>
<td>DSS -- Bhattacherjee 1998; Fuerst and Cheney 1982; Igbiria and Guimaraes 1994; King and Rodriguez 1981</td>
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<tr>
<td>Expert system -- Leonard-Barton and Deschamps 1988</td>
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<tr>
<td>Interactive report system -- Schewe 1976</td>
<td></td>
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<tr>
<td>Market system -- Lucas and Spitler 1999</td>
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<tr>
<td>Marketing information system -- Jobber and Watts 1986</td>
<td></td>
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<tr>
<td>Online help desk system -- Venkatesh 2000</td>
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<tr>
<td>Portfolio management system -- Ginzberg 1981; Venkatesh and Davis 2000; Venkatesh et al. 2003</td>
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<tr>
<td>Property management system -- Venkatesh 2000</td>
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<tr>
<td>Sales information system -- Lucas 1975; Robey 1979</td>
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<tr>
<td>Scheduling system -- Venkatesh and Davis 2000</td>
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<tr>
<td>Student information system -- Rai, Lang, and Welker 2002</td>
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</tr>
</tbody>
</table>

| **Communication and Collaboration Systems** |  |
| Computer conferencing system -- Orlikowski et al. 1995; Yates et al. 1999 |  |
| Electronic information exchange system -- Hiltz and Turoff 1981 |  |
| Electronic mail -- Adams, Nelson, and Todd 1992; Fulk 1993; Gefen and Straub 1997; Kettinger and Grover 1997; Szajna 1996 |  |
| Lotus Notes -- Orlikowski 2000 |  |
| Online meeting manager -- Venkatesh et al. 2003 |  |
| Video telephone system -- Kraut et al. 1998; Webster 1998 |  |
| Voice mail system -- Adams et al. 1992; Straub et al. 1995 |  |

| **Computers** |  |
| Computing resource center -- Taylor and Todd 1995a, 1995b |  |

| **Office Applications** |  |
| Graphics -- Adams et al. 1992 |  |
| Office systems -- Lucas and Spitler 1999; Tyre and Orlikowski 1994 |  |
| Spreadsheet -- Adams et al. 1992 |  |
| Text editor -- Kay and Thomas 1995 |  |
| Word processing -- Adams et al. 1992; Davis et al. 1989 |  |

| **System Software** |  |
| Client/Server system -- Guimaraes and Igbiria 1997 |  |
| In-house LAN -- Burkhardt 1994 |  |
| Mainframe systems -- Lucas and Spitler 1999 |  |
| Windows operating system -- Karahanna et al. 1999; Venkatesh 2000; Venkatesh and Davis 2000 |  |

| **World Wide Web/Internet** |  |
| Internet -- Teo, Vivien, and Raye 1999 |  |
| WWW -- Agarwal and Prasad 1997 |  |

†Examined feature level use
Table 2 Measures of Use Employed by IT Adoption/Use Researchers

| Frequency of Use (Objective) | Number of calls placed and received in two week period -- Kraut et al. 1998 Number of customer records on system per account -- Robey 1979 Number of messages sent, received, forwarded in day -- Fulk 1993; Gefen and Straub 1997; Straub et al. 1995; Szajna 1996 Number of requests for reports -- Schewe 1976 Number of sessions -- Ginzberg 1981; Hiltz and Turoff 1981 Number of user queries -- Venkatesh and Morris 2000; Venkatesh et al. 2000 Relative frequency of user queries -- Swanson 1974 Sequence and number of queries submitted -- King and Rodriguez 1981 Time using computer during week -- Burkhardt 1994 |
| Length of Use (Objective) | Hours of use -- Hiltz and Turoff 1981; Taylor and Todd 1995a, 1995b; Venkatesh et al. 2003 Length of sessions -- Hiltz and Turoff 1981 Number of minutes per month of terminal use -- Ginzberg 1981 Number of sessions -- Taylor and Todd 1995a, 1995b |
| Other (Objective) | Actual messages sent -- Orlikowski et al. 1995; Yates et al. 1999 Actual technology use -- Venkatesh et al. 2002 General use and specific use -- Fuerst and Cheney 1982 Logs of user commands issued -- Kay and Thomas 1995 Number of features used -- Bhattacherjee 1998; Straub et al. 1995 Percentage of records updated annually -- Robey 1979 |
Table 3 Time After Adoption Examined by IT Adoption/Use Researchers

| Indeterminate, But at Least | Use monitored for 12 weeks -- Taylor and Todd 1995a, 1995b
Use monitored for 4 months -- Swanson 1974
One year -- Compeau et al. 1999; Guimaraes and Igbaria 1997 |
| Less than 1 Year | Single decision making session -- Bhattacharjee 1998; King and Rodriguez 1981
4 weeks -- Xia and Lee 2000
2 months to 3 years (mean 8 months) -- Bhattacharjee 2001
3 months -- Venkatesh 2000
14 weeks -- Davis et al. 1989
15 weeks -- Szajna 1996
3 to 6 months -- Hartwick and Barki 1994
3 months and 9 months after implementation -- Burkhardt 1994
Across 4 months -- Tyre and Orlikowski 1994
5 months -- Venkatesh and Davis 2000; Venkatesh and Morris 2000; Venkatesh et al. 2000
6 months -- Venkatesh et al. 2003; Venkatesh et al. 2002
5-9 months after adoption -- Ginzberg 1981
Across 8 months -- Tyre and Orlikowski 1994 |
| Between 1 and 2 Years | Across 12 months -- Webster 1998
3 months to 2 years -- Leonard-Barton and Deschamps 1988
15 months -- Robey 1979
Across 18 months -- Kraut et al. 1998; Orlikowski et al. 1995; Yates et al. 1999 |
| More than 2 years | 6 months to five years -- Fuerst and Cheney 1982
Across 3 year period -- Kay and Thomas 1995
Data collected across 3.5 years of system use -- Hiltz and Turoff 1981
Up to 5 plus years -- Ivivari 1996 |
<table>
<thead>
<tr>
<th>Prior History Not Considered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adams et al. 1992; Agarwal and Prasad 1997; Bhattacherjee 1998; Compeau and Higgins 1995;</td>
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<tr>
<td>Compeau et al. 1999; Davis et al. 1989; Fuerst and Cheney 1982; Fulk 1993; Gefen and Straub</td>
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<td>1997; Ginzberg 1981; Goodhue and Thompson 1995; Guimaraes and Igbaria 1997; Hartwick and</td>
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<tr>
<td>Igbaria et al. 1997; livari 1996; Jobber and Watts 1986; Karahanna et al. 1999; King and</td>
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<tr>
<td>Rodriguez 1981; Leonard-Barton and Deschamps 1988; Lucas 1975; Lucas and Spiter 1999; Rai</td>
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<tr>
<td>et al. 2002; Robey 1979; Schewe 1976; Straub et al. 1995; Swanson 1974; Szajna 1996; Taylor</td>
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<tr>
<td>and Todd 1995a, 1995b; Teo et al. 1999; Thompson et al. 1991; Venkatesh and Davis 2000</td>
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<tr>
<th>Prior History Considered Indirectly</th>
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<tbody>
<tr>
<td>Confirmation -- Bhattacherjee 2001</td>
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<tr>
<td>Changes in user perceptions over time -- Burkhardt 1994</td>
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<tr>
<td>Changes in feature use over time -- Hiltz and Turoff 1981</td>
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<tr>
<td>Changes in choices and use of commands over time -- Kay and Thomas 1995</td>
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<tr>
<td>Changes in individual, task, and social variables over time -- Kraut et al. 1998</td>
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<tr>
<td>Changes in use over time -- Orlikowski 2000; Orlikowski et al. 1995; Tyre and Orlikowski</td>
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<tr>
<td>1994; Webster 1998; Yates et al. 1999</td>
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<tr>
<td>Changes in predictors of intention over time -- Taylor and Todd 1995a; Venkatesh 2000;</td>
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<tr>
<td>Venkatesh et al. 2000; Venkatesh et al. 2003; Xia and Lee 2000</td>
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<tr>
<td>Changes in predictors of use over time -- Taylor and Todd 1995a</td>
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<tr>
<th>Prior History Considered Directly</th>
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<tbody>
<tr>
<td>Thompson et al. 1994</td>
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<tr>
<td>Extent of prior email use (in months) -- Kettinger and Grover 1997</td>
</tr>
<tr>
<td>Prior use -- Venkatesh et al. 2000; Venkatesh et al. 2002</td>
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<tr>
<td>Cognition</td>
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<tr>
<td>Effort expectancy</td>
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<td>Facilitating conditions</td>
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<td>Image</td>
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<td>Job-fit</td>
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<td>Job relevance</td>
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<td>Outcome expectations</td>
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<td>Output quality</td>
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<td>Perceived behavioral control</td>
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<td>Performance expectancy</td>
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<td>Relative advantage</td>
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<td>Result demonstrability</td>
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<td>Richness</td>
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<td>Trialability</td>
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<td>Visibility</td>
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Table 6 Individual Difference Studied by IT Adoption/Use Researchers

<table>
<thead>
<tr>
<th>Individual Difference</th>
<th>Example Study</th>
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</thead>
<tbody>
<tr>
<td>Cognitive style</td>
<td>Fuerst and Cheney 1982; Lucas 1975</td>
</tr>
<tr>
<td>Organizational level</td>
<td>Howard and Mendelow 1991; Igbaria 1990</td>
</tr>
<tr>
<td>Personality</td>
<td>Jobber and Watts 1986; Kraut et al. 1998</td>
</tr>
<tr>
<td>Voluntariness of use†</td>
<td>Agarwal and Prasad 1997; Iivari 1996; Karahanna et al. 1999; Venkatesh et al. 2003</td>
</tr>
<tr>
<td>Work experience</td>
<td>Burkhardt 1994; Fuerst and Cheney 1982; Howard and Mendelow 1991; Schewe 1976</td>
</tr>
</tbody>
</table>

†Although most researchers studied voluntariness of use as a cognition, UTAUT proposes voluntariness of use as an individual difference which modifies the relationship between cognitions and intentions (Venkatesh et al. 2003). We include voluntariness of use as an individual difference to be consistent with UTAUT.
### Table 7 Description of Interventions Sources and Actions

<table>
<thead>
<tr>
<th>Intervention Source</th>
<th>Description</th>
<th>Intervention Actions</th>
</tr>
</thead>
</table>
| **Users**           | IT application users | - Self-orchestrated learning  
|                     |             |   - Formal/informal training  
|                     |             |   - External documentation  
|                     |             |   - Observation of others  
|                     |             |   - Experimentation with IT features  
|                     |             |   - Experimentation with work tasks  
|                     |             |   - Direct actions taken regarding  
|                     |             |   - IT application modification or enhancement  
|                     |             |   - Work task/process modification or enhancement  
| **Peers**           | Co-workers (same unit)  
|                     | Other professional referents (not direct co-workers)  
|                     | Internal -- same organization  
|                     | External -- other organization | - Formal and informal training  
|                     |             | - Direct actions taken regarding  
|                     |             | - IT application modification or enhancement  
|                     |             | - Work task/process modifications or enhancement  
|                     |             | - Joint actions taken with users  
|                     |             | - IT application modification or enhancement  
|                     |             | - Work task/process modification or enhancement  
| **Experts (Business and Technology)** | Lead users and gurus  
|                     | Professional Staff  
|                     | Internal Consultants  
|                     | External Consultants  
|                     | Service Providers  
|                     | Business Partners | - Formal and informal training  
|                     |             | - Direct actions taken regarding  
|                     |             | - IT application modification or enhancement  
|                     |             | - Work task/process modifications or enhancement  
|                     |             | - Joint actions taken with users  
|                     |             | - IT application modification or enhancement  
|                     |             | - Work task/process modification or enhancement  
| **Managers**        | Direct supervisors  
|                     | Middle management  
|                     | Senior executives | - Indirect  
|                     |             | - Sponsorship and championship  
|                     |             | - Resource provision  
|                     |             | - Directives and mandates  
|                     |             | - Direct  
|                     |             | - IT application feature use  
|                     |             | - Work task/process involvement  
|                     |             | - Incentive structures  
|                     |             | - Inputs/influence into design of  
|                     |             |   - User, peer, or technologist interventions  
|                     |             |   - IT application modification or enhancement  
|                     |             |   - Work task/process modification or enhancement  
|                     |             |   - Incentive structure modification or enhancement |
REFERENCES


James, W. *Principles of Psychology*, Holt, New York, NY, 1890.


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<tr>
<th>No.</th>
<th>Author(s)</th>
<th>Title and Details</th>
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