Unraveling the “paradox of the active user”: Determinants of individuals’ innovation with it-based work routines

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RESEARCH-IN-PROGRESS

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ABSTRACT

As individuals become more experienced with information technologies (ITs), they become limited by well-learned behavioral routines for using an IT, which act to inhibit innovation. This "paradox of the active user" can prove problematic for organizations, which derive benefits when organizational ITs are used to their fullest potential. Thus, to advance research on individual differences and post-adoption use behaviors, this research-in-progress develops a research model examining the relationships among habit, IT mindfulness, and embeddedness of an IT-based routine on individuals' innovation with IT. Identifying factors that foster or inhibit individuals' attempts to innovate with ITs can provide actionable guidelines for designing managerial interventions to manage and maintain desired levels of user-initiated innovation in the post-adoptive context.

Keywords (Required)

IT Innovation, Post-Adoption, IT Usage, Habit, Mindfulness, Individual Differences, Routine

INTRODUCTION

Because organizations derive benefits from how information technologies (ITs) are used over time (Hsieh and Zmud, 2006), researchers have become increasingly interested in investigating individual post-adoptive behaviors (Jasperson, Carter et al., 2005). The goal of this research stream is to understand what factors influence individuals' behavioral attempts to use an IT to its *fullest potential* (Chin and Marcolin, 2001). However, post-adoptive research suggests that as individuals become more experienced with a system (and therefore more likely to act as effective sources of innovation), they are less likely to engage in cognitive processing, which leads to few user-initiated innovations (Agarwal, 2000; Jasperson et al., 2005, Limayem, Hirt and Cheung, 2007; Nambisan, Agarwal et al., 1999; and others).

One explanation, for the phenomenon described above, is that experienced users become limited by well-learned behavioral routines for using an IT, which act to inhibit exploration. Fu and Gray (2004) found evidence that two types of behavioral routines emerge through use of an IT: 1) general routines that may be used in similar task environments, or elsewhere in the current task environment; and 2) specialized routines that are most efficient only under specific conditions. Computer based applications are generally designed so that users can progress quickly from general to specific routines as they become more familiar with the specific application environment. The assumption underlying this design choice is that as users gain more experience with a specific application, they will engage in autonomous learning and exploration. This will lead to replacement of general routines with specialized routines (as appropriate) over time. However, individuals often persist in the use of general routines, even in situations where they are demonstrably less efficient (Fu and Gray, 2004).

Individuals learn routines via feedback from interacting with an IT in the course of carrying out work tasks. At the same time, as individuals reach a certain level of expertise, well-learned routines may inhibit paying attention to alternative or novel uses of the technology. It is important to note that routinized behavior may or may not have beneficial effects for the organization. This implies that in some situations it is in the organization's interest to promote innovative IT use behaviors, while in others, it is not. Consequently, to provide managers with actionable guidelines for managing individuals' post-adoptive behaviors, it is important to understand what factors constrain or facilitate individuals' attempts to innovate. This leads to the following research question: *What factors influence individual behavioral attempts to seek out new ways of interacting with information technologies in the course of carrying out work-related tasks?*

THEORETICAL DEVELOPMENT

The dependent variable in this study is propensity to innovate with IT-based routines, defined as a user's action orientation towards creating new applications of IT in their work routines (Nambisan et al., 1999). Evidence from the HCI literature suggests a number of factors that could influence individuals' propensity to innovate with IT-based routines. For example, in a review of the literature, Bhavnani and John (2000) provide the following three key reasons for why individuals' use of IT becomes routinized over time: 1) the *Einstellung effect* of current use being dominated by prior knowledge (Luchins and Lichins, 1970; Flemming, Bhavnani and John, 1997)—also called *assimilation bias* (Carroll and Rosson, 1987); 2) *production bias*, also referred to as "the paradox of the active user" (Caroll and Rosson, 1987), where users—focused on completing the task at hand—prefer to stick with an already learned general routine than invest time in learning new and, possibly, more efficient specialized procedures; and 3) a lack of opportunities in the work environment for exploration and learning.

To help understand why some individuals find new applications for IT within their work routines while others do not (Bhavnani, Peck and Reif, 2008), it is useful to explore the influence of constructs that relate to the factors identified above and, in particular, to examine the antecedents and impact of two constructs that would appear to exert opposite influences on technology use: (1) *IT mindfulness* (Wright, Thatcher, et al., working paper), refers to the active pursuit of new stimuli, flexibility, finding new ways of doing things, and engagement with the context of IT use; and (2) *habit,* which reflects a tendency "to repeat responses given a stable supporting context" (Oullette and Wood, 1998, p. 55). In this study, we conceptualize IT mindfulness as the obverse of production bias and habit as a form of assimilation bias. As outlined in our hypotheses development, IT mindfulness is expected to positively impact an individual's propensity to innovate, while habit is expected to have an inhibitory effect. The influences exerted by both constructs are expected to be moderated by opportunities (or lack of) in the work environment for exploration and learning.

IT Mindfulness

Mindfulness refers to "conscious awareness in which the individual is implicitly aware of the context and content of information" (Langer, 1992, p. 289). It can be conceptualized as a state (Langer, 1992), a cognitive ability (Sternberg, 2000), or as a trait (Langer, 1989; 2004). As a state, individuals are described as having a propensity toward mindfulness (Brown and Ryan, 2003). As a cognitive ability, mindfulness refers to an individual's typical mode of thinking (Sternberg, 2000). As a trait, mindfulness is viewed as an individual difference that can be measured in similar ways to personality. Langer (1989, 1992, 2004) views mindfulness as both a state and a trait composed of four cognitive domains: 1) novelty producing—relating to the generation of new ideas/ways of doing things (Langer, 1989); 2) novelty seeking—involving the active pursuit of new stimuli (Wright et al., working paper); 3) flexibility, or the ability to adapt behavior to different contexts; and 4) engagement with the current situation (Langer, 2004). Consistent with the work of Langer (1989, 2004), this study conceptualizes IT mindfulness as a more or less stable characteristic that may exhibit change over time—i.e. IT mindfulness can be viewed as a product of an individual's history of interactions with an IT.

While high levels of IT mindfulness reflect a predisposition to toward novelty seeking behavior in the use of IT, a lack of mindfulness reflects a tendency toward rigid cognitive processing and obliviousness "to novel (or simply alternative) aspects of the situation" (Langer et al., 1985, p. 289). Research suggests that individuals who are not predisposed toward novelty seeking or novelty producing behavior are more susceptible to production bias (i.e. to be focused on completing the task at hand, rather than being alert to the distinctiveness of a situation) (Carroll and Rosson, 1987). Thus, a lack of mindfulness is consistent with a tendency to persist in using well-learned routines, while mindfulness implies the obverse. Consequently, we suggest that mindfulness, or the extent to which an individual is predisposed to novelty seeking, novelty producing, flexibility, and engagement with the current situation will be positively related to an individual's predisposition to "create" new applications of IT in their work routines. Formally stated:

H1: Mindfulness will be positively associated with propensity to innovate with IT-based routines

Two factors in particular are believed to negatively influence mindfulness. The first is misplaced confidence. According to Langer (1989, 1997), unless confidence is tempered by a degree of uncertainty, openness to new information is likely to inhibited. The second factor is anxiety: while an individual who overestimates their ability may not be open to new information, someone who is overly anxious is even more likely to be committed to a particular course of action.

Computer self-efficacy (CSE), relates to an individual's "judgment of their capabilities to use computers in diverse situations" (Thatcher and Perrewe, 2002, p. 383). While CSE has been shown to be a strong predictor of frequency of use (Compeau et al., 1999), we suggest that the relationship between CSE and IT mindfulness degrades as a task is mastered. This is consistent with literature that suggests misplaced confidence may inhibit an individual's openness to new information and their ability to adapt to new situations (Langer, 1989, 1997). According to Caroll and Rosson (1987) an individual's previous success in using a procedure, decreases the likelihood that they will seek information (either from reference materials or other individuals) to help learn new ways of doing things. Thus, we posit that while CSE is an important driver of frequency of use, it will be negatively related to IT mindfulness. Formally stated:

H2a: Computer self efficacy will be positively associated with frequency of use

H2b: Computer self efficacy will be negatively associated with IT mindfulness

Habit

Our review of the literature provides evidence that the persistent use of IT-based routines is associated with assimilation bias (Caroll and Rosson, 1987)—i.e. a tendency to rely on past patterns of behavior in determining future action (Langer, 2004). Insomuch as it reflects a *learned* response so that behavior is performed automatically (Limayem et al., 2007), habit can be viewed as a form of assimilation bias. An example of assimilation bias can be seen in the email user who has habitually used a web based email interface (e.g. AOL or Hotmail) and subsequently will continue to use this type of interface despite advances in technology which offer more efficient email access. Assimilation bias has been shown to inhibit learning and exploration in computer-based interactive tasks (Fu and Gray, 2004; Horsky et al., 2005). Based on this reasoning, we suggest that habit will be negatively associated with an individual's predisposition to "create" new applications of IT in their work routines:

H3: Habit will be negatively associated with propensity to innovate with IT-based routines

While habit has been conceptualized as *past use* by some researchers (e.g. Kim et al., 2005), others assert that because habit is a learned response, frequency of past use is a predictor of habit (e.g. Limayem et al., 2007). Consistent with this, Fu and Gray (2004) provide evidence that the more often an IT-based procedure has been used in the past, the more likely it will continue to be used in the future. In an examination of individuals' use of inefficient IT-based procedures, these authors found that experienced professionals (architects) performing complex IT-based routines (CAD tasks) persisted with inefficient procedures that had been frequently used, even when more efficient specialized procedures had been shown to exist. This empirically supports the view that the more frequently a behavior is performed the more likely it is to become habitual. Thus, we posit:

H4: Frequency of past use will be positively associated with habit

A general feeling of anxiety "when confronted with problems or challenges" (Thatcher and Perrewe, 2002, p. 383) has been posited to have a negative influence on flexible cognitive processing and adaptive behaviors (Langer, 1989, 1997). According to Langer, individuals who are overly anxious are more likely to stay committed to a particular course of action. We suggest that when it comes to enacting IT-based routines, individuals with high levels of computer anxiety are more likely to stay committed to familiar IT-based routines because they fear losing important data or making mistakes that they cannot correct). Formally stated:

H5: Computer anxiety will be positively associated with habit.

The Impact of Stable Contexts and Exceptions

Authors agree that a stable context is an important condition for enactment of habitual behavior (e.g. Limayem et al., 2007; Oullette and Wood, 1998; Wood et al., 2005; Wood and Neal, 2007). A stable context can be characterized by the presence of similar situational cues and goals across more or less regularly occurring situations (Limayem et al., 2007). In this study, we operationalize stable context as embeddedness of IT-based routines. Embeddedness of IT-based routines refers to the extent to which an individual consistently enacts an IT-based routine across stable situations and/or the extent to which the IT-based routine overlaps with IT-based routines of others (e.g. individuals or departments).

A stable context may be an antecedent of habit and/or a moderator of the relationship between habit and behavior. To that end, we propose two hypotheses: First, we posit that embeddedness of IT-based routines will be positively associated with habit. Because embeddedness reflects infusion of an IT into organizational work routines (Cooper and Zmud, 1990; Saga and Zmud, 1994), the construct reflects a stable context, which should facilitate habit formation (Limayem et al., 2007). Alternatively, the degree to which habit can predict future behavior may be contingent on a stable supporting context

(Oullette and Wood, 1998). This suggests that embeddedness of an IT-based routine will *moderate* the relationship between habit and propensity to innovate. Thus,

H6: Embeddedness of IT-based routines will be positively associated with habit.

H7: Embeddedness of IT-based routines will positively moderate the relationship between habit and propensity to innovate with IT-based routines

Because embeddedness of IT-based routines is associated with the stability of the behaviors enacted during the routine itself, a highly embedded IT-based routine does not easily facilitate exploration and innovation. Thus, it follows that embeddedness of IT should moderate the relationship between IT mindfulness and propensity to innovate. For example, when an individual's use of a technology overlaps with others' work routines, this should act to inhibit learning and exploration. Thus,

H8: Embeddedness of IT-based routines will negatively moderate the relationship between IT mindfulness and propensity to innovate with IT-based routines

An exception occurs when something within the routine or environment is presented which interrupts the normal flow and process of the routine. One example is a mandatory firmware update that changes the layout and interface of the software an individual uses to complete his/her work tasks. This exception may introduce uncertainty and instability into the routine, such that individuals may feel challenged in their ability to complete tasks. The frequency of exceptions (i.e. the number of times that the current IT-based routine has been insufficient to deal with a required work task) is expected to negatively moderate the relationships between CSE and IT mindfulness and frequency of use and habit: Langer (1989) suggests that the negative impact of CSE on IT mindfulness can be tempered by uncertainty. In addition, we expect the construct to weaken the relationship between frequency of use and habit because the user must be alert to occasions when their IT-based routine must be adapted in order to complete the task. Thus,

H9: Frequency of exceptions will negatively moderate the relationship between CSE and IT mindfulness

H10: Frequency of exceptions will negatively moderate the relationship between frequency of use and habit

Table 1 provides definitions of the constructs to be used in this study. Figure 1 presents the proposed research model

Factors from other literature	**IS constructs**	**IS construct definitions**
Propensity to persist with general routines (Fu and Gray, 2004)	Propensity to innovate with IT-based routines (Nambisan et al., 1999).	The user's predisposition to "create" new applications of IT in their work routines.
	Frequency of Exceptions	The number of times that the current IT-based routine is insufficient to deal with a required work task
Production bias—focus on task at hand rather than learning new ways of doing things (Caroll and Rosson, 1987)	IT Mindfulness (Wright et al., working paper)	Involves the active pursuit of new stimuli, flexibility, finding new ways of doing things, and engagement with the context of IT use.
	Computer Self Efficacy (Compeau and Higgins, 1995)	An individual's beliefs about his or her ability to use computers
Assimilation bias—current use is determined by prior knowledge	Habit (Oullette and Wood, 1998)	A tendency "to repeat responses given a stable supporting context" (Oullette and Wood, 1998, p. 55)
	Computer Anxiety (Thatcher and Perrewe, 2002)	Anxiety about the implications of computer use such as the loss of important data or fear of other possible mistakes.
	Frequency of Past Use (Bagozzi and Warshaw, 1990)	The extent to which the individual has used the routine in the past.

Lack of opportunities in workplace for learning and exploration.	Embeddedness of IT-based routines	The extent to which an individual consistently enacts an IT-based routine across situations and/or the extent to which the IT-based routine overlaps with IT-based routines of others (e.g. individuals or departments)

Table 1: Construct Definitions

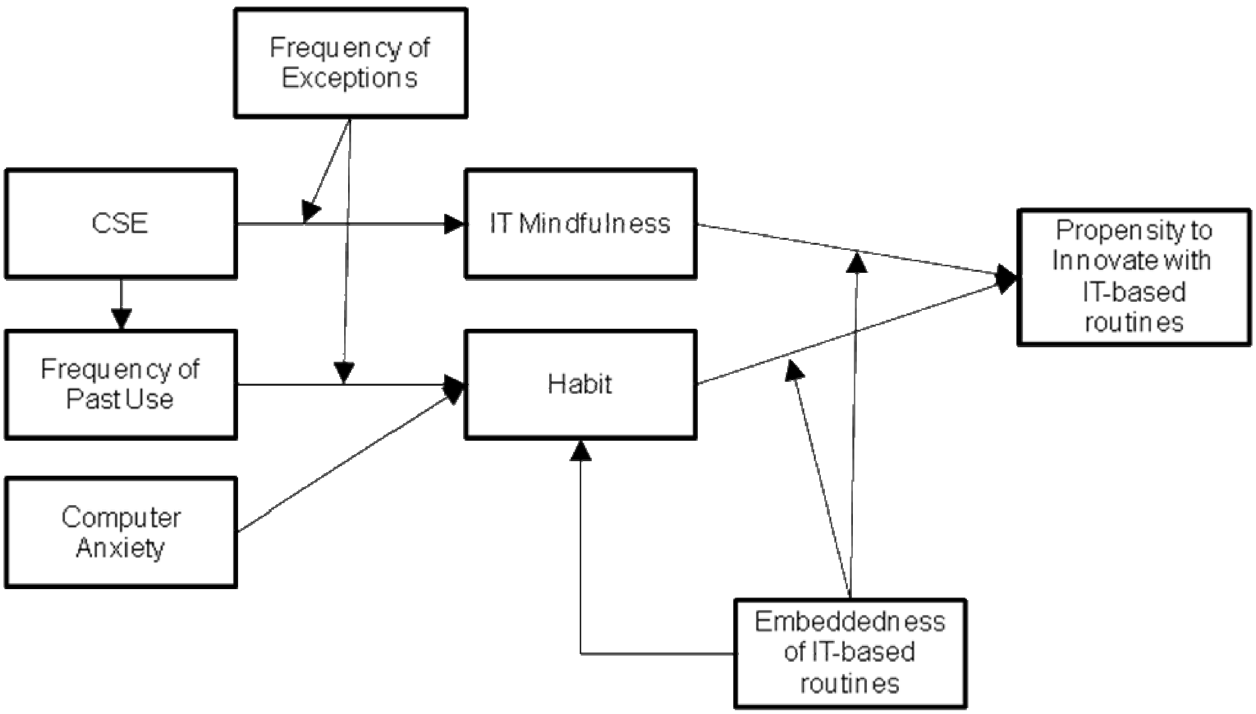

Figure 1: Proposed Research Model

PROPOSED METHOD

Because the proposed constructs are perceptual in nature, a survey with valid psychometric properties is expected to be a suitable data collection method (Malhotra and Grover 1998). The research model can be tested empirically using either cross-sectional or a longitudinal survey research design with data collected using a web-based survey at two points in time from experienced users of a specified IS-application (a longitudinal design will reduce CMV). The population of interest is all individuals that use information technologies to enable completion of tasks within an organizational context. The sampling frame includes only those individuals who are currently working full-time; have experience using a specified target technology to complete work tasks; and express a willingness to complete a survey at 2 separate time points. Construction of a sample frame from the relevant population as well as probabilistic sampling methods will support the external validity of our study (Berkowitz, 1982). Consistent with prior research, respondents will be given a unique number and matched across the two surveys (e.g. Compeau and Higgins, 1995).

Measures

Wherever possible, measures will be adapted from existing scales (see Table 1). The proposed constructs of embeddedness of IT-based routines and propensity to innovate with IT-based routines require new measures to be developed. In developing and validating these, we will follow the procedure laid out by Churchill (1979). First, we will refer to relevant literature to help generate sample items. Items for the proposed constructs will be placed in a common pool and subjected to rounds of sorting by judges. We will pre-test the measures to ensure that the items are tapping the full domain of the construct. Following pre-testing, we will conduct a pilot test to purify our measures with students enrolled in undergraduate business courses at two south-eastern universities. The target technology for our pilot test will be Blackboard®--a learning management system commonly in use at US universities. Blackboard is considered an appropriate technology for the pilot test because students use it to carry out similar course-related across many courses in which they are enrolled. Assuming that reliability and validity tests are satisfactory, we will proceed with full data collection.

Data Collection

A representative sample of members of Zoomerang®'s online market research panel will be recruited as participants in our full data collection. To limit the potential for statistical conclusion error, we will target a sample size that provides sufficient power to detect an effect. In the current model, there are 13 variables to be measured. As a rule of thumb, a minimum sample size of 100 or 5 multiplied by the number of variables in the model (whichever is larger) will be needed. Since we are collecting data at two time points, we need to ensure that our sample size at time 2 is greater than 100. Based on previous research using this design (e.g. Compeau and Higgins, 1995), we anticipate at least 50% attrition at time 2. Consequently, we will aim for a minimum sample size of 300 respondents at time 1.

At time 1, data will be collected relating to embeddedness of IT-based routines, frequency of exceptions, frequency of past use, CSE, computer anxiety, IT mindfulness, habit, and any control variables. At time 2, we will collect data relating to individuals' propensity to innovate.

Data Analysis

Data will be analyzed using confirmatory factor analysis (CFA) to assess the measurement model in terms of factor loadings, as well as convergent and discriminant validity. Common method variance (CMV) will also be assessed to ensure that covariance among variables is not a result of the method used to collect data. While effects due to CMV are likely to be ameliorated by separating collection of predictor and criterion variables (Malhotra et al., 2006; Podsakoff et al., 2003), it will be important to carefully consider the length of time lag between time 1 and time 2, so that intervening events due not introduce internal validity error (Podsakoff et al., 2003). Conducting follow-up interviews with respondents can help rule out rival explanations for differences in the criterion variables. The structural model and hypotheses will be tested using covariance-based structural equation modeling techniques. Covariance-based techniques will be used because the variables are modeled as reflective (i.e. the direction of causality is from the variable to the items).

LIMITATIONS

One limitation of this study is its use of only one target technology to test the proposed constructs and relationships. In today's computer rich work environments, it is conceivable that individuals will enact IT-based routines across multiple software applications (Lyytinen, 2010). Future research should explore determinants of individuals' propensity to innovate with IT-based routines in the context of multiple technologies. Additionally, some may consider that using students for pilot testing is problematic because students are a qualitatively different sample frame than individuals who work full-time. However, we believe that using student respondents to purify measures is appropriate because these individuals are active users of the target technology across situations and possess the technical knowledge and skills necessary to adequately test our hypotheses. Moreover, research suggests that students do not differ significantly from other individuals in their decisions to use technology (Sen et al., 2006). Finally, this study does not propose to measure intended or actual use behaviors. In the future, researchers may consider extending the model developed here to include measures of post-adoption use. Doing so, could provide insights into whether an individual's propensity to innovate with IT-based routines has enduring effects on different use behaviors.

CONCLUSION

Understanding how and why individuals use ITs in the way they do, is important for understanding how organizations can derive long-term benefits from their technology investments. To this end, the development and proposed testing of our research model could uncover valuable insights into factors that influence an individual's propensity to innovate with IT-based routines. This research-in-process contributes to current literature on individual differences by exploring the roles of habit and IT mindfulness in an innovation and infusion context. This research also contributes to unraveling the paradox of the active user by extending knowledge of the determinants of production bias and assimilation bias in individuals. Shedding light on factors that influence an individual's behavioral attempts to innovate with IT can provide actionable guidelines for organizations which derive benefits from how ITs are used over time. Processes and routines can be modeled and developed to ensure adequate context for desired levels of IT innovation.

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