THE DUALITY OF HABIT IN INFORMATION TECHNOLOGY ACCEPTANCE

by

GRETA L. POLITES

(Under the Direction of Elena Karahanna)

ABSTRACT

End user resistance to information systems (IS) adoption and use is a key concern for both research and practice. To date, behavioral models of IS use have focused primarily on the conscious decisions made by users in choosing to adopt or continue using a particular system. Only recently have researchers begun to explore the unconscious role of habit in influencing IS usage. The current research deviates from prior studies that focus on habit's role in superseding intentions to predict continued use of a system, by viewing habit with an *existing* system and the resulting inertia as inhibitors of technology acceptance as it pertains to a *new* system. Our research follows the three-manuscript model. In the first manuscript, we situate habitual IS usage behaviors within the context of their associated work routines and task sequences, and provide a theoretical understanding of how habits develop and how they can be disrupted within an organizational context, acknowledging their dual facilitating and inhibiting effects: that is, habitual use of an existing system encourages continued usage of the system but discourages adoption of new systems. In the second manuscript, we focus on the development of a theoretically based and thoroughly validated instrument for measuring habitual IS use in an organizational work environment. In the final manuscript, we use the newly-developed measure to address the negative impacts of IS habits on adoption of newly introduced systems, by situating habit and its consequence, inertia, in a nomological network of technology acceptance

constructs and hypothesizing their effects on behavioral beliefs and intentions. As such, we extend our theoretical understanding of the role of habit in technology acceptance, and lay the foundations for further study of organizational interventions to both break undesired IS usage habits and encourage the development of new ones.

INDEX WORDS: IS habit, Technology acceptance, Inhibitors, Organizational routines, Environmental triggers, Context change, Habitual inertia, Automaticity

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# DEDICATION

*To my parents, who probably never imagined this day would come, back when I was a high school dropout who only wanted to ride racehorses.*

*To my two sons, David and Daniel, who sacrificed just as much (if not more) than I did in ensuring the completion of this research.*

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# CHAPTER 1

# INTRODUCTION AND LITERATURE REVIEW

## PROBLEM STATEMENT AND MOTIVATION

End user resistance to information systems (IS) adoption and use is a key concern for both research and practice. This is particularly true given the expenses involved in both implementing and maintaining new systems. Gartner Group has estimated that in 2006, North American-based companies devoted an average of 2.7% of their revenue to their IT operating budget (or an average of $6,800 per employee); similar figures have been reported for Western European companies, while Asian/Pacific firms tend to spend half as much (DeSouza et al. 2005; Gomolski and Smith 2007; Roberts et al. 2007). These figures can vary greatly by industry, however, ranging from approximately 1% of revenue for transportation companies to as high as 15% of revenue for information retrieval firms (DeSouza et al. 2005; Gomolski 2005).

Despite large IT budgets, however, many companies experience unsuccessful IS implementations, and one reason for this is user rejection. The 2006 Standish Group Chaos Report indicates that 19% of all IS projects currently fail, with "failure" being defined as projects that are cancelled or systems that are not ultimately used (Rubenstein 2007). The costs of these failures can be spectacular; a 2003 KPMG survey of 134 European companies reports an average cost for IT project failures of $14 million, and individual failures as high as $240 million (Rosen 2005). While these numbers have improved since the first Chaos Report in 1994, they still indicate much room for improvement in implementing new systems and encouraging user acceptance (Rubenstein 2007).

IS research has taken a number of different approaches, and used many different theoretical perspectives, to try to better understand the phenomena associated with new system failures, focusing on both the individual and organizational levels of analysis (see Joshi 1991; Lapointe and Rivard 2005; Markus 1983 for examples). Individual level research has focused heavily on understanding the various factors influencing user *acceptance* of information technologies (e.g., Davis 1989; DeLone and McLean 1992; DeLone and McLean 2003; Moore and Benbasat 1991; Venkatesh et al. 2003). Much less attention has been paid to developing an understanding of factors that may *inhibit* technology adoption and use. Most IS acceptance research to date has also been derived from social psychology intention models, that focus primarily on the role of *conscious intentions* in predicting future behavior. The importance of such *nonconscious*, automatic predictors as habit in explaining use has only recently begun to receive serious attention in the IS literature (e.g. Cheung and Limayem 2005; Gefen 2003; Kim and Malhotra 2005; Kim et al. 2005; Limayem et al. 2003a; Limayem and Hirt 2003; Limayem et al. 2003b), coinciding with a recent increase in interest in studying these nonconscious predictors in social psychology as well.

Most IS habit studies to date have been based on the simple premise that helping users develop the habit of using a new system will improve technology acceptance. There has been little theoretical or empirical attention to the concept that deeply ingrained habitual behavior toward an old system may negatively affect intentions and use of a newly introduced one. Nonconscious processes can also serve as inhibitors to technology adoption, and thus extant habitual usage behaviors must be aggressively confronted. The present research therefore focuses on old system habit and its consequence, inertia, as distinct theoretical concepts that serve as inhibitors of new IS acceptance. It not only empirically investigates the role that habit, through

inertia, plays in impacting user attitudes and intentions toward adopting a new system, but also discusses the role of action slips, which may inhibit technology acceptance even in situations where the user sincerely intends to adopt and use the new system. This research is intended to address several key weaknesses and gaps in the current IS literature regarding the study of habitual IS use, as described below.

First and foremost, IS habits have not been studied from the perspective of how they are embedded in larger, and often very complex, work routines. To date, studies have empirically focused primarily on student use of web-based classroom support systems (e.g., Cheung and Limayem 2005b; Limayem and Hirt 2003) and the World Wide Web (WWW) (e.g., Limayem et al. 2003b; Limayem et al. 2007), along with habitual use of e-commerce and information websites (e.g., Gefen 2003; Kim and Malhotra 2005; Kim et al. 2005; Wu and Kuo 2008), over a relatively short time frame (generally six weeks or less). Thus there is still a major gap in our understanding of habitual system use in an organizational work environment. Disrupting IS habits presupposes an understanding of how IS habits embedded in organizational routines are developed and reinforced. Thus it is important to examine not only the immediate behavior in question, but also the various work processes, contextual factors, and other immediate antecedents that are triggering the undesired behavior.

Second, measures currently used to study IS habit are for the most part inconsistent, vague, or otherwise lacking in validity. The problem of defining and operationalizing habit is not unique to the IS literature; it is regularly debated among experts in the social psychology arena as well. Some researchers use frequency of past use as a proxy for habit, while others have attempted to develop various self-report measures. Ajzen (2002, p.109) has stated that “whether a frequently performed behavior has or has not habituated is an empirical question, and to answer

it we need an independent and validated measure of habit." This problem of proper operationalization of habit appears to be one of the key reasons why Ajzen himself has been resistant to incorporating habit into existing behavioral models such as the Theory of Planned Behavior (TPB). Thus, having a valid scale with which to measure habitual IS usage behaviors that is independent of frequency of past use is key to developing a proper understanding of the role that habit plays in both encouraging and inhibiting various forms of IS use.

Third, as we have stated earlier, IS research on habit has focused primarily on its role in superseding intentions in predicting *continued* use of a system. However, while it is certainly useful to know that people use certain systems habitually, it is just as insightful to examine what *negative* impacts habitual use may have on perceptions, intentions, and actual usage of new systems, as well as on perceptions, intentions, and actual usage related to extended or exploratory use of existing systems. This is important because information systems are a major organizational change agent. The introduction of new technologies creates opportunities for the introduction and practice of more efficient organizational and individual level work routines and task sequences. However, strong existing IS habits can prevent us from seeing, accurately evaluating, and adopting these improvements.

Finally, very little research has explicitly addressed the issue of how to go about *changing* habitual behaviors, and this gap in knowledge is especially noticeable in the IS literature. One common response when discussing how to change IS usage habits is "just turn the old system off and force the people to use the new system." However, this is not always an option. In many organizations today, there are multiple tools that can be used to perform any given task, yet these tools do not all perform equally, nor are they equally preferred by the "powers that be" within the organization. It is not likely, in implementing a new software

application, that the company is going to revoke access to all the other possible software tools for performing that task. Thus in considering how one changes habits of organizational IS use, another approach besides "pulling the plug" may be necessary. IS research needs to focus more on such organizational or managerial interventions to break undesirable IS usage habits.

## OBJECTIVES AND RESEARCH QUESTIONS

In our present research, we seek to study work-related IS usage habits within the context of the individual work routines in which they are embedded, and to develop a measure that is appropriate for understanding IS habits from this perspective. Using this newly-developed measure, we will address the negative impacts that habitual IS use may have on behavioral beliefs and intentions in regard to the adoption of newly introduced systems. Finally, we will lay the foundations for further study of organizational interventions to break undesired IS usage habits. Thus the major research questions underlying this dissertation are as follows:

*RQ 1: What role do organizational routines play in the development, sustenance, and disruption of IS usage habits?*

*RQ 2: How can we best measure IS habit in an organizational context, using a theoretically based scale that is both valid and reliable?*

*RQ 3: How does habitual use of an existing system impact user acceptance of a new system in organizations?*

## DISSERTATION STRUCTURE

This dissertation is based on a three-manuscript model, and is organized as follows. **Chapter Two** represents Paper One and addresses Research Question One. It presents a review of the extant literature on habits, work routines, and behavioral change from the fields of social psychology, organizational behavior, and information systems that provides the theoretical foundation for the remaining two papers. We begin by defining habit as a form of goal-directed automaticity, and examining how habit has been conceptualized in the social psychology

literature. We then move to a discussion of habits as they occur in an organizational context, integrating the psychology and organizational behavior literature on schemas, scripts, and work routines, and discussing how this improved understanding can inform the study of work-related IS usage habits.

A key goal of this paper is to highlight the importance of studying IS usage habits as they are embedded within larger, more complex, task sequences. Finally, we integrate the literature on the development and disruption of habits, highlighting ways in which various contextual factors can enforce existing habits and contribute to "action slips" that inhibit intended behavioral change. We also discuss potential organizational interventions to break IS usage habits. Throughout our discussion, we incorporate a series of testable propositions related to habitual IS use in organizations, closing with a discussion of implications for further IS research in this area.

**Chapter Three** represents Paper Two, and addresses Research Question Two. It focuses on the development of a theoretically based and thoroughly validated instrument for measuring habitual IS use in an organizational work environment. In developing this measure, we follow the vast majority of social psychology researchers today (e.g. Aarts and Dijksterhuis 2000; Bargh 1996; Sheeran et al. 2005; Verplanken and Orbell 2003) in viewing habit as a form of goal-directed, or goal-dependent, automaticity. We view habit as an aggregate, multidimensional construct consisting of the four dimensions of *intentionality*, *awareness*, *controllability*, and *mental efficiency*. Since habit is in fact a psychological construct, we argue that it is not appropriate to measure IS habit based simply on one's frequency of past use. We further believe that it should be possible to capture habit through appropriate self-report measures tapping all its various dimensions.

Most previous self-report measures have viewed habit as a simple first-order reflectively measured construct (e.g., Gefen 2003; Limayem et al. 2003b; Verplanken and Orbell 2003). However, based on Bargh's (1989) classification of the different forms of automatic behavior, we argue that habit is best viewed as a second-order, aggregate construct. In addition, the conceptualization of habit as a goal-directed form of behavior implies that IS habit must be measured within the context of specific task-oriented work routines and business processes. In other words, it is not adequate to simply ask an individual whether they use *System X* habitually; rather, we must ask whether they use System X habitually to achieve specific *work goals*. It is entirely possible that a given IS may be used habitually for some tasks but not for others (or even that certain features of an IS are used habitually whereas other features are not).

**Chapter Four** represents Paper Three, and addresses Research Question Three. We propose that the negative impact of habit on new system adoption is mediated by inertia, which is defined as *persistence of existing behavioral patterns, even in the presence of better alternatives or incentives to change*. We draw from status quo bias theory to situate habit and its inertial consequences in a nomological network of technology acceptance constructs and hypothesize its effects on behavioral beliefs and intentions. Per status quo bias theory, habitual users of the extant system will have higher perceptions of sunk costs associated with switching to a new system. Habit, perceived sunk costs, perceived transition costs, and individual differences related to resistance to change will all lead to higher levels of inertia. Inertia will in turn lead to lower perceptions of the relative advantage and ease of use of a new system, as well as lower intentions to adopt and use the new system. The paper empirically tests the theoretical model within which both habit and its consequence, inertia, are embedded.

**Chapter Five** draws conclusions across all three studies, and addresses limitations and future research directions. First, it is critical that future research examine IS habit longitudinally within an organizational setting, focusing on habitual IS usage behaviors that are embedded within complex work routines and task sequences. In addition, since we used intention as our ultimate dependent variable, future studies should focus on the impact of IS habit on the intention-behavior link, particularly investigating the role that action slips play in overruling intentions to use a new system. Another fruitful direction for future research is to look at the negative impact of habitual IS use on extended or exploratory use of specific IS *features*. Failure to practice extended use, or explore new system features, may result in lower individual productivity and less net benefits for the organization as a whole from the implementation of a given IS.

Future research should also explicitly test the organizational interventions we have proposed here for disrupting existing habits and encouraging the development of new habits. In particular, studies should investigate the impact of specific interventions, over time, on the different dimensions of habit. Finally, previous researchers have suggested that there may be different profiles of habits, implying that habit is in fact a profile construct. The multidimensional habit measure we present here can perhaps be used in the future to investigate the possibility that there is a typology of habits in IS use, by examining the relative contribution of each habit dimension in situations differing based on the level of embeddedness of the habit within a larger task sequence, whether the system is being used in a very task-oriented setting, or whether it is being used for primarily personal or hedonic purposes.

## CONTRIBUTIONS TO THEORY AND PRACTICE

Our study contributes to both the IS and habit literature by integrating what is currently known about habit across various disciplines to better understand the nature of IS habits as they are embedded within larger, often complex, organizational work routines and task sequences. We also integrate current knowledge about the contextual factors that impact habit development and disruption, to apply these more specifically to the IS environment and increase understanding of exactly what each of these factors mean when applied to scenarios of user interaction with an information system.

Another key contribution of our study is the development and validation of a new scale for use in measuring IS habits in organizations. In the past, habit has often been measured as frequency of past use, and many self-report habit measures include items from dimensions that do not fall within the content domain of habit. Further, habit has been conceptualized as unidimensional and reflective in structure, whereas we argue that it is in fact a multidimensional aggregate construct. Proper specification of the habit construct has important implications for the study of habit within a nomological network of technological acceptance constructs.

We also contribute to the IS and habit literature by explicitly modeling old system habit and its consequence, inertia, as inhibitors of technology acceptance. To date, while researchers have often implied that old system habits might have a negative impact on new system perceptions and intentions, the mechanism by which this impact occurs has not been theorized or empirically tested. Finally, we draw from a number of disciplines to present a series of propositions regarding organizational interventions to disrupt unwanted IS habits and encourage the development of new IS habits. We propose that these interventions impact the dimensions of

habit in different ways, and that a combination of intervention strategies is best for accomplishing the organization's goals.

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CHAPTER 2

# THE EMBEDDEDNESS OF IS HABITS IN ORGANIZATIONAL ROUTINES: DEVELOPMENT AND DISRUPTION[1]

[1] Polites, G. L. and E. Karahanna. To be submitted to *MIS Quarterly*.

## INTRODUCTION

The psychological construct of habit has attracted much attention in recent research on technology acceptance and continuance (e.g., Cheung and Limayem 2005b; Gefen 2003; Jasperson et al. 2005; Kim and Malhotra 2005; Kim et al. 2005; Limayem and Hirt 2003; Limayem et al. 2003b; Limayem et al. 2007; Wu and Kuo 2008). These studies generally argue that continued use of an IS over time is largely a function of habit rather than conscious intentions, and therefore encouraging the development of *new* IS usage habits can play a key role in the successful implementation of newly introduced systems. Though these studies have enhanced our understanding of *continuance* behaviors, extant studies on IS habit are limited in contributing to our understanding of how IS usage habits develop and operate in an *organizational* context. To date, studies have empirically focused primarily on student use of web-based classroom support systems (e.g., Cheung and Limayem 2005b; Limayem and Hirt 2003) and the World Wide Web (WWW) (e.g., Limayem et al. 2003b; Limayem et al. 2007), along with habitual use of e-commerce and information websites (e.g., Gefen 2003; Kim and Malhotra 2005; Kim et al. 2005; Wu and Kuo 2008), over a relatively short time frame (generally six weeks or less).

Within organizations, however, IS usage habits may develop over a long period of time, and are almost always embedded within a larger context of frequently practiced, higher-level routines or task sequences. As such, the use of a particular IS for a particular task, and in fact the entire task sequence in which this usage is embedded, may over time reach the point that it is triggered automatically, without conscious thought and outside the individual's awareness, any time a higher-level work goal is encountered (Ashforth and Fried 1988; Bargh 1990; Norman 1981). Thus understanding how work-related IS habits form, how they enable and inhibit

behavior, and how they can be disrupted, requires that we examine them within the context of organizational routines.

Furthermore, while prior IS habit research has focused on how habits *facilitate* usage of information systems, of equal importance is how habitual use of existing systems *inhibits* adoption and use of new systems. Organizational routines have long been recognized as a source of inertia inhibiting behavioral change at the organizational, group, and individual levels of analysis. However, organizational routines can and do change when the circumstances are right (Becker et al. 2005; Bresnen et al. 2005; Cohen and Bacdayan 1994; Feldman 2000; Feldman and Pentland 2003; Howard-Grenville 2005). Unfortunately, though, while the formal processes and sanctioned task sequences associated with an organizational routine may undergo change after the introduction of a new IS, the embedded situational triggers of old, undesirable individual-level habits may remain (Norman 1981). Thus in order to learn how to effectively break an individual's IS usage habits and encourage the development of new ones in an organizational context, we must understand the relationship between organizational routines, organizational and individual level scripts, and individual level habitual behaviors. We must also situate and study specific habitual IS usage behaviors within their associated work routines or task sequences, and seek out their contextual triggers. In so doing, we can better inform organizations concerning how to not only plan more effective actions to encourage *new* usage behaviors, but also to prevent action slips[2] of *old* behaviors.

Thus, the objective of the current manuscript is to contribute to the IS habit literature by (a) situating habitual IS usage behaviors within the context of their associated work routines and task sequences; and (b) providing a theoretical understanding of how habits develop and how

[2] Norman (1981, p.1) defines an action slip as "the performance of an action that was not what was intended."

they can be disrupted in an organizational context acknowledging the dual facilitating and inhibiting effects of habit on IS adoption and continuance.

We begin by defining habit and discussing habits as they occur in an organizational work context, integrating the psychology and organizational behavior literature on schemas, scripts, and work routines. We especially highlight the importance of studying IS habits as they are embedded within larger, more complex, task sequences. Next, we integrate the literature on the development and disruption of habits, highlighting ways in which contextual factors can enforce existing habits and encourage habitual usage but also ways in which contextual factors contribute to action slips which inhibit intended behavioral change. We also discuss potential organizational interventions to eliminate or modify these contextual triggers, encourage more conscious control over behavior, and thus break IS usage habits. Throughout our discussion, we offer a series of propositions designed to direct the study of IS habits in the future. We close with a discussion of implications for IS research in this area.

## DEFINITION OF HABIT

While habit has been defined and operationalized in many different ways (see Tables 3.3 and 3.4 in Appendix A; additional references can be found in Limayem et al. 2007), we follow the majority of social psychology researchers today (e.g., Aarts and Dijksterhuis 2000b; Bargh and Ferguson 2000; Sheeran et al. 2005; Verplanken and Orbell 2003) in viewing habit as a form of *goal-directed automaticity*. We thus define habit as "learned sequences of acts that have become automatic responses to specific cues, and are functional in obtaining certain goals or end-states" (Verplanken and Aarts 1999, p.104).[3] Viewing habits as entire, sometimes lengthy,

[3] Though Limayem et al. (2007) make a distinction between "habit" and "habitual behavior," regarding habit as a mindset or behavioral tendency that leads to the practice of (habitual) behavior (see Ouellette and Wood 1998), in this paper we use the two terms interchangeably while recognizing both the psychological nature of habit and the fact that habits cannot be measured by simply looking at one's behavior.

sequences of behaviors is particularly appropriate in understanding habitual IS use in organizations, where choice of a given IS may be just one step within a much larger automatized sequence of work activities.

As goal-directed automaticity, habit is a multidimensional construct consisting of the four dimensions of *intentionality*, *lack of awareness*, *difficulty of control*, and *mental efficiency* (Bargh 1989; Bargh 1994; Verplanken and Orbell 2003). Habits are intentional in that they are functional or goal-oriented in nature. Nevertheless, habitual behavior occurs outside of awareness, in that the individual may be unaware of the situational trigger leading them to perform the behavior, or unaware of how the trigger is interpreted at the moment it occurs. This is particularly true when a highly scripted sequence of activities is involved. Further, habitual behavior is difficult to control, in that it may be difficult to resist the urge to perform a task in a particular way, especially if it is part of a larger automatized work routine. Finally, habitual behavior is mentally efficient, meaning that it frees the individual's attentional resources to do other things at the same time (Bargh 1994; Verplanken and Orbell 2003). This savings of memory space and processing time is particularly useful when one must perform a complex yet programmable sequence of actions on a frequent, ongoing basis (Schank and Abelson 1977). It is worth noting that as a mental construct with features of automaticity, habit should not simply be equated with frequency of past behavior as in some extant research, but rather should be viewed as a psychological multi-dimensional construct.

There are two popular yet conflicting ways of conceptualizing habit as automatic behavior. The first has its foundation in behaviorism, and views habit from a stimulus-response perspective that largely ignores the importance of psychological states and mental processes in habit formation. From this perspective,

> The more often performance of the behaviour in response to the situation has been positively reinforced, the stronger the situation-behaviour link (i.e. the stronger the habit). (Sheeran et al. 2005, p.48)

The second approach to conceptualizing habit, the cognitive-motivational view, focuses on the importance of *goals* in habit development, and views goals as mediating the relationship between the environmental context and response. Thus habits are mental associations between these goals and the resulting behavior (Aarts and Dijksterhuis 2000a; Aarts and Dijksterhuis 2000b; Sheeran et al. 2005; Verplanken 2006; Verplanken and Orbell 2003). From this perspective,

> …situational features become associated with a particular goal, and activation of that goal leads to performance of the behaviour. Positive reinforcement strengthens the link between the goal and the behaviour as one learns that the behaviour leads to the goal or expected result. Furthermore, recurrent instigation of the goal in the same situation increases the link between situation and goal…Because the situation, goal, and action are assumed to be mentally represented, it follows that perception of the situation is capable of automatically activating the representation of the goal and the resultant action (all the way down to the motor program). This way, habitual action may be initiated and subsequently executed without much awareness of the goal driving the action. (Sheeran et al. 2005, p.48)

While some followers of the behaviorist approach concede that habitual behavior may have had its *origin* in attaining certain goals, they argue that *over time*, that goal link is lost and thus an individual may continue practicing a habitual behavior long after it has lost its original meaning, simply due to triggering stimuli (Wood and Quinn 2004; Wood et al. 2005). While we do not deny the possibility of this phenomenon, we will follow the latter conceptualization of habits as goal-directed automaticity in the remainder of our paper. In other words, we recognize that situational features are capable of automatically activating goals outside of a person's awareness (Bargh and Ferguson 2000; Bargh et al. 2001), and that this goal activation then leads to practice of the habitual behavior. In an organizational context where work behaviors are

largely instrumental in nature, viewing habit as goal-directed automaticity makes even more sense. This is because "the tasks individuals need to accomplish [in a work setting] have the same function as goals in nonwork contexts (Frese and Zapfe, 1994)" (Ohly et al. 2006, p.259).

A few examples of the relationship between situational features and automatically activated goals may be helpful here. In Bagozzi and Dholakia's (1999) study of consumer goal setting and goal striving, they proposed a hierarchy of goals using the example of weight loss. While an individual's focal goal ("*what* they want") is to lose weight, superordinate goals ("*why* they want it," e.g., to live longer or to look and feel good) as well as subordinate goals ("*how* they will achieve it," e.g., through exercise and dieting) are also present. While any of the goals in the goal hierarchy may be automatically activated by a situational feature (e.g., viewing oneself in the mirror, walking past the refrigerator or exercise bike), it is the behavior associated with the subordinate goal (which originated from action planning) that actually has the potential to habituate over time.

We draw from Bagozzi and Dholakia's approach to relate situational features and goal hierarchies to IS usage habits in organizations (Table 3.1). Notice that in both examples shown in Table 3.1, the individual is aware of the situational feature or stimulus, but they are not necessarily aware of activation of all the various goals in the hierarchy or their choice of the action response. This is particularly true if either scenario has occurred frequently enough in the past for the response to become habituated.

**Table 3.1. Situational Features and Goal Hierarchies**

| Situational feature | Automatically activated focal goal (“*What* do you want?”) | Superordinate goal (“*Why* do you want to achieve the focal goal?”) | Subordinate goal (“*How* is the focal goal achieved?”) |
|---|---|---|---|
| System not working | Get it fixed | Be able to get work done | Call, email, or log problem in a tracking system |
| Business event occurs (e.g., a drop in sales of a certain product) | Determine the reason and get it corrected | Improve the company’s bottom line or competitive position | Use a particular IS to drill into data, use a particular communication tool to contact and discuss the problem with others |

## STUDYING HABIT IN AN ORGANIZATIONAL CONTEXT

Many of the tasks performed within an organizational setting are repetitive in nature. This is true for both simple tasks and more complex *sequences* of tasks as well as for tasks at various *levels of analysis* (e.g., organizational, group, and individual). However, not all frequently repeated organizational behavior is habitual. By definition, habits can only apply to individual work routines and not to routines at higher levels of analysis (Becker 2005; Cohen and Bacdayan 1994). Thus to understand habits in a work context, we must first understand the relationship between individual work routines (both habitual and nonhabitual) and the concepts of cognitive schemas and scripts, which serve as foundations for the development of habitual work behaviors.

### Cognitive Schemas and Scripts

Figure 3.1 situates work-related habits within the larger concepts of cognitive schemas, scripts, and work routines. A *cognitive schema* is a knowledge structure that represents some specific, frequently encountered, aspect of our world, and that serves “as a guide for the interpretation of information, actions, and expectations” (Gioia and Poole 1984, p.450). *Scripts* are a specific type of schema known as *action* or *event schemas*, which represent standard, generally frequently practiced, event or behavior sequences, such as those that commonly take

place in a work environment. Scripts not only help us to make sense of a frequently encountered business situation, but they also inform us of the appropriate behavior to practice in that situation (Gioia and Poole 1984; Schank and Abelson 1977). Scripts may be either *weak* (specifying what will happen in a given situation, but not necessarily the exact order of occurrence) or *strong* (specifying both what will happen and in what sequence) (Gioia and Poole 1984).

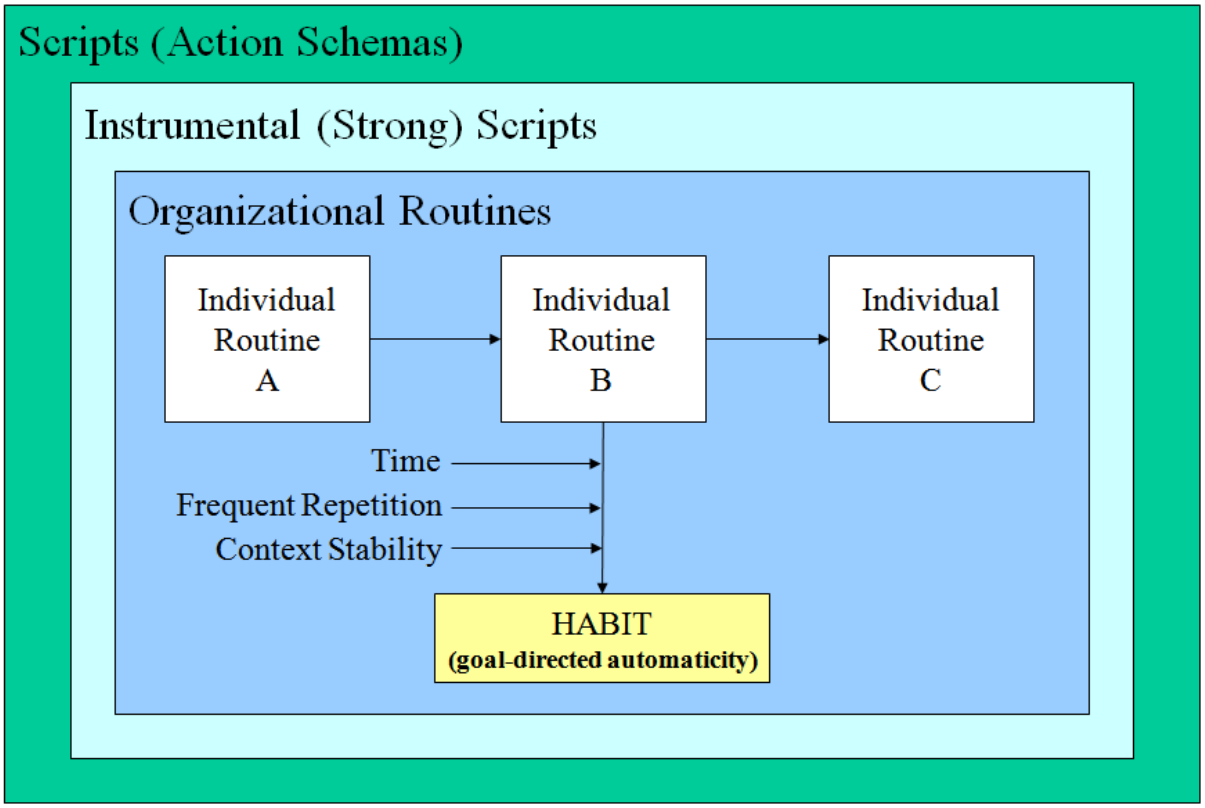


**Figure 3.1. The Relationship Between Scripts, Organizational and Individual Level Work Routines, and Habits**

*Instrumental scripts* are a form of strong script that represent a precise sequence of actions that must be followed to attain a specific goal. Goal-oriented *work routines* have their origins in instrumental scripts, which may operate at the organizational, group, or individual level of analysis. Further, individual level routines are often, though not always, embedded

within larger organizational (or group) routines, and are carried out in succession. Only these *individual-level* work routines, and more specifically, individual-level routines based on strong scripts, have the potential to develop into habits. Put differently, individual-level work routines (defined as specific goal-oriented task sequences performed by a single employee) that are performed repeatedly in a stable context will, over time, have a tendency to become automatized, i.e., initiated outside awareness, in a mentally efficient manner, and without conscious control. At this point, the routine has become a *habit*, meeting all the qualifications of goal-directed automaticity. In the sections following, we further elaborate on the relationship between organizational routines and habits, and discuss the difference between habitual IS *choice* versus habitual ways of *using* an IS as they occur within larger work routines and task sequences.

**Differentiating Habits from Organizational Routines**

Routines at all levels of analysis (organizational, group, or individual) may lead to increased efficiency in task performance or, conversely, encourage inertia that ultimately inhibits change (Pentland and Feldman 2005). In addition, routines at all levels of analysis may or may not be truly performed automatically (Pentland and Rueter 1994). However, while organizational routines and habits are often discussed together (see Pentland and Feldman 2005 for a complete list of references), they can be easily distinguished in that organizational routines are "multi-actor, interlocking, reciprocally-triggered sequences of actions" (Cohen and Bacdayan 1994, p.554) that cannot be studied by looking at only one individual actor, whereas habits exist *solely* at the individual level of analysis (Becker 2005).

Despite this difference, individual habits are often *embedded* within larger, multi-actor organizational routines (as shown in Figure 1), meaning that the triggers for these habitual behaviors are events that occur as the multi-actor script is being carried out. Thus organizational

routines are often a composite of many individual-level habituated task sequences. For example, a person in one department may be responsible for completing a particular automatized sequence of tasks, after which they pass the work off to an individual in another department, who then performs their own automatized sequence of tasks, etc., until the business process has been completed. The point in time when the work gets passed from Person A to Person B is in fact the trigger or cue for Person B's habitual scripted behavior (Becker 2004). Thus in some ways, organizational routines can be viewed as a combination of organizational structures and individual level habits that, "when triggered, lead to sequential behaviors" (Becker 2005).

### IS Habit as Habitual IS Choice

It is important to note that in the present study, "habitual IS use" or "IS habit" refers only to the *habitual choice of a given IS* to perform specific tasks. We do not address habitual ways of *using* that system (e.g., precise keystroke sequences followed) in the process of actually *carrying out* those tasks with a given IS. However, as Murray and Haubl (2007, p.78) describe, these habitual ways of using a system can in turn "create switching costs that *lead* to habitual choice."

As discussed before, the literature is clear that entire, lengthy (and sometimes quite complex) work-related task sequences may become habituated over time. However, the choice of a given IS to perform a task is often only one step in a much larger automatized task sequence. While extant habit research has looked at this isolated "choice" activity in the context of travel mode choice (e.g., Aarts and Dijksterhuis 2000a; Aarts and Dijksterhuis 2000b; Aarts et al. 1997b; Bamberg et al. 2003; Klockner and Matthies 2004; Møller 2003; Verplanken et al. 1997; Verplanken et al. 1994), eating and drinking habits (e.g., Burg et al. 2006; Honkanen et al. 2005; Saba and diNatale 1998; Saba and diNatale 1999; Saba et al. 1988; Saba et al. 2000; Sheeran et al. 2005; Towler and Shepherd 1991-1992; Verplanken and Faes 1999), and consumer

purchasing patterns (e.g., Gefen 2003; Greenfield 2005; Ji Song and Wood 2005; Khalifa et al. 2002; Khalifa and Liu 2005; Verplanken et al. 2005; Verplanken and Wood 2006), it has not examined these "habits of choice" as they occur embedded within larger, instrumental, automatized task sequences.

Within an organization, the habitual choice of a given IS may not always appear to be tied to a specific, complex, work-related task sequence. For example, an employee may have a habit of coming in to work first thing in the morning, and automatically opening up Microsoft Outlook (or some other email program) to see what messages have arrived overnight. However, even in this situation, the IS use may be considered embedded within a larger "start of the workday" routine. In other situations, use of a specific IS (or a lack thereof) is much more intricately tied into existing, and even organizationally mandated, business processes involving multiple actors, such as organizational routines related to processing a loan application or customer service request. As work is passed from one group or individual to the next, individual decisions are repeatedly made as to which IS to use to complete one's tasks. Over time, these decisions, or choices of a particular IS for a particular task, become habituated.

Consider the example of change management. Many companies have a clearly defined process for documenting and tracking change requests. Major steps in the work process may include logging an initial request for a change to an existing software application, formally approving that request, and assigning it to one or more IT workers who will then make the necessary system changes, all the while documenting their work and keeping the end user(s) and other stakeholders notified of their progress at regular checkpoints along the way.

Given the complex yet often routine nature of the change management/tracking process, there is ample opportunity for a number of IS habits to develop. For example, habitual forms of

communication may develop, with some individuals automatically picking up the telephone or sending an email to check on the status of a request (or to provide updates on the same), rather than recording this information in a formal change control system. Some users may have also developed their own personal routines for logging their work, rather than updating this information and storing relevant documentation in a publicly sanctioned location. Thus when an organization implements a new change management system, which is intended to handle all communications and workflow associated with the change management process, it must take into account that many of the system's prospective users may have already formed habitual ways of (i.e., habitual choices for) performing their tasks that conflict with the processes and goals implied by the new system.

### General versus Specific IS Habits

"General IS habits" have been defined as those characterized by high usage comprehensiveness, that is, where the system is used for many different purposes or tasks, whereas "specific IS habits" are those with limited usage comprehensiveness, that is, where the system may be used for only one or a relatively small number of tasks (Limayem et al. 2007). In the former case, one would measure habit with respect to using the system in general (e.g. habitual use of the web) and not tied to a specific task. In the latter case, habit is measured with respect to a specific task (e.g. habitual use of the web to catch up on news). While Limayem et al.'s research focuses on general IS habits, we focus here on *specific* IS habits, since we are concerned with habitual IS choice for a specific task, based on the embeddedness of that task within a specific, larger task sequence.

It is possible for a particular IS to be chosen habitually when embedded within some work routines but not others. For example, many business processes require the gathering of

various forms of information. An individual may use a particular search engine, research database, or managed query tool for one task, while using a completely different one for another, even though both systems are equally capable of producing the required information. This reiterates the fact that just as individual IS usage behaviors are embedded within much larger work routines, their habitual nature can only be understood properly if we study them within this larger context.

A focus on specific IS habits is also appropriate in that successfully disrupting an existing habit of choosing System A upon the introduction of a new System B (that may only be a valid alternative for a small percentage of all the tasks that the employee currently uses System A for) requires intervention strategies that are targeted at only those tasks for which use of System A is no longer desirable. We now turn our attention to the *ways* in which the choice of a particular IS may become habitual in certain business situations.

## HOW HABITS DEVELOP

The presence of a script for performing certain tasks or responding to particular situations encountered in the course of one's work does not necessarily imply that each step in the sequence of actions has become habituated in the psychological sense, or that people do not have the ability to "stand back and look at what they are doing" (Gioia and Poole 1984, p.452). However, following scripts over a long period of time may *predispose* individuals to perform certain behaviors "mindlessly" or automatically (Ashforth and Fried 1988). Habits form when behaviors (including scripted task sequences and work routines) that are initially carried out consciously and intentionally are "overlearned" as a consequence of being repeated frequently over time in a stable context (Deci 1980) and with satisfactory experience (Limayem et al 2007). We briefly discuss the role of repetition, comprehensiveness of use (which we here associate

with repetition), and satisfaction on habit development before turning our attention to a more in-depth discussion of the role of context stability in supporting work-related habits. We focus on context stability because it is the least studied, and perhaps in the case of IS usage habits, the least understood, of all the recognized antecedents of habit.

## Repetition

Researchers have long argued that frequent repetition of a behavior is a necessary precursor to habit formation. Through repetition, individuals learn to associate situational cues with particular behavioral responses. In addition, behaviors that are repeated more frequently (e.g., daily tasks) are believed to lead to stronger habits than less frequently practiced behaviors (e.g., weekly or monthly tasks) (Limayem et al. 2007; Ouellette and Wood, 1998).

Limayem et al. have suggested "comprehensiveness of use" as an additional antecedent of IS habits, positing that

> people who use an information system in many different ways, will tend to develop stronger habits with respect to the usage of that IS than others who use the IS in more limited ways. In other words, users who take full advantage of an IS's overall functionality will not confine their IS usage to specific situations only. (2007, pp.715-716)

Limayem et al. use the World Wide Web as an example of a system that can be used for many different tasks (e.g., searching for information, communicating, shopping). However, one must keep in mind that their study focused on general, as opposed to specific, IS habits, which are not our focus here. Nevertheless, it is possible that this "comprehensiveness of use" may strengthen habits through simply increasing opportunities for repetition by using the system across various tasks.

### Satisfaction

Although satisfaction with the performance of a behavior is much less frequently discussed in the social psychology literature on habit, Limayem et al. (2007) have included satisfaction as a key enabler of habit formation. If one is satisfied with a given experience, such as the use of a particular IS to perform a work task, they will tend to repeat that activity again in the future, when they find themselves in a similar situation. As one becomes more comfortable with performing a behavior (e.g., using a given IS), their level of satisfaction is expected to increase, leading to further use of that system, and eventually (in many cases) a habit of using that system for that task.

### Context Stability

Table 3.2 summarizes the contextual factors most commonly believed to exert an influence on individual behavior patterns. Social psychology studies on the impact of context stability on the performance of habitual behaviors have tended to be subjective in nature, and have focused on non-work related behaviors such as watching news on TV, exercising, and purchasing fast food (Ji Song and Wood 2005; Wood et al. 2005). In the marketing literature, these same situational variables have not been examined directly in terms of how they might explain habitual behaviors, but rather in terms of their impact on individuals' choice of beverages, meat products, snack products, fast foods, leisure activities, and motion pictures (Belk 1975). Nonetheless, several of the contextual variables listed in Table 3.2 have potential to provide insight into how organizational work habits in general, and IS usage habits in particular, are reinforced over time, as well as to provide insight into how these IS usage habits might be disrupted or modified by adjusting individual contextual elements. We discuss each of these contextual elements in the following sections.

**Table 3.2. Contextual Variables Impacting the Performance of Habitual Behavior**

| Variable | Sources | Description |
|---|---|---|
| Time | Belk 1975; Ji Song and Wood 2004; Wood and Quinn 2004; Wood et al. 2005 | Refers to the time of day, week, etc. when the individual normally performs the behavior in question. However, the time that a behavior is performed may also be relative to other events that have taken, or will take, place. Along with physical location, time is considered one of the two most important contextual factors enabling the development of habits in everyday life. |
| Physical Surroundings | Belk 1975; Ji Song and Wood 2004; Wood and Quinn 2004; Wood et al. 2005 | Most commonly used to refer to one's physical location when performing an action. However, it may also refer to lighting, sounds, weather, and visual stimuli associated with the immediate environment. Along with time, location is considered one of the two most important contextual factors enabling the development of habits in everyday life. |
| Social Setting | Belk 1975; Ji Song and Wood 2004; Wood et al. 2005 | Refers to one's social surroundings when performing an action. A particular behavior may tend to be practiced habitually when in the company of a particular set of other individuals. |
| Task Definition | Belk 1975; Wood and Quinn 2004 | Refers to one's intent or requirement to perform a particular activity, or their understanding of the task. Possibly analogous to the intentionality dimension proposed by proponents of the goal-directed automaticity view of habits. |
| Mood | Belk 1975; Ji Song and Wood 2004, Wood et al. 2005 | Speaks to one's mindset and internal state immediately prior to performing the action. Momentary moods that may impact behavior include "acute anxiety, pleasantness, hostility, and excitation" (Belk 1975, p.159). Difficult to capture accurately through retrospective self-reports (Wood et al. 2005). |
| Other Antecedent States | Belk 1975; Wood and Quinn 2004 | Goes beyond momentary moods to include momentary conditions such as "cash on hand, fatigue, and illness" that occur immediately antecedent to the performance of the behavior (Belk 1975, p.159). |

### Temporal Context

Time is a very common contextual cue for triggering IS habits, since many work-related tasks involving computer systems often have to be performed at specified times of the day or week (e.g., first thing in the morning, last thing in the evening, every Friday or Monday). Many managers have reports that they generate and review each morning when they first come in to work or they examine digital dashboards to monitor key performance indicators. Other employees may have to run through daily checklists, or submit various types of status reports at

the end of the day, week, or month. And of course, one of the first tasks that many people do when arriving at work in the morning is to turn on their PC and check their email and voicemail.

While some tasks involving computer use must be performed at a very specific time of day, or performed repeatedly at specific times throughout the day (e.g., morning weather reports at a governmental agency, hourly quality control checks in a manufacturing plant), many of these "time of day" triggers for IS use are actually relative in nature. For example, an employee who arrives at work at 1:00 PM instead of 8:00 AM, will most likely still begin the day by checking her emails and listening to voicemail messages left while she was gone. Thus the temporal trigger to the IS use is *arriving at work*, regardless of the exact time that this takes place.

Temporal context may also be viewed as relative in that commonly performed work tasks are triggered by the activities of other individuals or by specific business events that occur regularly, yet not always at the exact same time each day. Many forms of interdepartmental workflow would fit this description, including the tasks related to setting up accounts and processing paperwork for a new employee, processing a loan application, completing a trouble ticket, or processing a financial aid request at a university. This implies that the performance of habitual IS behaviors may be primarily *event-driven* (see Becker 2004; Becker 2005), particularly when embedded within larger scripted group or organizational work routines. Thus we posit:

> *Proposition 1: Stability of temporal context (relative or exact) during which IS usage is initiated will influence the development and sustenance[4] of work-related IS habits.*
>
> *Proposition 2: Embedding IS use within larger scripted work routines that involve the same recurring business events or triggers will influence the development and sustenance of work-related IS habits.*

[4] In the propositions that follow, "development and sustenance" refers to the creation, strengthening, and reinforcement / maintenance of habits over time.

**Physical Context**

The physical environment may play a role in triggering IS use as well, if an individual is in the habit of only using a specific office, cubicle, or other portion of the workspace to perform certain tasks. The mere sight of (or entrance into) this physical space (particularly at a certain time of day) can trigger activities to be performed automatically (Limayem et al. 2007). Thus one may potentially use a different IS to complete the same task depending on whether they are working in their office, in another location at work, at home, or traveling on business, and over time, these different choices may become habituated based on built-in situational triggers. In addition, individuals may perform different tasks altogether, as a consequence of the physical environment triggering a different set of work routines.

Other elements of the physical context may play a more important role in determining which IS an individual chooses to use, particularly when there is more than one option available for completing a given task. Belk (1975, p.159) refers to these elements as the "visible configurations…surrounding the stimulus object" (with the stimulus objects in his study being products for sale on a store shelf). For example, the appearance and layout of the user interface, including the placement of objects and startup icons, as well as embedded links to other applications, may all encourage and trigger habitual use of a system. An end user does not need to consciously think about the location of the web browser icon on their desktop, or the location of a particular application in the Windows program list, or the location of the weather section on a news web site. Rather, over time, the user simply clicks on the icon, browses to the application name in the Programs list, or scrolls down the web page to the weather report, without ever thinking about it. Such behaviors will likely continue habitually until the "launch point" for the

desired application is relocated, removed, or modified in some other way (see Kim et al. 2005). Thus we posit:

> *Proposition 3: Stability of the physical environment in which IS use takes place will influence the development and sustenance of work-related IS habits.*

> *Proposition 4: Stability of the user interface configuration associated with accessing the system will influence the development and sustenance of work-related IS habits.*

**Social Context**

While the temporal and physical contexts are generally considered to be the most important triggers of habitual behavior across a wide variety of situations (see Wood and Quinn 2004; Wood et al. 2005), social context may also play a role in triggering automatic use of a given IS. This is particularly true when more than one system is available with which to perform a given task. For example, an employee may use the officially sanctioned workflow tracking system when in the presence of his or her superiors (knowing that to do otherwise might earn him a reprimand), but use other, more informal methods (such as phone calls and emails) when alone and not being watched. Over time, the tendency to select either the sanctioned or informal workflow system may be automatically triggered by who is present when the employee needs to perform a workflow-related task. Thus we posit:

> *Proposition 5: The consistent presence of significant referents sanctioning use of a specific IS will influence the development and sustenance of work-related IS habits.*

**Task Definition**

Occasionally, two work tasks may superficially appear to be the same, and yet the individual selects a different IS to perform each of them. In such a case, understanding this habitual selection of one IS over another depends on a more precise definition of each task, e.g., the specific role the individual is fulfilling while performing the task, or the purpose or person

for whom the task must be completed. Belk (1975) uses the example of a person shopping for a small appliance to buy as a wedding gift, versus to buy for themselves. The difference in the situation leads to a different role being played, and therefore different steps being followed, or different decisions being made, to fulfill the task. Similar situations may occur with IS use. For example, an academic researcher may use Google or MSN for general information searches on a research topic, an online library database such as Web of Science for electronic journal searches, and Google Scholar for quick keyword searches of research that has been done on a given topic. Over time, these varying search engine choices may become habituated based on the task at hand (see Lending and Straub 1997 for an example of how the choice of literature search techniques may become habituated over time based on characteristics of the situation).

Since we are investigating specific, as opposed to general, IS habits (see Limayem et al. 2007), we focus here on the development and sustenance of IS habits associated with the individual tasks themselves, and recognize that even though a given system may offer different features, habits initially develop in relation to using that system (or particular features of that system) for a given task, and not necessarily for all features and all tasks. However, while individual habits are task-specific, Limayem et al.'s introduction of the IS habit antecedent of "comprehensiveness of use" indicates that it is possible that the wider the range of tasks a particular system supports and the more habituated use of that system has become for each individual task, the stronger the habit toward using the system *overall*, across *all* tasks, will become.

This is similar to the way in which computer self-efficacy has been conceptualized at both the general and task-specific levels (see Marakas et al. 1998). Task-specific computer self-efficacy exists when an individual feels capable of performing a specific task using a computer,

and is further associated with a specific computing environment and type of application (e.g., word processor, spreadsheet, database). General computer self-efficacy, on the other hand, exists when that individual feels capable of using a computer across a number of different application domains (Marakas et al. 1998). We draw from Marakas et al.'s conceptualization of the multiple levels of self-efficacy to demonstrate the relationship between task-specific and general IS habits and IS usage, in Figure 3.2.

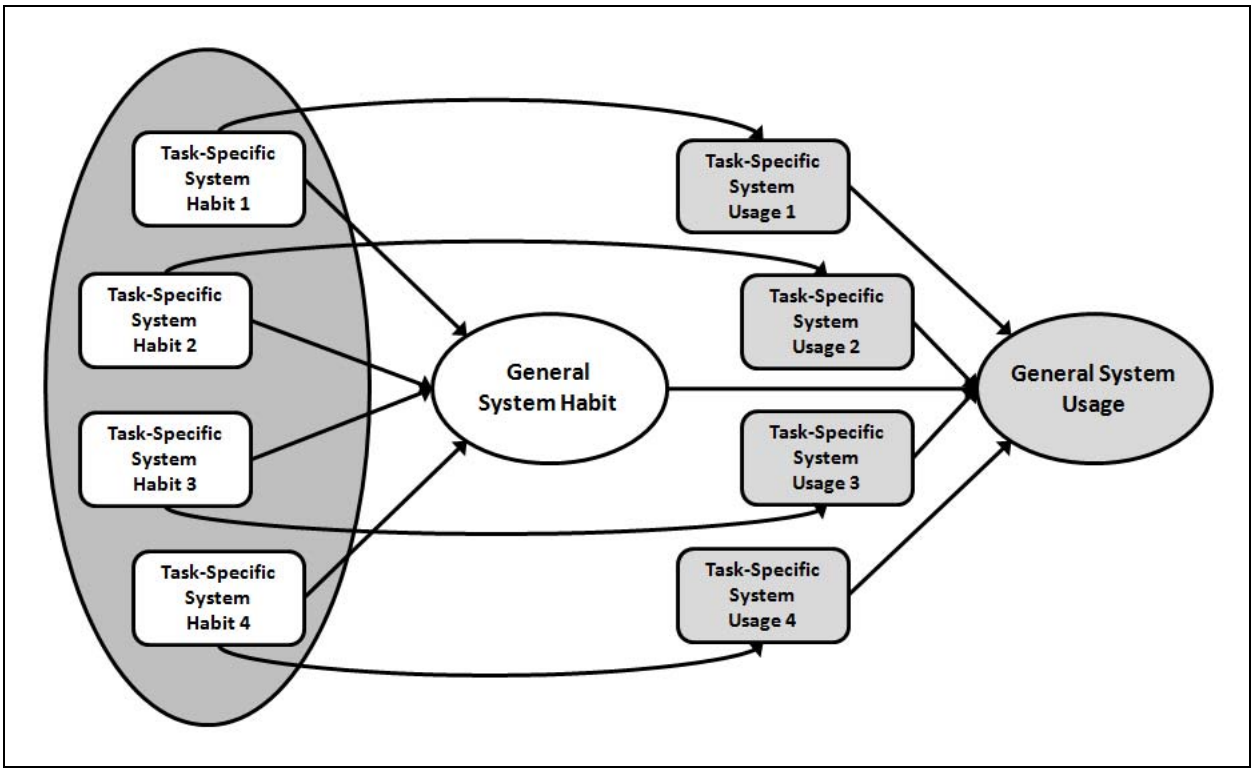


**Figure 3.2. Relationship Between General and Task-Specific System Habits and System Usage**

We can see from the lefthand side of this figure that many different tasks can be performed using a particular IS. Over time, the choice of that IS to perform some or all of these tasks may become habituated. If the set of tasks for which the system is habitually selected is large enough (in relation to all possible tasks that can be performed with that system), then a

general system habit may develop. Just as each task-specific habit will predict future use of the system for that task, so too will a general system habit predict general (overall) use of that system in the future. Thus we posit:

> *Proposition 6: The number of **specific** IS habits associated with use of a particular system will influence the development and sustenance of **general** IS habits.*

Task definition can be viewed in other ways. For example, task definition can represent the specific sequence of steps that need to be performed to carry out a much larger work task. Whereas event triggers are perhaps the most important situational factor leading to habitual IS use within the context of a *multi-actor* routine, task definition is key to triggering habitual use for lengthy *single-actor* routines (where the "events" are actually antecedent steps in the individual task sequence). This is true whether the user is consciously aware of every action they are taking, or keystroke that they are entering, while performing the overall task or not. Once a given sequence of steps is committed to memory and performed on an ongoing basis, the individual steps embedded in that larger sequence will be carried out without conscious thought. Thus we posit:

> *Proposition 7: The level of embeddedness of IS use in larger stable task sequences will influence the development and sustenance of work-related IS habits.*

**Antecedent States**

To a lesser extent, anxiety, stress, fatigue, and a need for speed of execution in performing tasks may all trigger the automatic use of particular systems (Belk 1975; Wood and Quinn 2004). In fact, consciously directed behaviors have been shown to be associated with higher levels of stress than habitual behaviors, and fatigue may inhibit one's ability to override habits and consciously choose a new IS to perform a task over the existing system (see Wood et

al. 2002). Thus if an employee is feeling overwhelmed, stressed, or under time pressure to complete a given task, he or she may automatically revert back to the use of a system which lowers stress or promises faster task completion (i.e., revert back to habitual patterns of selecting a given IS to perform work-related tasks). Thus we posit:

> *Proposition 8: Antecedent states such as anxiety, stress, fatigue, and a need for speed of execution will negatively influence the development and sustenance of new work-related IS habits.*

**Similarity of the Past and Present Context**

An important point to keep in mind is that the role of context stability in encouraging habitual behaviors does *not* imply that things must always unfold exactly as they have in the past in order to trigger a given habitual behavior. Oftentimes, if the situational cue is close enough to what the individual is used to encountering, this will still trigger performance of their habitual behavior (Norman 1981; Wood and Quinn 2004). This is particularly true since a number of different contextual factors may be operational at any given time, forming combinations that together lead to a certain behavior being performed (Wood and Quinn 2004).

There is an underlying tension between the development and strengthening of habits, and their disruption. While the contextual features described before play a role in strengthening habits, their modification provides leverage in *disrupting* these same habits. We now turn to a theoretical discussion of IS habit disruption which is important to overcoming habitual inertia to adopting a new IS.

## DISRUPTING IS USAGE HABITS

Since behavior has been shown to be predicted by both conscious intentions and subconscious habits (see Kim and Malhotra 2005; Kim et al. 2005; Limayem and Hirt 2003; Limayem et al. 2007; Ouellette and Wood 1998), it is important to focus research attention not

only on changing attitudes and intentions toward the *new* system, but also on disrupting existing habitual behaviors related to the use of the *existing* system.

As discussed previously, habits are individual-level cognitive scripts that originated in pursuit of specific goals, and that over time, have come to be performed automatically in response to situational cues. To break a habit, we must therefore break the link between the goal and its associated behavior (Gollwitzer and Sheeran 2006; Sheeran et al. 2005; Verplanken 2005). This can be accomplished in one of two ways: *interfering* with an individual's existing goals, or *distracting* the individual to pursue new goals (Schank and Abelson 1977). Such interventions work primarily by manipulating the various aspects of context discussed earlier (see Table 3.2). In the absence of such interventions, "action slips" may occur, such that use of the old system continues, even after the individual has voiced intentions to switch to the new one.

In the following section, we integrate a number of different theory bases, including those dealing with attitude/intention models, action slips, context change, script disruption, self-efficacy, training, implementation intentions, and the dimensions of habit themselves, to analyze intervention strategies for breaking IS usage habits. While previous literature on organizational change and change management has focused on overcoming *conscious* inertia and resistance to change resulting from long-practiced work habits (see Armenakis and Bedeian 1999 for a review of the literature), we focus here instead on disrupting automatic, *subconscious* habitual inertia. Since habit impacts attitudes and intentions regarding IS use (Gefen 2003; Kim and Malhotra 2005; Limayem and Hirt 2003), disrupting existing usage habits should positively impact adoption of a new information system.

Our theoretical development examines how action slips can prevent the successful adoption of new systems and how the goal-directed nature of habits can help determine where to focus intervention efforts to disrupt habits. We then provide a detailed discussion of specific intervention strategies for disrupting IS usage habits and preventing action slips from occurring. Since habit is a multidimensional aggregate construct, any intervention strategies that an organization undertakes should address one or more of the four habit dimensions. Thus throughout our discussion that follows, we argue for a multi-pronged approach to disrupting IS usage habits that individually addresses each of the four habit dimensions (intentionality / functionality, lack of awareness, difficulty of control, and mental efficiency). This multi-pronged approach focuses on both the *disruption* of each dimension with respect to habitual use of the *old* system, and in *strengthening* each dimension with respect to developing habitual use of the *new* system. Figure 3.3 summarizes how interventions that we discuss in the sections that follow influence the four habit dimensions to disrupt old habits and strengthen new ones.

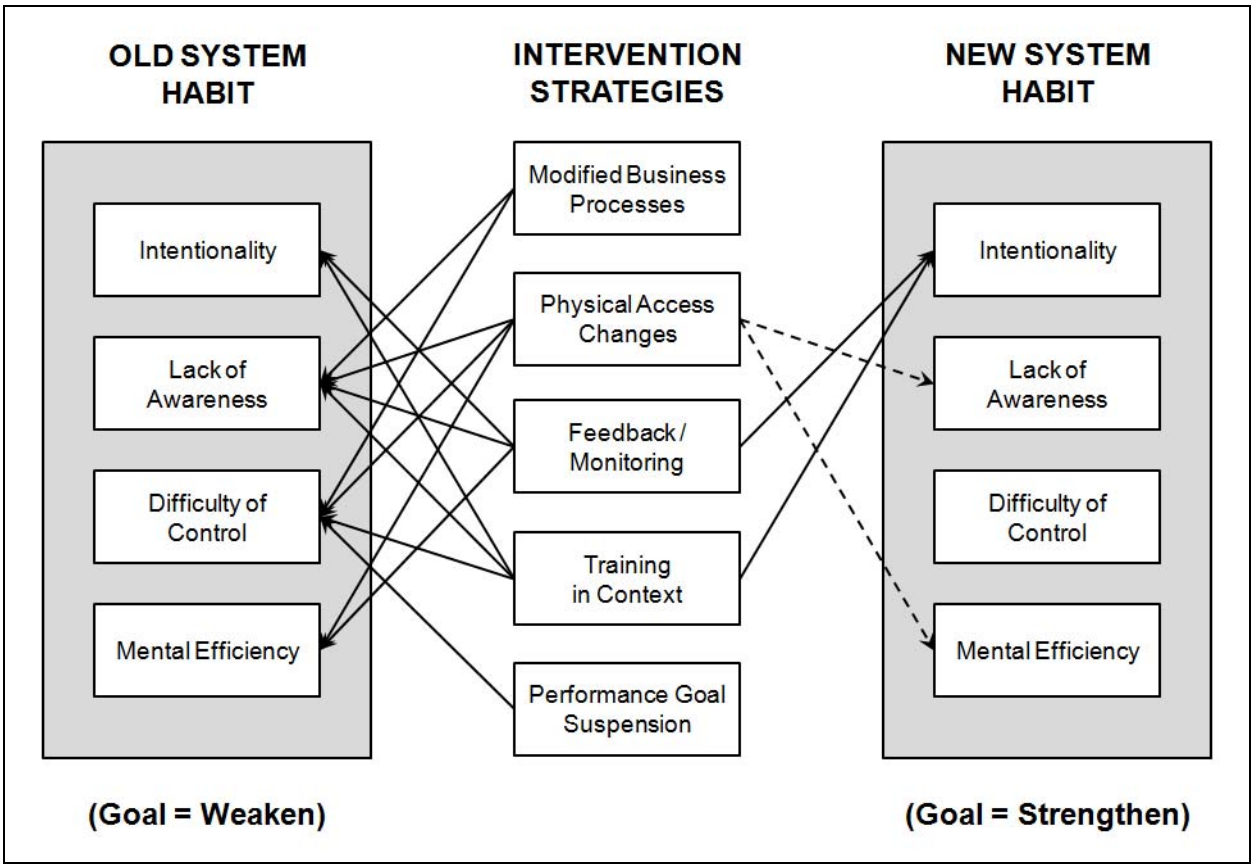


**Figure 3.2. Impact of Habit Disruption Techniques on the Dimensions of Habit**

### The Role of Action Slips in Inhibiting New IS Adoption and Use

Viewing IS usage habits as being embedded within a larger task sequence aids in understanding one of the key ways in which habitual use of an existing IS can inhibit use of a newly introduced one. In many cases a user may be trained on how to use the *new* system, recognize its advantages, and even voice intentions to use it, yet "slip up" and continue using the old system when an occasion arises to do so. Such behavior is referred to as an *action slip*, defined quite simply as "the performance of an action that was not what was intended" (Norman 1981, p.1).

Several different categories of action slips have been identified (see Norman 1981), but only one, *faulty activation of schemas,* appears to be relevant to IS use in a work setting. In particular, a type of faulty activation known as a *capture slip* occurs "when a familiar habit substitutes itself for the intended action sequence…if the habit is strong enough, even partial matches from the situation are apt to activate the relevant parent schema, and once activated, it can get triggered" (p.8).An example of a capture slip is a bus driver who, while off duty and driving the family car, pulls over to the side of the road as if to pick up passengers (Bargh 1996).

Action slips can occur in an organizational setting as well. Consider the example of an employee who for several years has come in to work in the morning, sat down at her desk, logged on to her PC, and automatically opened Microsoft Outlook to check her email before beginning the day's tasks. If the company introduced Lotus Notes but left Microsoft Outlook installed (at least temporarily) on everyone's machines, one can easily picture the employee coming in to work in the period of time immediately following implementation and, without thinking, automatically going through her normal "start of day" routine, including opening Microsoft Outlook.

While this example is relatively simple in nature, any time two different task sequences (such as those associated with use of an old and new IS) are triggered by the same business event, there is potential for action slips to occur leading to the wrong sequence of activities beginning and being carried to its conclusion. This is true even if the worker is aware of the new business process and intends to follow it (including having voiced an intention to use the new system), and is particularly likely to occur when the two task sequences begin in a similar fashion. When the triggering event occurs, the similarity in other contextual cues may lead the

worker to begin the new sequence but then "slip up," automatically reverting to doing things in the old way without even being aware (at least at that moment in time) of having done so.

Thus habits in regard to an old behavior can inhibit the performance of a new behavior, despite intentions otherwise, as a consequence of action slips (see further support in Betsch et al. 2004; Fishbein and Ajzen 1975; Heckhausen and Beckmann 1990; Møller 2003; Ouellette and Wood 1998; Verplanken and Faes 1999). Over time, if no organizational interventions are in place to cue employees to their behavioral slips and encourage change, they may continue automatically using the old system to the point that "inaction inertia" (Tykocinski et al. 1995) sets in, and a voluntary switch to the new IS becomes less and less likely. Therefore we propose:

> *Proposition 9: All else being equal, habitual use of an existing IS will inhibit usage of a newly introduced IS by moderating the relationship between behavioral intention to use the new system and actual usage of the new system, such that the relationship is weaker in the presence of strong* ***preexisting*** *IS habits.*

### The Role of Goals in Developing Habit Disruption Strategies

Given the definition of habits as goal-directed automaticity, habit researchers have proposed that the proper way to break a habit is to break the link between the goal and the behavior (Gollwitzer and Sheeran 2006; Sheeran et al. 2005; Verplanken 2005). From this perspective, it is critical to determine the goal of a particular instance of IS use in order to break that link.

Since habitual work routines can be viewed as script or task hierarchies, a lengthy or complex work routine will generally have a single overarching business goal[5] that it seeks to accomplish. However, as we previously discussed, smaller goals may also be associated with individual steps in the task sequence (Schank and Abelson 1977). These subtasks and subgoals

[5] In the workplace, habits primarily focus on achieving instrumental, as opposed to affective or physiological, goals (Locke and Latham 1984; Locke and Latham 1990).

are in turn associated with the business events and task definitions that make up the behavioral context. It is likely that these smaller subgoals are the actual triggers for much habitual IS usage behavior, and as such may be activated either consciously or subconsciously. By correctly identifying the goal or subgoal triggering a particular instance of habitual IS use, appropriate intervention strategies can be devised that break the goal-behavior link at the corresponding location in the task hierarchy.

If the company is replacing an entire task sequence or business process with a markedly different, "tightly coupled," new one, the relevant goal most likely resides at the top level of the hierarchy, and one should simply need to break the link at the top level, such that the old sequence never has an opportunity to begin. Given the drastic difference between the old and new sequences as they play out, all triggers further down the hierarchy will be automatically bypassed.

On the other hand, if the old and new task sequences are similar or share steps, or if the process is "loosely coupled," one must pay much more attention to the exact point where the individual's IS use is triggered and seek to break that link. This is particularly true if the business process involves multiple actors, and the habitual use occurs at one of the work hand-off points. Here, the top-level goal remains unchanged, and the subgoals become relevant. The task sequence has a much greater potential of being carried through to completion uninterrupted, unless action is taken to break the link at the subgoal / subtask level. Thus the goal of the intervention is to prevent this from happening. Thus we posit:

> *Proposition 10: IS habits that are embedded within larger routinized task sequences will be triggered by subgoals in the overall goal hierarchy, rather than by the overarching, high-level business goal.*

*Proposition 11: The level of similarity between the old and new business processes in which IS use is embedded will determine the proper intervention strategy for breaking the link between goals and behavior.*

*Proposition 11a - When the old and new processes in which IS use is embedded are drastically different, and the new process is tightly coupled, efforts to disrupt IS usage habits will be more successful when they are designed to break the link between the overarching, higher-level business goal and the habitual behavior.*

*Proposition 11b - When the old and new processes in which IS use is embedded are similar or share subtasks, efforts to disrupt IS usage habits will be more successful when they are designed to break the link between the immediate (lower level) subtask/subgoal and the habitual behavior.*

Determining the exact goal that triggers a habitual behavior is made more complicated by the fact that pursued goals are often subconscious in nature, meaning that a person may not be able to articulate clearly to a researcher what her actual goal for performing a habitual behavior is (see Cohen and Bacdayan 1994). In fact, she may never have even thought about it but rather simply learned how to follow the standard operating procedure for a particular task. While all scripts are theorized to have their basis in goal attainment, over time (and through constant repetition) they begin to require less and less of the individual's attention to the point that the person may no longer even be aware of beginning the behavior. Thus, habitual work behaviors may continue to be practiced even when the associated goal is no longer present (Wood and Quinn 2004). For example, a person may generate a particular report every day which no longer has any legitimate business purpose, simply because "they always have." Thus we recognize that there are times where the exact goal cannot be elucidated; in such cases, interventions must focus on the contextual factors, including visibly observable business events, that are subconsciously triggering that goal.

## Context Focused Habit Disruption Strategies

One common response regarding how to break IS usage habits is to "just turn the old system off and force the people to use the new system." However, this is not always an option. Just as the hypothetical bus driver cannot simply stop driving past bus stops when off duty, neither can individual access to a particular IS always be eliminated in its entirety. In many organizations today, there are multiple tools that can be used to perform any given task, yet these tools do not all perform equally, nor are they equally preferred by the "powers that be" in the organization.

Take for instance the production of business intelligence (BI) reports. If a user has database access and is skilled at writing SQL, he might be able to query the database directly for the needed information. Alternatively, if he is skilled in the use of MS Access, he can link to an external "industrial grade" database from within Access and create his own queries and reports there. Many users also pull data into Excel for manipulation, or use any number of off-the-shelf managed query tools or custom-built applications that the firm possesses. It is not likely that, in implementing a new BI tool, the company is going to revoke desktop access to either Excel or MS Access, or to all the other possible software tools available for creating a particular report. Thus in considering how an organization can change individual IS usage habits, another approach besides "pulling the plug" may be necessary.

### Script Disruption Techniques

The script literature suggests several ways in which habitual work routines might be disrupted. The first method is through the use of *interference*, which is defined as "states or actions which prevent the normal continuation of a script" (Schank and Abelson 1977, p.52). Interference may involve *obstacles* ("where some enabling condition for an impending action is

missing") or *errors* ("where an action is completed with an unexpected and inappropriate result") (Schank and Abelson 1977, p.52). The second method of disrupting habitual routines is through the use of *distractions*, which are defined as "unexpected states or actions which initiate new goals for the actor, carrying him temporarily out of the script" (Schank and Abelson 1977, p.53; see also Wood and Quinn 2004). The key difference between interference and distraction techniques is that interference prevents the individual from successfully pursuing their goal, whereas distraction leads the individual to pursue a different goal altogether.

Both interference and distraction techniques work by changing aspects of the context in which undesired habitual usage behaviors occur, such that action slips are reduced or prevented altogether. These contextual factors, discussed previously in Propositions 1 through 8, are summarized in Figure 3.4. Contextual changes succeed by forcing the individual to exit from their behavioral script, become more aware of their actions, and thereby exert more conscious control over their behavior (Wood et al. 2005). Interventions to change the behavioral context can also increase the user's awareness of the contextual triggers *themselves*, again enabling more conscious control over behavior. We now turn to a more detailed discussion of the use of interference and distraction techniques to disrupt IS usage habits.

**Interference: Eliminating Triggers by Changing Business Processes**

As stated before, the most obvious example of an interference technique is the case where a user's access to a particular system is eliminated altogether. However, less drastic approaches exist. Interference in situations where both the old and new system remain available for use can be accomplished in one of two ways. The first involves substantially modifying business processes to eliminate built-in contextual triggers to habitual behavior. The second involves modifying elements of context within existing (unchanged) business processes.

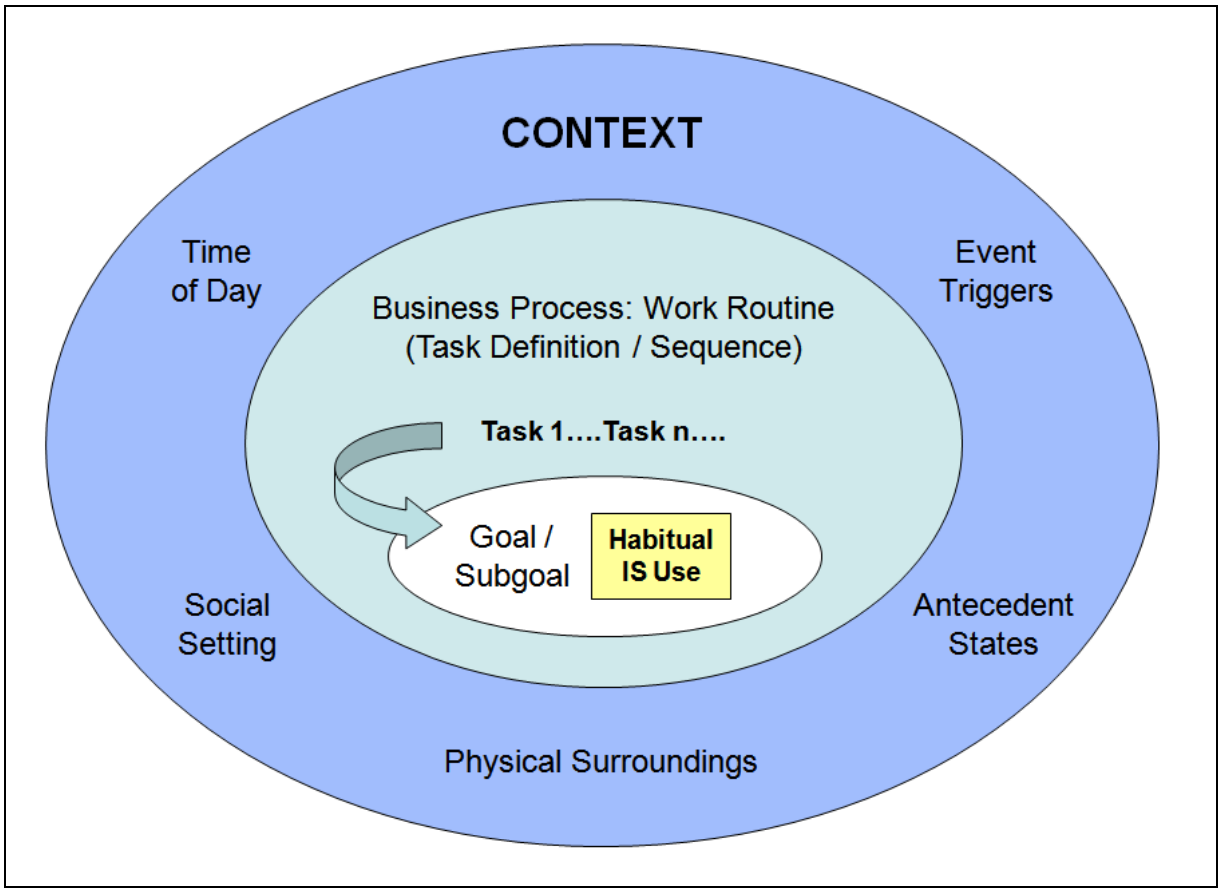


**Figure 3.4. Contextual Factors Relevant to Habit Disruption Techniques**

Many times the introduction of a new IS, such as an ERP for example, does in fact bring with it major changes to business processes. However, even when it does not, it may still be possible to intentionally modify business processes or SOPs in such a way that it becomes more difficult, if not downright impossible, to use the old IS to perform a given task sequence. Such an intervention strategy might involve the manipulation of several different contextual variables (see Figure 3.3), bringing about substantial enough changes to business processes that existing contextual triggers built into timeworn routines and SOPs will never have the chance to be activated.

For example, business process improvement efforts may naturally result in changes to the sequencing and timing of subtasks within a larger process, such that tasks are performed by

different people or departments, at different times, or no longer performed at all. Event triggers may be changed by either setting up automatic alerting systems, or automating certain tasks altogether. The physical context of a task sequence can be modified by embedding the interface for performing those tasks within a larger, integrated system, such as a portal or other web interface. Setting up dashboard reports that "push" the information to the end user further eliminates the need to use the old IS to "pull" data for commonly used reports. All of these business process changes either eliminate or modify antecedents to a given action (IS use), thereby disrupting the automatic cues to behavior in such a way that the user has to stop and think about what to do next, rather than simply operating on "autopilot" (in other words, increasing their levels of *awareness* of, and thereby their ability to *control*, their behavior).

It is very important that the modified business processes achieve a certain threshold of differentiation from the way that they have been performed in the past in order to eliminate action slips. This is because action sequences tend to be complex, with many component schemas, and they also tend to take considerable time to complete. Thus multiple intentions and schemas may be active at any given time. According to Norman,

> "the determination of the appropriate triggering conditions for a given schema then becomes a critical factor in the correct performance of an act…The model provides each schema with a set of specific conditions that are required for it to be triggered. An activated schema can be triggered by current processing activity whenever the situation matches its conditions sufficiently well. Exact match is not required" (1981, p.4).

Norman provides an example of driving home from work, but needing to stop at a fish store:

> Because the fish store route is almost identical to the route required to go home, it is specified as a deviation from the better-learned, more frequently used home route schema. For this purpose I must set up a new schema, one that is to be triggered at a critical location along the usual path. If the relevant schema for the deviation is not in a sufficiently active state at the critical time for its triggering, it is apt to be missed, and as a result, the more common home route followed: I find myself home, fishless (1981, p.5).

Thus implementing only minor changes to existing business processes may not have the desired effect in relation to increasing user awareness and conscious control over actions, and therefore may not result in the desired elimination of old usage habits. Therefore we posit:

> *Proposition 12: Modifying business processes (task definition, task sequence, timing, event trigger, or physical context) upon the introduction of a new IS to provide maximally dissimilar triggers to activation of new IS behaviors will lead to fewer action slips.*
>
> > *Proposition 12a: Modifying business processes upon the introduction of a new IS will reduce action slips by increasing the user's **awareness** of their behavior.*
> >
> > *Proposition 12b: Modifying business processes upon the introduction of a new IS will reduce action slips by forcing the user to exercise conscious **control** over their behavior.*

**Interfering with the Performance of Scripts for Existing Business Processes**

It is not always possible to drastically change business processes when implementing a new IS. However, it *is* possible to manipulate other aspects of context in order to encourage behavioral change. As we have seen previously, context change acts to disrupt habits and prevent action slips primarily by making individuals more aware of their behaviors as they perform them, such that they can exercise more conscious control over their actions (Wood et al. 2002). Changing a business process may halt automatic processing long enough for the individual to have to consciously consider how to complete a task. This in turn may disrupt automatic use of a given IS for a given task.

One way of interfering with an automated script when business processes cannot be changed is to manipulate the physical surroundings context variable. Broadly defined, physical surroundings include such visual cues to action as the content and configuration of the user interface (Kim et al. 2005). Thus it should be possible to trigger conscious thought, and therefore

consciously performed behaviors, by modifying the user interface, if not to eliminate links to the old IS altogether, then at least to make it more difficult for the user to locate and click on them. Leaving programs installed, but removing them from the desktop, Windows Start menu, or portal interface (if one exists) can all accomplish this purpose. Thus we posit:

*Proposition 13: Modifying how the user accesses the old system will reduce action slips.*

*Proposition 13a: Modifying how the user accesses the old system counteracts existing habits by increasing the user's **awareness** of their behavior.*

*Proposition 13b: Modifying how the user accesses the old system counteracts existing habits by forcing the user to exercise conscious **control** over their behavior.*

*Proposition 13c: Modifying how the user accesses the old system counteracts existing habits by disrupting the **mental efficiency** with which the old behavior can be performed.*

One could also manipulate the physical surroundings variable, to take advantage of the fact that habitual users will tend to automatically navigate to the same location in the user interface where they had formerly started up the old application, even after the introduction of a new one. Thus a simple act of replacement, such as placing the icon or link for the *new* system in exactly the same location where the icon or link for the *old* system used to be, can turn potential action slips into opportunities to habituate use of the new system. Thus we posit:

*Proposition 14: Maintaining the stability of the physical surroundings context variable by replacing the old system access point with an access point for the new system will encourage the development of new IS usage habits.*

*Proposition 14a: Maintaining the stability of the physical surroundings context variable by replacing the old system access point with an access point for the new system encourages the development of new habits by decreasing the **level of awareness** necessary to choose the new IS.*

*Proposition 14b: Maintaining the stability of the physical surroundings context variable by replacing the old system access point with an access point for the new system encourages the development of new habits by increasing the **mental efficiency** of choosing the new IS.*

**Distraction: Influencing Behavior Through Monitoring and Feedback**

*Distraction* techniques for disrupting habitual scripts focus on introducing unexpected states that will lead the user to exit the script by pursuing new goals (Schank and Abelson 1977). Distraction can also be accomplished through context manipulation. For example, it has been demonstrated that people who know that they are being watched while they work tend to become much more aware of what they are doing (Wood et al. 2002). This in turn may make them more likely to pursue a course of action (such as using a new IS) that they know is preferred by the organization and individuals within it whose opinions hold sway for them. Thus one potential distractionary approach to modifying IS usage habits (i.e., an approach aimed at initiating new usage goals) is to implement some form of *monitoring function*, combined with a *feedback mechanism* to make users more aware of their behavior (Norman 1981, p.11). Such monitoring and feedback mechanisms serve to alter the social context factor.

A common yet simple example of changing the social context to disrupt a script and encourage new IS usage goals is implementation of a pop-up message that prompts the user when they click to open the old (habitually used) system. The message might prompt the user as to whether they really want to use the old system or not, suggest or remind them to use the new system instead, or even ask them if they would like to make the new system their default choice going forward. The message could also inform the user of how many times they have ignored the prompt to use the new system in the past, or have a delay / countdown that required the user to wait before the old system started up. Such messages force the user to both think about what they

are doing and actively respond to the message. If the time delay that is introduced is relatively substantial, or if organizational tracking of user behavior is incorporated into the monitoring/feedback mechanism (with the user aware that their choices are being tracked and presumably viewing being found noncompliant to be a bad thing), we might also expect them to come to view the old behavior as a less desirable means of achieving work goals, thus impacting the intentionality of old system use (negatively) and new system use (positively). Thus we posit:

*Proposition 14: Implementing feedback and monitoring systems in conjunction with the introduction of a new IS will reduce action slips.*

*Proposition 14a: Implementing feedback and monitoring systems will reduce action slips by increasing the user's* ***awareness*** *of their behavior.*

*Proposition 14b: Implementing feedback and monitoring systems will reduce action slips by decreasing the* ***mental efficiency*** *with which the user can perform the old behavior.*

*Proposition 15: Implementing feedback and monitoring systems will promote the development of new habits by highlighting the* ***situation-goal-behavior link****, thereby encouraging the user to associate the new IS with achieving* ***work-related goals****.*

**The Impact of Training Methods on the Performance of Habitual Behaviors**

End user training has long been viewed as an important organizational intervention for improving user acceptance and increasing the success rate of new system implementations. In addition, training has been viewed as a method to first *unfreeze* old habits of "feeling, thought, and action" by "focusing on needs that end users cannot satisfy by habitual behavior," then *move* the user to try new ways of behaving to meet these needs, and finally *freeze* the new behavior through ongoing contact if they did in fact find it useful for these new needs (Lewin 1952; Nelson and Cheney 1987, p. 548).

Training provides hands-on experience that can change users' attitudes, beliefs, and perceptions of usefulness and ease of use (Agarwal and Prasad 1999), and increase their feelings of self-efficacy (Compeau et al. 1999; Compeau and Higgins 1995; Gist et al. 1989). Training also helps individual users to overcome knowledge barriers, such as a lack of sufficient knowledge of the capabilities of the software application itself, or a lack of knowledge regarding how to use the application to perform key business tasks (Olfman et al. 2006; Sharma and Yetton 2007).

However, while providing training for the purpose of increasing self-efficacy and eliminating knowledge barriers is important, engrained IS usage habits require that we go beyond simply increasing *knowledge* of how to perform a given task or series of tasks, to increasing awareness of all the various *situational triggers* associated with use of the old (and new) system for that task, and reprogramming the *response* to those triggers. The fact that identical (or even sufficiently similar) triggers associated with task sequences can lead to action slips implies that experience obtained during formal training with a new IS might be useless if it is not practiced within the context of an entire task sequence, or at minimum with its associated antecedent trigger. Training a user to use the new system in a situation where actual situational triggers are in operation may not prevent action slips altogether, but might make them less likely to occur.

One method of accomplishing this (particularly when the situational triggers arise from the actions of other individuals) is through group training, taking into account entire sequences of tasks as work is passed from one individual or group to another. In fact, recent research on training methods for new systems that are business process-oriented in nature (such as collaborative, workflow, and ERP systems) has highlighted the importance of taking task

interdependencies with other users into account when training individuals on how to use the system (Olfman et al. 2006). As Kang and Santhanam point out,

> In executing a single task within a business process, each individual's action is guided by organizational routines, that is, learned collective sequences of procedures executed by participants in a business process…Cohen and Bacadayan [1994] empirically demonstrate a strong link between a user's knowledge of how to execute an individual task and the collective sequences by which organizational routines are completed. Therefore, when organizational routines are changed (such as, by reengineering a business process with a collaborative application), individual users have to be sensitized to changes in the collective pattern of work, and in their implications on individual procedural knowledge of how to execute a task (2003-2004, p.262).

When training on a new system is designed around *existing* work routines, i.e., around the way that the new IS use is embedded within larger, otherwise unchanged, task sequences, it becomes possible to "recondition" the user's response to triggering events or situations such that they will be more likely to use the new system. This reconditioning takes place in two ways, the first of which focuses on disrupting dimensions of the habit construct in regard to use of the *old* system, and the second of which focuses on strengthening the dimensions of the habit construct in regard to use of the *new* system.

By training users in the context of real task sequences (whether individual or collaborative in nature), users will develop a greater awareness of situational triggers. This increased awareness will in turn give them the ability to exercise more conscious control over their choice of which IS to use to complete a given task, therefore leading to less action slips with the old system. Such training is an extension of the concept of training on collaborative task knowledge (to cover both individual and group task sequences), and goes beyond the goals of increasing self-efficacy and overcoming knowledge barriers, to include disruption of engrained usage habits. Thus we propose:

*Proposition 16: Training users on a new IS within the context of actual work routines and situational triggers will result in fewer action slips than providing users with self-efficacy and knowledge-based training outside the context of these routines.*

*Proposition 16a: Training users on a new IS within the context of actual work routines and situational triggers will have a positive impact on a user's* ***awareness*** *of habitual use of the old system when completing work tasks.*

*Proposition 16b: Training users on a new IS within the context of actual work routines and situational triggers will have a positive impact on a user's* ***ability to control*** *habitual use of the old system when completing work tasks.*

Training within the context of existing work routines also helps the user to associate the new IS with specific work-related goals/tasks and subgoals/subtasks.[6] Furthermore, training within "real world" work situations gives the user practice at using the new system that, if repeated frequently enough in the training environment, will make using the new system for specific tasks more natural and "behaviorally efficient" (see Gupta and Bostrom 2006 for a more detailed discussion from the perspective of enactive learning). This "behavioral efficiency" could eventually lead to mental efficiency as well; however, in most training environments, we would not expect enough repetition to occur for the habit dimension of mental efficiency to become truly developed at that time, making the link between contextual training and mental efficiency indirect at best. Thus we expect such training methods to have a direct positive impact on strengthening habit in regard to the development of *new* habits primarily through goal associations, leading us to propose the following:

*Proposition 17: Training users on a new IS within the context of actual work routines and situational triggers will encourage the development of new IS*

[6] This association can also be encouraged through the provision of training designed to impart what Olfman et al. (2006) refer to as "tool conceptual" and "motivational" knowledge; however, a discussion of such training techniques is beyond the scope of our current study.

*usage habits by enforcing the **situation-goal-behavior link**, thereby increasing the user's association of the new IS with achieving specific **work-related goals**.*

**Counteracting Habitual Use that is Triggered by Antecedent States**

We have previously discussed how working under conditions of stress and fatigue may cause a worker to revert back to habitual patterns of IS use, which require fewer mental resources (Wood et al. 2002). Work-related stress is particularly likely to occur shortly after the introduction of a new IS, when the new system may still be unfamiliar, and completion of even simple tasks may take longer. Changed business processes associated with the new system may also lead to stress.

The change management literature suggests that employee stress can be reduced through managerial strategies that provide the employee with empathy and support. Incremental change is also less likely to be traumatic to the employee (Armenakis and Bedeian 1999; Kettinger and Grover 1995), implying that timing the switch to the new system is important (both in avoiding multiple changes occurring at once, and in taking enough time to roll out big systems) (Kemppainen 2004). Flexible milestones are generally preferred during the implementation phase as well (Stoddard and Jarvenpaa 1995). All of this implies that reasonable and attainable performance goals should be set while end users get used to the changes brought on by the new system. Thus we posit:

*Proposition 18: Temporarily suspending or relaxing performance goals after the introduction of a new IS will reduce action slips, by decreasing stress and fatigue, and thereby increasing the user's ability to exercise **control** over habitual behavioral choices.*

**The Importance of Combining Disruption Techniques**

Any given method of encouraging behavioral change, when used as the *sole* method of promoting such change, tends to possess weaknesses. According to Wood and Quinn (2004,

p.46), some habits are "likely tied to specific aspects of context," whereas others "are likely tied to configurations of cues and thus depend on combinations of locations, times, interaction partners, and moods." When a relevant feature of the context is changed, people may ask themselves, "How can I still meet my goal given the new context?" Thus while changing the situational cues may help in disrupting habits, if enough similarity remains, the behavior in question may continue to be practiced. It is possible that naturally occurring shifts in context may operate much differently than "strategic decisions" to make contextual changes that will impact behavioral cues.

For these reasons, habit researchers today have suggested that interventions to encourage behavioral change should occur at multiple stages of the implementation process, and should target both habits themselves and individuals' conscious attitudes and beliefs related to these habits. *Upstream interventions* (which include formal policies and incentive programs at the macro level) occur before habit performance takes place, and aim to "disrupt old environmental cues and establish new ones" (Verplanken and Wood 2006, p.1). *Downstream interventions*, on the other hand, provide education and information at the individual level, and are aimed at increasing self-efficacy, changing attitudes and intentions, and motivating self-control. Downstream interventions can be combined with naturally occurring context changes to "provide informational input at points when [everyday] habits are vulnerable to change" (Verplanken and Wood 2006, p.1).

In the IS domain, *downstream interventions* would focus on providing information and training in order to impact the user's decision making process concerning the new technology. As we have discussed earlier, such training should ideally take place within the context of actual work routines, as the IS usage behavior is embedded in these larger task sequences, in order to

encourage reprogramming of behavior in the "real world." However, since strongly engrained habits are activated automatically outside awareness, curtail information search, and tend to persist without a noticeable change in context, *downstream-plus-context-change* interventions should also be pursued, for the purpose of altering or taking advantage of natural changes in the user's environmental context. As we have seen, these interventions may include substantial changes to the business processes associated with the IS in question, as well as changes to the user interface and other features of the physical surroundings, which will make it more difficult for users to continue automatically in a previously learned, habitual pattern of behavior. Finally, *upstream interventions* can target social norms and contextual supports for the desired action, making it easier for employees to perform the new behavior, leading to changes in attitudes which will help to encourage and cement their intentions to make a change (Verplanken and Wood 2006). Figure 3.5 seeks to place the various interventions for old habit disruption and new habit strengthening discussed in this paper within the context of the "upstream vs. downstream" intervention framework.

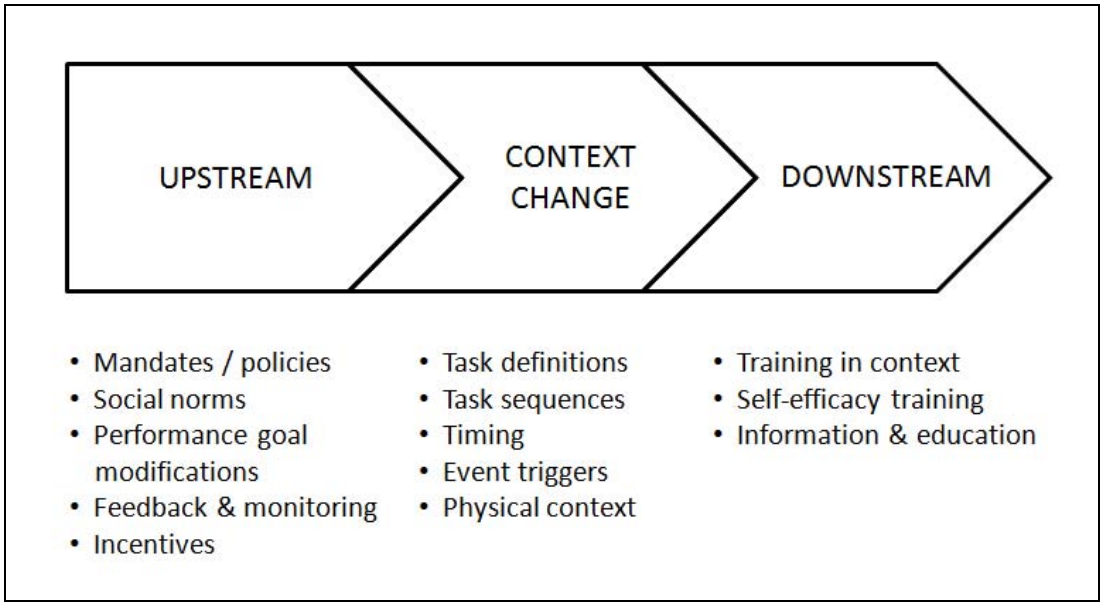


**Figure 3.5. Upstream and Downstream IS Habit Interventions**

## CONCLUSIONS AND IMPLICATIONS FOR IS RESEARCH

Many of the IS usage behaviors performed in a work environment are performed in a habitual fashion, meaning that they are performed automatically, outside awareness, and occasionally not subject to conscious control. Habit plays both a positive and negative role in IS use. While habit facilitates the practice of routine behaviors (and thus increases both the user's behavioral and mental efficiency when performing work tasks), it also serves to inhibit innovative usage behaviors. Habit may prevent users from adopting and using new information systems, or it may prevent them from exploring unused system features that might provide individual or organizational benefits such as increased productivity.

In order to properly understand IS habits and how they can be changed, we must study them within the context of the larger task sequences in which they are embedded. Often entire sequences of activities making up common work routines are practiced habitually. Thus it is important to implement interventions that not only look at the immediate behavior in question, but that change the various work processes, contextual factors, and other immediate antecedents that are triggering the undesired behavior. Various ways of disrupting habitual behavior have been suggested in the social psychology, marketing, and organizational literature. We have argued that these interventions need to take place at multiple stages in the process of implementing a new IS, covering the bases of changing user attitudes toward the new IS, reprogramming their subconscious behavioral processes through appropriate training methods which take into account the embeddedness of the IS use within larger task sequences rather than simply increasing self-efficacy, setting up barriers to make it more difficult to continue practicing undesirable usage behaviors, and finally, providing users with monitoring and feedback that will encourage their continued conscious performance of tasks involving IS use,

until they reach a place where the new IS behavior has become routinized and even automatic itself.

To date, studies on IS habit have focused on relatively simple behaviors that take place outside of an organizational environment, and that are studied over a relatively short period of time. We encourage testing of the propositions presented here in an organizational environment, focusing on IS usage behaviors that are embedded within simple to complex work routines and task sequences. We further argue for the importance of examining habitual usage behaviors, and the various intervention strategies suggested for modifying them, via longitudinal studies, where the development of work-related IS habits and the success of organizational efforts to disrupt old habits can be properly examined.

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CHAPTER 3

# REVISITING THE HABIT CONSTRUCT IN IS RESEARCH[7]

[7] Polites, G. L. and E. Karahanna. To be submitted to *MIS Quarterly*.

## INTRODUCTION

Behavior, such as individual acceptance and use of new information systems in organizations, is determined by both conscious and automatic responses. Until recently, however, the primary focus of such organizational research has been on the role of conscious intentions in predicting future behavior, as well as the cognitive and affective factors impacting such intentions. Only recently has the psychological construct of habit, representing automatic behavioral responses, been incorporated into these models. Despite the current interest in developing a better understanding of habit and its impact on behavior, however, habit continues to be improperly measured.

The problem of defining and operationalizing habit is not unique to the organizational literature; it is regularly debated among experts in the social psychology discipline as well (see Ajzen 2002; Bamberg et al. 2003a; Eagly and Chaiken 1993; Verplanken and Orbell 2003). Many researchers use frequency of past behavior as a proxy for habit, while others have attempted to develop self-report or other types of measures (e.g., Limayem et al. 2003; Verplanken and Orbell 2003). Ajzen (2002, p.109) has argued that "whether a frequently performed behavior has or has not habituated is an empirical question, and to answer it we need an independent and validated measure of habit."

The objective of the current study is to improve upon recent attempts to measure habit separately from behavioral frequency. While these attempts have advanced measurement towards a more appropriate theory-based habit measure, we posit that the structural form of habit has been misspecified. We argue that, rather than being a unidimensional construct with reflective indicators, habit is a second-order construct with formative dimensions. We further develop these dimensions, clarifying which previously proposed facets of habit truly belong

within its content domain, and which represent either antecedents or consequences of habit and thus should be excluded from its content domain. Our specific focus in this study is on habitual use of information systems (IS) to complete work-related tasks.

The paper proceeds as follows. We begin by defining habit and discussing its content domain from the perspective of habitual behaviors occurring within an organizational context. Next, we discuss the structure of habit, and how this structure has been misspecified in prior habit research. Finally, we develop a new, theory-based measure of habit, and subject it to a series of rigorous validity tests. This process includes testing the new measure within a nomological network of constructs demonstrating the role of habit in IS continuance.

## CONCEPTUAL BACKGROUND

### Definition of Habit

We follow the majority of social psychology researchers today in conceptualizing habit as a form of goal-directed (also called goal-dependent) automaticity, and thus define habit here as "learned sequences of acts that have become automatic responses to specific cues, and are functional in obtaining certain goals or end-states" (Verplanken and Aarts 1999, p.104). In an organizational setting, habits have their basis in instrumental scripts[8] and individual-level work routines, which are often embedded within larger multi-actor routines and over time may come to be performed automatically in the pursuit of a work-related goal (Becker 2004; Becker 2005; Gioia and Poole 1984; Schank and Abelson 1977).

[8] Scripts are a form of cognitive schema that represent standard, generally frequently practiced, event or behavior sequences. Scripts not only help individuals to make sense of frequently encountered business situations, but they also inform them of the appropriate behavior to practice in a given situation. Instrumental (or strong) scripts represent a precise sequence of actions that must be followed to attain a specific goal (Gioia and Poole 1984; Schank and Abelson 1977).

As a form of goal-directed automaticity, habits are performed intentionally yet outside of awareness, and are difficult to control yet mentally efficient (Aarts and Dijksterhuis 2000a; Bargh 1994; Bargh and Ferguson 2000; Sheeran et al. 2005; Verplanken and Orbell 2003). While habits are often defined in terms of frequently performed past behavior, this behavioral frequency in and of itself does not indicate the presence of a habit. Rather, it is only when behaviors have come to be practiced automatically that they are truly habitual (Limayem et al. 2007). Some habits are viewed as nonvolitional and unintentional; however, it is entirely possible for automatic, routinized behavior sequences to be volitional and part of intentional behavior systems. Examples of common behaviors that are "volitional yet automatic" include driving a car and exercising (see Ajzen 2002; Ouellette and Wood 1998); many habitual behaviors practiced in the course of performing one's work tasks could be categorized similarly.

While most experts agree that habit is a form of automaticity, they disagree as to how habitual behavior is actually *developed* and *triggered*. The cognitive-motivational view of habits places great importance on the role of goals in habit formation, positing that

> …situational features become associated with a particular goal, and activation of that goal leads to performance of the behaviour. Positive reinforcement strengthens the link between the goal and the behaviour as one learns that the behaviour leads to the goal or expected result. (Sheeran et al. 2005, p.48)

From this perspective, goals mediate the relationship between the environmental context and behavioral response. Further, the situation, goal, and action are all mentally represented, such that over time, as the link between them is strengthened, perceptions of the situation can automatically activate the goal outside of one's awareness, leading to performance of the habitual behavior (Aarts and Dijksterhuis 2000a; Aarts and Dijksterhuis 2000b; Sheeran et al. 2005; Verplanken and Orbell 2003). It is this goal-directedness that makes habits "intentional" in nature.

## The Content of Habit: Habit's Dimensions

In determining the proper domain of the habit construct, we draw heavily from Bargh's work on automaticity (e.g., Bargh 1989; Bargh 1994; Bargh 1996; Bargh et al. 2001), since it has served as the foundation for most recent habit research (e.g., Aarts and Dijksterhuis 2000b; Kim et al. 2005; Sheeran et al. 2005; Verplanken and Orbell 2003). As a form of goal-directed automaticity, habit should be assessed using measures incorporating the dimensions of *intentionality*, *controllability*, *awareness*, and *mental efficiency*. *Intentionality* is defined here as the initiation (automatic or otherwise) of a behavior for the purpose of achieving a specific outcome. *Controllability* refers to the amount of difficulty an individual would have in controlling, or resisting, the urge to perform a particular behavior. *Awareness* may refer to one's awareness of the situational cue *triggering* performance of a habitual behavior, or to their awareness of how that cue is *interpreted* (thus leading to automatic performance of the behavior). *Mental efficiency* is defined as "the extent to which the perceptual or judgmental process demands attentional resources" (Bargh 1994, p.24). While other dimensions and theoretical concepts have been incorporated into habit measures in the past (see Tables 4.8 and 4.9 in Appendix B), these other dimensions and concepts do not align with the widely accepted theoretical definition of habit as goal-directed automaticity. This is true even for studies that define habit as we do, or in a manner otherwise consistent with goal-directed automaticity.

For example, Verplanken and Orbell (2003) included *history of behavioral repetition* in their oft-cited self-report habit index (SRHI), and *frequency of past behavior* has long been used as a measure of, or proxy for, habit in both the social psychology and IS literature (e.g., Aarts and Dijksterhuis 2000b; Kim and Malhotra 2005; Norman and Conner 2006; Sheeran et al. 2005; Triandis 1980). While frequent repetition plays an important role in habit *development*, it is not

a dimension of habit per se. Many actions are performed repeatedly in the course of doing one's job, yet not all these actions have truly habituated (Ajzen 2002; Ashforth and Fried 1988; Gioia and Poole 1984; Pentland and Rueter 1994). Past behavioral frequency may also reflect the influence of many other internal and external factors besides habit (Ajzen and Fishbein 2000). In fact, recent evidence suggests that some behaviors may manifest the psychological features of automaticity, yet differ substantially in regard to their frequency of occurrence (Aldrich et al. 2007; Verplanken et al. 2005b). This implies that it is more important to know how frequently one performs a behavior in relation to the *number of opportunities available* to do so, than to simply record that a behavior has been repeated often over the course of time.

Several studies (e.g., Ouellette and Wood 1998; Wood et al. 2002; Wood et al. 2005) seek to determine habit strength based not only on past behavioral frequency but also on the stability of the performance context. However, frequent repetition of a behavior in a stable context simply increases the likelihood that a behavior will habituate, making context stability an *antecedent* of habit, as opposed to a facet of it.

Aside from the studies measuring habit as frequency of past behavior and incorporating context stability into a determination of habit presence, the vast majority of remaining studies listed in Tables 4.8 and 4.9 in Appendix B have used some type of self-report measure to capture habit. In many cases, researchers have simply asked respondents to indicate whether they perform a particular behavior "out of habit" or "by force of habit" (e.g., Aarts and Dijksterhuis 2000b; Conner and McMillan 1999; Orbell et al. 2001; Tourila and Pangborn 1988; Towler and Shepherd 1991-1992; Wittenbraker et al. 1983). One must question whether the word "habit" (or the word "automatically," which is also used in some habit scales) is understood in the same way by all respondents. Thus we follow Knussen et al. (2004) in identifying such items as

representing constructs termed “Perceived Habit” and “Perceived Automaticity” to indicate the incongruity that could exist between a respondent’s personal definition of habit or automatic behavior and the theoretical definitions of these constructs.

Verplanken and Orbell’s inclusion of *self-identity* in the SRHI is based on the view that “habits are part of how we organize everyday life and thus may reflect a sense of identity or personal style” (2003, p.1317); they allow us “to define ourselves, to explain ourselves to others, to locate ourselves in our social and cultural environment” (Hardcastle 2003, p.249). However, this proposed aspect of habit does not possess the relevance in an organizational work environment that it might in other aspects of one’s life. While we do not deny that one’s personal style and desire for self expression may lead them to develop particular ways of performing their regular work activities, these personalized ways of completing tasks may or may not habituate over time. Thus while self-identity may aid in the development of habits, it is not a part of habit itself.

In addition, while we might find someone who identifies themselves as a “Mac person” or an “open source person” in their *personal* technology choices, in a work environment one is often constrained to performing tasks using systems that have been mandated to them. Given the goal-directed and task-oriented nature of work habits, we would not expect to hear someone say, for example, that “using Microsoft Outlook to send emails is a part of who I am.” Several extant studies have separated self-identity from habit and posited relationships between the two constructs. For example, both Charng et al. (1988) and Conner and McMillan (2006) have demonstrated that self-identity only predicts intentions and behavior related to donating blood and using cannabis in the presence of a strong habit (operationalized as frequent past performance of the same activities). Wood and Neal (2007, p.852) further argue that people may

use their habits to infer, after the fact, "personal dispositions [such as self concept beliefs] to value particular response outcomes."

Carvajal (2002) included *quickness*, *accuracy*, and *effortless performance* in his definition of habit. While quickness and effortless performance may relate to procedural and mental efficiency (the latter of which is a dimension of habit), accuracy is not a dimension of habit, since one could develop a habit of performing a task *inaccurately*. Further, one may be able to perform a task quickly, accurately, and effortlessly simply due to having attained a level of skill or expertise, or due to characteristics of the task itself and not because of habit.

In the organizational and IS literature, habit is commonly equated with *routinization* (e.g., Kim et al. 2005; Ohly et al. 2006), although the organizational literature on routines is explicit in pointing out that not all routines are practiced automatically, and thus have not truly habituated (see Gioia and Poole 1984; Pentland and Rueter 1994). Other IS studies have incorporated several concepts into their habit scales that relate to entirely different constructs altogether. For example, Gefen (2003) defined habit as a "previous usage preference," and thus included items indicating one's preference for using a particular website. Such a preference may be an *outcome* of website usage habits (and could also *precede* habit formation), but is not a dimension of habit itself.

Finally, Limayem and Hirt (2003) included items representing addiction and compulsion in their IS habit scale, and several studies that define IS habit in terms of goal-directed automaticity (e.g., Cheung and Limayem 2005; Limayem and Hirt 2003; Limayem et al. 2003a; Limayem et al. 2007) have included items related to how "natural" the system is to use, or the "obviousness of the choice" of that system, none of which tap the four features of goal-directed

automaticity described by Bargh. Further, the choice of a given system to perform a task can be natural, and an obvious choice, without being habitual.

In the following sections, we clearly specify what each of the four dimensions in our definition of habit represents, and relate them to IS usage habits in an organizational setting.

**Intentionality**

The dimensions of intentionality and controllability both refer to one's level of control over their thoughts and behavior. Intentionality, however, focuses on the instigation, or *startup*, of a behavioral process as opposed to its continuation. From the "pure" goal-dependent automaticity perspective, the behavior being performed is triggered by a goal that is mentally represented; one that was once consciously pursued but that is now automatically activated by situational cues in the environment. Therefore, intentionality speaks more to the fact that links between a situational cue and action were formed based on intentions developed in the *past*, rather than any sort of conscious involvement in the *present* (Bargh and Gollwitzer 1994; Bargh et al. 2001).

Intended goal-dependent automaticity is most often associated with performing well-established scripts and work routines, and other situations where an individual is capable of skilled or expert performance, such as driving a car, walking, or even using an IS in a particular way (Bargh 1989; Bargh 1994; Narvaez and Lapsley 2005). The organizational literature supports the view that individuals may have the power to decide to "start up" certain routinized behavior sequences, but once such a sequence is undertaken, it may continue to completion in a habitual fashion (see Becker 2004). A simple way to look at intended goal-dependent automaticity is that the outcome is "what was intended by the current processing goal" (Bargh

1989, p.20). Thus we define intentionality here as the initiation (automatic or otherwise) of a behavior for the purpose of achieving a specific outcome.

In an organizational environment, we view habits as originating in pursuit of a business goal (whether or not that goal is subconsciously activated or not actively considered every time a person initiates a behavior), and therefore possessing an intended outcome. In addition, a large or complex work routine or task sequence may consist of many smaller subtasks which are pursued to achieve smaller subgoals that are associated with the overall, high-level business goal. The use of an IS may be undertaken to accomplish only one, several, or all of these subtasks. For this reason, we argue that habits in an organizational environment should be measured in relationship to specific work tasks that are performed in very specific work situations, thus incorporating intentionality.

**Controllability**

Controllability refers to one's ability to "stifle or stop a process once started, or at least to override its influence if so desired" (Bargh 1994, p.16). Whether there is such a thing as a work-related habit that cannot be truly controlled given enough effort is debatable. However, as Verplanken and Orbell (2003, p.1317) point out, "although most habits are, in principle, controllable (e.g., by deliberate thinking and planning), it often appears difficult to overrule strong habits."[9] If an individual has been performing a sequence of work tasks in a particular way, or using a particular IS to complete subtasks embedded within a larger task sequence,

[9] Two forms of "automatic" behavior have been described in the literature, based on how difficult they are to change. Automatized behavior is viewed as more flexible and easy to change, whereas automatic behavior is acquired to satisfy nonconscious motives and is therefore more resistant to change. Examples of automatized behavior include shifting gears in a car, and playing a piano or playing basketball in a certain way, utilizing certain moves. While automatized behaviors are performed involuntarily (in that they are not consciously chosen at the time of performance), they can be brought under voluntary control, given the proper intervention strategies (Deci 1980).

repeatedly for a long period of time, it may be difficult to resist the urge to do so again in the future, particularly if that behavior is part of a larger automatized script.

For example, consider a multi-actor organizational routine related to new employee setup at a large firm. The new employee's records must first be created by the human resources (HR) department, which then notifies the IT department to request that specific login IDs and levels of application access are needed. After creating the IDs and enabling access, the IT department must notify both HR and the new employee that the work has been completed, and send the employee their login information. However, the company may lack a formal workflow or change management system for handling this request and notification process, meaning that the IT worker must use the telephone or email to notify the employee of their new ID.

Over time, the IT worker responsible for creating login IDs may have developed a specific sequence of steps for completing this task in an efficient manner, and performed it frequently enough that the entire task sequence has become habituated. If a new work order system with internal messaging capabilities is then implemented in the organization, the IT worker may have great difficulty resisting the urge to pick up the telephone or to open up MS Outlook to send an email after the ID has been created, since the notification step has come to be cued automatically by preceding steps in the overall sequence, which have been performed in an identical way several times a day over a long period of time.

**Awareness**

A person may be unaware of a mental process in any one of three ways (see Bargh 1994, p.7):

- They may be unaware of the stimulus itself.
- They may be unaware of the way in which the stimulus event is interpreted.

- They may be unaware of what is truly influencing their judgments or feelings, and thus may misattribute the reason to something else that they are aware of.

In a work environment, we assume that individuals are often (though not always) aware of the stimuli that lead them to behave in a particular habitual manner. In fact, increasing one's awareness of these stimuli and their effects is one way in which interventions can be planned to change undesirable behaviors (Sheeran et al. 2005). However, awareness of a stimulus may manifest differently depending on the specific task or subtask under investigation.

As stated earlier, scripts and work routines can be viewed as being composed of a hierarchy of goals or tasks. At the top level is the overarching business goal, which is composed of any number of smaller goals and tasks that must be accomplished in order to attain the top-level goal. Undoubtedly, an employee is aware of the need to complete a task at the top level of the task hierarchy. For example, the IT worker we described earlier is aware of having received a request to create a login ID. However, that IT worker might have been performing the entire "login ID request fulfillment" task sequence, founded on a strong script or work routine, for such a long time that he is she no longer aware of the individual triggers or cues associated with each subtask along the way. Thus, for example, the IT worker may not consciously take note of the fact that successful creation of the ID (perhaps announced via a window popping up on his or her screen stating that the ID now exists in the database) triggers the choice and use of a particular IS to notify the employee that the task has been completed.

**Mental Efficiency**

Being able to perform work tasks efficiently is of utmost importance in most organizations; an analysis of efficiency should go beyond *procedural* efficiency, however, and also address *mental* efficiency. According to Bargh (1994, p.24), mental efficiency refers to "the

extent to which the perceptual or judgmental process demands attentional resources." In other words, habits "free mental capacity to do other things at the same time" (Verplanken and Orbell 2003, p.1317; see also Ashforth and Fried 1988, Becker 2005). Such freedom provides benefits to both the individual and the organization as a whole. For example, there is evidence that stress during multi-tasking is less likely to occur when the simultaneously practiced behaviors are habitual in nature (Wood et al. 2002). Conservation of cognitive capacity may also reduce qualitative overload and role ambiguity for managers and professionals with complex jobs, allowing them to "focus on the task at hand" (Ashforth and Fried 1988, p.309). On the other hand, the ability to perform common task sequences in such as "mindless" manner can cause individuals to overlook important changes in the task environment that require different responses, and can also inhibit sensemaking in regard to such events (Ashforth and Fried 1988; Louis and Sutton 1991).

Given that the choice of a particular IS (potentially over alternative systems) to perform a specific task is often embedded within much larger individual work routines and task sequences which may have habituated over time, we focus on mental efficiency of the *choice* of an IS for a given task, as opposed to the mental efficiency of actually *using* that IS to carry out the task. This is in line with habit studies in social psychology that focus on travel mode choice (e.g., Aarts and Dijksterhuis 2000a; Aarts et al. 1997; Bamberg 2006; Bamberg et al. 2003a; Bamberg et al. 2003b) rather than behaviors related to the actual act of driving a car.

We have argued before that the content domain of habit includes only the dimensions of intentionality, controllability, awareness, and mental efficiency, and excludes a number of related constructs that have been viewed as dimensions or facets of habit in the past. While work-related habits that are performed by individuals in an organizational setting have the same

characteristics as habits performed in other contexts, habits in the workplace often consist of much lengthier and more complex task sequences. The choice of a given IS to perform a task may be just one step in a much larger habituated task sequence, and as such, this choice may have become habituated over time. Thus IS habit in organizations involves intentionality (in that one uses an IS to accomplish work-related goals). Once the choice of a given IS has habituated, that choice becomes difficult to control, occurs at least in part outside one's awareness, and is mentally efficient. We now turn to a discussion of the ways in which the structure of the habit construct has been specified in the past, and argue for a new specification based on automaticity theory.

## The Structural Form of Habit

A unidimensional construct refers to a single theoretical concept that lacks distinct dimensions, whereas a multidimensional construct incorporates several distinct yet related dimensions *into* a single theoretical concept (Edwards 2001). While virtually all of the studies shown in Tables 4.8 and 4.9 in Appendix B that use self-report measures of habit other than past behavioral frequency have conceptualized habit as unidimensional and reflectively measured,[10] it is clear from our discussion before that habit is a multidimensional construct.

Multidimensional constructs may possess either a superordinate or aggregate structure. A superordinate construct represents a "general concept that is manifested by specific dimensions" (Edwards 2001, p.145). In other words, each dimension of the construct represents a different manifestation or actualization of the underlying construct. Only the variance that each of the dimensions shares is of interest to the researcher, and it is expected that the dimensions are in

[10] The sole exception is Verplanken et al. 2005, which used a subset of measures from the normally unidimensional reflective SRHI scale to model travel mode habit as a second-order reflective construct with the two dimensions of Lack of Awareness and Frequency. Verplanken et al. also argued that the SRHI could potentially be used to present habit "profiles," and help researchers distinguish between "different profiles of habits" but no studies have conceptualized or empirically modeled habit as such.

fact highly correlated with each other and will move together (Law and Wong 1999). An aggregate construct, on the other hand, "combines or aggregates specific dimensions into a general concept" (Edwards 2001, p.145). In other words, the construct is an *outcome* of the combination of all its associated dimensions, which are known as causal or formative indicators (Law and Wong 1999). *All* of the variance associated with each dimension is of interest to the researcher, and dropping a dimension may drastically change the meaning of the construct. While the various dimensions are often moderately correlated, it is not necessary that they be so. In addition to whether or not the dimensions covary, Jarvis et al. (2003) suggest that a construct has formative indicator dimensions if three other conditions hold:

- the dimensions are not interchangeable with each other,
- the dimensions do not necessarily have the same predictors, and
- the direction of causality is from the dimensions to the construct, rather than from the construct to the dimensions.

Failure to properly specify a multidimensional construct as being *formed* by its dimensions, versus being *reflected* by its dimensions, may lead to poor model fit or biased parameter estimates in an otherwise "good-fitting" model when the construct is included in a nomological network (Diamantopoulos et al. 2008; Diamantopoulos and Winklhofer 2001; Jarvis et al. 2003; Petter et al. 2007). Paths leading into the misspecified construct may be deflated, leading to Type II errors, while paths emanating from the construct may be inflated, leading to Type I errors (Jarvis et al., 2003; Petter et al. 2007).

We argue here that habit should be modeled as a second-order construct with formative dimensions.[11] Support for this argument comes from Bargh's work on automaticity (e.g., Bargh

[11] Both Diamantopoulos et al. (2008) and Jarvis et al. (2003) refer to this structure as "reflective first-order, formative second-order."

1994; Bargh 1996; Bargh et al. 2001). Habit is simply one type of automaticity, in which intentionality is present, there is little to no awareness or control over the behavior (though there may be awareness of the goal or stimulus *leading* to behavior performance), and the behavior is mentally efficient to perform. Other types of automaticity may lack goals or intentions, and have differing levels of awareness or focal attention (see Bargh 1989 and Narvaez and Lapsley 2005 for a full discussion). This implies that the four dimensions of automaticity do not always move together, and do not always have the same relative strength.

Certain habitual behaviors may be more subject to individual control than others, and the situational cues that trigger these habits to occur may likewise fall within the individual's awareness more in some situations than in others. Some of these differences in dimension strength may be a function of how long the habit has been practiced, or such characteristics as the extent of its embeddedness within a larger activity sequence. For example, an individual may be more aware of situational cues to use a particular IS, and therefore more able to modify his/her behavior upon receipt of the cue, for long-running organizational scripts involving multiple actors, than for lengthy strong scripts involving that individual alone. This is because there may be an extended "break in the action" when multiple actors are involved, allowing the individual to be more aware of his/her surroundings and responses, whereas a lengthy individual-level script may have multiple cued steps being carried out in rapid succession, leaving little time or mental capacity to attend to individual cues and break out of the script.

Thus a habit may exist with each of the four dimensions having differing strengths (implying that weak correlations between dimensions are possible), but a *strong* habit should manifest high values (in the proper direction) on all four dimensions. Obtaining low values on some of the dimensions but not on others might imply that we are dealing with a new, weak, or

otherwise poorly formed habit. Finally, we should point out that the dimensions of habit may have different predictors. For example, different interventions for disrupting habits are designed to impact the individual dimensions in different ways (see Polites and Karahanna 2008 for a full discussion on this topic). This again implies that we should view habit as a second-order construct formed by, rather than reflecting, its various dimensions.

## METHODOLOGY AND RESULTS

Our scale development approach was based on the recommended approaches by Churchill (1979) and Netemeyer et al (2003). An overview of the four phases of our scale development process, the steps included in each phase, and the objectives of each phase, is shown in Figure 4.1.

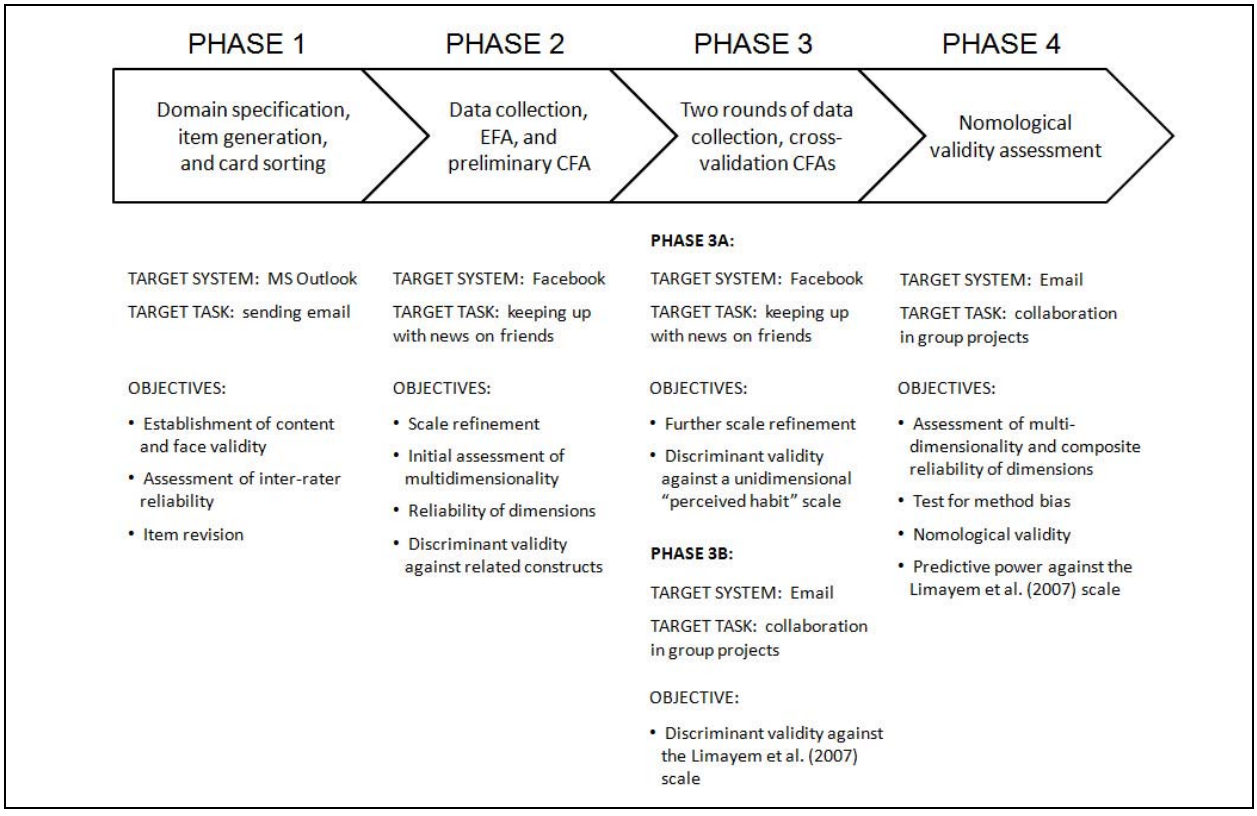


**Figure 4.1. Overview of the Scale Development Process**

### Phase 1: Item Generation and Card Sorting

As recommended by Churchill (1979) and Netermeyer et al. (2003), existing self-report habit scales (including those shown in Tables 4.8 and 4.9 in Appendix B) were examined and screened for items that might be useful in a new habit scale based on the dimensions of habit identified before. Where necessary, new items were created based on the theoretical definition of the construct so that an adequate number of candidate items would be available for preliminary testing of each dimension and for ensuring content validity (Churchill 1979). In addition, item lists were compiled to capture the more general concepts of perceived habit and perceived automaticity. This was done so that we could gauge whether respondents' own personal definitions of "habit" and "automatic behavior" differed from the theoretical definition of habit. All items were designed specifically for relevance in the context of individual IS use.[12]

The functional, or goal-directed, aspect of habitual behavior is manifested in a task-specific way; in other words, habit regarding an IS should be triggered in association with specific tasks that users need to accomplish. This view is supported by Ohly et al. (2006):

> In the work setting, the tasks individuals need to accomplish have the same function as goals in nonwork contexts (Frese & Zapf, 1994). When a task is presented to an individual, and the task is familiar because it has been accomplished repeatedly in the past, environmental features will automatically activate the necessary behavioral pattern. That is, the way to solve the task is not consciously chosen each time the task is completed. (p.259)

To incorporate the goal-directed nature of habit into our scale, we thus worded items in regard to a specific task (see also Bamberg et al. 2003a; Verplanken and Orbell 2003). For this reason, our study differs from that of Limayem et al. (2007) in focusing on specific, as opposed to general, IS habits.[13] Further, given our interest is in habitual *choice* of a particular system to perform a

[12] The complete initial set of items is available from the authors on request.

[13] General IS habits have been defined as those characterized by "high levels of usage comprehensiveness," whereas specific IS habits have been defined as being characterized by "limited usage comprehensiveness" (Limayem et al.

task, items were worded to focus on the awareness, controllability, and mental efficiency of that choice.

**Preliminary Validity Tests**

Given the confusion that has existed in the past concerning how to define and measure habit, and the lack of consistency in prior measures, it was imperative to conduct thorough, rigorous testing on the new scale. Thus the pool of candidate items was thoroughly tested for content and face validity. This process involved sorting and judging by experts, student volunteers, and members of the target population, following the procedures developed by Moore and Benbasat (1991). To keep the judging exercise simple, we selected Microsoft Outlook as the target system, and sending emails as the associated task. In addition to items representing the three habit dimensions of Awareness (AWARE) (e.g., "Whenever I need to send an email, I choose to use Microsoft Outlook without even being aware of making the choice"), Controllability (CTRL) (e.g., "I [would] find it difficult to overrule my impulse to use Microsoft Outlook to send an email"), and Mental Efficiency of System Choice (EFFCH) (e.g., "I do not need to devote a lot of mental effort to *deciding* that I will use Microsoft Outlook to send an email"), items were also included representing the following closely related constructs: Mental Efficiency of System Use (EFFUSE), History of Behavioral Repetition (HIST), Self-Identity (ID), Perceived Ease of Use (PEOU), Perceived Habit (PH), and Perceived Automaticity (PAUTO). A complete list of items used appears in Table 4.10 in Appendix B.

Each candidate item was printed on a card, and the complete set of items was randomized prior to being given to each volunteer for sorting. An instruction sheet was provided to each participant, and they were allowed to ask questions to ensure that they understood the process

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2007, p.716). According to Limayem et al., the greater the number of specific tasks an individual uses a given system for, the greater the likelihood that a general habit of using that system, regardless of the task, will develop.

adequately before beginning. Each participant performed his/her sorting and judging task without any help or communication with the other judges. Two rounds of card sorting were used until the inter-rater agreement and hit ratio of correctly placed items reached acceptable levels. (see Table 4.10 in Appendix B for items and Table 4.1 for agreement scores, Cohen's Kappa, and hit ratio for each round).

In the first round of sorting, a panel of four email users (two PhD students, a government employee, and another student) were asked to sort all of the items into groups of their own choosing, and then to name and define each group (round 1A). They were subsequently given the category names and asked to resort the items (round 1B). Based on the hit ratio and Cohen's Kappa, items were modified accordingly. In the second round of card sorting, a different panel of five consisting of faculty, PhD students from different business disciplines, and one MBA and one undergraduate student was asked to sort the items into groups. This time the panel was provided with a list of constructs and their definitions at the beginning of the exercise. Results are presented in Table 4.1. As can be seen from the table, both Cohen's Kappa and the hit ratio were acceptable after the second round (Moore and Benbasat 1991).

**Table 4.1. Card Sorting Results**

| Round | Raw Agreement | Cohen's Kappa | Hit Ratio |
|---|---|---|---|
| Round 1A | 0.61 | 0.58 | 66.0% |
| Round 1B | 0.81 | 0.79 | 87.0% |
| Round 2 | 0.84 | 0.82 | 88.5% |

### Phase 2: Pilot Study Scale Validation and Refinement via EFA and Preliminary CFA

We conducted a pilot study using undergraduate students in the Fall 2007 Introductory MIS course at a university in the southeastern United States. The students were asked to respond

to a survey related to their use of Facebook, and received extra credit for doing so[14]. Out of 347 students who participated in the survey, we received 337 usable responses. Since IS habits refer to the use of an IS for specific tasks, the target task for wording questionnaire items was "keeping up with news on your friends." For example, an item from the Awareness dimension was worded, "Whenever I want to get the latest news on my friends, I start using Facebook without even realizing it." The order of all items appearing on the questionnaire was randomized.

To purify the scales measuring each of the first order dimensions of habit (all with reflective indicators), reduce their length, and assess whether the habit scale is unidimensional as posited in prior research or multidimensional as we suggest, we ran Exploratory Factor Analysis (EFA) and reliability analysis as recommended by Churchill (1979). In running the EFA, we specified the exact number of factors to extract in advance.

Based on the EFA, three items were eliminated from the habit scale (one item from Awareness, one from Controllability, and one from Mental Efficiency of Choice). Table 4.2 shows the results of the EFA and the internal consistency reliabilities (Cronbach's alpha), after eliminating these three items, for our three habit dimensions, as well as the additional two dimensions of History of Behavioral Repetition and Self-Identity used by Verplanken and Orbell (2003). These dimensions were included to show that the three habit dimensions of our habit conceptualization are indeed distinct from other related dimensions such as the two additional dimensions included in the SHRI scale by Verplanken and Orbell (2003). Results of the EFA suggest that the habit scale is not unidimensional. Rather, as evident by Table 4.2, results confirm the multidimensional structure of the habit construct posited in the current research.

[14] An alternative assignment was provided to those not wishing to participate in the survey.

**Table 4.2. Factor Analysis Results and Reliabilities**

| | Factor* | | | | |
|---|---|---|---|---|---|
| | **AWARE** | **ID** | **CNTRL** | **HIST** | **EFFCH** |
| Aware1 | 0.916 | | | | |
| Aware2 | 0.867 | | | | |
| Aware4 | 0.844 | | | | |
| Aware3 | 0.835 | | | | |
| Aware6 | 0.725 | | | | |
| ID2 | | 0.943 | | | |
| ID5 | | 0.922 | | | |
| ID4 | | 0.917 | | | |
| ID6 | | 0.697 | | | |
| Cntrl2 | | | 0.903 | | |
| Cntrl5 | | | 0.896 | | |
| Cntrl7 | | | 0.885 | | |
| Cntrl1 | | | 0.759 | | |
| HIST2 | | | | 0.862 | |
| HIST1 | | | | 0.860 | |
| HIST3 | | | | 0.771 | |
| EffCh2 | | | | | 0.892 |
| EffCh1 | | | | | 0.847 |
| EffCh5 | | | | | 0.782 |
| | **AWARE** | **ID** | **CNTRL** | **HIST** | **EFFCH** |
| ***Reliability*** | **.92** | **.92** | **.93** | **.87** | **.80** |
| ***% Variance Extracted*** | **51.37%** | **11.20%** | **6.91%** | **5.33%** | **4.21%** |
| ***Eigenvalue*** | **9.76** | **2.13** | **1.31** | **1.01** | **0.80** |
| * Cross-loadings below .40 are omitted from the table to improve readability. The largest cross-loading in the dataset was 0.285 (representing ID6 on HIST). | | | | | |

Following the EFA, we conducted a CFA to further test the dimensionality of our habit scale and assess the discriminant validity of the resulting dimensions. Based on the results of this CFA, as well as an examination of inter-item correlations and each item's individual contribution to construct reliability, we dropped an additional Awareness item. As results of Table 4.3 show,

both our 3-dimension and the 5-dimension model of Verplanken and Orbell (2003)[15] are significantly better (based on chi-square difference tests) from a unidimensional model of habit, supporting a multidimensional habit scale. Further, a series of nested model chi-square difference tests, using both the 5-dimension model of Verplanken and Orbell (2003) and our 3-dimension model, conducted by constraining the correlation between each pair of constructs in the model, indicate the presence of discriminant validity across all dimensions. Thus, results suggest that habit is a multi-dimensional construct and that the dimensions of Awareness, Controllability, and Mental Efficiency are distinct from each other and from the two other SHRI dimensions. Though both our 3-dimension model and Verplanken and Orbell's 5-dimension model exhibit adequate fit, based on our prior theoretical discussion, our habit construct consists of the three dimensions of Awareness, Controllability, and Mental Efficiency.

**Table 4.3. Pilot Study CFA Results**

| Fit Index | 5-Dimension Model | Unidimensional Model | 3-Dimension Model | Unidimensional Model |
|---|---|---|---|---|
| Chi-Square | 319.821 | 2069.679 | 82.166 | 925.275 |
| Df | 125 | 135 | 41 | 44 |
| GFI (>0.90) | 0.903 | 0.594 | 0.957 | 0.666 |
| NFI (>0.90) | 0.975 | 0.872 | 0.984 | 0.868 |
| AGFI (>0.80) | 0.867 | 0.485 | 0.931 | 0.500 |
| RMSEA (<0.08) | 0.0689 | 0.207 | 0.0547 | 0.244 |
| SRMR (<0.05) | 0.0488 | 0.107 | 0.0276 | 0.107 |

Finally, as it is important to examine whether a new scale is distinct from other closely related constructs, and thus to get a more rigorous assessment of convergent and discriminant validity, we ran an EFA with items from the related constructs of Perceived Habit and Perceived Automaticity. Furthermore, we included items from the Perceived Ease of Use scale to ensure

[15] It is important to note that Verplanken and Orbell (2003),however, modeled their habit construct tapping these five dimensions as unidimensional.

that measures of mental efficiency were empirically distinct from measures of Perceived Ease of Use. Results of the EFA show that the three dimensions of habit are distinct from these other constructs.

### Phase 3: Cross-Validation CFAs

Following pilot testing, we conducted two studies to finalize the habit scales by cross-validating and providing a more rigorous assessment of construct validity (Churchill 1979; Netermeyer et al. 1990). The first cross-validation sample ("Phase 3A" in Figure 4.1) consisted of 205 students from another section of the Fall 2007 Introductory MIS course at the same university, collected several weeks later. As in the pilot study, the focus was use of Facebook. The purpose of this was to cross-validate our habit dimensions using a similar sample of students and the same technology and once again assess discriminant validity against a "perceived habit" scale.

The second cross-validation sample ("Phase 3B" in Figure 4.1) consisted of 336 students enrolled in various IS courses in Spring 2008.[16] The purpose of this study was to again test the psychometric properties of the habit dimensions using a completely different target technology and task (i.e., the use of email for collaborating on group projects). Cross-validating the scales in a different context (students, task, and technology) provides stronger evidence of their psychometric properties. Furthermore, the study examined the discriminant validity of our three habit dimensions against an existing unidimensional self-report habit scale ("LimH") (Limayem et al. 2007). The order of items was randomized for both the Phase 3A and Phase 3B questionnaires.

[16] Please note that Phases 3B and 4 make use of the same data set.

As can be seen from the fit statistics in Table 4.4, in both studies the three dimensional scale of habit exhibited good psychometric properties. Furthermore, in both studies, results from a series of nested model chi-square difference tests, conducted by constraining the correlation between each pair of constructs in each of the four models, indicated discriminant validity. The nested tests also provided evidence that our three dimensions of habit are distinct from both a generic "perceived habit" measure, and the three-item habit scale used in Limayem et al. (2007). Demonstrating that our three habit dimensions are distinct from a "perceived habit" measure supports the argument that individuals have different personal definitions of what "habit" is, and these personal definitions may not match the theoretical definition of habit. Likewise, demonstrating that our dimensions are distinct from the Limayem et al. measure provides evidence that the latter (more parsimonious) scale is not tapping the same content domain.

**Table 4.4. Cross-Validation CFA Results**

| | **Facebook Study** | | | **Email Collaboration Study** | | |
|---|---|---|---|---|---|---|
| **Fit Index** | **Unidim. model** | **3 dim model** | **3 dims + PH** | **Unidim. Model** | **3 dim model** | **3 dims + LimH** |
| Chi-Square | 759.474 | 31.351 | 129.88 | 822.774 | 128.748 | 369.027 |
| Df | 44 | 41 | 98 | 44 | 41 | 71 |
| GFI (>0.90) | 0.623 | 0.990 | 0.971 | 0.691 | 0.963 | 0.919 |
| NFI (>0.90) | 0.852 | 0.993 | 0.989 | 0.823 | 0.982 | 0.969 |
| AGFI (>0.80) | 0.434 | 0.983 | 0.960 | 0.537 | 0.940 | 0.881 |
| RMSEA (<0.08) | 0.267 | 0.000 | 0.025 | 0.230 | 0.060 | 0.066 |
| SRMR (<0.05) | 0.114 | 0.013 | 0.016 | 0.124 | 0.032 | 0.041 |
| PH = Perceived Habit, LimH = Limayem et al. (2007) habit measure | | | | | | |

### Phase 4: Nomological Validity – Habit's Role in IS Continuance

The last test in finalizing the scale is to embed the construct in a nomological network to examine whether the construct exhibits the theorized relationships with other constructs in the network. In addition, we examine the psychometric properties of habit as an aggregate

multidimensional construct and not just of its three dimensions. To do so, we surveyed 603 students from eight different MIS courses at a university in the southeastern United States, in Spring 2008. The order of all items appearing on the questionnaire was randomized. Respondents were asked about their use of various collaboration / file sharing tools when working in group projects. Only the responses from students indicating that email was their primary form of collaborating and sharing files with teammates were used, since we expected the use of email for this task to become habitual over time. This resulted in a sample size of 336.

In order to test the nomological validity of an improved habit measure, it must be embedded within a network of relationships. Figure 4.2 presents a model situating IS habit within a nomological model of well established antecedents to technology acceptance (for definitions of these constructs, see Table 4.11 in Appendix B). This model is based on Kim and Malhotra's (2005) study embedding habit in the nomological network leading to IS continuance, and is consistent with other prior studies that have incorporated habit in both technology acceptance and IS continuance models (e.g., Gefen 2003; Limayem and Hirt 2003). As such, we use it as our nomological net.

According to the model, habit will increase perceptions of a system's usefulness and ease of use, as well as intentions to use the system in the future. The cognitive cost-benefit paradigm suggests that individuals trade off accuracy in their decision-making processes in order to save effort (Payne et al. 1993). Thus, given the relative effortless use of a specific system that is implied by habitual performance of work tasks using that system, habit can be expected to positively influence perceptions of usefulness as well as ease of use. Further, self perception theory states that "people do not form specific evaluations on routine behavior until they are asked to do so;" rather, they simply answer questions related to both perceptions and future

intentions in the following way: "'I guess I agree; I am always [using the system]. I would not have [used the system] as much as I did, otherwise'." (Kim and Malhotra 2005, p. 745; see also Ouellette and Wood 1998).[17]

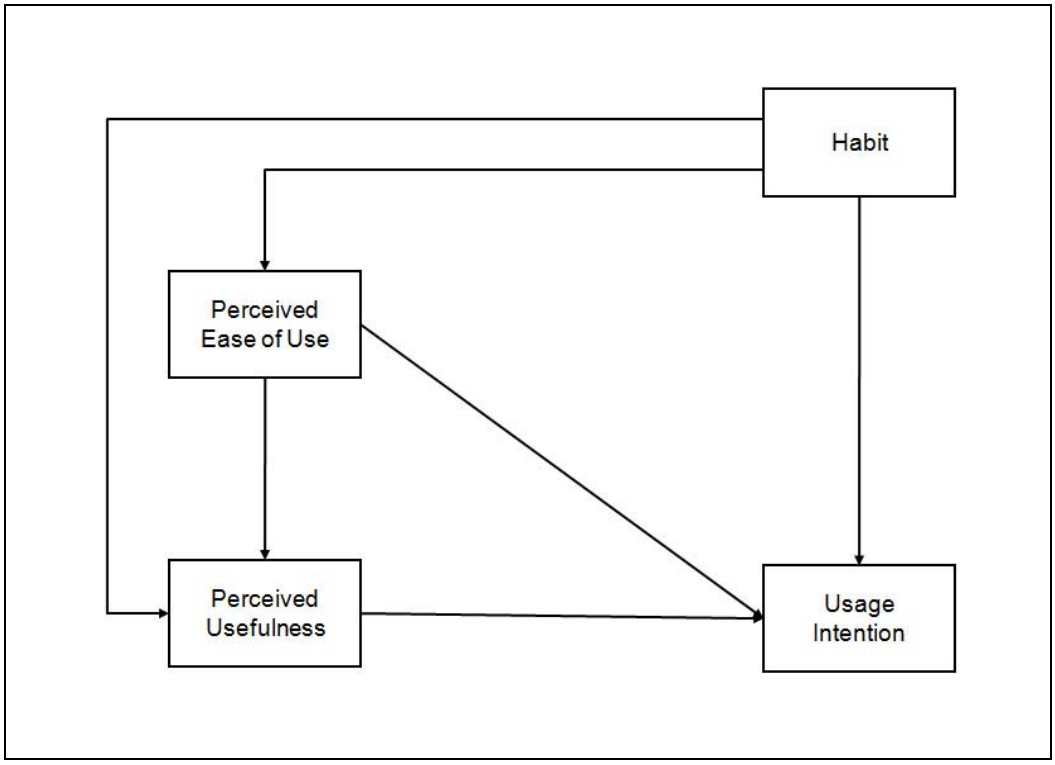


**Figure 4.2 Testing IS Habit within Its Nomological Net**

## Testing the Measurement Model

We used PLS-Graph to assess the psychometric properties of the three habit dimensions vis-a-vis the other three constructs in the model using guidelines suggested by Fornell and Larcker (1981) and Werts et al. (1974). As can be seen from Table 4.5, composite reliability

[17] A more complete nomological network incorporating habit would include actual usage as the ultimate dependent variable. This is because behavior is theorized as having both conscious and automatic drivers (Triandis 1980; see Limayem et al. 2007 for a detailed discussion of the various competing theoretical views on the relationship between habit, intention, and behavior). Since we did not have usage data available in this data set, we also conducted a more conservative post hoc analysis of habit's nomological validity designed to partial out the effect of cognition on habit, and demonstrate that our habit measure does in fact capture something that is distinct from PEOU and PU. This additional analysis demonstrates that habit does in fact have significant additional explanatory power above and beyond PEOU and PU in predicting intention. Full results of this analysis can be found in Appendix B.

scores range from .84 to .94, exceeding the .707 recommended guideline. Discriminant validity is assessed by (a) items loading on their constructs at .70 or above and not cross-loading; and (b) the square root of the Average Variance Extracted (AVE) for each construct exceeding the construct's correlations with other constructs. Furthermore, for convergent validity, the AVE has to exceed .50. As can be seen from Tables 4.5 and 4.6, our scales meet these guidelines. Furthermore, the scale was once again tested for unidimensionality using the LISREL procedure we described previously. Results once again support the multidimensional structure of the habit scale (unidimensional habit scale: Chi-squared (df)= 677.17 (44); GFI=.69; AGFI=.54; NFI=.82; RMSEA=.23; SRMR=.12; Multidimensional habit scale: Chi-squared (df)= 82.55 (41); GFI=.96; AGFI=.93; NFI=.98; RMSEA=.054; SRMR=.033). The fit statistics also provide additional evidence of good psychometric properties of the 3-dimensional habit scale.

**Table 4.5. Descriptive Statistics and Inter-Construct Correlations**

| Construct | Range | Mean (SD) | Comp. Reliab. | AWARE | CNTRL | EFFCH | PEOU | PU | INTENT |
|---|---|---|---|---|---|---|---|---|---|
| AWARE | (1.5, 7) | 5.24 (1.18) | .94 | **.90** | | | | | |
| CNTRL | (1, 7) | 4.16 (1.28) | .92 | .55 | **.85** | | | | |
| EFFCH | (3, 7) | 5.79 (0.77) | .84 | .46 | .28 | **.79** | | | |
| PEOU | (2, 7) | 5.81 (0.87) | .86 | .20 | .21 | .42 | **.87** | | |
| PU | (2.7, 7) | 5.63 (0.86) | .88 | .17 | .21 | .36 | .67 | **.84** | |
| INTENT | (1, 7) | 5.74 (1.00) | .93 | .26 | .33 | .43 | .57 | .63 | **.93** |
| Shaded diagonal contains square root of the AVE | | | | | | | | | |

**Testing for Method Bias**

Self-reported data may include common method bias that carries the potential to inflate the correlations between variables in a study, particularly when all the data are collected from a single survey at one point in time with similar Likert scales (Spector 2006). We used several techniques to assess the potential impact of common method bias on our results.

First, we examined the matrix of item-to-item correlations. The lowest correlation between pairs of items in a given dataset can be viewed as the upper limit to how much method bias can be present in the data (Lindell and Whitney 2001; Malhotra et al. 2006). There were nine nonsignificant item-to-item correlations, and several statistically significant correlations of approximately .10 in our sample. Since several of the nonsignificant correlations were associated with items from constructs that were hypothesized to be positively correlated, this indicates the absence of widespread method bias (Conger et al. 2000).

**Table 4.6. PLS Item Factor Loadings and Cross Loadings**

| Construct | Items | AWARE | CNTRL | EFFCH | PEOU | PU | INTENT |
|---|---|---|---|---|---|---|---|
| HABIT – AWARE | AWARE2 | **.91** | .50 | .44 | .16 | .18 | .27 |
| | AWARE3 | **.85** | .43 | .39 | .13 | .12 | .21 |
| | AWARE4 | **.92** | .50 | .42 | .23 | .18 | .25 |
| | AWARE6 | **.92** | .53 | .40 | .17 | .13 | .21 |
| HABIT – CNTRL | CNTRL1 | .34 | **.82** | .22 | .22 | .22 | .34 |
| | CNTRL2 | .52 | **.90** | .23 | .16 | .14 | .28 |
| | CNTRL5 | .52 | **.83** | .22 | .13 | .14 | .19 |
| | CNTRL7 | .54 | **.87** | .27 | .17 | .19 | .27 |
| HABIT – EFFCH | EFFCH1 | .19 | .13 | **.70** | .28 | .32 | .30 |
| | EFFCH2 | .46 | .26 | **.85** | .41 | .30 | .35 |
| | EFFCH5 | .43 | .27 | **.82** | .29 | .25 | .36 |
| PEOU | PEOU2 | .18 | .21 | .41 | **.88** | .59 | .52 |
| | PEOU3 | .16 | .15 | .31 | **.86** | .58 | .47 |
| PU | PU1 | .07 | .16 | .21 | .40 | **.72** | .40 |
| | PU2 | .19 | .15 | .37 | .63 | **.89** | .60 |
| | PU3 | .16 | .22 | .31 | .63 | **.90** | .57 |
| INTENT | Intent1 | .24 | .33 | .40 | .55 | .61 | **.94** |
| | Intent2 | .25 | .27 | .39 | .51 | .56 | **.93** |

Next, we ran a CFA in LISREL that included a method construct. This allowed not only comparison of the loadings of each item on its own factor and the method factor, but it also allowed calculation of the amount of method bias present in the entire dataset, using the CFA MTMM technique described by Podsakoff et al. (2003) and Malhotra et al. (2006). The estimated amount of method bias present in the dataset was only 1.2%. As such, common method bias does not appear to be a significant threat to the validity of the results.

**Testing the Nomological Model**

We tested the structural model using PLS-Graph. To correctly model the habit construct in PLS, we first ran the nomological model in PLS with the three habit dimensions disaggregated, and used the resulting factor scores for Awareness, Controllability, and Mental Efficiency to calculate factor scores for the three dimensions forming habit. Since habit is modeled as an aggregate second-order construct, we tested for multicollinearity between the three habit dimensions, since this could cause problems in our analysis. Variance inflation factor (VIF) values for the three dimensions ranged from 1.3 to 1.7, well below the threshold of 3.3 suggested by Diamantopoulos and Siguaw (2006) and Petter et al. (2007).

Figure 4.3 shows the magnitude and significance of the path coefficients in the nomological network model. All relationships are significant as hypothesized providing support for the nomological validity of the habit construct. Overall, 22% of the variance in PEOU is explained by Habit; 50% of the variance in PU is explained by Habit and PEOU; and 51% of the variance in Intention is explained by Habit, PEOU, and PU. The three habit dimensions of Awareness, Controllability, and Mental Efficiency have weights of -0.13, 0.45, and 0.85 respectively. The weight for Awareness was non-significant, whereas both the weights for Controllability and Mental Efficiency were significant at $p<.01$.

Although tests of multicollinearity between the three habit dimensions based on the Variance Inflation Factor (VIF) indicated no problems, correlations between constructs (on which VIF calculations are based) are always higher than they appear due to measurement error (Goodhue et al. 2009). Informal evidence obtained by dropping one habit dimension at a time from the nomological model indicates that multicollinearity may in fact be present between Awareness and Mental Efficiency. All three dimensions have significant weights individually, but the weight of Awareness is nonsignificant in the presence of Mental Efficiency. This indicates that Awareness and Mental Efficiency are both important in determining Habit, but their independent effects cannot be disentangled.

Further, there is some discussion as to whether formative indicators (or dimensions in this case) with non-significant weights should be eliminated from the scale. However, if the content validity of a scale is affected by removing an indicator (and it should be if the indicators are formative dimensions of the construct) then eliminating items from the pool should be theoretically justified rather than merely based on empirical results (Bollen and Lennox 1991; Diamantopoulos and Winklhofer 2001; Diamantopoulos and Siguaw, 2006; Diamantopoulos et al., 2008; Petter et al, 2007). Since Awareness is an integral part of what defines habit, we retain Awareness as an integral part of the habit scale despite its non-significant weight.

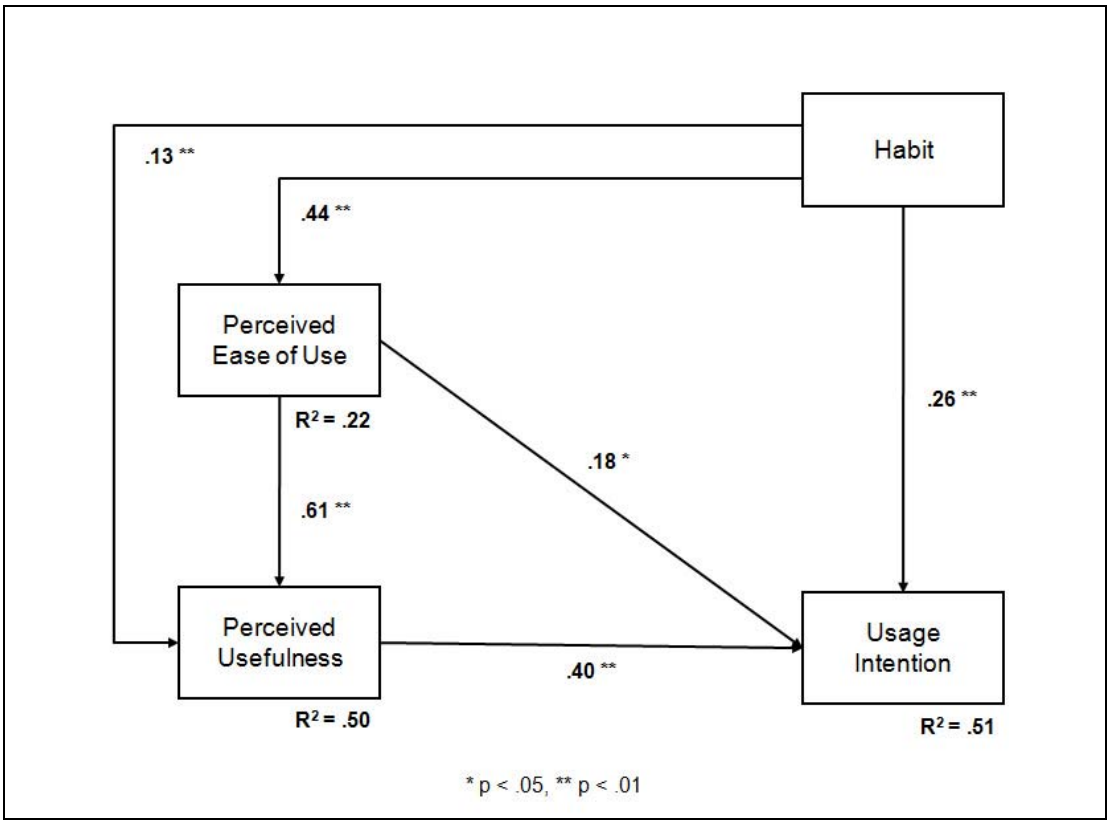


**Figure 4.3. Nomological Model Results**

We also compared the model conceptualizing habit as a second-order construct with formative dimensions with a model containing Limayem et al's (2007) 3-item reflective habit scale which was recently proposed in the IS literature. As already discussed, though this measure is parsimonious and easy to administer, it does not accurately capture the habit domain. Results are shown in Table 4.7. For this particular technology (email) and task (collaboration and file sharing in group projects), our multidimensional scale has approximately the same predictive power as Limayem's 3-item scale, with similar magnitudes of the path coefficients and virtually identical R-squared values for each endogenous construct. However, the Habit → Perceived Usefulness relationship in the model using the Limayem et al. habit measure is higher, possibly suggesting that the Limayem et al scale may be tapping at other constructs as well. For example,

the item measuring how natural the system is to use may be tapping at task-technology or technology–person fit rather than at habit per se and thus have additional effects on PU.

**Table 4.7. Comparison of Habit Measure Performance**

| Hypothesis | Relationship | Habit as Second Order Formative | Habit as Conceptualized in Limayem et al. 2007 |
|---|---|---|---|
| H1 | PEOU → Intention | .18 ** | .19 ** |
| H2 | PEOU → PU | .61 *** | .56 *** |
| H3 | PU → Intention | .40 *** | .33 *** |
| H4 | Habit → PU | .13 *** | .24 *** |
| H5 | Habit → PEOU | .44 *** | .47 *** |
| H6 | Habit → Intention | .26 *** | .34 *** |
| ** $p < .05$, *** $p < .01$ | | | |

## DISCUSSION

Our results support the argument that habit is in fact a multidimensional construct. For this particular technology (email) and task (collaboration and file sharing in group projects), Awareness (indicating that one's choice of email for this task occurs outside awareness), Controllability (indicating difficulty in controlling one's choice of email for this task) and Mental Efficiency (indicating that the choice of email for this task is mentally efficient) are all important determinants of habit. However, multicollinearity between the Awareness and Mental Efficiency dimensions prevents us from disentangling their independent effects. Further studies are necessary to explore the relationship between these two dimensions in more depth.

Our results also indicate that specifying habit as a second-order construct with formative dimensions within a larger nomological model yields results consistent with both theory and findings from prior studies. Given the results presented before, showing that our scale performs roughly equivalent to the much shorter and simpler IS habit scale of Limayem et al. (2007), one

might ask, “What are the practical benefits to using the more complex scale?” After all, if the researcher is simply interested in including habit as an additional predictor in a technology acceptance model, and is not interested in studying what causes IS habits to form, or how habits can be disrupted, the two scales perform equally well, and using a parsimonious measure may be important.

We would argue first that the Limayem et al. scale does not properly tap the content domain of habit in that it may not be measuring habit at all. The same is true for other unidimensional reflective measures of habit used in the literature, including those that simply ask respondents whether they use a given system “out of habit.” Some respondents may record a high score for the item “I use System X by habit” simply because they have been using it for a long time, or because it is part of their daily (mandated) work routine. However, simply using a system frequently or using a system over a long period of time does not necessarily mean that the person makes the choice to use that system outside their conscious awareness, or that it would be difficult *not* to use the existing system for a given task if an alternative system was available. Thus precision in measuring IS habits is an important goal in achieving a better understanding of user behaviors and the effect of habit on these.

Further, misspecification of habit as a reflectively measured construct leads to biases in the path coefficients of antecedents and consequents of habit (upward biases in the consequent paths and downward biases in the antecedent paths) (Jarvis et al 2003; McKenzie et al 2005; Petter et al 2007) and the possibility of Type I and Type II errors (Petter et al 2007). Thus, misspecification may lead to erroneous conclusions as to the relative effect of habit in the nomological net.

In addition to the misspecification problems associated with measuring habit as unidimensional and reflective, such measures limit researchers' ability to investigate the factors that lead to the strengthening of IS habits over time, or to investigate potential organizational interventions for disrupting these same usage habits. The relative magnitude of one's awareness, controllability, and mental efficiency may differ across technologies and tasks, particularly when the use of a given system is (or is not) deeply embedded within a larger automatized work routine. Thus different interventions may be appropriate depending on the dimension(s) of habit that is (are) most in need of change (see Polites and Karahanna 2008). Thus a given intervention can be investigated from the perspective of how it (1) makes the user more aware of their automatic behaviors, (2) makes it more difficult to carry out a habitual sequence of behaviors without having to stop and think about what they are doing, or (3) makes it easier for the user to choose the new system when performing work routines that have become at least partially automatized over time. Since habit is a formative construct, weakening one dimension of habit will lead to a weaker habit overall, just as strengthening one dimension of habit will lead to a stronger habit overall. Researchers and practitioners can use this to their advantage in planning out appropriate intervention strategies for different usage situations.

## LIMITATIONS

Our study is limited in that we used student subjects in both developing and validating the scale. Further studies are necessary using workers in an organizational setting, where IS habit can be investigated as it is embedded within larger, more complex work routines. Nonetheless, we believe the use of student subjects to test the nomological validity of the scale was appropriate, since it was not a contrived or experimental setting. Students were asked to answer questions regarding their actual use of various tools (of which email was only one) to carry out a

real and necessary task (collaborating and exchanging files with project teammates). Employees in many organizations also use email as their primary collaboration and file exchanging tool when working on real projects.

Another limitation of our study is that it was cross-sectional in nature, and only captured perceptions and intentions regarding IS use. Specifically, we have tested the nomological validity of the habit measure using intention as the ultimate dependent variable. While consistent with prior literature (e.g., Gefen 2003, Kim and Malhotra 2005), a stronger nomological network would examine actual system usage as the dependent variable. This would demonstrate the fact that behavior is driven by both conscious and automatic factors (Triandis 1980; see Limayem et al. 2005 for a more detailed discussion). Thus future research should examine the impact of IS habit on perceptions, intentions, and actual use over time, via a longitudinal study. The scale's performance could also be tested within other types of behavioral models.

## CONCLUSION AND FUTURE RESEARCH DIRECTIONS

The proper measurement of habit has long been a problem in both social psychology and organizational research. While habit is often operationalized as frequency of past behavior, many researchers today have acknowledged the inappropriateness of using such a measure for a construct that is inherently psychological in nature. This is an even bigger concern in an organizational context, since many of the activities that individuals perform at work must be performed on a regular basis (often daily or multiple times each day). However, while the frequency with which these tasks are performed at work makes habits more likely to form, simply performing a task on a regular basis (thus making it part of one's "routine"), does not mean that the performance of that task has habituated. When designing organizational interventions for the purpose of changing employee behavior, simply knowing that a given

individual frequently uses a given IS to perform a given task, does not mean that the individual will resist (either consciously or subconsciously, due to habit) the introduction of a new system. Measuring habit properly (which includes properly tapping its content domain) will give additional insight into situations where one's performance of a behavior has truly habituated and may be difficult to change without interventions designed to disrupt automatic behavioral responses.

The choice of one IS over another to complete a particular task is just one step in what is possibly a much larger habituated task sequence. When a new system is implemented in an organization, users may continue to use the old system simply because the choice to do so has become habituated, and is triggered by preceding steps in the task sequence that have not changed with the introduction of the new system. This may lead to widespread failure to adopt the new system, unless strategies are put in place to disrupt and retrain users' habits *in regard to the entire task sequence* prior to new system implementation. Thus developing a better understanding of the extent of old system usage (and in fact, the extent of an entire task sequence encompassing that usage) that is performed outside of awareness, in a mentally efficient manner, and is possibly difficult to change without external interventions, is important to researchers and practitioners alike.

By specifying habit correctly as a multidimensional construct with formative dimensions, and recognizing that the relative weight of each dimension may differ across different tasks and technologies, or differ based on whether a habit is relatively new or deeply engrained, researchers can better examine the effectiveness of various organizational interventions for disrupting habits. This is because they can pinpoint the differential impact (if any) of each intervention on awareness, controllability, and mental efficiency of the existing behavior.

Practitioners can then design appropriate intervention strategies to target each individual dimension of habit.

Verplanken et al. (2005b) have suggested that there may be different profiles of habits, implying that habit is in fact a profile construct. However, the Verplanken and Orbell (2003) SRHI scale (on which their suggestion was based) has thus far yielded little to no evidence to support this view. One problem is that while the SRHI was designed to capture various aspects of habitual behavior (including levels of awareness, mental efficiency, and controllability, as well as past behavioral performance and self-identity), the growing number of studies that have used the SRHI have specified it as a unidimensional, reflective construct.

The habit measure we present here can perhaps be used in the future to investigate the possibility that there is a typology of habits in IS use or other contexts (just as there is a typology of automaticity (Bargh 1989; Bargh 1994; Bargh 1996; Bargh et al. 2001). This is possible because we have clearly delineated each dimension of habit and rigorously tested its multidimensionality. For example, does one's awareness of the trigger for using a particular IS depend on how deeply embedded use of that system is within a larger work routine? The relative contribution of each habit dimension might also depend on whether the system is being used in a very task-oriented setting, or for primarily personal or hedonic purposes. Thus future research should investigate the relative strength of each habit dimension in a number of different IS usage scenarios, to determine whether typologies in fact exist.

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# CHAPTER 4

# THE DUALITY OF HABIT IN INFORMATION TECHNOLOGY ACCEPTANCE[18]

[18] Polites, G. L. and E. Karahanna. To be submitted to *MIS Quarterly*.

## INTRODUCTION

User resistance to the adoption of new information systems (IS) has long been a concern to researchers and practitioners alike. While recent IS research has begun to investigate the role of subconscious, automatic predictors of behavior such as habit, it has focused primarily on the role played by habit in the *continued* use of an existing IS, or similarly, how the development of habitual behavior toward a new system may lead to increased *future* use. There has been little extrapolation to the concept that deeply ingrained habitual behavior toward an old system may *negatively* affect perceptions of a newly introduced one, and thus *inhibit* adoption of the new system.

Using the status quo bias (Samuelson and Zeckhauser 1988) and habit literatures as theoretical lenses, this study expands extant technology acceptance models to explore how habit toward an old system can impact perceptions of a new system. Findings from both the organizational change and social psychology literature indicate that a strong habit may have a negative impact on intention and its antecedents. However, the manner in which this impact occurs has not yet been theoretically explained. Through developing a better theoretical understanding of habit as an inhibitor of technology acceptance, it may be possible to uncover better methods for organizations to use in breaking these old habits and increasing new system adoption.

## THEORETICAL BACKGROUND

Adoption decisions do not occur in a vacuum but rather within the context of existing systems, habitual patterns of behavior, and organizational routines. While the organizational literature on change management and resistance to change recognizes the role that deeply engrained routines and habitual behaviors may have on inhibiting change at a group or

organizational level, habit itself is strictly an individual-level construct (Becker 2005; Cohen and Bacdayan 1994).[19] As such, habit's role in inhibiting change at the individual level, within the context of habituated IS use to perform work tasks, has not been studied. The current research focuses on this gap, specifically investigating the role of habit in influencing perceptions and intentions related to new system use.

## Definition of Habit

Many different and conflicting theoretical and operational definitions of habit have been used in the past. We define habit as "learned sequences of acts that have become automatic responses to specific cues, and are functional in obtaining certain goals or end-states" (Verplanken and Aarts 1999, p.104).[20] As a form of goal-directed automaticity, habit cannot simply be associated with frequency of past behavior (as is commonly done), but rather should be conceptualized as a multidimensional, formatively measured psychological construct consisting of the four dimensions of *intentionality*, *awareness*, *controllability*, and *mental efficiency* (Bargh 1989; Bargh 1994; Polites and Karahanna 2008b; Verplanken and Orbell 2003). Habits are intentional in that they are functional or goal-oriented in nature. Nevertheless, habitual behavior occurs outside of awareness, in that the individual may be unaware of the situational trigger leading them to perform the behavior, or unaware of how the trigger is interpreted at the moment it occurs. Further, habitual behavior is difficult to control, in that one may find it difficult to resist the urge to perform, especially if it is part of a larger automatized

[19] Routines at all levels of analysis (organizational, group, or individual) may lead to inertia inhibiting change. Organizational routines by definition involve multiple actors, but may be a composite of many individual-level habituated task sequences. Thus while organizational routines (and the formal processes and sanctioned task sequences associated with them) can and do change over time, the embedded situational triggers of old, undesirable individual-level habits may remain (Norman 1981). Further, individual-level routines are differentiated from habits in that while following a routine over a long period of time may *predispose* individuals to perform certain tasks automatically, not all routine behavior is truly habituated (Ashforth and Fried 1988; Gioia and Poole 1984).

[20] Though Limayem et al. (2007) make a distinction between "habit" and "habitual behavior / habitual use," in this paper we use the terms interchangeably.

work routine. Finally, habitual behavior is mentally efficient, meaning that it frees the individual's attentional resources to do other things at the same time (Bargh 1994; Verplanken and Orbell 2003). This savings of memory space and processing time is particularly useful when one must perform a complex yet programmable sequence of actions on a frequent, ongoing basis (Schank and Abelson 1977).

In the workplace, IS usage behaviors are often embedded within larger and occasionally complex work routines and task sequences. When these routines and task sequences are practiced repeatedly and satisfactorily over a long period of time in a stable environment (see Limayem et al. 2007; Ouellette and Wood 1998), they tend to be performed automatically (Ashforth and Fried 1988; Gioia and Poole 1984). Thus an individual may not consciously decide to use a particular IS to perform a work-related task on a given occasion, but rather do so automatically as one step in a much larger, habituated script. While such automatization is useful in that it allows individuals to focus their limited mental resources on things other than the details of performing a given behavior, it can also be detrimental, in that the individual may become less aware of contextual cues and may no longer make conscious IS choices that could lead to improved productivity and better decision making (Ashforth and Fried 1988; Louis and Sutton 1991).

## Habit and IS Usage

A review of technology acceptance research reveals only a handful of studies that have focused specifically on habit (e.g., Gefen 2003; Kim and Malhotra 2005; Kim et al. 2005; Limayem and Hirt 2003; Limayem et al. 2007; Wu and Kuo 2008). While these studies have improved our understanding of how IS habits may develop and lead to sustained usage, there are still important gaps in understanding the role of habitual IS use in organizations. First, with few

exceptions (e.g., Kim et al. 2005; Limayem and Hirt 2003; Limayem et al. 2007; Wu and Kuo 2008), habit has been equated with either experience, preference, or frequency of past behavior, none of which capture the character of habit as a subconscious psychological construct. In addition, extant studies have all viewed habit as a positive influence on *continued* use of an existing system, although they have alluded to the idea that habitual use of an existing system could potentially interfere with the adoption of a new one (see Gefen 2003; Limayem et al. 2001).

Research examining habit's impact on beliefs and intentions is sparse. There are two different views on habit's impact on the antecedents of behavior. However, both views examine the effects of habitual use of a system on beliefs and intention towards the *same* system (and not on beliefs and intention towards a *new different* system as in the current study). The first view is that deliberate cognitive processing (via behavioral beliefs and intentions) and automatic processing (via habit) are alternate determinants of behavior. Thus habitual users will engage in the behavior automatically, and will not make ongoing evaluations of their behavior unless some circumstance triggers the need for conscious thought (Petty and Cacioppo 1981; Ronis et al. 1989). The second view, based on self-perception theory (Bem 1972), is that habitual users look at their behaviors for guidance in forming attitudes, in essence saying "I am always practicing Behavior X, therefore I must like it" (Eagly and Chaiken 1993; Kim and Malhotra 2005). Neither viewpoint, however, provides much insight into the role of existing habits in predicting attitudes toward *new* behaviors. Thus in the following sections, we present a series of hypotheses regarding the manner in which old system habit impacts perceptions related to use of a newly introduced system.

In our research, we explicitly argue for, and empirically test, the view that habitual use of an extant system can operate as an *inhibitor* to acceptance of a new IS, by encouraging the development of inertia, which negatively impacts both perceptions of a new system and intentions regarding its use. As such, we acknowledge the dual facilitating and inhibiting roles played by habit in technology acceptance. Below we present our conceptualization of the role of pre-existing IS habits on acceptance of new systems.

## RESEARCH MODEL

The proposed model (Figure 5.1) builds upon existing IS behavioral models to incorporate the new constructs of old system habit and inertia, as well as related constructs from the status quo bias and resistance to change literature (e.g., perceived transition and sunk costs, and individual propensity to resist change). The model includes the two innovation diffusion beliefs of relative advantage (RA) and perceived ease of use (PEOU), as well as intention to use the new system. The relationships between PEOU, RA, and Intention have been theoretically justified and empirically supported in many prior studies (see reviews in Lee et al. 2003; Venkatesh et al. 2003) and given that they are not the focus of our research, we do not offer formal hypotheses for them here.

Our model focuses on the impact of IS habit on new system perceptions and behavioral intentions. However, the manner in which this impact occurs has not been theorized in detail in the past. We posit that habit influences behavior through increasing perceptions of sunk costs, as well as through increasing inertia that acts as an inhibitor to change. However, since inertia may have other sources beside habit, we control for several other factors, including individual differences and prior experience with the new system. We also include subjective norm and self-efficacy as controls, given their recognized role in impacting usage intentions.

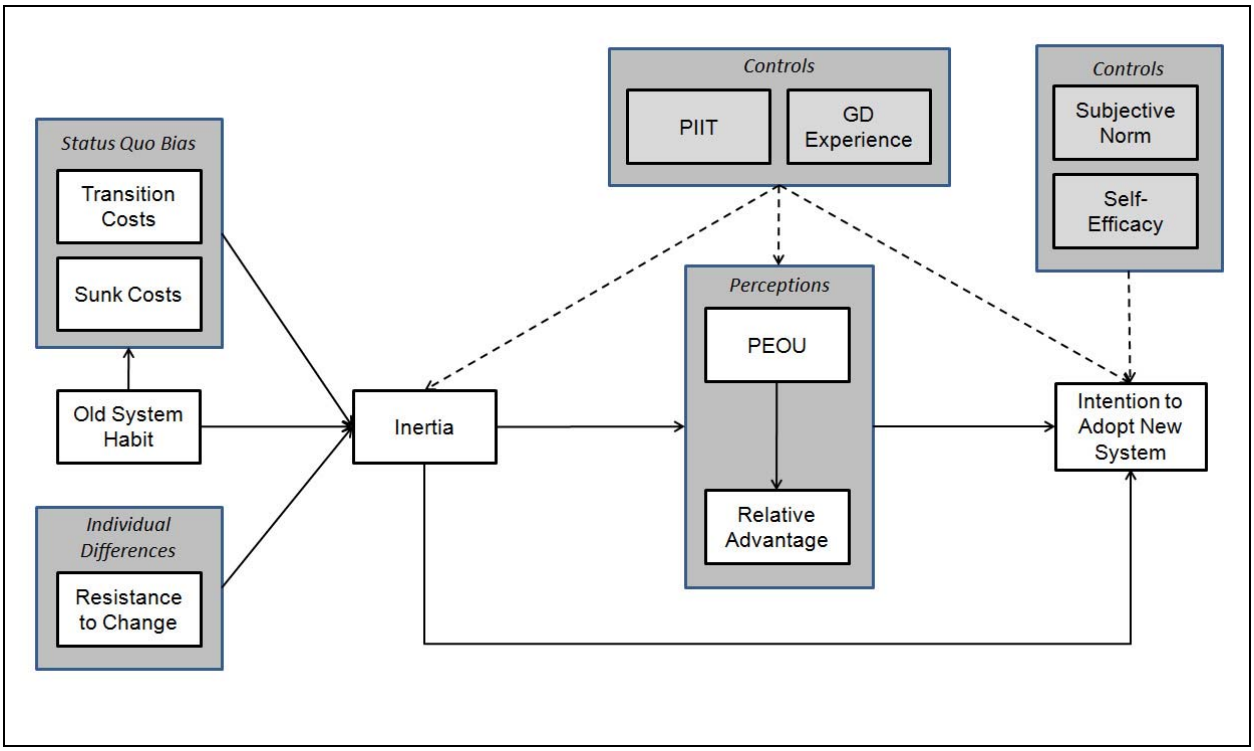


**Figure 5.1 Conceptual Model**

### Inertia as Habit Persistence

Our model explicitly incorporates the concept of inertia, which in a general context denotes "remaining at rest or in uniform motion in the same straight line unless acted upon by some external force" (Merriam-Webster Dictionary). We formally define individual level inertia in an organizational setting as *persistence of existing behavioral patterns, even in the presence of better alternatives or incentives to change*. In other words, inertia represents continuance of the status quo (see Samuelson and Zeckhauser 1988).

Inertia can be conceptualized as having behavioral, cognitive, and affective components (see Barnes et al. 2004; Ergün et al. 1999; Oliver 1999; Oreg 2003; Piderit 2000). *Behavior-based inertia* implies that use of a system continues simply because it is what the individual user has always done. *Cognitive-based inertia* implies that an individual continues to use a system even though they are aware that it might not be the best, most efficient, or most effective way of

doing things (Rumelt 1995). Finally, *affect-based inertia* occurs when an individual continues using a system because it would be stressful to change, or because they enjoy or feel comfortable doing so.

At the *organizational* level, inertia leads to increased commitment to established practices that in turn increase rigidity and decrease information processing (Fredrickson and Iaquinto 1989; Gilbert 2005). Embedded routines have been identified as a common source of inertia in organizations (Rumelt 1995). Since organizational routines are composed of many interlocking individual-level habit sequences (Becker 2004), this implies that habitual use of an existing IS can be a major source of inertia when a new system is introduced. In fact, some researchers have defined inertia as "habit persistence" (see Roy et al. 1996; Rumelt 1995).

Since habitual IS users engage in behaviors automatically, they will not reevaluate those behaviors absent a context change triggering a strongly felt need to do so (Petty and Cacioppo 1981; Ronis et al. 1989), but will instead simply continue with their existing behavioral patterns. In fact, under everyday conditions, habits are often viewed as beneficial since they prevent the individual from having to make decisions, thus reducing the costs of "individual choice and responsibility, including gathering and processing information and weighing outlay against input" (Wood and Quinn 2004, p.55). Further, the difficulty of controlling habits and the mental efficiency with which they can be performed may cause an individual to consciously ignore alternatives, giving lip service to the idea that an alternative may be better in some way, but clinging to behaviors that have already been deemed satisfactory and have become comfortable to perform (Lending and Straub 1997).[21] In addition, past research has shown that individuals

[21] Development and strengthening of IS habits has been shown to be in part a consequence of continuously reinforced satisfaction with prior usage situations (see Limayem et al. 2007). Wood and Quinn (2004, p.8) indicate that individuals will continue performing behaviors due to an "avoidance-based self-regulatory process" where they seek to avoid an undesired state representing "what would happen if they quit doing the behavior."

feel less overwhelmed and stressed when practicing habitual behaviors, since their practice requires few cognitive resources. Simply considering alternative behaviors can increase stress, leading an individual to become more committed to their current behavioral patterns (Wood and Quinn 2004). Thus we posit:

*H1. Old system habit will positively impact inertia.*

Although inertia has often been defined as habit persistence, we recognize that inertia can exist even in the absence of genuinely automatic, subconsciously performed behaviors. This may occur when behavior has become routinized over time but not truly habituated. Thus inertia can have both conscious and subconscious sources. We discuss the relationship between habit, inertia, and bias toward the status quo in more detail in the following section.

**Habit, Inertia, and the Status Quo**

Inertia is occasionally attributed to a *conscious bias* toward the status quo (see Samuelson and Zeckhauser 1988, who use the term "status quo inertia"). Status quo bias relates specifically to the decision making process and implies both that the existing course of action is considered superior to alternatives, and that switching to a new course of action is deemed too costly as a consequence of either rational decision making or misguided / exaggerated perceptions (Moshinsky and Bar-Hillel 2007). This results in a “bias or preference to stay with the current situation” (Kim and Kankanhalli, p.1), which may manifest itself externally as inertia.

One explanation given for status quo bias is *rational decision making* based on an assessment of transition costs. Common transition costs include the time and effort required to adapt to a new situation. These costs make a switch from the status quo much less likely to occur (Samuelson and Zeckhauser 1988). Prior research has shown that individuals will justify continuing their use of an existing system due to concerns about the time required to learn a new

one (see Lending and Straub 1997). Thus we expect that when the time and effort required to learn another system are perceived as being high, individuals will be more likely to stick with the status quo, resulting in greater levels of inertia.

Another explanation for status quo bias is *psychological commitment*, which can be a consequence of misperceived sunk costs (Samuelson and Zeckhauser 1988, p.33). Sunk costs represent an individual's reluctance to "cut their losses," and tendency to justify previous commitments to a course of action (good or bad) by making subsequent commitments. The more one has invested in an existing course of action, the more likely they will be to continue down that path in the future (Samuelson and Zeckhauser 1988). Sunk costs in an IS setting include the time and effort already invested in learning to use the existing system, as well as "skills related to the previous way of working (which will be lost as a result of switching), and the work that might be lost as a result of switching" (Kim and Kankanhalli, p.11). This implies that the more time and effort an individual has already invested in learning the existing system, the more likely they will be to exhibit inertia, based on perceptions of high sunk costs. Thus we posit:

*H2. Perceived transition costs will positively impact inertia.*

*H3. Perceived sunk costs will positively impact inertia.*

We propose that perceived sunk costs will partially mediate the relationship between old system habit and inertia. Habits generally take substantial time to develop, since they require frequent repetition of a given behavior in a stable context (Ouellette and Wood 1998). When a behavior is first performed, it requires conscious attention and effort. However, as this behavior habituates (as a consequence of frequent performance over time), it requires less attentional resources and becomes more mentally efficient and difficult to control. The speed and accuracy with which a user can perform a habituated task sequence increase as well (Carvajal 2002; Wood

and Quinn 2004). While an individual may not be aware of the triggering stimulus to perform a habit at the moment it occurs, they are no doubt cognizant that the development and strengthening of their habit over time has resulted in improved task performance which will be lost, at least in the short term, if they switch to another system or method of performing that task. Thus they may fall into the trap of taking sunk costs into account in continuing their existing behavior patterns. Thus we posit:

*H4. Old system habit will positively impact perceptions of sunk costs.*

**Individual Propensity to Resist Change**

As indicated in the previous section, we recognize that inertia may have a number of sources beside habit. Therefore we also include individual propensity to resist change (Oreg 2003) in our model as an individual difference impacting inertia. Oreg's resistance to change scale consists of four dimensions, based on sources of resistance believed to have their foundation in an individual's personality. These dimensions include routine seeking ("the incorporation of routines into one's life"), emotional reactions to imposed change, short-term thinking ("a short-term focus when addressing change"), and cognitive rigidity (2003, pp.681-682).

Routines are not habits per se (see Limayem et al. 2007), although a routine that is repeated frequently over time in a stable context may develop into a habit. According to Oreg, some individuals do not like to have control over their life situation taken away from them by imposed, rather than self-initiated, change. In addition, some individuals are less able to deal with the stress associated with change. Short-term thinkers tend to focus on the "immediate inconvenience or adverse effects" of a change (Oreg 2003, p.682). They do not like to have to do more work in the short term due to changes. Finally, individuals with high levels of cognitive

rigidity do not change their minds easily; they find it more difficult to do so and thus do it less often. In addition, they may be close-minded and less willing and able to adjust to new situations (Oreg 2003, p.681). All of these individuals would be more likely to develop inertia, even in the absence of a habit. In fact, the affective, cognitive, and behavioral dimensions of resistance to change proposed by Oreg parallel the three dimensions of inertia. Thus:

*H5. Individual propensity to resist change will positively impact inertia.*

**The Impact of Inertia on Technology Acceptance**

Inertia is expected to negatively impact or bias a user's perceptions of a newly introduced system. As inertia sets in, the volume and diversity of information processing tends to decrease. The costs associated with simply making a *decision* to perform an analysis can become too high (Samuelson and Zeckhauser 1988). Even when a comparative analysis is performed, the "costs of thinking" may result in an inaccurate or otherwise inadequate analysis (Shugan 1980). This implies that when an individual is using an existing IS in an inertial state, they will be less likely to form accurate perceptions of both the ease of use and relative advantage associated with use of the new system, due to an incomplete analysis.

According to the elaboration likelihood model of persuasion, the lack of motivation that inertial users may have to fully consider other alternatives will likewise make them less likely to carefully analyze and critically evaluate a new IS, and less likely to be persuaded to make lasting attitude changes (Petty and Cacioppo 1986; see also Ronis et al. 1989). This view of the impact of inertia on perceptions corresponds with the functional view of attitudes (Katz 1960), which posits that attitudes and beliefs may serve ego-defensive, value-expressive, knowledge, or instrumental functions. Inertial users do not want to step outside their "comfort zone" or deal with the stress associated with changing long-standing behavioral patterns. Thus IS users who

are in an inertial state may raise their perceptions of the difficulty of using the new system, and lower their perceptions of the advantages associated with such use, to help justify their lack of desire for change (see Verplanken and Wood 2006).

Self perception theory (Bem 1972), which has been used in the past to explain how habitual use of an *existing* system can lead to increased positive perceptions of that system, can also be used to explain lowered perceptions of the benefits of *new* system use. The self perception process is believed to cause habitual users to rely on their past behavior, as opposed to current deliberations, to guide their perceptions and intentions (Eagly and Chaiken 1993; Kim et al. 2005). In this case, the inertial individual draws from past decisions (to use the old system) to guide present and future choices, by saying to oneself, "if it was good enough for me then, it is (must be) good enough for me now" (Samuelson and Zeckhauser 1988, p.39). Thus the individual avoids having to make a decision about the relative advantages of the old versus new systems, and justifies continuance in the status quo.

Finally, status quo bias theory posits that, in the absence of rational reasons for maintaining the status quo, status quo bias may be the result of *cognitive misperceptions of loss aversion*, whereby "the losses of changing from the current situation appear larger than the gains" (Kim and Kankanhalli, p.10). This may result in lowered perceptions of the relative advantages of using the new system. Status quo bias theory also indicates that *rational decisions based on uncertainty* regarding whether the new system will truly perform better than the old one may lead to a biased assessment of relative advantage (Samuelson and Zeckhauser 1988). Thus we posit:

> *H6. Inertia will negatively impact perceptions of the ease of use of the new system.*

*H7. Inertia will negatively impact perceptions of the relative advantage of the new system.*

We also expect inertia to have a direct impact on intentions above and beyond its impact mediated by perceptions. Once inertia has set in, a behavior may continue even in the face of changing attitudes and beliefs, and inhibit conscious decision-making regarding behavioral change (Ronis et al. 1989). This is particularly true if the newly formed attitudes and beliefs are not held in an enduring way or have not achieved the threshold required to bring about real change (Petty and Cacioppo 1986). Thus an individual may view a new system as being easy to use and advantageous for completing certain work tasks, yet still not voice intentions to use it for those tasks in the future. Based on status quo bias theory and the multidimensional nature of inertia, this may be due to lingering uncertainties over the new system, a desire to maintain consistency in performing one's job, or a desire to avoid potential additional stress associated with change (Samuelson and Zeckhauser 1988).

In an organizational environment, this phenomenon has been labeled as "action disconnects," "behavioral lock-in," and "captivity," which may lead to resistance to change even when the individual acknowledges the presence of superior alternatives, or resistance due to disinterest in changing one's ways (Barnes et al. 2004; Ergün et al. 1999; Rumelt 1995). In a study of faculty response to a new technology for conducting literature searches, Lending and Straub (1997) found that

> …even when the respondent was aware that an alternative technology existed, which might offer a better fit than the method currently used…the respondent typically continued in habitual use of a possibly sub-optimal technology…These participants knew that the method they were using was often not the best and also knew that other and better methods existed. (p.470)

Thus, the Lending and Straub study provides evidence that users may engage in "persistent use," even when better systems are available. Therefore we posit:

*H8. Inertia will negatively impact intentions to use the new system.*

**Control Variables**

We include several control variables in our study, that may impact both inertia and perceptions related to use of the new system (see Figure 5.1). We briefly discuss each control variable here; however, we do not introduce formal hypotheses for them.

*Personal innovativeness* at a global level has been defined somewhat vaguely as a "willingness to change" (Hurt et al., 1977 in Agarwal and Prasad 1998, p. 206), and as such has shown low predictive power in domain-specific studies. Personal innovativeness in the specific domain of IT (PIIT), defined as ""the willingness of an individual to try out any new information technology" (Agarwal and Prasad 1998, p.206), on the other hand, has been shown to be an important predictor in technology acceptance models. While individuals with a high level of PIIT may still develop IS usage habits, we would expect them to be less likely to develop inertia. We thus include PIIT as a control impacting inertia, PEOU, RA, and new system usage intentions.

Prior IS research based on TPB has found both *subjective norm* (see Venkatesh et al. 2003 for a review) and *self-efficacy* (as an internal factor in facilitating conditions; see Taylor and Todd 1995) to have an impact on intentions to use a new system. Thus while these constructs are not a focus of our study, we include them as control variables in our model for the sake of completeness.

Finally, we include *past experience with the new system* as a control variable. It is possible in situations where use of a particular system is not mandated, that individuals have had an opportunity to have prior exposure to, and experience with, alternative systems. Thus we

include experience with the new system as a control impacting inertia, PEOU, RA, and intentions to use the new system in the future for a specific task.

## METHODOLOGY

Existing self-report habit scales (e.g., Cheung and Limayem 2005; Kim et al. 2005; Limayem and Hirt 2003; Limayem et al. 2007; Verplanken and Orbell 2003) do not adequately account for its nature as a multidimensional, formatively measured psychological construct (see Bargh 1989; Bargh 1994), thus we used the more comprehensive habit scale developed by Polites and Karahanna (2008b). We also developed a 9-item scale for inertia that captures each of its three dimensions, and subjected it to rigorous validity tests. However, since our research model includes usage intention as the ultimate dependent variable, including the behavior-based dimension of inertia to predict intention would create a tautology. Thus we removed this dimension from our scale before running the structural model. Sources for the scales used for all constructs are provided in Table 5.6 in Appendix D.

Since we are focusing on specific as opposed to general IS habits (see Limayem et al. 2007),[22] an important part of the research design was selection of an appropriate usage behavior to measure. Further, we were interested in the impact of habit in situations where both the old and new systems are available for use (i.e., situations in which use of the new system is not mandated). To fulfill both requirements of the study, we surveyed 603 students from eight different MIS courses at a university in the southeastern United States, in Spring 2008. Respondents were asked about their use of collaboration / file sharing tools when working in group projects, and received extra credit for completing the survey. An alternate assignment was

[22] General IS habits have been defined as those characterized by "high levels of usage comprehensiveness," whereas specific IS habits have been defined as being characterized by "limited usage comprehensiveness" (Limayem et al. 2007, p.716). According to Limayem et al., the greater the number of specific tasks an individual uses a given system for, the greater the likelihood that a general habit of using that system, regardless of the task, will develop.

provided to those not wishing to participate in the survey. The two systems used for the study, old (i.e., what the students are currently using) and new respectively, were email and GoogleDocs for collaborating and exchanging files in group projects.

Data were collected at two points in time. Part one of the survey asked respondents questions regarding the tool they were currently using for collaboration and file sharing in group projects. Constructs on the survey included Old System Habit (i.e. habit towards usage of their current collaboration tool), individual differences (Resistance to Change and PIIT), perceptions related to the current system (e.g., PEOU, Perceived Usefulness, Social Factors, Usage Intention), and demographic data (gender, age, class standing, and major).

Part two of the survey was administered two weeks later, using student email addresses to match responses across the two parts of the survey. 556 of the original 603 respondents completed the second part of the survey. Respondents were asked to read a brief introduction to Google Docs (see Appendix E), and then visit the Google Docs website and review additional information about the use of Google Docs for collaboration and file sharing in team projects. They were then given a brief (4-question) quiz designed to ensure that they had actually read the requested information. Survey constructs included Inertia and perceptions of Google Docs (e.g., PEOU, Relative Advantage, Transition Costs, Sunk Costs, Subjective Norm, Self-Efficacy, Google Docs Usage Intention). We also asked additional questions on this survey designed to provide more detailed information on exactly how their current collaboration / file sharing method was used to support group projects (e.g., average project group size, average time to complete a project deliverable, average number of files exchanged over the course of a project). Finally, we captured data on respondents' prior experience (if any) using Google Docs.

Only the responses from students indicating on both parts of the survey that email was their primary form of collaborating and sharing files with teammates were ultimately used, since we expected the use of email for this task to have become habitual over time. We also removed respondents who indicated that they had more Google Docs experience than actually possible based on the date that Google Docs was introduced on the market. This resulted in a final sample size of 334. Demographic information on the respondents is shown in Table 5.1.

**Table 5.1. Sample Characteristics**

| **Variable** | **Category** | | **Frequency** |
|---|---|---|---|
| Gender | Male | | 171 (51.2%) |
| | Female | | 163 (48.8%) |
| Age | < 20 years | | 146 (43.7%) |
| | 20-24 years | | 182 (54.5%) |
| | 25-29 years | | 3 ( 0.9%) |
| | 30+ years | | 3 ( 0.9%) |
| Class Standing | Freshman | | 96 (28.7%) |
| | Sophomore | | 141 (42.2%) |
| | Junior | | 61 (18.3%) |
| | Senior | | 36 (10.8%) |
| Average Completion Time Per Project Deliverable<br><br>(Note: a single project may have more than one deliverable associated with it) | 1 to 2 days | | 189 (56.6%) |
| | 3 to 7 days | | 116 (34.7%) |
| | More than one week, but less than one month | | 28 ( 8.4%) |
| | More than one month, but less than a semester | | 0 ( 0.0%) |
| | All semester (3 to 4 months) | | 1 ( 0.3%) |
| **Variable** | **Range** | **Mean** | **Std. Dev.** |
| Avg. Group Size (number of persons) | (2, 6) | 4.60 | 0.657 |
| Avg. Number of Files Exchanged Per Deliverable | (1, 30) | 3.72 | 2.406 |
| Google Docs Experience (mos.) | (0, 15) | 0.69 | 2.084 |

## Testing the Measurement Model

We used LISREL to assess construct unidimensionality and to perform a CFA. Results indicated a multidimensional structure for Habit, Inertia, and the Resistance to Change individual difference (need to report the LISREL stats) as expected. Reverse coded items for Routine Seeking and Cognitive Rigidity (see Table 5.6 in Appendix D), were dropped due to low loadings on their respective factors in the CFA. We then used PLS-Graph to further validate the scales. Habit, Inertia, and Resistance to Change were each conceptualized as second-order formative, first-order reflective, multidimensional constructs with their first-order dimensions being reflectively measured. Thus we first assessed the psychometric properties of all the reflectively measured scales using guidelines suggested by Fornell and Larcker (1981) and Werts et al. (1974), prior to modeling Habit, Inertia, and Resistance to Change in PLS as aggregate constructs.[23]

Composite reliability scores for the final reflectively measured scales ranged from .80 to .96, exceeding the .707 recommended guideline (see Table 5.2). Discriminant validity was assessed by (a) items loading on their constructs at .70 or above and not cross-loading; and (b) the square root of the Average Variance Extracted (AVE) for each construct exceeding the construct's correlations with other constructs. Furthermore, for convergent validity, the AVE has to exceed .50. As can be seen from Tables 5.2 (following) and 5.5 (Appendix D), our scales meet these guidelines.

[23] While Oreg (2003) conceptualized Resistance to Change as a second-order reflective construct, we believe that it is more appropriately conceptualized as second-order aggregate. As Petter et al. (2007) have pointed out, many formative / aggregate constructs have been misspecified in organizational literature in the past, increasing the chances of Type I and Type II errors.

## Table 5.2. Descriptive Statistics and Inter-Construct Correlations

| | Mean (Std Dev) | Comp. Reliab. | GDRA | GDPEOU | SN | GDIntent | ABI | AWARE | TranCost | CogRig |
|---|---|---|---|---|---|---|---|---|---|---|
| **GDRA** | | 0.93 | **0.90** | | | | | | | |
| **GDPEOU** | | 0.90 | 0.55 | **0.90** | | | | | | |
| **SN** | | n/a | 0.46 | 0.37 | **n/a** | | | | | |
| **GDIntent** | | 0.96 | 0.71 | 0.62 | 0.56 | **0.96** | | | | |
| **ABI** | | 0.84 | -0.40 | -0.39 | -0.22 | -0.50 | **0.80** | | | |
| **AWARE** | | 0.94 | 0.12 | 0.03 | 0.06 | 0.06 | 0.13 | **0.90** | | |
| **TranCost** | | 0.90 | -0.30 | -0.68 | -0.29 | -0.48 | 0.31 | -0.03 | **0.72** | |
| **CogRig** | | 0.90 | -0.17 | -0.19 | -0.14 | -0.25 | 0.28 | 0.03 | 0.22 | **0.90** |
| **EReact** | | 0.86 | 0.03 | -0.12 | -0.07 | -0.08 | 0.23 | 0.11 | 0.22 | 0.28 |
| **RtSeek** | | 0.80 | -0.11 | -0.21 | -0.12 | -0.21 | 0.30 | 0.12 | 0.31 | 0.46 |
| **STF** | | 0.84 | 0.00 | -0.18 | -0.02 | -0.11 | 0.23 | 0.08 | 0.28 | 0.30 |
| **CTRL** | | 0.92 | 0.03 | -0.12 | 0.03 | -0.05 | 0.27 | 0.55 | 0.08 | 0.18 |
| **EFFCH** | | 0.83 | -0.10 | 0.03 | -0.12 | -0.08 | 0.17 | 0.44 | -0.10 | 0.11 |
| **CBI** | | 0.94 | -0.23 | -0.37 | -0.20 | -0.36 | 0.56 | 0.12 | 0.36 | 0.15 |
| **SunkCost** | | 0.93 | -0.19 | -0.25 | -0.04 | -0.21 | 0.32 | 0.10 | 0.25 | 0.14 |
| **PIIT** | | 0.91 | 0.16 | 0.29 | 0.28 | 0.32 | -0.24 | 0.04 | -0.42 | -0.25 |
| **GDExp** | | 1.00 | 0.10 | 0.17 | 0.16 | 0.15 | -0.12 | -0.12 | -0.14 | -0.05 |
| **SE** | | 0.95 | 0.10 | 0.42 | 0.11 | 0.24 | -0.25 | -0.01 | -0.57 | -0.11 |

Legend:

GDRA = Relative Advantage (Google Docs)
GDPEOU = Perceived Ease of Use (Google Docs)
SN = Subjective Norm (Google Docs)
GDIntent = Usage Intention (Google Docs)
ABI = Affective-Based Inertia
AWARE = Habit: Awareness
TranCost = Transition Costs
CogRig = Cognitive Rigidity
EReact = Emotional Reaction
RoutSeek = Routine Seeking
STFocus = Short Term Focus
CTRL = Habit: Controllability
EFFCH = Habit: Mental Efficiency of Choice
CBI = Cognitive-Based Inertia
SunkCost = Sunk Costs
PIIT = Personal Innovativeness with IT
GDExp = Prior Google Docs Experience
SE = Self-Efficacy

All constructs were measured on a 1-7 scale with the exception of Self-Efficacy, which was measured on a 10-point scale.

**Table 5.2, continued. Descriptive Statistics and Inter-Construct Correlations**

| | EReact | RtSeek | STF | CTRL | EFFCH | CBI | SunkCost | PIIT | GDExp | SE |
|---|---|---|---|---|---|---|---|---|---|---|
| **EReact** | **0.82** | | | | | | | | | |
| **RtSeek** | 0.50 | **0.81** | | | | | | | | |
| **STF** | 0.61 | 0.58 | **0.79** | | | | | | | |
| **CTRL** | 0.28 | 0.25 | 0.21 | **0.86** | | | | | | |
| **EFFCH** | -0.01 | 0.04 | -0.07 | 0.27 | **0.78** | | | | | |
| **CBI** | 0.17 | 0.20 | 0.17 | 0.21 | 0.09 | **0.91** | | | | |
| **SunkCost** | 0.10 | 0.20 | 0.11 | 0.25 | -0.02 | 0.11 | **0.93** | | | |
| **PIIT** | -0.26 | -0.47 | -0.29 | -0.08 | 0.04 | -0.27 | -0.03 | **0.87** | | |
| **GDExp** | -0.16 | -0.24 | -0.21 | -0.10 | -0.09 | -0.07 | -0.03 | 0.23 | **1.00** | |
| **SE** | -0.25 | -0.31 | -0.27 | -0.11 | 0.09 | -0.15 | -0.20 | 0.46 | 0.08 | **0.93** |

Legend:

GDRA = Relative Advantage (Google Docs)
GDPEOU = Perceived Ease of Use (Google Docs)
SN = Subjective Norm (Google Docs)
GDIntent = Usage Intention (Google Docs)
ABI = Affective-Based Inertia
AWARE = Habit: Awareness
TranCost = Transition Costs
CogRig = Cognitive Rigidity
EReact = Emotional Reaction
RoutSeek = Routine Seeking
STFocus = Short Term Focus
CTRL = Habit: Controllability
EFFCH = Habit: Mental Efficiency of Choice
CBI = Cognitive-Based Inertia
SunkCost = Sunk Costs
PIIT = Personal Innovativeness with IT
GDExp = Prior Google Docs Experience
SE = Self-Efficacy

All constructs were measured on a 1-7 scale with the exception of Self-Efficacy, which was measured on a 10-point scale.

## Testing for Method Bias

Self-reported data may include common method bias that carries the potential to inflate the correlations between variables in a study, particularly when all the data are collected from a single survey at one point in time with similar Likert scales (Spector 2006). We used several techniques to assess the potential impact of common method bias on our results. First, we collected data over two time periods, as described earlier. Items related to old system habit and individual difference variables were administered two weeks prior to administration of items related to perceptions of the new system. Temporal separation of survey administration reduces common method bias concerns (see Podsakoff et al. 2003).

Second, we examined the matrix of item-to-item correlations. The lowest correlation between pairs of items in a given dataset can be viewed as the upper limit to how much method bias can be present in the data (Lindell and Whitney 2001; Malhotra et al. 2006). There were a large number (473) of nonsignificant item-to-item correlations in the dataset, including 59 nonsignificant correlations associated with items from constructs hypothesized to be either positively or negatively correlated, as well as 44 statistically significant correlations between 0.09 and 0.10 in our sample. This indicates the absence of widespread method bias (Conger et al. 2000).

Finally, we ran a CFA in LISREL that included a method construct. This allowed not only comparison of the loadings of each item on its own factor and the method factor, but it also allowed calculation of the amount of method bias present in the entire dataset, using the CFA MTMM technique described by Podsakoff et al. (2003) and Malhotra et al. (2006). The estimated amount of method bias present in the dataset was only 1.2%. As such, common method bias does not appear to be a significant threat to the validity of the results.

## Testing the Structural Model

Since Habit, Inertia, and the individual difference construct, Resistance to Change, are all conceptualized as second order aggregate constructs, we needed to generate factor scores for each of their first order dimensions. These factor scores are then used as formative measures of the second order aggregate constructs. To do so, we first ran the model in PLS with the dimensions for each construct disaggregated. The resulting construct scores for each dimension were then used in the final model as measures of the aggregate Habit, Inertia, and Resistance to change constructs.

One of the concerns with formatively measured constructs is multicollinearity across the formative indicators of each construct. We thus tested for multicollinearity. Variance inflation factor (VIF) values for the two Inertia dimensions equaled 1.5, well below the threshold of 3.3 suggested by Diamantopoulos and Siguaw (2006) and Petter et al. (2007), whereas VIF values for the four Resistance to Change dimensions ranged from 1.3 to 1.9, again indicating no serious concerns with multicollinearity in the data.

VIF values for the three Habit dimensions ranged from 1.3 to 1.7. Despite the fact that these values are within the accepted range, the fact that the weight for the habit dimension of Controllability exceeded 1.0 in the PLS structural model indicated that multicollinearity could in fact be a concern. Thus we summed the factor scores for each of the three habit dimensions to create a single item measure of habit to eliminate this problem. The model with habit as a single item measure yielded similar results to the model with habit as a second-order aggregate construct. Table 5.3 presents the weights for the PLS structural model using the summed habit score, whereas Table 5.4 presents the inter-construct correlations for the PLS model that includes the formatively measured constructs.

As indicated in Table 5.3, two of the four Resistance to Change individual difference dimensions had nonsignificant weights, and two items for the first-order formative Subjective Norm construct were likewise nonsignificant (GDSF4 would be considered significant at p<.10). There is some discussion as to whether formative indicators and dimensions with non-significant weights should be eliminated from the scale. However, if the content validity of a scale is affected by removing an indicator (and it should if the indicators are formative dimensions of the construct) then eliminating items from the pool should be theoretically justified rather than merely based on empirical results (Bollen and Lennox 1991; Diamantopoulos and Winklhofer 2001; Diamantopoulos and Siguaw, 2006; Diamantopoulos et al., 2008; Petter et al, 2007). Since each of the nonsignificant dimensions (and the Subjective Norm items) is an integral part of what defines its respective construct, we retained all dimensions and items as an integral part of their respective scales despite their non-significant weight.

**Table 5.3. Weights for Aggregate and Formative Constructs**

| **Construct** | **Dimension / Item** | **Weight** |
|---|---|---|
| Resistance to Change | Cognitive Rigidity | 0.441 *** |
| | Emotional Reaction | 0.238 (n.s.) |
| | Routine Seeking | 0.444 * |
| | Short-Term Focus | 0.118 (n.s.) |
| Inertia | Affective-Based | 0.820 *** |
| | Cognitive-Based | 0.267 * |
| Subjective Norm (first-order formative) | GDSF1 (friends) | 0.460 *** |
| | GDSF2 (friends) | 0.221 * |
| | GDSF3 (teammates) | 0.421 *** |
| | GDSF4 (teammates) | -0.196 (n.s.) |
| | GDSF5 (professors) | 0.247 ** |
| | GDSF6 (professors) | -0.003 (n.s.) |
| * p<.05, ** p< .01, *** p<.001 | | |

## Table 5.4. Inter-Construct Correlations for PLS Model with Second Order Aggregate Constructs

| Construct | GDRA | GDPEOU | SN | GDIntent | Inertia | Habit | TranCost | Resist | SunkCost | PIIT | SE | GDExper |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **GDRA** | 1.00 | | | | | | | | | | | |
| **GDPEOU** | 0.55 | 1.00 | | | | | | | | | | |
| **SN** | 0.46 | 0.37 | 1.00 | | | | | | | | | |
| **GDIntent** | 0.71 | 0.62 | 0.56 | 1.00 | | | | | | | | |
| **Inertia** | -0.39 | -0.43 | -0.24 | -0.51 | 1.00 | | | | | | | |
| **Habit** | 0.02 | -0.03 | -0.02 | -0.03 | 0.25 | 1.00 | | | | | | |
| **TranCost** | -0.30 | -0.68 | -0.29 | -0.48 | 0.35 | -0.02 | 1.00 | | | | | |
| **Resist** | -0.12 | -0.23 | -0.14 | -0.24 | 0.35 | 0.20 | 0.33 | 1.00 | | | | |
| **SunkCost** | -0.20 | -0.25 | -0.04 | -0.21 | 0.30 | 0.14 | 0.25 | 0.19 | 1.00 | | | |
| **PIIT** | 0.17 | 0.29 | 0.28 | 0.32 | -0.27 | 0.00 | -0.42 | -0.43 | -0.03 | 1.00 | | |
| **SE** | 0.10 | 0.42 | 0.11 | 0.24 | -0.25 | -0.01 | -0.57 | -0.29 | -0.20 | 0.46 | 1.00 | |
| **GDExp** | 0.10 | 0.17 | 0.16 | 0.15 | -0.12 | -0.13 | -0.14 | 0.20 | -0.04 | 0.23 | 0.08 | 1.00 |

Legend:
GDRA = Relative Advantage (Google Docs)
GDPEOU = Perceived Ease of Use (Google Docs)
SN = Subjective Norm (Google Docs)
GDIntent = Usage Intention (Google Docs)
Inertia = Inertia
Habit = Habit (Email)
TranCost = Transition Costs
Resist = Resistance to Change (individual difference)
SunkCost = Sunk Costs
PIIT = Personal Innovativeness with IT
SE = Self-Efficacy
GDExp = Prior Google Docs Experience

Figure 5.2 shows the results of the structural model. All hypothesized relationships are significant at p<.01. The control variable of Self-Efficacy was not a significant predictor of New System Usage Intentions and not shown in Figure 5.2. This finding is not entirely unexpected, given prior studies that have found self-efficacy to be non-significant when predicting intentions in conjunction with PEOU (Venkatesh et al. 2003).

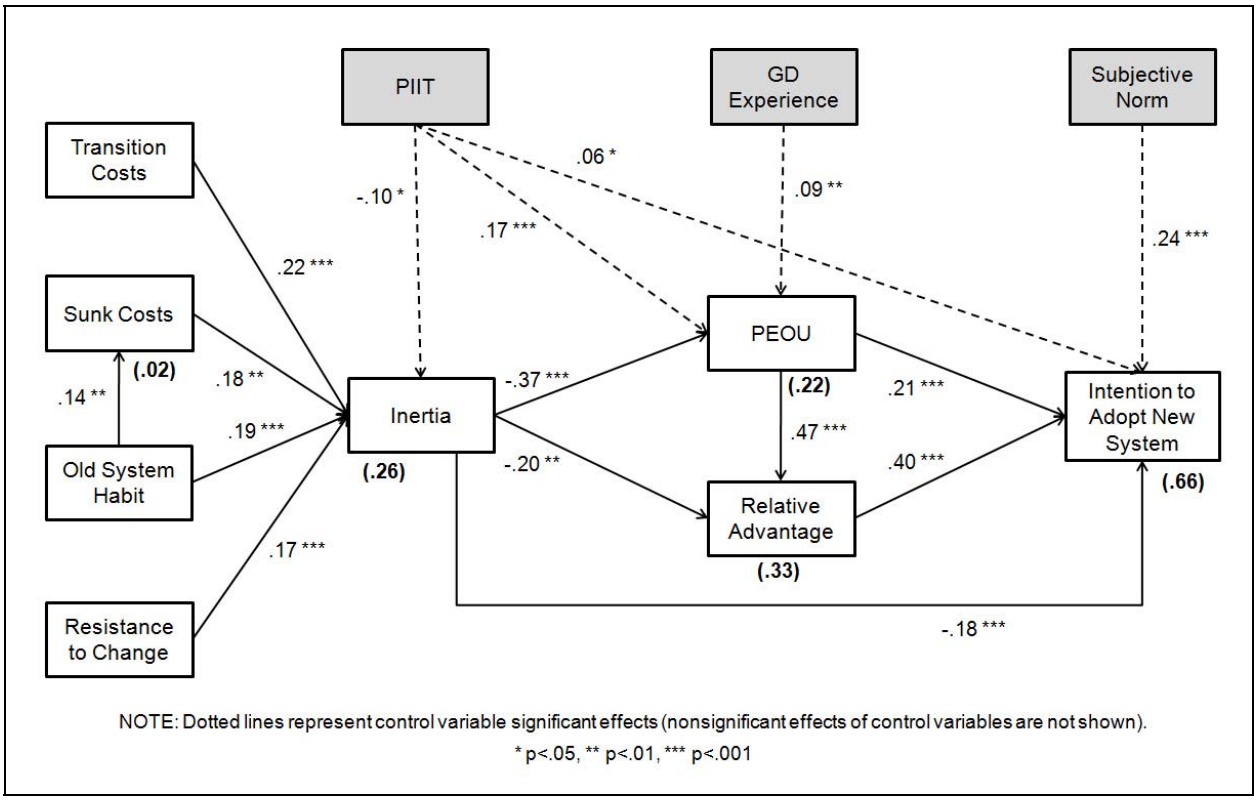


**Figure 5.2 PLS Results**

Finally, we performed tests of the mediating effect of Inertia in the Habit → Inertia → GDPEOU, Habit → Inertia → GDRA, and Habit → Inertia → Intention relationships, following the approach recommended by Baron and Kenny (1986). Results indicate that Inertia does in fact fully mediate each of these three relationships.

## DISCUSSION AND LIMITATIONS

Our results support the view that habitual use of an existing system for specific tasks leads to inertia, and that inertia in turn leads to decreased perceptions of the ease of use and relative advantage of a newly introduced system. Further, perceived sunk costs associated with time invested in learning to use the old system partially mediate the relationship between habit and inertia. Finally, inertia has a negative impact on intentions to use the new system, above and beyond its impact through perceptions.

The inclusion of individual difference variables as controls in our model indicates that these personality trait variables do in fact have an impact on the development of inertia, in addition to the impact of habit. Thus future research should further investigate the relationships between habit and individual difference variables in predicting user acceptance behaviors.

Our study is limited in that we used student subjects. Further studies are necessary using workers in an organizational setting, where the impact of IS habit can be investigated as it is embedded within larger, more complex work routines. Nonetheless, we believe the use of student subjects was appropriate, since it was not a contrived or experimental setting. Students were asked to answer questions regarding their actual use of email to carry out a real and necessary task (collaborating and exchanging files with project teammates). Employees in many organizations also use email as their primary collaboration and file exchanging tool when working on real projects. Further, students were asked about their perceptions of an alternative tool (Google Docs) that is often recommended by professors teaching classes involving group projects and that can also be used for collaboration and file sharing in “real world” organizational settings.

## IMPLICATIONS AND FUTURE RESEARCH DIRECTIONS

Deviating from prior IS studies on habit, the current research views habit – i.e., habitual use of the extant system – as an inhibitor of technology acceptance as it pertains to a new system. We draw from status quo bias theory to situate habit and its inertial consequences in a nomological network of technology acceptance constructs and hypothesize its effects on behavioral beliefs and intentions. As such, we extend our theoretical understanding of the role of habit in new system acceptance. However, our study has examined intention as the ultimate dependent variable. Future studies should examine the impact of old system habit on actual new system usage, via the intention-behavior link. Despite the lack of theorizing in prior literature of habit's role in inhibiting new behaviors, there is a widespread awareness that individuals' intentions can be overruled by habits when the latter are strongly ingrained in one's psyche (Fishbein and Ajzen 1975; Gefen 2003; Ouellette and Wood 1998).

One way in which this can occur is through *action slips*, defined as "the performance of an action that was not what was intended" (Norman 1981, p.1). An action slip may occur "when a familiar habit substitutes itself for the intended action sequence…if the habit is strong enough, even partial matches from the situation are apt to activate the relevant parent schema, and once activated, it can get triggered" (Norman 1981, p.8). This implies that after introduction of a new IS, if the business process or other contextual factors remain similar enough to what an individual has encountered in the past, the triggers and cues embedded in existing work routines may lead individuals to continue performing their tasks using the old IS, despite having at some point voiced intentions to the contrary. Overcoming the power of a habit may take much conscious, deliberate effort, since intentions may not be strong enough to override actions cued automatically by the environment (Ouellette and Wood 1998).

Inertia may play a role in inhibiting adoption and continued use of a new system as well. For example, repeated action slips could lead to *inaction inertia*, which represents that idea that

> foregoing an attractive action opportunity (initial inaction) decreases the likelihood that subsequent action will be taken in the same domain…[I]naction inertia occurs when the second action opportunity is in some sense 'worth' substantially less than the initial opportunity, even though the current action opportunity still has positive value in an absolute sense. Having passed up one opportunity to gain, the person becomes more likely to pass up another opportunity to gain but gain less." (Tykocinski and Pittman, 1998, p.607)

The potential of action slips leading to inaction inertia over time highlights the importance of studying organizational interventions that can alter those features of the performance context that enable action slips to occur.

The negative impacts of habit are not limited to situations of new system adoption. Long after users have adopted a new system and begun using it on a regular basis, they may form habitual ways of using that system that negatively impact their ability or inclination to engage in deeper use of the system and its features. This may in turn reduce benefits obtained from the system (Jasperson et al. 2005). Thus another fruitful area for future research would be to explore habitual use of specific system features, and its negative impacts on system exploration and productivity.

Studying the inhibiting influence of habit (through inertia) has both theoretical and practical implications for organizations that wish to take steps to encourage habit disruption and reformation. Several suggestions for breaking and modifying habits have been suggested in the social psychology literature. Most importantly, habit researchers stress that interventions designed to disrupt habitual behaviors should occur at multiple stages of the implementation process (Verplanken and Wood 2006). *"Upstream" interventions* (which include large-scale initiatives, incentives, policy changes, and structural changes) target social norms and contextual

supports for the desired action (in this case, new system use), encouraging attitude changes that can help to both encourage and cement an individual's intentions to adopt the new system. Such interventions might seek to disrupt habits (and thereby decrease inertia inhibiting change) by modifying features of the performance context to prevent old habit performance altogether, or they might simply make the performance environment more conducive to practice of the new behavior (Verplanken and Wood 2006).

As an example, we have shown that habitual users are more likely to factor in sunk costs in making decisions on whether to adopt a new technology. If concerns over sunk costs relate to potential performance loss from using the new system, then management could temporarily loosen performance requirements during the transition to the new system (see Kim and Kankanhalli, 2009). This might also decrease affect-based inertia, or continued old system use due to perceptions of stress associated with the change to something new.

*"Downstream" interventions* focus on providing information and training to the individual user in order to impact their decision making process concerning the new technology. While information-based interventions may be helpful in changing perceptions of the relative advantage and ease of use of a new system for "normal" users, they have limited success in changing the perceptions of habitual users who are in an inertial state (see Verplanken and Wood 2006). It might be more useful to focus information dissemination and training efforts on better understanding and allaying user concerns about the costs (real or perceived) associated with switching to the new system (Kim and Kankanhalli, 2009). Training and information-based interventions designed to make the user more comfortable with switching to and using the new system, and less stressed over the proposed change, could be helpful in overcoming inertia as well.

Since strongly held habits are activated automatically outside the individual's awareness, curtail information search, and tend to persist without a noticeable change of context, implementing interventions designed to change attitudes and intentions is not enough. Thus "*downstream-plus-context-change" interventions* have been proposed to either eliminate or interfere with the contextual cues and triggers leading to individual performance of habitual behaviors (Wood and Quinn 2004; Wood et al. 2005). Some of these contextual changes, which can be viewed as components of the facilitating conditions construct, include time of day, physical surroundings, event triggers, and the task definitions and goals associated with existing work routines and business processes. In many cases, the introduction of a new system will automatically result in changes to the performance context (e.g., through redesigned business processes associated with the new system), setting up an environment conducive to habit change. However, context changes can be intentionally implemented as well. Each of these contextual modifications succeeds by making it more difficult for users to continue automatically in a previously learned, habitual pattern of behavior, by increasing awareness and making it easier to practice conscious control over their behaviors.

Thus a combination of "upstream" and "downstream-plus-context-change" interventions can directly disrupt and weaken old system habits, and thereby reduce the resulting inertia which inhibits attitudinal and behavioral change. However, since inertia has other sources beside habit (including individual personality differences), it is also critical to incorporate "upstream" and "downstream" interventions that are specifically designed to change user perceptions of the sunk costs, transition costs, and discomforts associated with switching to the new system, and convince users that the value of new system use exceeds perceived costs. This will clear the way for the development and strengthening of new system usage habits.

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# CHAPTER 5

# CONCLUSION

## CONTRIBUTIONS OF RESEARCH TO THEORY AND PRACTICE

The study of IS habits is important because information systems are a major organizational change agent. The introduction of a new technology creates opportunities to institute more efficient organizational and individual level work routines and task sequences. However, strong existing IS habits can prevent individuals from seeing, accurately evaluating, and adopting these improvements in the way they perform their work. Thus it is critical for both organizations and managers to understand how IS habits develop and strengthen, so that they can implement appropriate strategies to weaken or disrupt undesirable usage habits, and encourage the development of new, more desirable ones.

We began this research by pointing out in the introductory chapter several key weaknesses and gaps in the extant literature on IS habit. We discuss below how the current research addresses each of these areas.

### Understanding IS Habits in Organizations

IS habits have not previously been studied from the perspective of how they are embedded in larger, often complex, work routines. In fact, most IS habit studies to date have focused on student or consumer use of websites outside the context of organizational work environments. We have thus integrated the psychology and organizational behavior literature on schemas, scripts, and work routines, highlighting the importance of studying IS habits as they are embedded within larger task sequences. We have also integrated the literature on the

development and disruption of habits, highlighting ways in which contextual factors can enforce existing habits and encourage habitual usage but also ways in which contextual factors contribute to action slips which can inhibit intended behavioral change. While a number of contextual factors (e.g., time, physical surroundings, social setting, task definition, mood, antecedent states) have been discussed previously in the social psychology and marketing literature, there have been no substantial attempts to understand exactly what each of these factors mean when applied to user interaction with an information system.

## Development of a Better Measure of Habit

Defining and operationalizing habit has long been a problem across many domains of research. Measures currently used to study IS habit are for the most part inconsistent, vague, or otherwise lacking in validity. We have developed a self-report measure of habit that is grounded in theory, and has undergone rigorous validity testing. Our results support the argument that habit is in fact a multidimensional aggregate construct, and should be measured as such.

Specifying habit as a second-order construct with formative dimensions within a larger nomological model yields results consistent with both theory and findings from prior studies. While our scale performed roughly equivalent to the more parsimonious, unidimensional reflective IS habit scale of Limayem et al. (2007), we argue that the Limayem et al. scale, like many other habit scales commonly used in the social psychology and IS literature, does not properly tap the content domain of habit and in fact may not be measuring habit at all. In addition, misspecification of habit as a reflectively measured construct can lead to biases in the path coefficients of antecedents and consequents of habit, and result in erroneous conclusions as to the relative effect of habit in the nomological net.

### Habit's Inhibiting Role in Technology Acceptance

Extant IS habit research has focused primarily on habit's role in superseding intentions in predicting *continued* use of a system. There has been no empirical work done regarding what negative impacts habitual use may have on perceptions, intentions, and actual usage of a *newly introduced* system. Deviating from prior IS studies on habit, the current research views IS habit as an inhibitor of technology acceptance as it pertains to a new system. We draw from status quo bias theory to situate habit and its inertial consequences in a nomological network of technology acceptance constructs and hypothesize its effects on behavioral beliefs and intentions. As such, we extend our theoretical understanding of the role of habit in new system acceptance.

While the current research does not empirically investigate the impact of old system habit on the new system intention-usage link, our results indicate that the inhibiting influence of habit on perceptions and intentions related to new system use is fully mediated by inertia. More specifically, habitual use of an existing system for specific tasks may lead to inertia, and that inertia in turn may result in decreased perceptions of the ease of use and relative advantage of a newly introduced system. Further, perceived sunk costs associated with the time invested in learning to use the old system partially mediate the relationship between habit and inertia. Finally, inertia has a negative impact on intentions to use the new system, above and beyond its impact through perceptions. Thus an individual using a system in an inertial state may perceive a new system as useful and easy to use, yet not voice intentions to actually use it.

The inclusion of individual difference variables as controls in our model indicates that these personality trait variables do in fact have an impact on the development of inertia as well, in addition to the impact of habit. Thus future research should further investigate the

relationships between habit and individual difference variables in predicting user acceptance behaviors.

### Intervention Strategies to Disrupt IS Habits in Organizations

Finally, very little research has explicitly addressed the issue of how to go about *changing* habitual behaviors, and this gap in knowledge is especially noticeable in the IS literature. We have already stressed the importance of studying IS habits within the context of the larger task sequences in which they are embedded. Often entire sequences of activities making up common work routines are practiced habitually. Thus it is important to implement interventions that not only look at the immediate behavior in question, but that change the various work processes, contextual factors, and other immediate antecedents that are triggering the undesired behavior.

Various ways of disrupting habitual behavior and counteracting its inertial consequences have been suggested in the social psychology, marketing, and organizational literature. We have argued that these interventions need to take place at multiple stages in the process of implementing a new IS, covering the bases of changing user attitudes toward the new IS, reprogramming their subconscious behavioral processes through appropriate training methods which go beyond increasing self-efficacy to take into account the embeddedness of the IS use within larger task sequences, setting up barriers to make it more difficult to continue practicing undesirable usage behaviors, and finally, providing users with monitoring and feedback that will encourage their continued conscious performance of tasks involving IS use, until they reach a place where the new IS behavior has become routinized and even automatic itself.

Measuring habit as a multidimensional aggregate construct will assist researchers in investigating the factors that lead to the strengthening of IS habits over time, and investigating

potential organizational interventions for disrupting these same usage habits. The relative magnitude of one's awareness, controllability, and mental efficiency may differ across technologies and tasks, and differ based on whether use of a given system is (or is not) deeply embedded within a larger automatized work routine. Thus different interventions may be appropriate depending on the dimension(s) of habit that is (are) most in need of change. Since habit is a formatively measured construct, weakening one of its dimensions will lead to a weaker habit overall, just as strengthening one of its dimensions will lead to a stronger habit overall. Researchers and practitioners can use this to their advantage in planning out appropriate intervention strategies for different usage situations.

## DIRECTIONS FOR FUTURE RESEARCH

To date, research on IS habit has focused on relatively simple behaviors that take place outside of an organizational environment, and that are examined over a relatively short period of time. Our own study was cross-sectional in nature, and used student subjects for both developing and validating the scale, and for testing our model of the inhibiting effects of habit in technology acceptance. Thus we encourage testing of the propositions and hypotheses presented here in an organizational environment, focusing on IS usage behaviors that are embedded within simple to complex work routines and task sequences. Studies should be longitudinal in nature, so that the development of work-related IS habits, and the success of organizational efforts to disrupt them, can be properly examined.

Our study has examined intention as the ultimate dependent variable. Future studies should examine the impact of old system habit on actual new system usage, via the intention-behavior link. Despite the lack of theorizing in prior literature of habit's role in inhibiting new behaviors, there is a widespread awareness that individuals' intentions can be overruled by habits

when the latter are strongly ingrained in one's psyche. One way in which this can occur is through action slips, which occur when intentions are not strong enough to override actions cued automatically by the environment. Repeated action slips could potentially lead to inaction inertia, whereby each "slip up" makes it much less likely that the individual will pursue the new behavior in the future. Thus it is particularly important to develop a better understanding of organizational interventions that can alter those features of the performance context that enable action slips to occur.

The negative impacts of habit are not limited to situations of new system adoption. Long after users have adopted a new system and begun using it on a regular basis, they may form habitual ways of using that system that negatively impact their ability or inclination to engage in deeper use of the system and its features. This may in turn reduce benefits obtained from the system. Thus another fruitful area for future research is to explore habitual use of specific system features, and its negative impacts on system exploration and productivity.

Finally, previous researchers have suggested that there may be different profiles of habits, implying that habit is in fact a profile construct. The habit measure we present here can perhaps be used in the future to investigate the possibility that there is a typology of habits in IS use or in other contexts (just as there is a typology of automaticity). This is possible because we have clearly delineated each dimension of habit and rigorously tested its multidimensionality. The relative contribution of each habit dimension might depend on the level of embeddedness of the habit within a larger task sequence, on whether the system is being used in a very task-oriented setting, or whether it is being used for primarily personal or hedonic purposes. Thus future research should investigate the relative strength of each habit dimension in a number of different IS usage scenarios, to determine whether typologies do in fact exist.

# APPENDICES

# APPENDIX A

# SUPPLEMENTARY TABLES FOR CHAPTER 3

## Table 3.3. Representative Habit Definitions Used in Research from Other Disciplines

| **Theoretical Definition** | **Example Studies** | **Behavioral Context** |
|---|---|---|
| GOAL-DIRECTED AUTOMATIC BEHAVIOR:<br><br>"learned sequences of acts that have become automatic responses to situations, and are functional in obtaining certain goals or desired effects" (Verplanken and Aarts 1999, p.104)<br><br>"habits are represented as links between a goal and actions that are instrumental in attaining this goal" (Aarts and Dijksterhuis 2000a, p.54); "these associations are shaped by frequent performance of actions and require the activation of the goal to become manifest" (Aarts and Dijksterhuis 2000a, p.60) | (Aarts and Dijksterhuis 2000a; Aarts and Dijksterhuis 2000b; Aarts et al. 1997a; Aarts et al. 1998; Verplanken and Aarts 1999; Verplanken et al. 1997; Verplanken et al. 1998) | Travel mode choice |
| | Aarts et al. (1997a) | Physical exercise |
| | Empelen and Kok (2006) | Condom use |
| | Honkanen et al. (2005) | Eating seafood |
| | Orbell et al. (2001) | Ecstasy use |
| | Sheeran et al. (2005) | Social drinking |
| | Verplanken and Orbell (2003) | Four studies covering a wide range of behaviors representing both daily and weekly habits |
| | Verplanken (2006), study 2 | Negative thinking about oneself |
| | Verplanken (2006) study 3 | Underlining words in a novel |
| BEHAVIOR THAT IS REPEATED IN A STABLE CONTEXT (*importance of goal-directedness is discounted*):<br><br>"tendencies to repeat responses given a stable supporting context" (Ouellette and Wood 1998, p.55)<br><br>"behavioral dispositions to repeat well-practiced actions given recurring circumstances" (Wood et al. 2005, p.918) | Ouellette and Wood (1998) | Meta-analysis of prior studies |
| | Wood et al. (2005) | Exercising, newspaper reading, and TV watching by students |
| | Wood et al. (2002) | Student participants kept a diary of all behaviors performed in their daily lives |
| | Thøgersen (2006) | Travel mode choice |

| Theoretical Definition | Example Studies | Behavioral Context |
|---|---|---|
| QUICK, ACCURATE, AND EFFORTLESS BEHAVIOR:<br><br>"practice automatizes voluntary acts so that they come to be performed quickly, easily, and with minimal focal attention" (Kimble and Perlmuter 1970, in Wood and Quinn 2004)<br><br>"A habit is a behavior that can be performed quickly, accurately, and effortlessly" (Carvajal 2002, p.10). | Kimble and Perlmuter (1970) | |
| | Carvajal (2002) | Sorting documents with key words into separate piles |
| FREQUENTLY PRACTICED BEHAVIOR THAT IS AUTOMATICALLY TRIGGERED BY STIMULUS CUES (*no explicit mention of goal-directedness or context stability*):<br><br>"situation-behaviour sequences that are or have become automatic, so that they occur without self-instruction" (Triandis 1980, p.204)<br><br>Habit is "automatically activated by environmental cues without deliberate reflection" (Bamberg 2006, p.823).<br><br>"behaviour comes under the control of stimulus cues and is performed automatically with little effort or conscious awareness… Habits are performed frequently, but they are also performed automatically, efficiently, and with little effort or conscious awareness" (Norman and Conner 2006, pp.58,66) | Bamberg (2006) | Travel mode choice |
| | Norman and Conner (2006) | Binge drinking |
| | Ronis et al. (1989) | Health-related behaviors |
| | (Saba and diNatale 1998; Saba and diNatale 1999; Saba et al. 1988; Saba et al. 2000) | Consumption of 9 types of fat-containing food products |
| | Towler and Shepherd (1991-1992) | Eating chips |
| | Triandis (1980) | |
| | Verplanken (2004) | Nurses chatting at work |
| ROUTINIZED BEHAVIOR:<br><br>Focus of the study was on task routinization, which was defined as automaticity in behavior. | Ohly et al. (2006) | Employees at a high-tech firm provided lists of their frequently performed tasks (e.g., developing software, dealing with documentation, handling emails, interacting with subordinates, attending meetings, dealing with customers) |

| Theoretical Definition | Example Studies | Behavioral Context |
|---|---|---|
| WELL-LEARNED BEHAVIOR / MENTAL STATE:<br><br>Habit implies behavior that is learned well from repeated past performances (based on Triandis, 1980).<br><br>"…habit is a mental state that is conceptually distinct from previous behavior. A person could perform a behavior many times and yet not think of herself as being in the habit, or she may perform a behavior only a few times and nevertheless consider the behavior to be habitual." (p.386) | Trafimow (2000) | Condom use |

## Table 3.4. Representative Habit Definitions Used in Recent IS Research

| Theoretical Definition | Example Studies | Behavioral Context |
|---|---|---|
| AUTOMATIC BEHAVIORAL TENDENCIES THAT RESULT FROM LEARNING:<br><br>"the extent to which people tend to perform behaviors (use IS) automatically because of learning" (Limayem et al. 2007, p.705)<br><br>"the automatic behavior tendencies developed during the past history of the individual such that a particular situation/stimuli will elicit the behavior even when the individual does not instruct him or herself to perform the act." (Limayem et al. 2001, p.277) | Limayem et al. (2007) | World Wide Web |
| | Limayem and Hirt (2003), Limayem et al. (2001) | Student use of WebBoard |
| | Khalifa et al. (2002) | Online grocery shopping |
| GOAL-DIRECTED AUTOMATIC BEHAVIOR:<br><br>"the extent to which using a particular IS has become automatic in response to particular situations" (Limayem et al. 2003b)<br><br>"goal-directed automatic responses to system use when encountering the same situation" (Wu and Kuo 2008, p.52) | Kim et al. (2005) | Website |
| | Limayem et al. (2003b) | World Wide Web (WWW) |
| | Cheung and Limayem (2005a), Cheung and Limayem (2005b), Limayem et al. (2003a) | Student use of Blackboard |
| | Wu and Kuo (2008) | Google searches |
| BEHAVIORAL PREFERENCES:<br><br>"previous usage preference of an IT" (Gefen 2003, p.2) | Gefen (2003) | Online CD / book vendors |
| BEHAVIOR THAT OCCURS OUTSIDE CONSCIOUS AWARENESS:<br><br>"a repeated behavioral pattern that automatically occurs outside conscious awareness"; "habit is made possible by a cognitive representation that links a situational cue and an action" (Kim and Malhotra 2005, p.746) | Kim and Malhotra (2005) | Websites |
| | Kim and Malhotra (2005) | Web based information system |

## APPENDIX B

## SUPPLEMENTARY TABLES FOR CHAPTER 4

### Table 4.8. Views of Habit in Prior Research from Other Disciplines: Conceptual and Operational Definitions

| | | Habit Dimensions | | | | Other Constructs | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Source, Study Context, and Habit Definition** | **# of Items** | **INT** | **AW** | **CTL** | **EFF** | **ID** | **HBR** | **FRQ** | **STB** | **PH** | **PA** | **Others** |
| Aarts and Dijksterhuis (2000a) – Travel mode choice<br>Goal-directed automatic behavior; links between goals and actions are shaped by frequent action performance in the presence of the goal. | 2 | | | | | | | X | | X | | |
| Bamberg et al. (2003a) – Travel mode choice<br>Automatic behavior requiring little cognitive effort to continue; different from past behavioral frequency. | 1 | | | | | | | | | | | Generalized intention (RFM)[24] |
| Bamberg (2006) – Travel mode choice<br>Habit is "automatically activated by environmental cues without deliberate reflection" (p.823). | 1 | | | | | | | | | | | Generalized intention (RFM) |
| Carvajal (2002) – Experiment sorting documents with key words into separate piles<br>A behavior that can be performed quickly, accurately, and effortlessly. | n/a | | | | | | | | | | | Speed, Accuracy, Effortlessness |

INT = intentionality / goal-directedness; AW = lack of awareness; CTL = controllability; EFF = mental efficiency; ID = self-identity; HBR = history of behavioral repetition / routine / pattern of tendency; FRQ = frequency of past behavior; STB = context stability; PH = perceived habit; PA = perceived automaticity; RFM = response-frequency measure of habit

"X" represents dimensions or concepts included in the operationalization of habit.

[24] The response-frequency measure of habit (RFM) (see Klockner et al. 2003; Verplanken et al. 1997) involves presenting participants with a commonly encountered situation (such as a travel destination) and asking them to respond as quickly as possible with the behavioral choice they associate with that situation. Bamberg et. al. (2003b, p.106) have questioned whether the responses given actually represent a "generalized intention to perform the behavior in question," rather than evidence of a habit per se.

| | | Habit Dimensions | | | | Other Constructs | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Source, Study Context, and Habit Definition** | **# of Items** | **INT** | **AW** | **CTL** | **EFF** | **ID** | **HBR** | **FRQ** | **STB** | **PH** | **PA** | **Others** |
| Conner and McMillan (1999) – Cannabis / marijuana use<br>With repeated performance, a behavior comes less under the influence of controlled processes and more under the influence of automatic processes that are triggered by specific cues. Self-identity is considered as being distinct from habit. | 2 | | | | | | | X | | X | | |
| Conner et al. (2007)<br>A behavior "having the characteristics of automatic or spontaneous behavior" (p.1728). Used the SRHI scale. | 12 | | X | X | X | X | X | | | | | |
| Empelen and Kok (2006) – Condom use<br>Learned sequences of acts that have become automatic in responses to specific cues, and that are functional in obtaining certain goals. | 2 | | X | | | | X | | | | | |
| Fischer et al. (2006) – Food preparation<br>With frequent repetition, little cognitive effort is required to perform a particular behavior. Over time, the link between a behavioral goal and its associated action becomes automatic. Used the SRHI scale. | 12 | | X | X | X | X | X | | | | | |
| Honkanen et al. (2005) – Eating seafood<br>Learned sequences of acts that have become automatic responses to specific cues, and are functional in obtaining certain goals or end states. Used a modified version of the SRHI scale. | 4 | | X | X | X | | X | | | | | |
| Mittal 1988 (in Limayem et al. 2003) – Seat belt use<br>Definition not available. | 2 | | X | | | | | | | | | |

INT = intentionality / goal-directedness; AW = lack of awareness; CTL = controllability; EFF = mental efficiency; ID = self-identity; HBR = history of behavioral repetition / routine / pattern of tendency; FRQ = frequency of past behavior; STB = context stability; PH = perceived habit; PA = perceived automaticity; RFM = response-frequency measure of habit

"X" represents dimensions or concepts included in the operationalization of habit.

| | | Habit Dimensions | | | | Other Constructs | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Source, Study Context, and Habit Definition** | **# of Items** | **INT** | **AW** | **CTL** | **EFF** | **ID** | **HBR** | **FRQ** | **STB** | **PH** | **PA** | **Others** |
| Norman and Conner (2006) – Binge drinking<br>Behavior that comes under the control of stimulus cues and is performed automatically with little effort or conscious awareness. "Habits are performed frequently, but they are also performed automatically, efficiently, and with little effort or conscious awareness" (p.66) | 1 | | | | | | | X | | | | |
| (Orbell et al. 2001) – Ecstasy (drug) use<br>Actions that have become automatic responses to specific situational cues and that are performed relatively unconsciously. | 2 | | | | | | | | | X | X | |
| (Ouellette and Wood 1998) – Meta-analysis of prior studies<br>Tendencies to repeat responses given a stable supporting context. | n/a | | | | | | | X | X | | | |
| (Sheeran et al. 2005) – Social drinking<br>A form of goal-directed automaticity; "learned sequences of acts that have become automatic responses to situations, and are functional in obtaining certain goals or desired effects" (p.48). | 5 | | | | | | | X | | | | |
| Thøgersen 2006 – Travel mode choice<br>An action that has been performed repeatedly in a stable context such that only minimal thought is required in order to initiate, implement, and terminate the action. | | | | | | | | X | | | | |
| Tourila and Pangborn 1988 (in Limayem et al. 2003) – Eating ice cream<br>Definition not available. | 1 | | | | | | | | | X | | |

INT = intentionality / goal-directedness; AW = lack of awareness; CTL = controllability; EFF = mental efficiency; ID = self-identity; HBR = history of behavioral repetition / routine / pattern of tendency; FRQ = frequency of past behavior; STB = context stability; PH = perceived habit; PA = perceived automaticity; RFM = response-frequency measure of habit

"X" represents dimensions or concepts included in the operationalization of habit.

| | | Habit Dimensions | | | | Other Constructs | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Source, Study Context, and Habit Definition** | **# of Items** | **INT** | **AW** | **CTL** | **EFF** | **ID** | **HBR** | **FRQ** | **STB** | **PH** | **PA** | **Others** |
| Towler and Shepherd (1991-1992) – Eating chips<br>Frequently repeated behavior, or behavior that is in some sense automatic or outside the subject's awareness. Perceived behavioral control was included as a construct separate from habit. | 2 | | | | | | | X | | X | | |
| Trafimow (2000) – Condom use<br>Behavior that is well-learned from repeated past performances. Habit is a mental state that is conceptually distinct from frequency of past behavior. | 3 | | | | | | | | | X | | Steadfastness, Reliability |
| Triandis (1979)<br>Situation-behavior sequences that have become automatic, such that they occur without self-instruction. | | | | | | | | X | | | | |
| Verbeke and Vackier (2005) – Fish consumption<br>Habit is part of perceived behavioral control, and must be defined independently of past behavior. | 2 | | | | | | | | | X | | Familiarity |
| Verplanken and Orbell (2003) – a wide range of different behaviors; Verplanken (2006) (study 2) – negative thinking about oneself<br>Learned sequences of acts that have become automatic responses to situations, and are functional in obtaining certain goals or desired effects. Used the SRHI scale. | 12 | | X | X | X | X | X | | | | | |
| Verplanken (2004) – Nurses chatting at work<br>Behaviors that are performed frequently and automatically. Scale "breaks down the habit construct into a number of specific features of habitual behavior, such as a history of repetition, the absence of deliberation, limited awareness, familiarity, and lack of control" (p.602). Used the SRHI scale. | 12 | | X | X | X | X | X | | | | | |

INT = intentionality / goal-directedness; AW = lack of awareness; CTL = controllability; EFF = mental efficiency; ID = self-identity; HBR = history of behavioral repetition / routine / pattern of tendency; FRQ = frequency of past behavior; STB = context stability; PH = perceived habit; PA = perceived automaticity; RFM = response-frequency measure of habit

"X" represents dimensions or concepts included in the operationalization of habit.

| | | Habit Dimensions | | | | Other Constructs | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Source, Study Context, and Habit Definition** | **# of Items** | **INT** | **AW** | **CTL** | **EFF** | **ID** | **HBR** | **FRQ** | **STB** | **PH** | **PA** | **Others** |
| Verplanken (2006) (study 3) – Underlining words in a novel<br>Learned sequences of acts that have become automatic responses to situations, and are functional in obtaining certain goals or desired effects. Used a modified version of the SRHI scale. | 6 | | X | | X | | | | | | X | |
| Verplanken et al. (2005a) – Snacking (healthy and unhealthy)<br>"learned and automatic responses to specific cues, which occur in stable contexts" (p.431). Used the SRHI scale. | 12 | | X | X | X | X | X | | | | | |
| Wittenbraker (1983) – Seat belt use<br>Definition not available. | 1 | | | | | | | X | | X | | |
| Wood et al. (2005) – college student exercising, newspaper reading, and TV watching<br>Behavioral dispositions to repeat well-practiced actions given recurring circumstances. | n/a | | | | | | | X | X | | | |
| Wood et al. (2002) – large range of different behaviors, as reported by subjects<br>Behaviors that are repeated [frequently] in stable contexts. | 5 | X | | | X | | | X | X | | | |

INT = intentionality / goal-directedness; AW = lack of awareness; CTL = controllability; EFF = mental efficiency; ID = self-identity; HBR = history of behavioral repetition / routine / pattern of tendency; FRQ = frequency of past behavior; STB = context stability; PH = perceived habit; PA = perceived automaticity; RFM = response-frequency measure of habit

"X" represents dimensions or concepts included in the operationalization of habit.

## Table 4.9. Views of Habit in Prior Organizational and IS Research: Conceptual and Operational Definitions

| | | Habit Dimensions | | | | Other Constructs | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Source, Study Context, and Habit Definition** | **# of Items** | **INT** | **AW** | **CTL** | **EFF** | **ID** | **HBR** | **FRQ** | **STB** | **PH** | **PA** | **Others** |
| Cheung and Limayem (2005a; 2005b; 2005c)<br><br>Goal-directed automaticity; the extent to which using a particular IS has become automatic in response to particular situations. | 6 | | | | | | | | | X | X | Naturalness, Obvious choice |
| Gefen (2003)<br><br>Previous usage preference of an IT; items were worded "to deal with the users' overall previous pattern of tendency and preference." | 4 | | | | | | X | | | | | Preference |
| Kim and Malhotra (2005)<br><br>"a repeated behavioral pattern that automatically occurs outside conscious awareness…habit is made possible by a cognitive representation that links a situational cue and an action" (p.746). Past use is considered a good proxy for habit. | 2 | | | | | | | X | | | | |
| Kim et al. (2005)<br><br>Discussion of habit draws in the concept of goal-directedness. The terms "habit" and "automaticity" are used interchangeably. Past use is an "essential driver of habit/automaticity" (p.423) and can be used as a proxy of habit. | 4, 2 | | | | | | X | X | | | | Dependency |
| Limayem and Hirt (2003)<br><br>Automatic or subconscious behavior; automatic behavioral tendencies; "the non-deliberate, automatically inculcated response that individuals may bring to IS usage" (p.66) | 5 | | | | | | | | | X | | Addiction / Compulsion, Naturalness |

INT = intentionality / goal-directedness; AW = lack of awareness; CTL = controllability; EFF = mental efficiency; ID = self-identity; HBR = history of behavioral repetition / routine / pattern of tendency; FRQ = frequency of past behavior; STB = context stability; PH = perceived habit; PA = perceived automaticity; RFM = response-frequency measure of habit

"X" represents dimensions or concepts included in the operationalization of habit.

| | | Habit Dimensions | | | | Other Constructs | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Source, Study Context, and Habit Definition** | **# of Items** | **INT** | **AW** | **CTL** | **EFF** | **ID** | **HBR** | **FRQ** | **STB** | **PH** | **PA** | **Others** |
| Limayem et al. (2007)<br><br>"the extent to which people tend to perform behaviors (use IS) automatically because of learning" (p.705) | 3 | | | | | | | | | | X | Naturalness, Obvious choice |
| Limayem et al. (2003a; 2003b)<br><br>Goal-directed automaticity; learned responses to a stimulus; the extent to which using a particular IS has become automatic in response to particular situations. Habit performance requires little to no conscious attention and minimal mental effort. | 6 | | | | | | | | | X | X | Naturalness, Obvious choice |
| (Ohly et al. 2006) – Frequently performed work tasks, as chosen by the subjects themselves.<br><br>Routinization is defined as automaticity in behavior. "Features of automaticity include unintentionality, uncontrollability, lack of awareness, and efficiency…Routinization develops through repeated execution of a behavior" (p.27). | 5 | | X | | X | | | | | | X | |
| Verplanken (2004) – Nurses chatting at work<br><br>Behaviors that are performed frequently and automatically. Scale "breaks down the habit construct into a number of specific features of habitual behavior, such as a history of repetition, the absence of deliberation, limited awareness, familiarity, and lack of control" (p.602). Used the SRHI scale. | 12 | | X | X | X | X | X | | | | | |
| Wu and Kuo (2008) – Google searches<br><br>"Learned sequences of acts that have become automatic responses to specific situations, and are functional in obtaining certain goals or end-states" (p.53). Habitual usage and past usage do not have the same predictive power. Used a subset of the SRHI scale. | | | X | X | X | | X | | | | | |

INT = intentionality / goal-directedness; AW = lack of awareness; CTL = controllability; EFF = mental efficiency; ID = self-identity; HBR = history of behavioral repetition / routine / pattern of tendency; FRQ = frequency of past behavior; STB = context stability; PH = perceived habit; PA = perceived automaticity; RFM = response-frequency measure of habit

"X" represents dimensions or concepts included in the operationalization of habit.

## Table 4.10. Candidate Scale Items

| Construct | Item Number | Generic Item Wording | Source | Card Sort 1 | Card Sort 2 | Study 1 EFA | Study 1 CFA | Study 2 CFA | Study 3 Nomol. |
|---|---|---|---|---|---|---|---|---|---|
| Intention-ality | Intentionality is assumed in a work environment, and is captured in our study by asking all questions in regard to the use of the targeted IS in specific situations in order to achieve specific work-related goals or to perform specific work-related tasks. | | | | | | | | |
| Awareness | **AWARE1** | Whenever I need to [perform Task A], I start using [System X] without even realizing it. | V&O 03 | X | X | X | DEL | | |
| | **AWARE2** | Whenever I need to [perform Task A], I choose to use [System X] without even being aware of (making) the choice. | New | X | X | X | X | X | X |
| | **AWARE3** | Whenever I need to [perform Task A], I unconsciously start using [System X]. | New | X | X | X | X | X | X |
| | **AWARE4** | Choosing [System X] when I want to [perform Task A] is something I do without being aware. | New | X | X | X | X | X | X |
| | AWARE5 | I am not always conscious of my decision to use [System X] to [perform Task A]. | New | X | X | DEL | | | |
| | **AWARE6** | Choosing [System X] to [perform Task A] is something I do unconsciously. | New | X | X | X | X | X | X |
| Mental Efficiency of Choice | **EFFCH1** | I do not need to devote a lot of mental effort to *deciding* that I will use [System X] to [perform Task A]. | New | X | X | X | X | X | X |
| | **EFFCH2** | *Selecting* [System X] to [perform Task A] does not involve much thinking. | New | X | X | X | X | X | X |
| | EFFCH3 | *Selecting* [System X] to [perform Task A] lets me function on "automatic pilot." | New | DEL | | | | | |
| | EFFCH4 | When I need to [perform Task A], I *choose* [System X] without giving it much thought. | New | X | X | DEL | | | |
| | **EFFCH5** | *Choosing* [System X] to [perform Task A] requires little mental energy. | New | X | X | X | X | X | X |
| | **EFFCH6** | *Selecting* [System X] to [perform Task A] does not require much mental attention. | New | | NEW | DEL | | | |
| Mental Efficiency of Use | EFFUSE1 | I do not need to devote a lot of mental attention to *using* [System X] to [perform Task A]. | New | X | X | X | | | |
| | EFFUSE2 | My *use* of [System X] to [perform Task A] doesn't demand much mental effort. | New | X | X | X | | | |
| | EFFUSE3 | The *process of using* [System X] to [perform Task A] doesn't demand a lot of mental energy. | New | X | X | X | | | |

| Construct | Item Number | Generic Item Wording | Source | Card Sort 1 | Card Sort 2 | Study 1 EFA | Study 1 CFA | Study 2 CFA | Study 3 Nomol. |
|---|---|---|---|---|---|---|---|---|---|
| | EFFUSE4 | I can *use* [System X] to [perform Task A] without having to devote my full attention to it. | New | X | X | X | | | |
| | EFFUSE5 | *Using* [System X] to [perform Task A] is something I can do when my attention is focused on something else. | New | X | X | X | | | |
| | EFFUSE6 | *Using* [System X] to [perform Task A] lets me function on "automatic pilot." | New | X | DEL | | | | |
| Control-lability | **CTRL1** | I (would) find it difficult to overrule my impulse to use [System X] to [perform Task A]. | New | X | X | X | X | X | X |
| | **CTRL2** | I (would) find it difficult to overcome my tendency to use [System X] to [perform Task A]. | New | X | X | X | X | X | X |
| | CTRL3 | I have been using [System X] to [perform Task A] for so long that it would be hard not to do so now. | New | X | DEL | | | | |
| | CTRL4 | It would require (a lot of) effort not to use [System X] to [perform Task A]. | V&O 03 | DEL | | | | | |
| | **CTRL5** | It would be difficult to control my tendency to use [System X] to [perform Task A]. | New | X | X | X | X | X | X |
| | CTRL6 | It would be hard for me to stop using [System X] to [perform Task A]. | V&O 03 | X | X | DEL | | | |
| | **CTRL7** | It is [would be] hard to restrain my urge to use [System X] to [perform Task A]. | New | X | X | X | X | X | X |
| Perceived Habit | PHABIT1 | I use [System X] to [perform Task A] as a matter of habit. / When I want to [perform Task A], I use [System X] as a matter of habit. | LH&C 03 | v.1 | v.1 | v.2 | v.2 | v.2 | |
| | PHABIT2 | It is a habit of mine to use [System X] to [perform Task A]. | LH&C 03 | X | X | X | X | X | |
| | PHABIT3 | Using [System X] to [perform Task A] has become a habit to me. | LH&C 03 | X | X | X | X | X | |
| | PHABIT4 | I launch [System X] to [perform Task A] by force of habit. / When I want to [perform Task A], I launch [System X] by force of habit. | LH&C 03 | v.1 | v.1 | v.2 | v.2 | v.2 | |
| | PHABIT5 | v.1: I use [System X] to [perform Task A] by force of habit.<br><br>v.2: When I want to [perform Task A], I use [System X] by force of habit. | LH&C 03 | v.1 | v.1 | v.2 | v.2 | v.2 | |

| Construct | Item Number | Generic Item Wording | Source | Card Sort 1 | Card Sort 2 | Study 1 EFA | Study 1 CFA | Study 2 CFA | Study 3 Nomol. |
|---|---|---|---|---|---|---|---|---|---|
| Habit Measures from Limayem et al., 2007 | LIMHAB1 | When faced with the task of [performing Task A], using [System X] is an obvious choice for me. | LH&C 07 | | | | | | X |
| | LIMHAB2 | Using [System X] to [perform Task A] is natural to me. | LH&C 07 | | | | | | X |
| | LIMHAB3 / PAUTO1 | Using [System X] to [perform Task A] has become automatic to me. | LH&C 07 | X | X | X | | | X |
| Perceived Automa-ticity | PAUTO2 | Using [System X] to [perform Task A] is second nature to me. | LH&C 03 | DEL | | X | | | |
| | PAUTO3 | Using [System X] to [perform Task A] is something I do automatically. | V&O 03 | X | X | X | | | |
| | PAUTO4 | I automatically choose [System X] whenever I need to [perform Task A]. | New | X | X | X | | | |
| History of Behavioral Repetition | HIST1 | Using [System X] to [perform Task A] is something I do frequently. | V&O 03 | X | X | X | X | | |
| | HIST2 | v.1: Using [System X] to [perform Task A] is something that belongs to my (daily, weekly, monthly) routine.<br><br>v.2: I have been routinely using [System X] to [perform task A]. | V&O 03 | v.1 | MOD | v.2 | v.2 | | |
| | HIST3 | Using [System X] to [perform Task A] is something I have been doing for a long time. | V&O 03 | X | X | X | X | | |
| Self-Identity | ID1 | Using [System X] to [perform Task A] is something that's typically "me." | V&O 03 | X | X | X | DEL | | |
| | ID2 | Using [System X] to [perform Task A] is something that is important in defining who I am. | New | X | X | X | X | | |
| | ID3 | Using [System X] to [perform Task A] is something that gives me a sense of identity. | New | X | X | X | DEL | | |
| | ID4 | Using [System X] to [perform Task A] is something that reflects who I am. | New | X | X | X | X | | |
| | ID5 | Using [System X] to [perform Task A] is something that reflects my sense of identity. | New | X | X | X | X | | |
| | ID6 | Using [System X] to [perform Task A] is a part of who I am. | New | X | X | X | X | | |
| Perceived | PEOU1 | I find [System X] easy to use for [performing Task A]. | K&M 05 | X | X | X | | | |

| Construct | Item Number | Generic Item Wording | Source | Card Sort 1 | Card Sort 2 | Study 1 EFA | Study 1 CFA | Study 2 CFA | Study 3 Nomol. |
|---|---|---|---|---|---|---|---|---|---|
| Ease of Use | PEOU2 | Using [System X] to [perform Task A] is clear and understandable. | K&M 05 | X | X | X | | | X |
| | PEOU3 | I find it easy to get [System X] to do what I want it to, when I (need to) [perform Task A]. | VMDD 03 | X | X | X | | | X |
| | PEOU4 | Becoming skillful at using [System X] for [performing Task A] is easy for me. | K&M 05 | X | X | X | | | |
| Perceived Usefulness | PU1 | Using [System X] enables me to [perform Task A] more quickly. | VMDD 03 | | | | | | X |
| | PU2 | I find [System X] useful for [performing Task A]. | VMDD 03 | | | | | | X |
| | PU3 | Using [System X] makes it easier to [perform Task A]. | VMDD 03 | | | | | | X |
| | PU4 | Using [System X] is an effective way of [performing Task A]. | VMDD 03 | | | | | | |
| System Usage Intention | INTENT1 | I intend to use [System X] to [perform Task A] on future group projects. | K&M 05 | | | | | | X |
| | INTENT2 | I plan to use [System X] to [perform Task A] on future group projects. | K&M 05 | | | | | | X |
| | INTENT3 | I predict that I will use [System X] to [perform Task A] on future group projects. | K&M 05 | | | | | | |
| Sources: | K&M 05 = Kim and Malhotra 2005<br>LH&C 03 = Limayem et al. 2003b<br>V&O 03 = Verplanken and Orbell 2003<br>VMDD = Venkatesh et al. 2003 | | | | | | | | |

## Table 4.11. Definitions of Constructs Used for Testing Nomological Validity

| Dimension | Theoretical Definition and Source |
|---|---|
| Perceived Usefulness | “the degree to which a person believes that using a particular system would enhance his or her job performance” (Davis 1989, p.320) |
| Perceived Ease of Use | “the degree to which a person believes that using a system would be free from effort” (Davis 1989, p.320) |
| Intention to Use | The user’s intention to continue using the system under investigation. |

## APPENDIX C

## POST HOC ANALYSIS OF NOMOLOGICAL VALIDITY

Our test of nomological validity modeled habit as a predictor of PEOU, PU, and usage intention. A more complete nomological network would include actual usage as the ultimate dependent variable, since behavior is theorized as having both conscious and automatic drivers (Triandis 1980; see Limayem et al. 2007 for a detailed discussion of the various competing theoretical views on the relationship between habit, intention, and behavior).

Since we did not have usage data available in our data set, we conducted a post hoc analysis of habit's nomological validity designed to partial out the effect of cognition on habit, and demonstrate that our habit measure does in fact capture something that is distinct from what is captured by PEOU and PU.

First, we ran a regression in SPSS with PEOU and PU as predictors of Habit (see column 2 in Table 4.12), and obtained standardized residuals from the results.[25] This residual measure (identified as "STDRESID" in Table 4.12) was then used in a regression analysis to predict Intention, both alone (column 4) and in conjunction with PEOU and PU (column 7). Regressions using the original Habit measure are shown in columns 3 and 6 for the sake of comparison.

As shown in Table 4.12, 3.5% of the variance in Intention is due to Habit, based on this more conservative test of nomological validity. This represents almost 8% more explained variance than what is provided by PEOU and PU alone. This analysis demonstrates that Habit does in fact have significant additional explanatory power above and beyond PEOU and PU in predicting Intention.

**Table 4.12. Post Hoc Analysis of Nomological Validity**

| | PEOU, PU → HABIT | HABIT → INTENT | STDRESID → INTENT | PEOU, PU → INTENT | PEOU, PU, HABIT → INTENT | PEOU, PU, STDRESID → INTENT |
|---|---|---|---|---|---|---|
| Adj R-squared | .136 | .186 | .035 | .467 | .504 | .504 |
| PEOU Beta | .30 *** | | | .39 *** | .33 *** | .39 *** |
| PU Beta | .10 (n.s.) | | | .34 *** | .32 *** | .34 *** |
| HABIT Beta | | .43 *** | | | .21 *** | |
| RESID Beta | | | .20 *** | | | .20 *** |
| *** p < .001 | | | | | | |

[25] While the PU to Habit link is nonsignificant in column 2, further tests indicate that this is a false negative due to the high correlation (.74) between PEOU and PU. This does not affect our analysis in any way, since we are only interested in the residual from this initial regression.

# APPENDIX D

## SUPPLEMENTARY TABLES FOR CHAPTER 5

### Table 5.5. PLS Item Factor Loadings and Cross Loadings

| Construct | Item | ABI | AWARE | CBI | CogRig | CTRL | EFFCH | EReact | GDExp | GDIntent |
|---|---|---|---|---|---|---|---|---|---|---|
| **ABI** | ABI1 | 0.76 | 0.06 | 0.37 | 0.25 | 0.24 | 0.02 | 0.33 | -0.13 | -0.38 |
| | ABI2 | 0.82 | 0.09 | 0.60 | 0.21 | 0.20 | 0.20 | 0.13 | -0.04 | -0.43 |
| | ABI3 | 0.81 | 0.16 | 0.38 | 0.21 | 0.20 | 0.21 | 0.07 | -0.11 | -0.38 |
| **AWARE** | AWARE2 | 0.15 | 0.91 | 0.10 | 0.03 | 0.51 | 0.41 | 0.12 | -0.11 | 0.04 |
| | AWARE3 | 0.07 | 0.84 | 0.08 | 0.01 | 0.43 | 0.38 | 0.08 | -0.10 | 0.11 |
| | AWARE4 | 0.14 | 0.93 | 0.14 | 0.01 | 0.51 | 0.42 | 0.08 | -0.11 | 0.02 |
| | AWARE6 | 0.09 | 0.91 | 0.09 | 0.04 | 0.53 | 0.38 | 0.13 | -0.13 | 0.08 |
| **CBI** | CBI1 | 0.52 | 0.14 | 0.90 | 0.12 | 0.19 | 0.09 | 0.15 | -0.04 | -0.25 |
| | CBI2 | 0.51 | 0.09 | 0.91 | 0.17 | 0.19 | 0.08 | 0.13 | -0.08 | -0.41 |
| | CBI3 | 0.50 | 0.12 | 0.93 | 0.11 | 0.19 | 0.08 | 0.19 | -0.08 | -0.29 |
| **CogRig** | CR1 | 0.25 | 0.04 | 0.14 | 0.90 | 0.17 | 0.07 | 0.28 | -0.01 | -0.21 |
| | CR3 | 0.26 | 0.01 | 0.13 | 0.90 | 0.16 | 0.13 | 0.22 | -0.08 | -0.23 |
| **CTRL** | CTRL1 | 0.26 | 0.34 | 0.22 | 0.17 | 0.79 | 0.22 | 0.29 | -0.09 | -0.12 |
| | CTRL2 | 0.23 | 0.51 | 0.16 | 0.17 | 0.90 | 0.21 | 0.21 | -0.07 | -0.05 |
| | CTRL5 | 0.19 | 0.52 | 0.12 | 0.11 | 0.84 | 0.21 | 0.23 | -0.11 | 0.06 |
| | CTRL7 | 0.24 | 0.54 | 0.20 | 0.17 | 0.88 | 0.25 | 0.22 | -0.06 | -0.02 |
| **EFFCH** | EFFCH1 | 0.13 | 0.20 | 0.07 | 0.06 | 0.13 | 0.75 | 0.03 | -0.09 | -0.09 |
| | EFFCH2 | 0.17 | 0.46 | 0.09 | 0.12 | 0.26 | 0.87 | -0.04 | -0.03 | -0.05 |
| | EFFCH5 | 0.07 | 0.43 | 0.01 | 0.07 | 0.27 | 0.71 | 0.01 | -0.15 | -0.03 |
| **EReact** | ER1 | 0.20 | 0.09 | 0.11 | 0.29 | 0.28 | 0.01 | 0.84 | -0.17 | -0.14 |
| | ER2 | 0.22 | 0.12 | 0.21 | 0.24 | 0.27 | -0.01 | 0.91 | -0.14 | -0.06 |
| | ER3 | 0.11 | 0.05 | 0.06 | 0.12 | 0.06 | -0.03 | 0.70 | -0.07 | 0.03 |
| **GDExp** | GDExp | -0.12 | -0.12 | -0.07 | -0.05 | -0.09 | -0.09 | -0.16 | 1.00 | 0.15 |
| **GDIntent** | GDInt1 | -0.46 | 0.04 | -0.34 | -0.26 | -0.05 | -0.08 | -0.10 | 0.15 | 0.96 |
| | GDInt2 | -0.49 | 0.07 | -0.34 | -0.21 | -0.04 | -0.07 | -0.06 | 0.14 | 0.96 |
| **GDPEOU** | GDPEOU1 | -0.33 | 0.04 | -0.35 | -0.17 | -0.10 | 0.02 | -0.08 | 0.19 | 0.57 |
| | GDPEOU2 | -0.38 | 0.02 | -0.31 | -0.17 | -0.12 | 0.03 | -0.14 | 0.12 | 0.54 |
| **GDRA** | RA1 | -0.39 | 0.10 | -0.19 | -0.18 | 0.03 | -0.10 | 0.03 | 0.11 | 0.68 |
| | RA2 | -0.34 | 0.10 | -0.20 | -0.15 | 0.02 | -0.07 | 0.03 | 0.09 | 0.64 |

| Construct | Item | ABI | AWARE | CBI | CogRig | CTRL | EFFCH | EReact | GDExp | GDIntent |
|---|---|---|---|---|---|---|---|---|---|---|
| | RA3 | -0.35 | 0.12 | -0.23 | -0.13 | 0.03 | -0.09 | 0.01 | 0.07 | 0.60 |
| **PIIT** | PIIT1 | -0.24 | 0.03 | -0.26 | -0.21 | -0.09 | 0.02 | -0.14 | 0.17 | 0.31 |
| | PIIT2 | -0.19 | 0.01 | -0.22 | -0.20 | -0.05 | 0.02 | -0.31 | 0.25 | 0.26 |
| | PIIT4 | -0.18 | 0.06 | -0.23 | -0.24 | -0.07 | 0.07 | -0.24 | 0.20 | 0.26 |
| **RtSeek** | RS1 | 0.21 | 0.06 | 0.12 | 0.30 | 0.21 | -0.09 | 0.52 | -0.19 | -0.12 |
| | RS3 | 0.28 | 0.13 | 0.19 | 0.43 | 0.20 | 0.13 | 0.33 | -0.21 | -0.21 |
| **SE** | SE1 | -0.27 | -0.02 | -0.15 | -0.10 | -0.10 | 0.07 | -0.24 | 0.10 | 0.26 |
| | SE2 | -0.23 | -0.01 | -0.14 | -0.07 | -0.10 | 0.08 | -0.22 | 0.06 | 0.21 |
| | SE3 | -0.20 | 0.02 | -0.11 | -0.15 | -0.09 | 0.10 | -0.23 | 0.05 | 0.19 |
| **SN** | GDSF1 | -0.21 | 0.08 | -0.16 | -0.15 | 0.05 | -0.09 | -0.07 | 0.13 | 0.50 |
| | GDSF2 | -0.18 | -0.06 | -0.15 | -0.10 | -0.05 | -0.15 | -0.09 | 0.21 | 0.38 |
| | GDSF3 | -0.16 | 0.04 | -0.18 | -0.10 | 0.02 | -0.12 | -0.03 | 0.16 | 0.49 |
| | GDSF4 | -0.11 | -0.04 | -0.10 | -0.12 | 0.00 | -0.20 | -0.03 | 0.19 | 0.30 |
| | GDSF5 | -0.17 | 0.02 | -0.12 | -0.11 | 0.01 | -0.10 | -0.04 | 0.09 | 0.38 |
| | GDSF6 | -0.05 | 0.04 | -0.01 | -0.14 | 0.06 | -0.02 | -0.06 | -0.02 | 0.23 |
| **STFocus** | STF2 | 0.25 | 0.04 | 0.19 | 0.25 | 0.20 | -0.05 | 0.60 | -0.19 | -0.11 |
| | STF3 | 0.13 | 0.09 | 0.09 | 0.30 | 0.14 | -0.12 | 0.41 | -0.16 | -0.06 |
| | STF4 | 0.10 | 0.07 | 0.09 | 0.16 | 0.15 | 0.00 | 0.39 | -0.15 | -0.09 |
| **SunkCost** | SnkCost1 | 0.27 | 0.08 | 0.06 | 0.10 | 0.20 | -0.04 | 0.09 | -0.01 | -0.15 |
| | SnkCost2 | 0.33 | 0.10 | 0.13 | 0.16 | 0.25 | 0.01 | 0.10 | -0.05 | -0.23 |
| **TranCost** | TrnCost1 | 0.26 | -0.01 | 0.32 | 0.18 | 0.06 | -0.10 | 0.18 | -0.11 | -0.42 |
| | TrnCost2 | 0.30 | -0.04 | 0.33 | 0.21 | 0.08 | -0.09 | 0.22 | -0.14 | -0.45 |

## Table 5.5, continued. PLS Item Factor Loadings and Cross Loadings

| Construct | Item | GDPEOU | GDRA | PIIT | RtSeek | SE | SN | STFocus | SunkCost | TranCost |
|---|---|---|---|---|---|---|---|---|---|---|
| **ABI** | ABI1 | -0.40 | -0.24 | -0.25 | 0.36 | -0.34 | -0.12 | 0.37 | 0.30 | 0.42 |
| | ABI2 | -0.26 | -0.34 | -0.20 | 0.15 | -0.13 | -0.21 | 0.08 | 0.17 | 0.17 |
| | ABI3 | -0.27 | -0.38 | -0.11 | 0.19 | -0.12 | -0.21 | 0.08 | 0.30 | 0.15 |
| **AWARE** | AWARE2 | 0.06 | 0.10 | 0.05 | 0.15 | 0.00 | 0.05 | 0.09 | 0.10 | -0.02 |
| | AWARE3 | 0.04 | 0.14 | 0.02 | 0.10 | 0.00 | 0.07 | 0.06 | 0.10 | -0.03 |
| | AWARE4 | 0.00 | 0.08 | 0.03 | 0.07 | -0.01 | 0.04 | 0.04 | 0.09 | -0.02 |
| | AWARE6 | 0.02 | 0.13 | 0.03 | 0.13 | 0.00 | 0.05 | 0.09 | 0.07 | -0.03 |
| **CBI** | CBI1 | -0.29 | -0.14 | -0.23 | 0.17 | -0.11 | -0.15 | 0.14 | 0.11 | 0.28 |
| | CBI2 | -0.39 | -0.30 | -0.29 | 0.20 | -0.15 | -0.23 | 0.13 | 0.11 | 0.36 |
| | CBI3 | -0.33 | -0.16 | -0.22 | 0.17 | -0.14 | -0.15 | 0.21 | 0.08 | 0.33 |
| **CogRig** | CR1 | -0.19 | -0.15 | -0.23 | 0.42 | -0.09 | -0.11 | 0.27 | 0.16 | 0.21 |
| | CR3 | -0.15 | -0.15 | -0.22 | 0.40 | -0.11 | -0.14 | 0.27 | 0.09 | 0.18 |
| **CTRL** | CTRL1 | -0.20 | -0.03 | -0.16 | 0.24 | -0.13 | -0.03 | 0.17 | 0.21 | 0.13 |
| | CTRL2 | -0.09 | 0.01 | -0.03 | 0.20 | -0.08 | 0.04 | 0.16 | 0.21 | 0.08 |
| | CTRL5 | -0.03 | 0.10 | -0.03 | 0.22 | -0.05 | 0.07 | 0.22 | 0.17 | 0.01 |
| | CTRL7 | -0.08 | 0.04 | -0.05 | 0.19 | -0.09 | 0.02 | 0.17 | 0.23 | 0.03 |
| **EFFCH** | EFFCH1 | -0.07 | -0.12 | -0.03 | 0.05 | 0.00 | -0.13 | -0.07 | -0.04 | -0.03 |
| | EFFCH2 | 0.06 | -0.06 | 0.08 | 0.02 | 0.10 | -0.07 | -0.07 | 0.00 | -0.10 |
| | EFFCH5 | 0.10 | -0.03 | 0.06 | 0.04 | 0.15 | -0.10 | -0.01 | 0.00 | -0.15 |
| **EReact** | ER1 | -0.19 | -0.04 | -0.31 | 0.44 | -0.30 | -0.12 | 0.50 | 0.14 | 0.25 |
| | ER2 | -0.09 | 0.05 | -0.18 | 0.46 | -0.18 | -0.03 | 0.58 | 0.06 | 0.18 |
| | ER3 | 0.05 | 0.05 | -0.11 | 0.29 | -0.10 | -0.02 | 0.40 | 0.04 | 0.09 |
| **GDExper** | GDExper | 0.17 | 0.10 | 0.23 | -0.24 | 0.07 | 0.16 | -0.21 | -0.03 | -0.14 |
| **GDIntent** | GDInt1 | 0.57 | 0.67 | 0.32 | -0.21 | 0.21 | 0.53 | -0.11 | -0.19 | -0.44 |
| | GDInt2 | 0.62 | 0.70 | 0.29 | -0.20 | 0.25 | 0.54 | -0.11 | -0.20 | -0.48 |
| **GDPEOU** | GDPEOU1 | 0.91 | 0.53 | 0.25 | -0.14 | 0.32 | 0.38 | -0.17 | -0.22 | -0.60 |
| | GDPEOU2 | 0.89 | 0.45 | 0.28 | -0.24 | 0.44 | 0.28 | -0.15 | -0.23 | -0.62 |
| **GDRA** | RA1 | 0.51 | 0.92 | 0.14 | -0.09 | 0.11 | 0.43 | -0.01 | -0.22 | -0.27 |
| | RA2 | 0.47 | 0.90 | 0.12 | -0.10 | 0.11 | 0.38 | -0.01 | -0.20 | -0.27 |
| | RA3 | 0.49 | 0.87 | 0.19 | -0.10 | 0.05 | 0.42 | 0.02 | -0.10 | -0.26 |
| **PIIT** | PIIT1 | 0.28 | 0.21 | 0.89 | -0.41 | 0.38 | 0.25 | -0.23 | -0.01 | -0.32 |
| | PIIT2 | 0.20 | 0.08 | 0.82 | -0.38 | 0.44 | 0.25 | -0.26 | -0.03 | -0.40 |
| | PIIT4 | 0.28 | 0.13 | 0.90 | -0.45 | 0.41 | 0.24 | -0.28 | -0.04 | -0.39 |
| **RtSeek** | RS1 | -0.19 | -0.07 | -0.30 | 0.74 | -0.23 | -0.07 | 0.61 | 0.16 | 0.25 |

| Construct | Item | GDPEOU | GDRA | PIIT | RtSeek | SE | SN | STFocus | SunkCost | TranCost |
|---|---|---|---|---|---|---|---|---|---|---|
| | RS3 | -0.16 | -0.10 | -0.45 | 0.88 | -0.27 | -0.13 | 0.38 | 0.17 | 0.26 |
| **SE** | SE1 | 0.41 | 0.12 | 0.44 | -0.31 | 0.96 | 0.13 | -0.26 | -0.18 | -0.55 |
| | SE2 | 0.36 | 0.06 | 0.43 | -0.28 | 0.93 | 0.10 | -0.23 | -0.16 | -0.51 |
| | SE3 | 0.39 | 0.10 | 0.41 | -0.28 | 0.92 | 0.06 | -0.27 | -0.20 | -0.54 |
| **SN** | GDSF1 | 0.33 | 0.41 | 0.24 | -0.12 | 0.13 | 0.89 | -0.04 | -0.05 | -0.29 |
| | GDSF2 | 0.22 | 0.23 | 0.26 | -0.16 | 0.10 | 0.67 | -0.07 | 0.00 | -0.21 |
| | GDSF3 | 0.27 | 0.38 | 0.27 | -0.10 | 0.07 | 0.87 | 0.02 | 0.00 | -0.25 |
| | GDSF4 | 0.12 | 0.17 | 0.18 | -0.06 | 0.04 | 0.54 | -0.02 | 0.02 | -0.17 |
| | GDSF5 | 0.29 | 0.34 | 0.13 | 0.00 | 0.02 | 0.68 | 0.02 | -0.07 | -0.15 |
| | GDSF6 | 0.09 | 0.11 | 0.11 | -0.07 | 0.03 | 0.41 | 0.04 | -0.01 | -0.13 |
| **STFocus** | STF2 | -0.15 | 0.01 | -0.26 | 0.53 | -0.27 | -0.03 | 0.91 | 0.14 | 0.29 |
| | STF3 | -0.15 | 0.01 | -0.24 | 0.42 | -0.13 | 0.01 | 0.76 | 0.05 | 0.18 |
| | STF4 | -0.13 | -0.01 | -0.20 | 0.41 | -0.22 | 0.00 | 0.69 | 0.03 | 0.15 |
| **SunkCost** | SnkCost1 | -0.17 | -0.12 | -0.02 | 0.15 | -0.17 | -0.01 | 0.10 | 0.92 | 0.19 |
| | SnkCost2 | -0.29 | -0.23 | -0.03 | 0.22 | -0.19 | -0.06 | 0.10 | 0.95 | 0.27 |
| **TranCost** | TrnCost1 | -0.61 | -0.25 | -0.33 | 0.25 | -0.47 | -0.25 | 0.25 | 0.23 | 0.90 |
| | TrnCost2 | -0.61 | -0.29 | -0.42 | 0.32 | -0.56 | -0.28 | 0.26 | 0.22 | 0.91 |

**Table 5.6. Model Constructs and Measures**

| Construct | Item | Item Wording |
|---|---|---|
| Habit – Awareness (Polites and Karahanna 2008b) | AWARE2 | Whenever I need to collaborate / share files with my teammates, I choose to use [EMAIL] without even being aware of (making) the choice. |
| | AWARE3 | Whenever I need to collaborate / share files with my teammates, I unconsciously start using [EMAIL]. |
| | AWARE4 | Choosing [EMAIL] when I want to collaborate / share files with my teammates is something I do without being aware. |
| | AWARE6 | Choosing [EMAIL] to collaborate / share files with my teammates is something I do unconsciously. |
| Habit – Controllability (Polites and Karahanna 2008b) | CTRL1 | I (would) find it difficult to overrule my impulse to use [EMAIL] to collaborate / share files with my teammates. |
| | CTRL2 | I (would) find it difficult to overcome my tendency to use [EMAIL] to collaborate / share files with my teammates. |
| | CTRL5 | It would be difficult to control my tendency to use [EMAIL] to collaborate / share files with my teammates. |
| | CTRL7 | It is [would be] hard to restrain my urge to use [EMAIL] to collaborate / share files with my teammates. |
| Habit – Mental Efficiency (Polites and Karahanna 2008b) | EFFCH1 | I do not need to devote a lot of mental effort to *deciding* that I will use [EMAIL] to collaborate / share files with my teammates. |
| | EFFCH2 | *Selecting* [EMAIL] to collaborate / share files with my teammates does not involve much thinking. |
| | EFFCH5 | *Choosing* [EMAIL] to collaborate / share files with my teammates requires little mental energy. |
| Indiv Diff – Cognitive Rigidity (Oreg 2003) | CR1 | Once I've come to a conclusion, I'm not likely to change my mind. |
| | CR3 | I don't change my mind easily. |
| | CR4 | My views are very consistent over time. *[item dropped due to poor loading in LISREL CFA]* |
| Indiv Diff – Emotional Reaction (Oreg 2003) | ER1 | If I were to be informed that there's going to be a significant change regarding the way things are done in my classes, I would probably feel stressed. |
| | ER2 | When I am informed of a change of plans, I tense up a bit. |
| | ER3 | When things don't go according to plans, it stresses me out. |
| Indiv Diff – Routine Seeking (Oreg 2003) | RS1 | I generally consider changes to be a negative thing. |
| | RS3 | I like to do the same old things rather than try new and different ones. |
| | RS4 | Whenever my life forms a stable routine, I look for ways to change it. *[reverse coded item dropped due to poor loading in LISREL CFA]* |
| Indiv Diff – Short-Term | STF2 | Often, I feel a bit uncomfortable even about changes that may potentially improve my life. |

| Construct | Item | Item Wording |
|---|---|---|
| Focus (Oreg 2003) | STF3 | When someone pressures me to change something, I tend to resist it even if I think the change may ultimately benefit me. |
| | STF4 | I sometimes find myself avoiding changes that I know will be good for me. |
| Indiv Diff – PIIT (Agarwal and Prasad 1998) | PIIT1 | If I heard about a new information technology, I would look for ways to experiment with it. |
| | PIIT2 | Among my peers, I am usually the first to try out new information technologies. |
| | PIIT4 | I like to experiment with new information technologies. |
| Inertia – Affective Based (new) | I [will] continue using my existing method for collaborating / sharing files with my teammates… | |
| | ABI1 | …because it would be stressful to change. |
| | ABI2 | …because I am comfortable doing so. |
| | ABI3 | …because I enjoy doing so. |
| Inertia – Behavioral Based (new) | I [will] continue using my existing method for collaborating / sharing files with my teammates… | |
| | BBI | …simply because it is what I have always done. |
| | BBI2 | …simply because it is part of my normal routine. |
| | BBI3 | …simply because I've done so regularly in the past. |
| Inertia – Cognitive Based (new) | I [will] continue using my existing method for collaborating / sharing files with my teammates… | |
| | CBI1 | …even though I know it is not the best way of doing things. |
| | CBI2 | …even though I know it is not the most efficient way of doing things. |
| | CBI3 | …even though I know it is not the most effective way to do things. |
| Transition Costs (Moore 2000) | TrnCost1 | Learning how to use Google Docs to collaborate / share files with my teammates would not take much time. [reverse coded item] |
| | TrnCost2 | Becoming skillful at using Google Docs to collaborate / share files with teammates would be easy for me. [reverse coded item] |
| Sunk Costs (Moore 2000) | SnkCost1 | I have already invested a lot of time in learning to use my current method for collaborating / sharing files with teammates. |
| | SnkCost2 | I have already invested a lot of time in perfecting my skills at using my current method for collaborating / sharing files with teammates. |
| Perceived Ease of Use | GDPEOU1 | I would find Google Docs easy to use for collaborating / sharing files with teammates. |

| Construct | Item | Item Wording |
|---|---|---|
| (Karahanna et al. 2006; Venkatesh et al. 2003) | GDPEOU2 | Using Google Docs to collaborate / share files with teammates would be clear and understandable. |
| Relative Advantage (Karahanna et al. 2006) | RA1 | Using Google Docs to collaborate / share files with my teammates, rather than our current method of collaborating / sharing files, would enhance my group's effectiveness. |
| | RA2 | Using Google Docs to collaborate / share files with my teammates, rather than our current method of collaborating / sharing files, would increase my group's productivity. |
| | RA3 | Using Google Docs to collaborate / share files with my teammates, rather than our current method of collaborating / sharing files, would improve my group's performance. |
| Social Factors (formative) (Venkatesh et al. 2003) | GDSF1 | My friends think I should use Google Docs to collaborate / share files with my teammates. |
| | GDSF2 | Most of my friends use Google Docs to collaborate / share files with teammates. |
| | GDSF3 | My teammates think I should use Google Docs to collaborate / share files with them. |
| | GDSF4 | Most of my teammates use Google Docs to collaborate / share files with their teammates. |
| | GDSF5 | My professors think I should use Google Docs to collaborate / share files with my teammates. |
| | GDSF6 | Most of my professors use Google Docs to collaborate / share files. |
| Internal Self-Efficacy (Thatcher et al. 2008) | SE1 | I could use Google Docs to collaborate / share files with teammates if there was no one around to tell me what to do. |
| | SE2 | I could use Google Docs to collaborate / share files with teammates if I had never used a system like it before. |
| | SE3 | I could use Google Docs to collaborate / share files with teammates if I had only the online help for reference. |
| Intention to Try (new, based on Bagozzi et al. 1992) | GDInt1 | I intend to use Google Docs to collaborate / share files with my teammates on my future group projects. |
| | GDInt2 | I plan to use Google Docs to collaborate / share files with my teammates on my future group projects. |
| Experience with Google Docs | GDExp | Please indicate how much experience, in months, you currently have using Google Docs. *(If you have never used Google Docs before, please enter "0.")* |

## APPENDIX E

## BRIEF INTRODUCTION TO GOOGLE DOCS

Google Docs is a free program that allows you to create and share work online. It includes an online word processor, spreadsheet, and presentation editor. Your project team members can upload existing documents in a number of common formats (including HTML, Microsoft Office, and several more), or you can even create and save new documents online. These documents can be exported to your PC at any time. Since all of your documents are stored securely online, they can be accessed and edited from anywhere, using only a web browser. Using Google Docs can help your project team ensure that there is always one single master copy of each of your project documents that each member of the team can access any time and work on. In addition, Google Docs enables real time collaboration, meaning that all your group members can log in simultaneously to view and edit documents together in real time, as well as chat with each other. Google Docs is completely free, and requires only a Google email account to get started.

To take a quick tour of Google Docs, or to get more detailed information on Google Docs capabilities, please follow the steps below:

(1) Go to the following website by opening a NEW BROWSER WINDOW: http://www.google.com/google-d-s/intl/en/tour1.html

(2) Review this website to get additional information on Google Docs and how it may be useful to you for collaborating / sharing files in future group projects. You may scroll up and down the pages, click on any links that you wish, and use any feature on the site. (NOTE: The "Help" link at the bottom of the Google Docs tour page provides a lot of helpful information on features and limitations of the Google Docs application, including the "Top 5 Questions" about Google Docs.)

(3) After reviewing the site, return to the survey and answer the questions below. (You may find it convenient to leave the Google Docs browser window open until you complete the survey.)

If you are finished with steps (1) and (2) above and are ready to proceed with answering questions (step 3), please click "submit" below.