

HOW HABIT LIMITS THE PREDICTIVE POWER OF INTENTION: THE CASE OF INFORMATION SYSTEMS CONTINUANCE¹

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Abstract

Past research in the area of information systems acceptance has primarily focused on initial adoption under the implicit assumption that IS usage is mainly determined by intention.

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While plausible in the case of initial IS adoption, this assumption may not be as readily applicable to continued IS usage behavior since it ignores that frequently performed behaviors tend to become habitual and thus automatic over time.

This paper is a step forward in defining and incorporating the “habit” construct into IS research. Specifically, the purpose of this study is to explore the role of habit and its antecedents in the context of continued IS usage.

*Building on previous work in other disciplines, we define habit in the context of IS usage as **the extent to which people tend to perform behaviors (use IS) automatically because of learning**. Using recent work on the continued usage of IS (IS continuance), we have developed a model suggesting that continued IS usage is not only a consequence of intention, but also of habit. In particular, in our research model, we propose IS habit to moderate the influence of intention such that its importance in determining behavior decreases as the behavior in question takes on a more habitual nature. Integrating past research on habit and IS continuance further, we suggest how antecedents of behavior/behavioral intention as identified by IS continuance research relate to drivers of habitualization.*

We empirically tested the model in the context of voluntary continued WWW usage. Our results support the argument that habit acts as a moderating variable of the relationship between intentions and IS continuance behavior, which may put a boundary condition on the explanatory power of intentions in the context of continued IS usage. The data also support that satisfaction, frequency of past behavior, and comprehensiveness of usage are key to habit formation and

thus relevant in the context of IS continuance behavior. Implications of these findings are discussed and managerial guidelines presented.

Keywords: IS continuance, habit, expectation–confirmation theory, satisfaction, adoption

Introduction

Based on the work by Rogers (1995), Fishbein and Ajzen (1975) and others, past information systems research has largely sought to explore how users come to *adopt* a particular information system. However, IS adoption is just the first step toward overall IS success. Usage behavior, commonly labeled as *post-implementation* (Saga and Zmud 1994) or *post-adoption* (Jasperson et al. 2005), is at least equally important to attaining information technology implementation. Bhattacharjee (2001b, pp. 351-352) even goes so far as to say that “long-term viability of an IS and its eventual success depend on its continued use rather than [its] first-time use.” In other words, before an IS implementation can truly be considered as a success, a significant number of users should have moved beyond the initial adoption stage, using the IS on a continued basis. Unfortunately, success in having users continue to use a new IS can be more difficult than it sounds: U.S.-based e-tailer Land’s End, Inc. calls it an art that requires equal parts of prodding and finesse.²

Obviously, how to promote continued IS usage or, alternatively, how to prevent discontinuance are essential questions for e-sellers (Parthasarathy and Bhattacharjee 1998) to consider. Similarly, management may, for example, face the need to prevent its employees from discontinuing to use a newly implemented enterprise resources planning (ERP) system in favor of switching back to the legacy application; it may have to counteract the slacking morale of its help-desk staff to enter complete sets of information on customer problems, and so forth.

Independent of the nature and origin of specific problems, the underlying issue remains the same. If management wants to promote continued IS usage behavior, it clearly needs to understand what drives it. Realizing a lack of knowledge in this area (see Saga and Zmud 1994), researchers have recently begun to study the subject in more detail (see Bhattacharjee 2001a, 2001b; Jasperson et al. 2005; Karahanna et al. 1999; Parthasarathy and Bhattacharjee 1998; Venkatesh et al. 2002).

Aside from focusing mainly on adoption, past IS research has also been conducted under the implicit assumption that IS usage is mainly determined by intention. While plausible in the case of initial IS adoption, this assumption may not be applicable to continued IS usage behavior as it ignores that frequently performed behaviors tend to become habitual, and thus automatic over time (Ouellette and Wood 1998). As argued by Thorngate (1976) and others, people’s baseline response to many situations that are related to continued IS usage may not be predominantly determined by intention, but rather be the result of habit.

Broadly, the purpose of this paper is to explore the role of habit in the context of continued IS usage. More specifically, we

- Synthesize prior research on habit and habit formation, highlighting its strengths and shortcomings, and extend current theorizing on habit by introducing a new antecedent of habit (comprehensiveness of usage), primarily relevant to the IS context
- Provide a working definition for habit in the context of IS continuance
- Integrate theory on habit with recent work on IS continuance
- Empirically test the resulting research model in which the relationship between intention and IS continuance behavior is moderated by habits
- Derive explicit managerial guidelines on how continued IS usage behavior can be influenced effectively

The paper begins with a summary of the literature on IS continuance, and then reviews and discusses prior work on habit in general, with a special focus on the nature of habit, its antecedents, and its relationship to intention and actual behavior. Further, we present our definition of habit in the context of IS, describe our research model, and present the design of the study and the research methodology. After discussing the findings, the paper highlights implications for both research and practice and points out promising areas for future research.

Theory

In this section, we first provide an overview of the concept of IS continuance and the underlying IS research stream. We

²“Old Habits Die Hard,” *Computerworld*, December 10, 2002.

then introduce the theoretical background for an IS-specific definition and explore under what conditions IS habits are likely to develop before discussing its various antecedents. We later describe various competing views on the nature of the relationship between intention, habit, and behavior, arguing that the impact of habit is probably best captured by modeling its relationship to intention and IS continued usage as a moderation effect on the relationship between them. Finally, combining existing work on IS continuance with our insights on habit, we suggest how to strengthen current theorizing on IS continuance by anchoring the habit construct and its antecedents into this body of work.

What Is IS Continuance?

In the past, most research in the area of technology acceptance has focused on the early phases in the usage life cycle, that is, on adoption. Primarily based on theories adapted from social psychology (theory of reasoned action, TRA; theory of planned behavior, TPB; and so forth), this research has explored the many antecedents and moderating effects leading to the initial acceptance (or not) of a particular IS. However, since many of these studies rely on cross-sectional data collected during the early phases of usage, the conclusions appear to be of only marginal importance for the present study. Hence, from our perspective, longitudinal adoption studies (Bajaj and Nidumolu 1998; Compeau et al. 1999; Davis et al. 1989; Venkatesh and Davis 2000; Venkatesh et al. 2000), basing their findings on data collected across several phases of the usage process, would appear to be more relevant. However, even these longitudinal studies still focus almost exclusively on adoption. Consequently, they do not offer much insight into what happens in later phases of the acceptance process. Realizing this gap in the literature, a few scholars have recently begun to study the nature of IS continuance and to compare it to adoption (Jasperson et al. 2005).

IS continuance, IS continuance behavior, or IS continuous usage describes behavioral patterns reflecting continued use of a particular IS. Continuance refers to a form of post-adoption behavior. Although the term *post-adoption* actually refers to a suite of behaviors that follow initial acceptance (Rogers 1995), including continuance, routinization, infusion, adaptation, assimilation, etc., in the literature it is often used as a synonym for continuance (see Karahanna et al. 1999). In this study we limit ourselves to the terms IS continuance or continued IS usage behavior.

IS continuance has been explored both at the organizational and individual level of analysis. Saga and Zmud (1994) asso-

ciated the IS post-adoption at the organizational level with the final three phases of their six-stage IT implementation model. These phases include organizational efforts undertaken to induce organizations to commit to the use of IT (acceptance), alterations that occur within the work system such that they are no longer perceived as new (routinization), and the process of embedding the IT into the organization's work system (infusion). Studied at the individual level (our focus), IS continuance behavior refers to a usage stage when IS use transcends conscious behavior and becomes part of normal routine activity (Bhattacharjee 2001b). Unlike the initial adoption decision, IS continuance is not a one-time event, but may better be envisioned as the result of a series of individual *decisions* to continue using a particular IS, thereby reflecting its longitudinal nature. The decisions to continue to use an IS follow an initial adoption decision. As the same decision is made repeatedly in response to the same recurring situation, IS continuance behavior tends to take on an increasingly habitualized (automatic) nature (Limayem et al. 2001). The IS continuance phase ends with the users' final decision to discontinue (Bhattacharjee 2001b).

Prior research on IS continuance confirms that it is not simply an extension of adoption behavior. While to date only a few studies have been dedicated to this area, the existing evidence suggests that adoption and continuance usage behavior are determined by different sets of antecedents (Limayem et al. 2003a). As early as 1995, Taylor and Todd found that the typical group of antecedents employed to explain the usage intention of adopters (attitude, subjective norms, and perceived behavioral control) explains considerably less variance in usage intention of more experienced users. Noting the difference, Taylor and Todd concluded that prior experience must be an important determinant of behavior. A few years later, Karahanna et al. (1999) confirmed these results with a similar study. Comparing inexperienced users (adopters) with experienced ones, they found that many of the antecedents that help explain intention to adopt a particular IS did not add any explanatory value in the case of experienced users. While adopters relied on beliefs such as ease of use, result demonstrability, trialability, visibility, as well as social norms in forming their intention, experienced users based their decision to continue using an IS merely on usefulness considerations and image perceptions. Karahanna et al. concluded that adopters employ a richer set of beliefs than their more experienced counterparts when making usage decisions.

Taking these findings into account, we note that the variance the authors were able to explain for experienced users was considerably smaller than that for adopters. Hence, the question now becomes whether IS continuance intention and

behavior are really driven by a mere subset of antecedents relevant for adoption or whether there are, in fact, other as-yet unexplored factors that exert additional impact. Addressing this issue, Venkatesh et al. (2002) reported that when they included short-term usage (prior usage behavior) as an additional antecedent, all other determinants (including behavioral intention, inherent motivation, etc.) became insignificant. Unfortunately, establishing an empirical link between prior and future behavior is generally not considered to add much to the theoretical understanding of the underlying phenomenon, as it merely reflects the fact that there exists a certain level of stability in usage behavior across time (Ajzen 1991; Verplanken and Aarts 1999). Further, it does not reveal what is really driving continued usage behavior above and beyond the antecedents derived from adoption research as identified by Karahanna et al. (1999), Taylor and Todd (1995), Venkatesh and Morris (2000), Venkatesh et al. (2003), and others. Bhattacherjee's (2001b) work, finally, builds on entirely different theoretical foundations. Dismissing adoption research as largely unsuitable to explain phenomena in the area of IS continuance, he turns to research in the area of consumer satisfaction. Borrowing heavily from expectation-confirmation theory (ECT), a theory with explicit focus on a user's psychological motivations that emerge *after* initial adoption, he develops an IS continuance model that includes concepts such as satisfaction, confirmation, and usefulness as the main antecedents of intention to IS continuance behavior. As his findings suggest, this approach is promising. The variance in intention to continue using an IS, he reports, is as high as 0.663.

For the reasons cited above, we decided to use Bhattacherjee's (2001b) recent work as our point of departure. It is based on a solid theoretical foundation that focuses on an individual's psychological motives during post-adoption, and it has been successfully adapted to the IS context. Further, while relatively parsimonious, it does not simply resort to powerful but theoretically less useful variables, such as prior behavior, to explain IS continuance. On the contrary, it posits both new and traditional IS variables to act as antecedents of IS continuance intention. The *new* variables are directly derived from ECT and include confirmation and satisfaction; in addition, the utilitarian value of technology (as represented by perceived usefulness, see Karahanna et al 1999; Venkatesh and Morris 2000; Venkatesh et al. 2002) has proven to be a salient predictor of continued IS usage. Lastly, we found that one of the key antecedents of IS continuance intention suggested by the model—satisfaction—is also a determinant of habit. As we show below, this permits us to embed the habit construct even better into the theory underpinning IS continuance behavior.

Overview of Bhattacherjee's IS Continuance Model

Bhattacherjee's (2001b) post-acceptance model of IS continuance seeks to explain an IS user's *intention to continue* using an IS. Based on expectation-confirmation theory (a theory widely used in the consumer behavior literature to study consumer satisfaction, post-purchase behavior, and the like), IS users' continuance decisions are similar to consumer's repurchase decisions as they also follow an initial adoption phase, are influenced by the initial use, and can potentially lead to an *ex post* reversal of the initial decision, that is, to the discontinuance of the IS (Bhattacherjee 2001b). Bhattacherjee's model positively relates intention to satisfaction and perceived usefulness. In the marketing literature, satisfaction is considered key to building and retaining a loyal base of long-term consumers. A similar argument can be made in the context of IS continuance where satisfaction with an IS tends to reinforce a user's intention to continue using the system. Further, by including perceived usefulness, Bhattacherjee's model reflects current thinking in the area of IS which holds that perceived usefulness is the only construct consistently influencing user intention across both adoption and post-adoption phases (see above). The model also relates satisfaction and perceived usefulness to the degree to which the user's expectations about the IS are confirmed. Expectations provide the baseline level against which confirmation is assessed by users to determine their evaluative response or satisfaction (Bhattacherjee 2001b, p. 355). The better they are met, the more useful it appears to users and the more satisfied they are.

Like most other studies in this area, Bhattacherjee's model relies uniquely on intention as the primary predictor of IS continuance behavior. While not explicitly modeled, the link between intention and IS continuance is clearly implied. However, by not including the construct, the model cannot account for the possibility that long-practiced behavior may no longer be under volitional control, but rather be influenced by antecedents other than intention. In other words, the ability of the model to predict IS continuance is limited if, in fact, the relationship between intention and continued IS usage is influenced by habit.

To overcome these limitations and to improve the explanatory value of the model further, we feel it needs to be extended by incorporating the *habit* construct, as well as its major antecedents. This way the model would be able to account for automatic (habitual) behaviors, in addition to the intentional ones already captured. Before we turn to discuss our model extensions in detail, we provide the necessary foundations informing our suggestions.

IS Habit: Conceptual Background and Definition

The concept of habit can be traced back to James (1890), who was probably the first to point out the importance of habits in managing our daily lives:

There is no more miserable human being than one in whom nothing is habitual but indecision, and for whom the lighting of every cigar, the drinking of every cup, the time of rising and going to bed every day, and the beginning of every bit of work, are subjects of express volitional deliberation (p. 122).

Habit is not the same as behavior and thus should not be confused with the latter.³ Instead it should be understood as a special kind of mind-set that enhances the perceptual readiness for habit-related cues, and prevents an individual from being distracted and from adopting other, less efficient courses of action (Verplanken and Aarts 1999). James (1890, p. 125) refers to this condition as a *behavioral tendency*, a tendency to repeat responses given a stable supporting context (Ouellette and Wood 1998, p. 55).

While habit has found only little attention in the IS literature (Bergeron et al. 1995; Karahanna et al. 1999; Limayem et al. 2003a; Limayem and Hirt 2003; Thompson et al. 1991; Tyre and Orlikowski 1994), over the years it has been extensively studied in other disciplines. Major work has been conducted in social psychology (see Aarts and Dijksterhuis 2000; Aarts et al. 1998; Bagozzi 1981; Bargh and Gollwitzer 1994; Bargh et al. 2001; Ouellette and Wood 1998; Thorngate 1976; Triandis 1980; Verplanken and Aarts 1999; Verplanken et al. 1998); health sciences (see Lindbladh and Lyttkens 2002; Orbell et al. 2001; Ronis et al. 1989); food consumption (see Saba and di Natale 1998, 1999; Saba et al. 1998; Saba et al. 2000), marketing/consumer behavior (see Bargh 2002; Guariglia and Rossi 2002; Tuorila and Pangborn 1988a, 1988b), and organizational behavior (see Louis and Sutton 1991; March and Simon 1958). In Table 1 we present a summary of prior studies on habit indicating subject areas, purposes, definitions employed, and type of theories advanced.

Across disciplines, habits are commonly understood as “learned sequences of acts that become automatic responses

³The distinction of habit and (habitual) behavior is essential. While the former is, as described in the text, some kind of mind-set, the latter refers to the resulting action taken by the individual. Thus the distinction between the concept of *habit* and habitual behavior can be likened to the widely accepted distinction between the concept of *intention* and resulting intentional/cognitive behavior.

to specific situations, which may be functional in obtaining certain goals or end states” (Verplanken et al. 1997, p. 540). They represent an individual’s **learned responses** to some kind of stimulus (Verplanken et al. 1998). While some authors argue that habits can form relatively quickly, sometimes simply as a result of imagined interactions or responses (see Thorngate 1976) or on the basis of a single (emotionally involving) experience (*Encyclopedia Britannica*), we strongly believe that the development of habits (proceduralization) requires a certain amount of repetition or practice (Aarts et al. 1998; Fiske and Taylor 1991; Orbell et al. 2001; Ronis et al. 1989). As a rule of thumb, a minimum of weekly repetition is needed to establish a habit and, importantly, habit formation requires a stable (or *habit conducive*) context (Ouellette and Wood 1998). A stable context promotes habit formation in that it only requires a minimum of the individual’s attention in reacting adequately to **certain situations**. Once a habit is established, behavior is performed **automatically** (Orbell et al. 2001; Triandis 1980, p. 204); that is, its performance requires little (if any) conscious attention and only minimal mental effort (Wood et al. 2002). So when a behavior is habit-driven, a person does not think about it (Mittal 1988); it is non-reflective (Lindbladh and Lyttkens 2002); and it diminishes the conscious attention with which our acts are performed (James 1890). Due to its minimal requirements on cognitive processing and deliberate control, habitual behavior is both effortless and efficient (Lindbladh and Lyttkens 2002); consequently, it reduces response latencies and “smooths” responses (Thorngate 1976). In other words, a “habit simplifies the movements required to achieve a given result, makes them more accurate and diminishes fatigue” (James 1890, p. 112).

Adapted to IS usage but in line with prior conceptualizations, we define **IS habit** as the extent to which people tend to perform behaviors (use IS) automatically because of learning. Defined this way, habit has relatively little conceptual overlap with intention (Saba et al. 1998; Trafimow 2000; Tyre and Orlikowski 1994) and may thus provide additional explanatory power in explaining IS usage.

Antecedents of IS Habits

As indicated above, habit has great potential to explain IS-related behaviors that may no longer be under total conscious control of the individual. To fully appreciate the role of habits in the context of continued IS usage, we now turn to a discussion of its antecedents with a focus on the conditions under which IS habits are most likely to form. Knowledge about habit antecedents is not only helpful in understanding how and why IS-usage related habits arise, but may also

Table 1. Summary of Prior Research Studies on Habit

Study	Area	Purpose	Definition of Habit	Theory [†]
Aarts and Dijksterhuis (2000)	Travel mode choice	To explore when travel choice behavior is habitual, activation of a travel goal automatically activates a travel mode in memory.	Habit is defined as “goal directed automatic behaviors that are mentally represented (p. 76).	–
Aarts et al. (1997)	Health-related behavior	To describe a theoretical model of exercise habit formation, and the effects of attitudes, perceived social norms, behavioral control and exercise experiences on the initiation and persistence of exercise habits.	No direct definition of habit, but the authors cite quotations where “habit” is described as “goal-directed” type of automaticity, being instigated by a specific goal-directed state of mind in the presence of triggering stimulus cues.	M
Aarts et al. (1998)	Travel mode choice	To explore if behavior is performed repeatedly and becomes habitual, it is guided by automated cognitive processes rather than being preceded by elaborate decision processes.	Habit is defined as “goal directed automatic behaviors that are mentally represented” (p. 1359).	M
Ajzen (1991)	Human decision process	To review research on various aspects of the theory of planned behavior.	Habit is conceptualized as past behavior.	–
Bagozzi (1981)	Actual blood donation behavior	To test the hypotheses concerning the attitude-behavior relation in the context of a longitudinal field study.	Habit is conceptualized as past behavior.	M or I
Bagozzi and Warshaw (1990)	Goal pursuit	To revise and extend the TPB to better explain goal pursuit.	Habit is conceptualized as frequency of past behavior.	I
Bargh (2002)	Consumer Behavior	To examine the role of nonconscious influences in real life in decisions and behavior.	Habit is conceptualized as automatic and nonconscious influence.	–
Bargh and Gollwitzer (1994)	Goal-directed action	To explore whether there is direct environmental control over behavior, in the form of behavioral responses automatically triggered by features of the current situation in which one finds itself. Further, to study the mediating role of thought or cognition in this process and argue that a certain form of thought—termed implementation intentions—has a unique role in the environment-to-action sequence (p. 71).	Habit is conceptualized as nonconscious activation.	–
Bargh et al. (2001)	Goal pursuit	To explore (in 5 experiments) whether performance and cooperation goals could be activated outside of conscious choice and awareness to then operate in ways similar to when those goals are pursued deliberately (p. 1024).	Habit is conceptualized as non-conscious activation.	–
Beck and Ajzen (1991)	Dishonest Action	To assess attitudes, subjective norms, perceptions of behavioral control, intentions and perceptions of moral obligations, as well as self-reports of behavior with respect to cheating on a test, shoplifting, and lying to get out of assignments.	Habit is conceptualized as past behavior.	I

[†]**Legend of Table Entries:** D = habit exerts a direct effect on behavior; I = the impact of habit on behavior is mediated by intentions (indirect effect); M = habit moderates the relationship between intentions and behavior; – = no specific theoretical view is put forward.

Table 1. Summary of Prior Research Studies on Habit (Continued)

Study	Area	Purpose	Definition of Habit	Theory [†]
Bergeron et al. (1995)	The use of executive information systems	To explore various factors related to EIS utilization, using as theoretical foundation a model from organizational behavior.	Habit is conceptualized as prior experience of EIS use (and measured in terms of frequency of behavior).	–
Charng et al. (1988)	Blood donation (role behaviors)	To investigate the usefulness of TRA for predicting the frequency of repeated behaviors in the real world, the authors compare predictions derived from TRA and identity theory regarding intentions to give blood and blood donation behavior.	Habit is the semiautomatic performance of a well-learned behavior (p. 305).	D
Dahlstrand and Biel (1997)	Environmentally friendly/non-friendly behavior	To propose a model for behavioral change as a process including 7 steps reaching from habitual non-environmentally friendly behavior to environmentally friendly behavior. Based on this model they assess where the largest differences between three groups of consumers with regard to variables such as importance of choice criteria, attitudes toward and for the environment, and convincing arguments for a behavioral change are found.	No definition provided.	M
Dunn (2000)	Adaptive and maladaptive behavior	To introduce the construct of habit on a continuum, from habit impoverishment, a condition in which habits are not available to support daily life, to habit domination, a condition in which habits consume so much energy that they interfere with a satisfying life.	The author conceptualizes habit from the neuroscience point of view. He introduced the concepts of thresholds for action, modulation, and motivation to reestablish homeostasis.	–
Fredricks and Dossett (1983)	Model Comparison: Attitude-behavior relations	To compare the Fishbein-Ajzen (1975) model of attitude-behavior relations with the Bentler-Speckart (1979) model.	Habit is conceptualized as prior behavior.	–
Guariglia and Rossi (2002)	Economics (consumption behavior)	To determine how much further one can improve current understanding of consumption decisions in the case of habit formation in an uncertain environment.	No definition provided.	–
Landis et al. (1978)	Social behavior (here: class room teaching)	To assess the relative impact of habit and behavioral intentions in predicting teacher behavior, using a model proposed by Triandis et al. (1972) (p. 227).	Habit is described as the frequency of the act in the behavioral history of the organism (p. 228).	M
Limayem et al. (2003a)	IS usage in the educational environment	To develop and test an integrated model of IS adoption and post-adoption.	The extent to which using a particular IS has become automatic in response to certain situations.	M
Limayem and Hirt (2003)	IS usage in the educational environment	To validate the idea that one can improve the explanatory power of models such as TPB by including the habit construct.	Habit refers to the nondeliberate, automatically inculcated response that individuals may bring to IS usage.	D
Lindblad and Lyttkens (2002)	Health-related behavior	To explore the nature of the decision process in health related behavior, using the categories of habit and choice as a focus for the analysis. Further to apply both a social and an economics type of theoretical lens to their data.	Habit is conceptualized as non-reflective, repetitive behavior (p. 451).	–
[†] Legend of Table Entries: D = habit exerts a direct effect on behavior; I = the impact of habit on behavior is mediated by intentions (indirect effect); M = habit moderates the relationship between intentions and behavior; – = no specific theoretical view is put forward.				

Table 1. Summary of Prior Research Studies on Habit (Continued)

Study	Area	Purpose	Definition of Habit	Theory [†]
Louis and Sutton (1991)	Cognitive processing	To propose a view of cognitive processing that involves automatic and cognitive modes, and moments of movements between modes.	Habit is defined as automatic cognitive processing.	–
Mittal (1988)	Seat belt usage	To examine the role of habit in the attitude-behavior discrepancy related to seat belt usage.	Habit is conceptualized as automated response (p. 993). The author distinguishes between two types of habit, pro-intentional ones (pro-use), and habits not in line with intentions (nonuse; e.g., bad habits).	M
Montano and Taplin (1991)	Mammography participation	To test an expanded TRA to predict mammography participation.	Habit is considered a measure of past behavior.	M
Orbell et al. (2001)	Ecstasy consumption	To explore to what extent variables specified by the TPB can predict ecstasy use intentions and behavior.	Habits are conceptualized to imply actions that have become automatic responses to specific situation cues and that are performed relatively unconsciously (p. 34).	I
Ouellette and Wood (1998)	Meta analysis on research on habit (past behavior)	To examine the relations between past behavior and future behavior.	Frequent performance in the past reflects habitual patterns that are likely to be repeated automatically in future responses (p. 54).	D and I [‡]
Quine and Rubin (1997)	The use of hormone replacement therapy	To examine women's attitude towards the use of hormone replacement therapy and try to predict intention to take it using the theory of planned behavior.	Habit is conceptualized as similar prior behavior.	I
Ronis et al. (1989)	Repeated health-related behaviors	To examine the function or roles of attitudes and related constructs (e.g., beliefs, values, decisions) in guiding repeated behavior. To propose that repeated behavior is largely determined by habits rather than by attitudinal variables.	Habit is defined as an action that has been done many times and has become automatic (p. 218).	M (implied)
Saba and di Natale (1998)	Fat consumption	To explore the most important predictors of actual consumption of different types of fats.	Habit is considered to be a behavior that is in some way automatic or out of the awareness of the subject or as a frequently repeated past behavior.	I
Saba and di Natale (1999)	Meat consumption	To understand the role of attitude, habit, and intention in predicting the actual consumption of meat, and to study the mediating role of intention in the impact of attitude and habit on meat consumption. Further, to test and compare 3 different models (all proposing a mediating effect of intentions).	Habit is considered to be a behavior that is in some way automatic or out of the awareness of the subject or as a frequently repeated past behavior.	I
Saba et al. (1998)	Milk consumption	To study the most important predictors of intention and behavior (milk consumption) using an extended version of TRA (added constructs: liking and habit) as the theoretical lens.	Habit is considered to be a behavior that is in some way automatic or out of the awareness of the subject or as a frequently repeated past behavior.	I
Saba et al. (2000)	Consumption of fat containing foods (in Italy)	To explore the most important predictors of actual consumption of fat containing foods.	Habit is considered to be a behavior that is in some way automatic or out of the awareness of the subject or as a frequently repeated past behavior.	D

[†]**Legend of Table Entries:** D = habit exerts a direct effect on behavior; I = the impact of habit on behavior is mediated by intentions (indirect effect); M = habit moderates the relationship between intentions and behavior; – = no specific theoretical view is put forward.
[‡]D in cases of stable context, I in cases of an unstable context

Table 1. Summary of Prior Research Studies on Habit (Continued)

Study	Area	Purpose	Definition of Habit	Theory [†]
Thorngate (1976)	Social behavior	To argue that habit is a much more common determinant of social behavior than cognition.	NONE, but descriptions of habit highlight among other things that it's a consequence of frequently performed behavior, efficient, free attention and short term memory for more important tasks, used in familiar situations.	M
Tuorila and Pangborn (1988a)	Consumption of selected sweet, salty, and fatty foods.	To compare predictions based on TRA and Triandis' model when applied to the context of sweet, salty and fatty food consumption.	Habit is considered to be a likely consequence of frequently performed behavior: "As the behavior occurs more and more frequently, it tends to become more and more controlled by habit" (p. 269).	D
Towler and Shepherd (1991-1992)	Chip consumption	To examine the role of beliefs, attitudes, subjective norm, perceived control and habit in the consumption of chips. To extend TRA by including habit as additional predictor variable.	The authors adopt Ronis et al.'s (1989) conceptualization of habit as a frequently repeated behavior that is in some sense automatic or out of the awareness of the subject (p. 38).	D
Trafimow (2000)	Intention to use condoms	To explore in two related studies how habit relates intentions (as dependent variable) and other variables in TRA.	Habit is defined as repeated past performance.	I
Triandis (1980)	NONE	To present a network of 34 interrelated hypotheses around the constructs of attitude and behavior in the broadest possible context.	Habits are situation-behavior consequences that are or have become automatic, so that they occur without self-instruction (p. 204).	D
Verplanken and Aarts (1999)	Social psychology (review and of previous studies on travel mode choices, etc)	To synthesize past work in support of the argument that habit is a concept worth studying, not only because of its potential to qualify existing research on planned behavior but also due because of its as well as its intrinsic characteristics (automaticity, dependency on situational constancy, functionality, and so forth).	Habits are learned sequences of acts that have become automatic responses to specific cues, and are functional in obtaining certain goals or end states. (p. 6, word version)	M
Verplanken et al. (1997)	Travel mode choices	To examine in 3 studies the role of habit on information acquisition concerning travel mode choices.	Habits comprise a goal-directed type of automaticity, which may be consciously instigated.	M
Verplanken et al. (1998)	Travel mode choices	To investigate (in a field experiment) the prediction and change in repeated behavior in the domain of travel mode choices.	Habits are conceptualized as learned acts that have become automatic responses to situations, which can be functional in obtaining certain goals or end-states (p. 112).	M
Verplanken et al. (1994)	Travel mode choices	To test a model of travel mode choice predicting behavior from the attitudes toward choosing a car, the attitude toward choosing an alternative mode (train) and (general) car choice habit.	Habits are relatively stable behavioral patterns, which have been reinforced in the past. Habits are executed without deliberate consideration, and result from automatic processes, as opposed to controlled processes like consciously made decisions (p. 287).	M

[†]**Legend of Table Entries:** D = habit exerts a direct effect on behavior; I = the impact of habit on behavior is mediated by intentions (indirect effect); M = habit moderates the relationship between intentions and behavior; – = no specific theoretical view is put forward.

Study	Area	Purpose	Definition of Habit	Theory[†]
Verplanken (2006)	Study 1: Eating snack Study 2: Mental habits Study 3: Word processing	To test and distinguish habit from frequency of occurrence	Habit is automaticity and mental efficiency of behavior occurring in stable contexts.	–
Wittenbraker et al. (1983)	Seat belt usage	To test both and the concept of habit in the context of TRA.	No definition of habit given. [BUT: authors criticize operationalization of habit as past behavior (p. 408).]	M
Wood et al. (2002)	Daily ongoing experiences (diary study)	To illustrate the differing thoughts and emotions involved in guiding habitual and nonhabitual behavior.	Habits are behaviors that are repeated in stable contexts (p. 1282). The disposition to perform habitual behaviors is implicit, expressed through the performance itself; it may not be reflected in people's thoughts or intentions. (p. 1281)	M (implied)
[†] Legend of Table Entries: D = habit exerts a direct effect on behavior; I = the impact of habit on behavior is mediated by intentions (indirect effect); M = habit moderates the relationship between intentions and behavior; – = no specific theoretical view is put forward.				

prove useful in deriving practical guidelines designed to assist management in influencing habit development among its IS users, such that it supports organizational needs.

From a thorough review of the general habit literature, it has become evident that there are three primary antecedents to habit development which seem to be valid across the board: frequent repetition of the behavior in question, the extent of satisfaction with the outcomes of the behavior, and relatively stable contexts. Considering the specific nature of IS usage, we are adding yet a fourth antecedent to this list: *comprehensiveness of usage* which refers to the extent to which an individual uses the various features of the IS system in question. Below we discuss each of these individual antecedents.

Frequency of Prior Behavior

An important precondition for the development of habit is that the behavior in question is performed repetitively. The more frequently it is performed, the more likely it is that the cognitive processes involved will take on an automatic nature (Ronis et al. 1989). For example, an e-mail user who checks her e-mail several times a day will eventually check her account “automatically.” By contrast, somebody who uses e-mail only occasionally may never really “get into the habit”

and will always have to form specific intentions to “do it.”

With sufficient frequency, the individual gains adequate practice, which implies that her familiarity with the behavior tends to increase such that the behavior can subsequently be performed with almost no cognitive effort. Therefore, the more often an individual performs a behavior, the more likely it is that the behavior will become habitual (see Charng et al. 1988, Wittenbraker et al. 1983).

The strength of the resulting habit, as defined by the extent to which people tend to perform behaviors automatically, is also directly related to the frequency with which the behavior is performed: the higher the frequency, the stronger the habit (Aarts and Dijksterhuis 2000). Thus, weekly performed behaviors usually give rise to weaker habits than, say, behaviors that are performed on a daily basis.

However, while repetition is a prerequisite for the formation of habit, repeated occurrence is not “habit itself” (Mittal 1988). For example, when supporting contexts shift (see the section on “Stable Context” below), or when behavior is difficult or not performed on a daily or weekly basis, past behavior is unlikely to reflect habit (Ouellette and Wood, 1998). Therefore, habit studies using frequency of behavior as a proxy measure should be considered with caution.

Satisfaction

Satisfactory experiences with a behavior are a key condition for habit development as they increase one's tendency to repeat the same course of action again and again (Aarts et al. 1997). In the IS context, online shopping offers a good illustration of the close relationship between satisfaction and habit formation (Reibstein 2002). If an online shopper evaluates her shopping experience positively, say, because she received exactly the right books at a considerable discount within the time period specified, it is likely that her willingness to shop again for books on the Internet increases. Generally speaking, once an individual has accomplished successfully his or her intended objective by performing a particular behavior, a repetition of the same behavior under similar conditions is likely. Usually, as people repeatedly try to carry out an action (with at least partial success), they tend to get better at it (Ronis et al. 1989). Associated feelings of increasing competence and/or ease may then contribute to an intensification of the level of satisfaction experienced as the behavior is performed frequently. Eventually, the satisfactory cue response links may take on an automatic (habitual) character (Verplanken and Aarts 1999).

Thorngate (1976) summarizes the relationship between satisfaction and habit development in the form of the following rule: "If a response generated in an interaction is judged to be satisfactory, it will tend to be reproduced under subsequent, equivalent circumstances from habit rather than thought" (p. 32).

Stable Context

In addition to frequent repetitions and satisfactory outcomes of a behavior, a relatively stable context is yet another important prerequisite for habit development. Stable contexts facilitate the propensity to perform repeated behaviors with minimal cognitive monitoring (Wood et al. 2002). Aarts et al. (1997) even claim that behavior is *contingent* on the opportunity to perform the behavior under similar, if not identical circumstances. A stable context is characterized by the presence of similar situational cues and goals across more or less regularly occurring situations. An example of a stable situation that triggers a user to check her e-mail may just consist of seeing her computer upon entering her quiet office in the morning.

How then does a stable context support the process of developing a habit? A stable context means that situational cues and relevant goals of the individual are *similar* (or the same) across consecutive situations. It follows that once an

individual has taken a decision to pursue a certain course of action when faced with a particular situation and if the behavior has led to a satisfactory outcome, the next time a similar situation arises the individual already knows what to do to achieve success. As discussed above, with further repetitions, the confidence of doing the right thing when taking the same action is only reinforced. Meanwhile increasingly less active decision making is required to bridge the cue-response link until finally the entire process—from detecting the situational cues to engaging in the behavior—is executed automatically. This habit-driven process may now only be interrupted if major properties of the situation change (e.g., the equipment to perform the action is no longer there or the user's goals have changed) such that a reevaluation of the usefulness of engaging in the usual course of action becomes necessary.

Comprehensiveness of Usage

The final antecedent that we would like to introduce is *comprehensiveness of usage*, which refers to the extent to which an individual makes use of the various applications offered under the umbrella of a single IS system. To our knowledge, the concept of comprehensiveness of usage (or similar) has not received any attention in the general habit literature. We assume that it has been passed over because it was simply not relevant in the various contexts within which habits have been studied so far. For example, it is easy to see that "wearing a seat belt" or "using a condom" *to a certain extent*—half or three-quarters maybe?—do not make much sense. On the contrary, and as we will explain below, being able to distinguish between individuals who use a multifeatured information system (e.g., the WWW) for many different purposes and those who don't holds considerable promise in explaining how habits form in the context of IS usage and bears considerable importance for practice.

In the case of multifunctional systems, users can choose among many different (sub)applications. In the specific case of the WWW, they can search/browse for information, communicate (via e-mail, telephony, or chat), download educational (course) materials, shop online, manage their finances, and much more. Clearly, not everyone uses such a system in the same way or to the same extent. Some users limit themselves to simple browsing while others engage in a slew of different activities. Intuitively, one may want to argue that those who use the WWW extensively are likely to develop a stronger WWW habit than those who use the WWW exclusively, say, for "searching information." We therefore propose 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. The associated higher frequency with which the system is then used fosters the individual's familiarity with the system which, in general, should positively influence the user's satisfaction and thus further promote the habit development process.

Borrowing the terminology suggested by Verplanken et al. (1994), we refer to IS habits that are characterized by high levels of usage comprehensiveness as *general*. Consequently, IS habits that are typified by limited usage comprehensiveness are labeled *specific*. According to Verplanken and Aarts, (1999, p. 106) general habits

seem [to be] particularly important to study, because these represent the behaviours that may have relatively much impact on a person's well being, in a favourable (e.g., exercising), or unfavorable sense (e.g., eating fatty food) sense.

Given that many information systems offer a broad array of functionality (the WWW is only one example) and that a general trend exists toward integrating ever more applications into a single system (directly or via portals), we think that pursuing the idea of usage comprehensiveness and thus the study of general and specific IS habits has considerable merit for both research and practice.

In sum, the strength of habit depends on the degree of frequency of prior behavior.

Distinguishing Habit from Other Related Terms and Concepts

In past research, several terms have been used as proxies for habit. Important examples are frequency of behavior, past behavior, reflexes, routines, and individual experience. In the paragraphs below we differentiate habit from these constructs. While the habit literature is relatively unanimous with respect to how the habit construct should be defined, the quality of the measurement of the construct still leaves much to be desired. Below we highlight the differences between habit and its various proxies. Understanding these differences helps to make better sense of apparently contradictory results in past research and prevents, at the same time, coming to unwarranted conclusions.

Frequency of behavior. While frequent repetition and practice are critical to the formation of habits, frequency of (past) behavior by itself only represents a necessary, but *not* a

sufficient condition (see Mittal 1988, p. 997). For one, it does not necessarily incorporate the key aspect of automaticity and "it is not clear whether all frequently performed behaviours are necessarily equivalent in this aspect" (Towler and Shepherd 1991-1992, p. 38). In his recent article, Verplanken's (2006) conducted three empirical studies and examined the relationship between frequency of occurrence and habit. He found that repetition is necessary for the formation of habit; however, habit should not be equated with frequency of occurrence, and should be considered as a distinct psychological construct involving features of automaticity, such as lack of awareness, difficulty to control, and mental efficiency. Similarly, Tuorila and Pangborn (1988a, p. 277) argue that it is inadequate to take a frequency measure as surrogate for a "true" habit measure, stating that the measurement of frequency of past behavior does not cover the conceptual definitions (or at least, covers only a small aspect of it). Further, behaviors that are performed in unstable contexts for which there aren't any established antecedents do not reflect habits since in this case the effects of past behavior are mediated by intention, and only intention acts as a direct predictor of actual behavior (Ouellette and Wood 1998). Likewise, Wood et al. (2002, p. 1281) conclude that although past performance frequency appears to be an effective predictor of future behavior, this relation is not necessarily informative about habits. Interestingly, while Thompson et al. (1991, p. 130) appeared to be of the opposite opinion, suggesting that habits *can* be operationalized as the "frequency of occurrence" of behavior, they chose to leave it out of the equation (see next point), anticipating major problems with measurement and conceptualization.

Past behavior. For ease of measurement, past behavior has been equated with habit (Thompson et al. 1991) and/or used as a substitute measure. However, Ajzen (1991) argues strongly against this practice: "Only when habit is defined *independently* of (past) behavior can it legitimately be added as an explanatory variable to the theory of planned behavior" (p. 203, emphasis added). The correlation between past and later behavior is nothing more than an indicator of the behavior's stability or reliability. Noting the problem associated with adding habit if defined as past behavior or previous use to their research model, Thompson et al. (1991, p. 126) still selected to omit the concept altogether: "Habits were excluded because, in the context of PC utilization, habits (i.e., previous use) have a tautological relationship with current use."

Reflexes are similar to habits in that they also represent behavioral sequences. However, they do not have to be learned, whereas habits require learning (Triandis 1980).

The term **routine** captures the notion that actual behavior mirrors "unvarying procedures, habits or customs that are a

regular part of daily life” (Saga and Zmud 1994, p. 75). According to this definition, routines (among other things) represent the observable consequences of habit. They describe a certain behavioral pattern (fixed and regular), but—in contrast to habit—do not determine it. In practical terms, the difference between routines and habit may be communicated best by the following example. An employee may be asked by her supervisor to follow a certain routine to get her work done. But it so happens that the employee considers the routine to be inadequate. Therefore, no matter how often she performs the routine, the employee is unlikely to turn it into a habit since its performance won’t satisfy her (satisfaction is a critical antecedent to habit development as discussed above). Instead of eventually performing the behavior habitually, the employee needs to keep reminding herself to follow it. Thus, while from the outside it may look as though the employee’s behavior is guided by habit (it is repeated frequently and under similar circumstances), it is not. Due to the lack of satisfying experiences resulting from its performance, it would not turn into a habit and thus remains controlled by intention. Consequently, any advantages habitual guidance brings along (e.g., efficiency) are less likely to materialize.

Finally, (*individual*) *experience* is another concept that is easily confused with habit. Tyre and Orlikowski (1994, p. 107, emphasis added) note, for example, that “*as users gained experience*, they established stable routines, norms, and habits for using the technology which decreased the need for discussion, coordination or effortful decision making.” To distinguish between habit and experience, it is useful to clarify the meaning of the latter. In other words, what exactly are we referring to when we claim somebody has experience? Following common practice in the IS literature of viewing experience in terms of years of performing a particular behavior, we have not found any theoretical nor empirical support in the habit literature. Experience defined this way is neither regarded to be a similar concept nor considered to be an antecedent of habit. However, if we talk about experiences in the sense of satisfactory or unsatisfactory outcomes of behavior, we can relate the term to habit in the form of the precondition satisfaction as discussed earlier in the paper. Unfortunately, lacking a good definition and appropriate instruments, previous scholars have opted to use experience as a direct substitute for habit (Bergeron et al. 1995, Thompson et al. 1991).

The Relationship Between Habit, Intention, and Actual Behavior

Defining habit so that it does not conceptually overlap with intention raises the question of *how the two constructs inter-*

relate. While the literature is relatively uniform regarding the definition of habit, we found three major views about how habit and intention may be associated with one another in predicting actual behavior (see Table 1). In the remainder of this section, we elaborate on these three perspectives, pointing out their respective strengths and weaknesses. We conclude the section by explaining in more detail the theoretical rationale behind the moderator-hypothesis, as advocated by the third group and adopted in this present study, and describe how we applied the insights of this perspective in formulating our research model of post-adoption behavior.

Prior Models

Habit as an indirect effect: Staying faithful to the tradition of the theory of reasoned action, the theory of planned behavior, and their derivatives, one group of scholars contends that there is neither a direct effect of habit on actual behavior, nor a moderating one on the relationship between intention and behavior. Instead, they argue that actual behavior is primarily driven by intention (see Table 1). The role of habit is thus reduced to a predictor of intention. Intention is modeled to mediate the effect of habit on actual behavior. It acts as a conduit through which the effect of habit together with that of attitude, social norms, etc., must funnel in order to influence behavior. The effect of habit on actual behavior is, therefore, limited to an indirect one. A review of the literature shows that, from our point of view, this model suffers from both theoretical and empirical shortcomings.

Theoretical shortcomings: Given the key property of habit to be automaticity, it becomes difficult to interpret the meaning of habit as being mediated by intention. Orbell et al. (2001) reported, for example, that habit contributed additional variance to the prediction of intention. Intention, in turn, was modeled as the sole determinant of actual (here, ecstasy) usage. Unfortunately, no convincing theoretical justification for the model nor any intuitively appealing interpretation of the finding was given. The work of Saba et al. (1998) serves as an additional example for the difficulty of developing a theoretically sound argument in favor of the mediating model. Confirming previous studies on milk consumption, Saba et al. (1998) and Saba and di Natale (1998) noted that usage of fats, despite their familiarity and ubiquity, was not directly influenced by habit. Instead, habit was found to influence intention, outweighing attitude. In a later study on meat consumption, Saba and di Natale (1999) “confirm” their initial finding, but a closer look at their results reveals that the mediating model simply represents the most parsimonious model out of a total of three that all tested with similar results. Two rival models, among others, one that modeled habit as a direct

effect, were almost equally well supported by their data. Moreover, contrasting their findings with work by Tuorila and Pangborn (1988b), Saba and di Natale (1999) noted that the fact that they did not find a statistically significant relationship between habit and actual behavior might simply have been due to how they conceptualized the construct. Unfortunately, suggestions as to how their conceptualization could be improved were not given.

Empirical shortcomings of studies supporting a mediating effect:

While severe theoretical problems with modeling the effect of habit on behavior being mediated by intentions exist, there are a number of empirical studies that support it. A closer look at these studies reveals that although reasons, such as measurement errors or choice of (inadequate) proxy measures, are given, none of the apparent empirical support is very solid. For example, in their study on goal pursuit, Bagozzi and Warshaw (1990) found that habit adds explanatory power to TRA as a significant predictor of intention. The problem here is that the authors conceptualize habit as frequency of past behavior. Doing so could represent a serious limitation since the key quality of habit—automaticity—is not accounted for. Beck and Ajzen's (1991) study conceptualizing habit as past performance shows a similar limitation. Commenting on the problem to measure habit with proxies such as "frequency of past behavior" or "past behavior," Ouellette and Wood (1998) note that in unstable contexts, frequently performed behavior requires conscious planning which means that, in this case, the effects of past behavior are mediated by intention, and only intention is a direct predictor of behavior. In short, instead of measuring habitual behavior, Bagozzi and Warshaw may have just as well measured intentional behavior. Their frequency of behavior measure does not permit differentiation between the two. The same applies in the case of measuring habit with the proxy "past performance." Thus, with such ambiguity, neither study warrants the claim that the effect of habit on actual behavior is mediated by intention.

Finally, two studies (Trafimow 2000; Quine and Rubin 1997) that model habit to influence intention instead of actual behavior did not include any measurements for actual behavior to start with. In predicting women's intention to take hormone replacement therapy, Quine and Rubin (1997) found that the beliefs of significant others, the women's personal beliefs, their degree of confidence in their ability to carry out the behavior, and the experience of similar prior behavior (a surrogate for habit) were important considerations. Likewise, Trafimow (2000) did not attempt to determine empirically the determinants of actual behavior (here, condom use), but limited his study to exploring the determinants of intention. Similar to Quine and Rubin, Trafimow found that habit contributes to explaining the variance in

intention, but—short of including actual behavior in his research model—he did not show empirically that habit is mediated by intention as opposed to exerting a main moderating effect on actual behavior. Interestingly, recognizing the omission of actual behavior as a serious limitation, Trafimow noted that instead of the indirect effect, there might indeed exist a moderating effect of habit on the relationship between intention and behavior (p. 391).

In summary, past research asserting that the effect of habit on behavior is mediated by intention suffers from three major shortcomings: (1) a lack of a convincing argument and a sound theoretical base, (2) imprecise measurement and/or conceptualization of the habit construct, and/or (3) an omission to include actual behavior in the model which would permit empirical testing of the relationship. In accordance, as these shortcomings rendered the mediating model fairly weak, we dropped it from our subsequent analysis.

Habit as a direct effect: In contrast to the work cited above, a second group of scholars maintains that habit and intention act as independent predictors of actual behavior. Charng et al. (1988, p.306) expected past repeated behavior (used as a surrogate for habit) to affect future behavior directly, rather than indirectly through behavioral intention. They reasoned that such a direct effect would imply the existence of a relatively autonomous habit in addition to the effect of conscious decision-making processes. Their study on blood donation supported this assumption: "Apparently the more donations one has made in the past, the more likely one is to donate in the future, independent of whatever overt or covert decision processes are indexed by the measure of behavioral intention" (p. 314). Mittal (1988) reported similar results. Studying seat belt usage, he found that if habitual and intentional behavior point in the same direction (i.e., both act either in favor of or against seat belt usage), both habit and intention exerted a direct effect on actual behavior.

Likewise, Tuorila and Pangborn (1988b) found support for their hypothesis that habit and intention would act in tandem as predictors of actual food consumption. With respect to the relative strength of the effect of both predictors, however, they got mixed results. While it turned out that intention was more important than habit with respect to the consumption of certain foods, the results pointed in the opposite direction with respect to others. In discussing their findings, the authors hinted that clearer results would have been obtained if habit had been operationalized more faithfully to its real nature.

Extending TRA by modeling habit as a direct predictor of actual behavior (here, chip consumption), Towler and Shepherd (1991-1992) found that habit and intention, independently of each other, influenced actual behavior. Similarly,

Saba et al. (2000) found that habit entered into the model as the most important predictor of the actual consumption of the foods analyzed in their study. Unfortunately, both the study by Towler and Shepherd and the one by Saba et al. offer only minimal theorizing (if any) to justify their findings. In fact, Towler and Shepherd point to the need for a clearer definitional and conceptual framework within which to measure and relate the habit construct to other variables.

Overall, from reviewing this research stream, it seems that the concept of habit and intention acting as independent predictors of actual behavior is partly supported. It is, however, likely that there is more to the effect of habit than commonly assumed here. Limayem and Hirt (2003) and Ouellette and Wood (1998), for example, surmise that the relationship between intention and habit is more complex than an additional simple independent effect would suggest.

Therefore, we present below the theoretical argument put forward by a third group of studies that argue for a slightly more complex relationship between habit, intention, and behavior in the form of a moderation effect.

The Case for Modeling IS Habit as a Moderator

Although Ajzen (1985, 2002) suggests that intention is the main causal mechanism behind the enactment of behavior (habitual or otherwise), the literature on habit maintains that the automaticity of behavior lessens the need to access intention (see Aarts et al. 1997). As early as 1890, James wrote, “habit diminishes the conscious attention with which our acts are performed” (Vol. 1, p. 114). Echoing James, Verplanken et al. (1998, p. 113) recently noted that “when [a] behavior is repeatedly and satisfactorily executed and becomes habitual, however, it may lose its reasoned character.” They further indicated that

such an interaction was predicted by Triandis’ (1977, 1980) model of attitude–behaviour relation. As part of this model, intentions are assumed to predict behaviour to the extent that the habit component is weak, and not, or to a lesser degree, when habit is strong (p. 113).

But how could the underlying workings of a moderation effect be envisioned? A stable context allows individuals to delegate the triggering of behavioral performance to the external environment such that cognitive processing is not required (Bargh and Gollwitzer 1994; Bargh et al. 2001). That is, on encountering the relevant environmental cue(s), the corresponding behavior is automatically triggered. Its direction and original goals do not change; they are independent of the

causal mechanism, driving it as long as the external conditions remain stable. As a consequence of repeating the same behavior successfully over and over again, the increasing automaticity of the behavior suppresses, more and more, the need to engage in active cognitive processing (James 1890). In the extreme, this process continues until it reaches a point where intention no longer exerts any influence on the behavior. Hence, behavioral intention only comes into play again when environmental conditions change (i.e., the context becomes unstable), when the behavioral response no longer meets the original goals satisfactorily, or the goals change altogether. When this happens, behavioral intention regains its pivotal role as predictor of behavior.

While scarce, sound empirical support for the moderator-hypothesis exists, direct or implied, in a number of recent studies (Montano and Taplin 1991; Ronis et al. 1989; Verplanken et al. 1998). Landis et al. (1978) reported, for example, that teachers’ habits were found to be a much stronger predictor of their classroom behavior than intentions. However, intentions became important when the habit component did not exist. Wood et al. (2002) found that the participants of their study—when involved in habitual behavior—were often thinking about other unrelated issues; however, this was not the case when they had to guide their actions consciously. Similarly, Aarts et al. (1998, p. 1364) discovered that habit attenuates the amount of information acquired and utilized before “deciding to do something.” Their findings led them to conclude that the presence of habit may set boundary conditions for the applicability of TRA or TPB. In a different study, the same authors reported that respondents who were not in the habit of performing a behavior (here, travel mode) engaged in more elaborate choice processes than those who performed the task in question habitually (Verplanken et al. 1997). Discussing these results, they remarked that “habit strength *interacted* with attitude or intention in the prediction of behavior” (emphasis added), providing evidence for the proposition that “weak habit individuals’ behavioral choices are guided by more extensive reasoning than strong habit individuals’ choices” (p. 556).

Perusing the existing evidence, we agree with Verplanken and Aarts (1999) that it is hard to draw strong conclusions from the empirical evidence for habit X intention interactions because they are often tested *in addition* to the main effects of habit and intention. However, Verplanken and Aarts also note that whereas a direct or main effect of habit may not be illuminating as to how habits and behavior relate, an interaction between intention and habit certainly sheds more light on the nature of the relationship between these two variables.

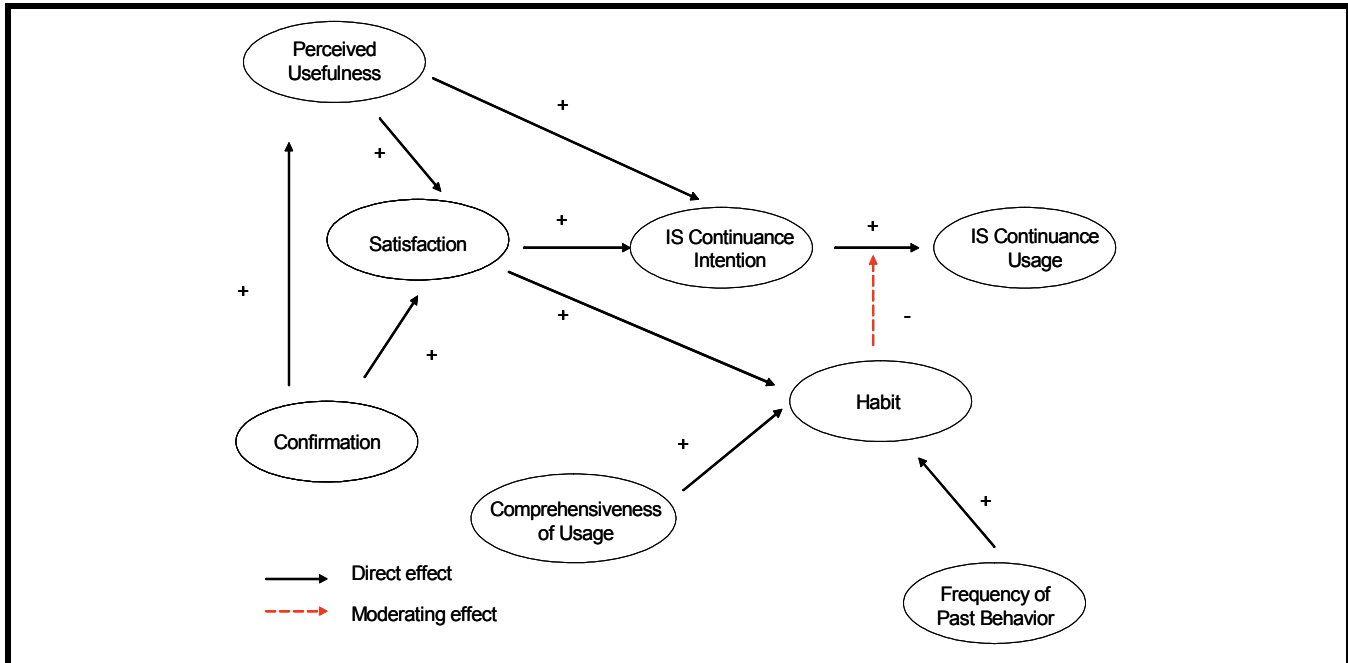


Figure 1. Research Model

Given the range of arguments as presented above, we adopted the moderation perspective for the research reported in this paper. Consequently, we summarize the conceptual relationship between intention and habit as follows: If individuals are habitually performing a particular behavior (for example, using a particular IS), the predictive power of intention is weakened. Thus, the more a behavior is performed out of habit, the less cognitive planning it involves. Applied to continued IS usage, this means that IS habit exerts a *moderating* (suppressing) effect on the relationship between intention and actual continued IS usage. The moderators—or as Rosenberg (1968, p. 85) labels them, suppressor variables (here, habit)—intercede to cancel out, reduce, or conceal a true relationship between two variables (here, intention and actual behavior). A suppressor variable is one which weakens a relationship, one which conceals its true strength. It therefore specifies under which circumstances certain effects—such as the effect of intention on actual continuance behavior—will hold (Baron and Kenny 1986), setting boundary conditions under which the effect in question (here, intention on actual behavior) can be expected to hold.

In order to clarify what this theoretical argument actually means, let us consider the following example. Individual A has the intention to continue using a particular IS, but has not established a strong habit to use it. Individual B has the same level of intention to continue using the IS, but has already

established a strong habit to use it. The question now becomes, what is the key determinant of behavior for individual A and individual B? Clearly, in case A, intention determines IS continuance. Trying to answer the question for B, the most we can say is that it is no longer intention that drives B's IS continuance behavior because the effect on behavior is suppressed by habit. Thus, A's intention would be a better predictor for her continuous IS use than B's. In other words, habit is expected to limit the predictive power of intention in case B.

In summary, modeling IS habit as a moderator does not refute the existence of the relationship between intention and actual IS continuance behavior. It merely asserts that its strength may be weakened depending on the strength of an individual's IS habit.

Integrating Habit and IS Continuance: Our Research Model

Incorporating the ideas described in the previous section into Bhattacharjee's (2001b) model, we extend it as follows (see Figure 1). Intention to continue using an IS positively relates to IS continuance *behavior* (i.e., usage). This relationship is *moderated* by the degree to which the behavior in question has become habitual.

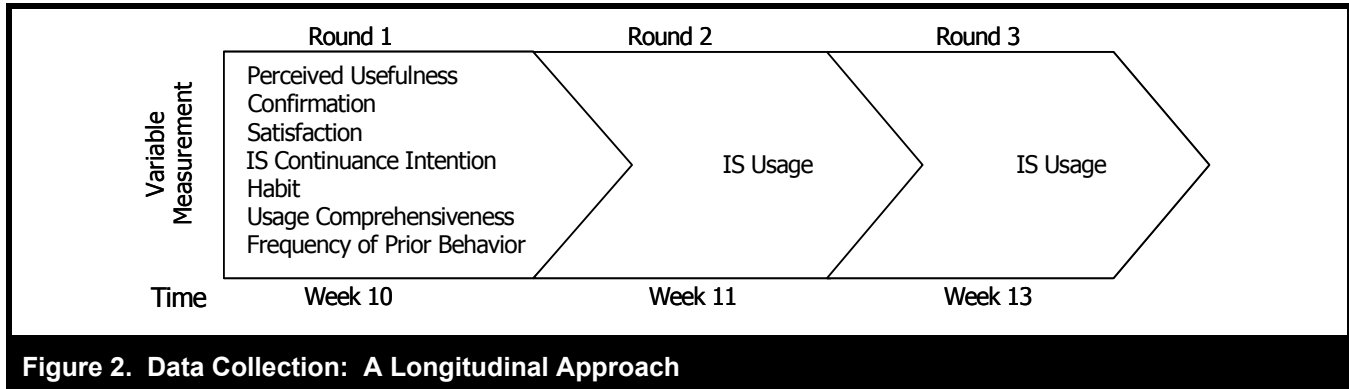


Figure 2. Data Collection: A Longitudinal Approach

Further, we incorporate our theoretical insights about habit antecedents in the following way. *Satisfaction* (a construct that already existed in Bhattacharjee's original model) is posited to be positively related to habit. Further, two new constructs—*frequency of past behavior* and *usage comprehensiveness*—are added and are positively related to habit. The remaining antecedent (*stability of context*) does not form part of the model since our data are collected in only one context and we therefore control for its impacts.

Habit is comprised of much more than satisfaction. Thus, satisfaction is the component that both intention and habit share. So, even though intentions are conscious and habits are unconscious, they both have a common root in satisfaction. The reason we can simply bypass them is because they are also both comprised of other factors.

Study Design and Method

We studied habit in the context of university undergraduate students' World Wide Web use. We administered questionnaires at three points in time. The sections below describe in detail the data collection procedure employed, the measurements used, and the type of data analysis performed.

Data Collection

We chose the context of university students' usage of the WWW since we believe that the use of this technology tends to be optional and that the students have developed different levels of habit in using it. Supporting this view, Jones (2002) reported that the majority of college students' WWW usage is not related to their schoolwork at all. In fact, most students judiciously use the WWW to keep in touch with their friends

using instant messaging and web-based e-mail. Commenting on how common the usage of WWW is among this group, Jones likens it to "turning on the tap and getting water or turning on the TV." He further noted that studying students' Internet habits is beneficial because it yields insight into future online trends. Moreover, WWW is a general application and the habit of using it falls under the category of general habit. As we mentioned earlier, Verplanken et al. (1994) also noted that studying general habits is particularly important because of the broad relevance to people's lives.

As shown in Figure 2, the data collection involved three rounds. The purpose of round 1 (week 10) was to assess perceived usefulness, confirmation, satisfaction, IS continuance intention, habit, usage comprehensiveness, and frequency of prior behavior. A self-administrated questionnaire was distributed to business students at a university in Hong Kong. Data collection in rounds 2 (week 11) and 3 (week 13) measured the students' continued WWW usage. Participation in this study was voluntary. In order to encourage them to participate in this study, students who answered the three questionnaires were invited to participate in a lucky draw for a USB memory stick.

The last four digits of the respondents' mobile phone numbers were used to match their answers across the three rounds of data collection. A total of 553 respondents answered the first questionnaire. A total of 227 respondents (129 females and 98 males) participated in all three rounds of data collection.

Measurement

Perceived usefulness, confirmation, satisfaction, and IS continuance intention were measured in Week 10, using items that have been validated in prior research. Table 2 lists the two questions for IS continuance that were assessed in weeks

Table 2. The Sample Measures	
Sources	Items
Perceived Usefulness (Davis 1989)	The WWW is of benefit to me.
	The advantages of the WWW outweigh the disadvantages.
	Overall, using the WWW is advantageous.
IS Continuance Intention (Bhattacharjee 2001b)	I intend to continue using the WWW rather than use any alternative technology.
	My intentions are to continue using the WWW rather than use any alternative technology
	If I could, I would like to continue my use of the WWW.
Confirmation (Bhattacharjee 2001b)	My experience with using the WWW was better than what I expected.
	The benefit provided by the WWW was better than what I expected.
	Overall, most of my expectations from using the WWW were confirmed.
Satisfaction (Bhattacharjee 2001b)	How do you feel about your overall experience of WWW use?
	a. Dissatisfied to satisfied
	b. Displeased to pleased
	c. Frustrated to contented
	d. Terrible to delighted
IS Continuance Usage (Kehoe et al. 1998)	In the last 7 days, how often did you use the WWW?
	In the last 7 days, how many hours did you use the WWW?
Usage Comprehensiveness	What are your primary uses of the WWW? Check all that apply: information searching; browsing/surfing; shopping; communication (i.e., hotmail, chat, etc.); reading online news/magazines; financial services/online banking; other (specify). The number of choices was used to assess WWW usage comprehensiveness.
Frequency of Prior Behavior (Bergeron et al. 1995; Szajna 1996)	In the last 4 weeks, how often did you use the WWW?
	Approximately how many times did you use the WWW during the last 4 weeks?

11 and 13. Here we followed Venkatesh and Morris (2000), who suggested employing the duration of usage along with frequency of use to more completely capture the intensity of usage. To obtain a final aggregate measure for continuous usage, we computed the average of both questions over the two periods.

Searching for an appropriate measure for habit, we thoroughly reviewed prior habit measurements. We found most scales to be composed of only one or two items; furthermore, many seemed to have been developed *ad hoc* (i.e., they did not appear to be the product of a rigorous instrument development and validation process).

Therefore, we developed the habit scale based on Churchill's (1979) robust paradigm. This approach has been widely adopted by IS researchers and has worked well in producing measures with desirable psychometric properties. Figure 3 summarizes the steps of developing the habit scale.

Following this approach, we generated a list of six items. In our current analysis, we only included the best three items (as shown in Table 3). These three items demonstrated a high degree of reliability and validity. Verplanken and Orbell (2003) assert that a well-designed self-reported measure of habit can reflect very well the extent to which a behavior is habitual.

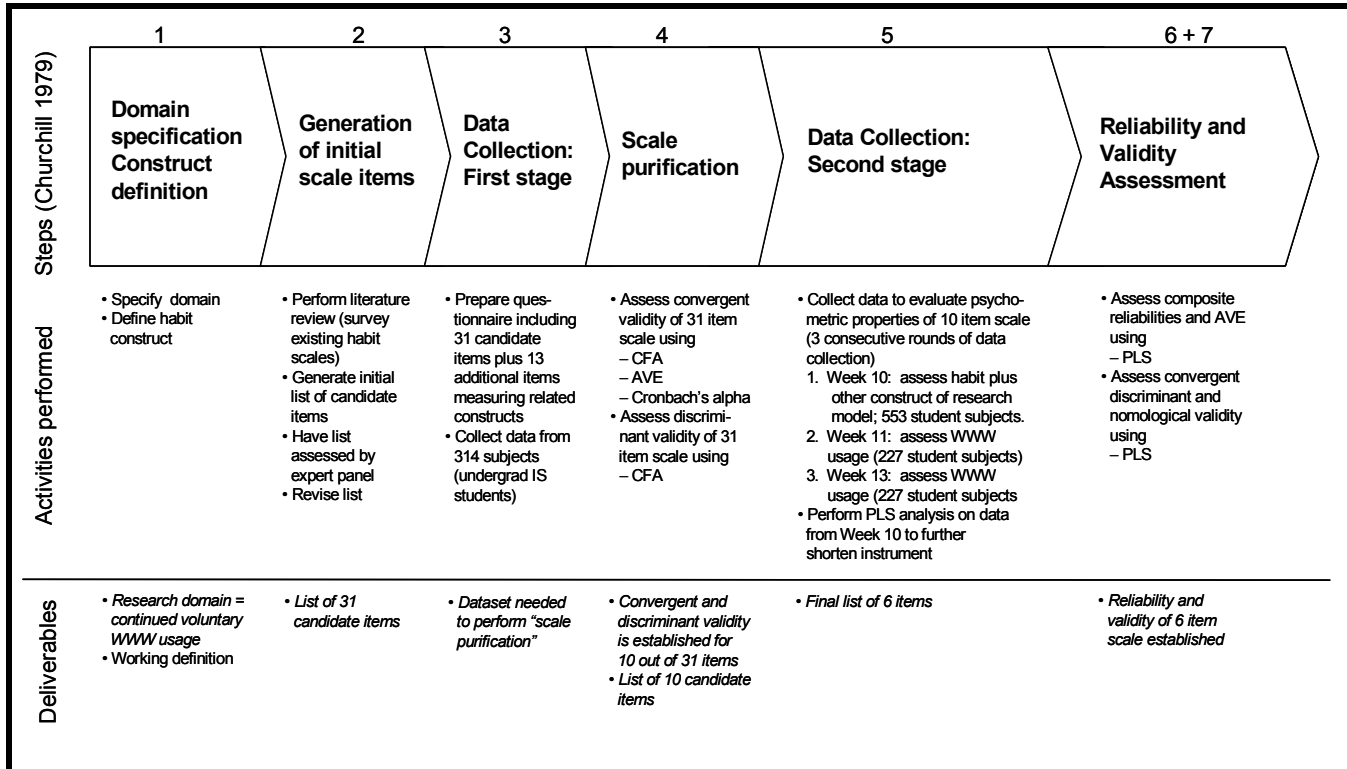


Figure 3. Overview of Scale Development Process

Table 3. Habit Items (Authors 2003)

Habit Items	Item Loading
Using the WWW has become automatic to me	0.84
Using the WWW is natural to me	0.84
When faced with a particular task, using the WWW is an obvious choice for me	0.83
Composite Reliability = 0.88 Average Variance Extracted = 0.70	

Data Analysis

The data analysis was performed in a holistic manner using partial least squares (PLS), that is, PLS-Graph version 3.00 (Chin 1994). PLS has enjoyed increasing popularity in recent years (Wold 1989) because of its ability to model latent constructs under conditions of non-normality and in some small to medium-sized samples (Chin 1998, Chin and Gopal 1995, Compeau and Higgins 1995). It allows one to both specify the relationships among the conceptual factors of interest and the measures underlying each construct, resulting in a simultaneous analysis of (1) how well the measures relate to each

construct and (2) whether the hypothesized relationships at the theoretical level are empirically true. This ability to include multiple measures for each construct also provides more accurate estimates of the paths among constructs, which is typically biased downward by measurement error when using techniques such as multiple regression. Furthermore, due to the formative nature of some of our measures and non-normality of the data, LISREL analysis was less appropriate. Equally important, PLS is better suited than CMSEM techniques for the testing of moderation effects. Finally, the item product terms approach, as suggested by Chin et al. (2003), was used to test the moderating effect of habit.

Table 4. Psychometric Table of Measurements					
Construct	Item	Weight	Loading	St. Error	t-value
Confirmation (Reflective)					
CR = 0.919 AVE = 0.791	Confirmation 1		0.857	0.032	26.946
	Confirmation 2		0.905	0.014	63.768
	Confirmation 3		0.905	0.015	60.553
Frequency of Prior Behavior					
CR = 0.773 AVE = 0.630	Frequency 1		0.806	0.127	6.361
	Frequency 2		0.781	0.102	7.622
Habit (Reflective)					
CR = 0.930 Ave = 0.768	Habit 1		0.876	0.027	33.087
	Habit 2		0.899	0.013	67.932
	Habit 3		0.873	0.020	43.137
IS Continuance Intention (Reflective)					
CR = 0.955 AVE = 0.875	IS Continuance Intention 1		0.923	0.015	62.415
	IS Continuance Intention 2		0.949	0.009	104.682
	IS Continuance Intention 3		0.935	0.012	80.238
IS Continuance Usage (Formative)					
	Usage 1	0.670		0.088	7.600
	Usage 2	0.500		0.102	4.924
Perceived Usefulness (Reflective)					
CR = 9.22 AVE = 0.797	Perceived Usefulness 1		0.900	0.015	61.667
	Perceived Usefulness 2		0.893	0.018	49.852
	Perceived Usefulness 3		0.886	0.026	33.707
Satisfaction (Reflective)					
CR = 0.908 AVE = 0.711	Satisfaction 1		0.817	0.028	29.327
	Satisfaction 2		0.888	0.017	53.361
	Satisfaction 3		0.836	0.035	24.111
	Satisfaction 4		0.830	0.029	28.966
Note 1: CR = Composite Reliability, AVE = Average Variance Extracted					
Note 2: Usage Comprehensiveness is a single-item construct					

Measurement Validity

Convergent Validity

Convergent validity indicates the extent to which the items of a scale that are theoretically related are also related in reality. Table 4 presents information about the weights and loadings of the measures of our research model. All items have significant path loadings at the 0.01 level. Weights are relevant for the formative measures while loadings are relevant for the reflective ones. The two formative items in the model with weights at 0.670 (t-value = 7.600) and 0.500 (t-value = 4.924) demonstrate a substantive contribution to their corresponding construct.

All of our reflective measures fulfill the recommended levels concerning composite reliability and average variance extracted. As shown in Table 4, all items were higher than 0.50, as recommended by Fornell and Larcker (1981). All the values of composite reliability and average variance extracted are considered satisfactory, with composite reliability at 0.773 or above and average variance extracted at 0.630 or above.

Discriminant Validity

Testing for discriminant validity involves checking whether the items measure the construct in question or other (related) constructs. Discriminant validity was verified with the squared

Table 5. Correlations Between Constructs with Reflective Measures (Diagonal Elements Are Square Roots of the Average Variance Extracted)

	PU	CONFIRM	SAT	INT	HABIT	FREQ
Perceived Usefulness (PU)	0.893					
Confirmation (CONFIRM)	0.618	0.889				
Satisfaction (SAT)	0.445	0.492	0.843			
IS Continuance Intention (INT)	0.736	0.732	0.511	0.935		
Habit (HABIT)	0.636	0.722	0.441	0.751	0.883	
Frequency of Prior Behavior (FREQ)	0.182	0.200	0.144	0.172	0.193	0.784

root of the average variance extracted for each construct higher than the correlations between it and all other constructs (Fornell and Larcker 1981). Table 5 shows that each construct shares greater variance with its own block of measures than with the other constructs representing a different block of measures.

Following Chin (1998), we further used the cross-loading method to assess discriminant validity of the scales employed in testing our research model. Table 6 reports the loading and cross-loading of all reflective measures in the model. Searching down the columns, one can see that the item loadings in their corresponding columns are all higher than the loadings of the items used to measure the other constructs. Furthermore, when searching across the rows, one finds the item loadings to be higher for their corresponding constructs than for others. Therefore, our measurements satisfy the two following criteria for discriminant validity suggested by Chin (1998, p. 321):

If an indicator loads higher with other LVs than the one it is intended to measure, the researcher may wish to reconsider its appropriateness because it is unclear which construct or constructs it is actually reflecting. Furthermore, we should expect each block of indicators to load higher for its respective Latent Variable (LV) than indicators for other LVs.

While our findings pass the more technical criteria put forward by the literature, we also have support for the existence of discriminant validity from theory. The correlation between intention and habit is relatively high at 0.751 (despite the fact that it passes the test by Chin et al. 1999). A correlation of this magnitude may, under certain circumstances, indicate that the measurement taps into the same construct. We are, however, convinced that this is not the case, the reason being as follows: From a theoretical point of view, it is not at all

unusual that habits and intentions correlate except when intentions are formed specifically to counter well established but unwanted responses (i.e., bad habits). For example, citing Bem (1972) and Festinger (1957), Ouellette and Wood (1998) argue,

this is because people are likely to form favorable intentions about acts they have frequently performed in the past. In the absence of extrinsic constraints on behavior, people are likely to infer that they intended to perform repeated acts and because of cognitive consistency pressures or through a self-perception process, they may generate consistent intentions for future responses (p. 56).

We found further support for this argument in the work of Towler and Shepherd (1991-1992) and Trafimow (2000), who reported similar or even higher levels of correlation between the two constructs than we do in the present study.

Overall, these results provide strong empirical support for the reliability and convergent validity of the scales of our research model.

Common Method Bias and Nonresponse Bias

To address the common method bias issue, we followed the technique “controlling for the effects of an unmeasured latent methods factor” as suggested by Podsakoff et al. (2003) and Widaman (1985). This technique suggested that the addition of a method factor to the latent construct model must not significantly improve the fit over the model with just the latent constructs specification. Further, the factor loading must continue to be significant in the method and latent construct model. The LISREL analyses were run on six indicators (three from the habit measure, three from the intention

Table 6. Loadings and Cross-Loadings for Reflective Measures

	Perceived Usefulness	Habit	Continuance Intention	Confirmation	Satisfaction	Frequency of Prior Behavior
PU1	0.902	0.603	0.731	0.636	0.449	0.206
PU2	0.895	0.527	0.656	0.556	0.420	0.152
PU3	0.886	0.575	0.649	0.539	0.336	0.148
HABIT1	0.553	0.876	0.627	0.640	0.345	0.162
HABIT2	0.587	0.901	0.719	0.645	0.390	0.181
HABIT3	0.546	0.873	0.714	0.662	0.354	0.162
CON INT1	0.673	0.694	0.924	0.677	0.433	0.162
CON INT2	0.704	0.697	0.951	0.692	0.483	0.161
CON INT3	0.691	0.722	0.939	0.694	0.429	0.108
CONFIRM1	0.506	0.589	0.639	0.861	0.438	0.240
CONFIRM2	0.531	0.652	0.641	0.900	0.411	0.122
CONFIRM3	0.605	0.682	0.673	0.907	0.424	0.138
SAT1	0.455	0.463	0.479	0.409	0.805	0.082
SAT2	0.403	0.379	0.440	0.430	0.890	0.137
SAT3	0.280	0.300	0.289	0.356	0.832	0.087
SAT4	0.336	0.325	0.360	0.391	0.829	0.140
FREQ BEH1	0.106	0.160	0.106	0.153	0.107	0.797
FREQ BEH2	0.191	0.155	0.139	0.143	0.106	0.799

measure) with two latent constructs (habit and intention) and a method factor. The LISREL analyses showed that the fit of the model did not improve significantly with the addition and specification of method parameters over the latent construct specifications alone.

In order to test for nonresponse bias, we compared the demographics of students who participated in the first round, but not in the last, to those who participated in the all three rounds of the study. Our findings indicated that there were no significant differences between them, leading us to believe that a nonresponse bias does not exist.

Results

Table 7 shows the descriptive statistics of the variables included in the research model. To demonstrate the importance of the IS habit construct in the context of IS continuance in

general, and its moderating effect in particular, we have organized the remainder of this section as follows. We first present the results of the IS continuance model *without* incorporation of the habit construct (*baseline model*). Then, we report the results of testing the IS continuance model, modeling habit as (1) a direct effect on IS continuance, and (2) a moderating effect on the relationship between intention and IS continuance. Finally, we conducted the hierarchical difference test to compare the explanatory power of the three models described above.

Baseline Model (Without Habit)

Figure 4 shows the results of testing the baseline model without incorporating the habit construct. This model accounts for 18.7 percent of the variance in IS continuance usage, 58.4 percent of the variance in IS continuance intention, 27.4 percent of the variance in satisfaction, and 38.1 percent of the variance in perceived usefulness. All path coefficients were significant, as hypothesized, at the 0.01 level.

Construct	Minimum	Maximum	Mean	Std. Deviation
Confirmation	1.67	7.00	5.01	0.92
Frequency of Prior Behavior				
Frequency 1	3.00	7.00	5.50	1.01
Frequency 2	1.00	100.00	12.79	12.31
Habit	1.00	7.00	5.04	1.02
IS Continuation Intention	1.33	7.000	5.46	1.08
IS Continuance Usage				
Continuance 1	1.00	6.00	3.37	1.16
Continuance 2	1.00	6.00	3.46	1.23
Perceived Usefulness	2.00	7.00	5.38	0.98
Satisfaction	2.00	7.00	4.95	0.89
Usage Comprehensiveness	0.00	6.00	2.36	1.46

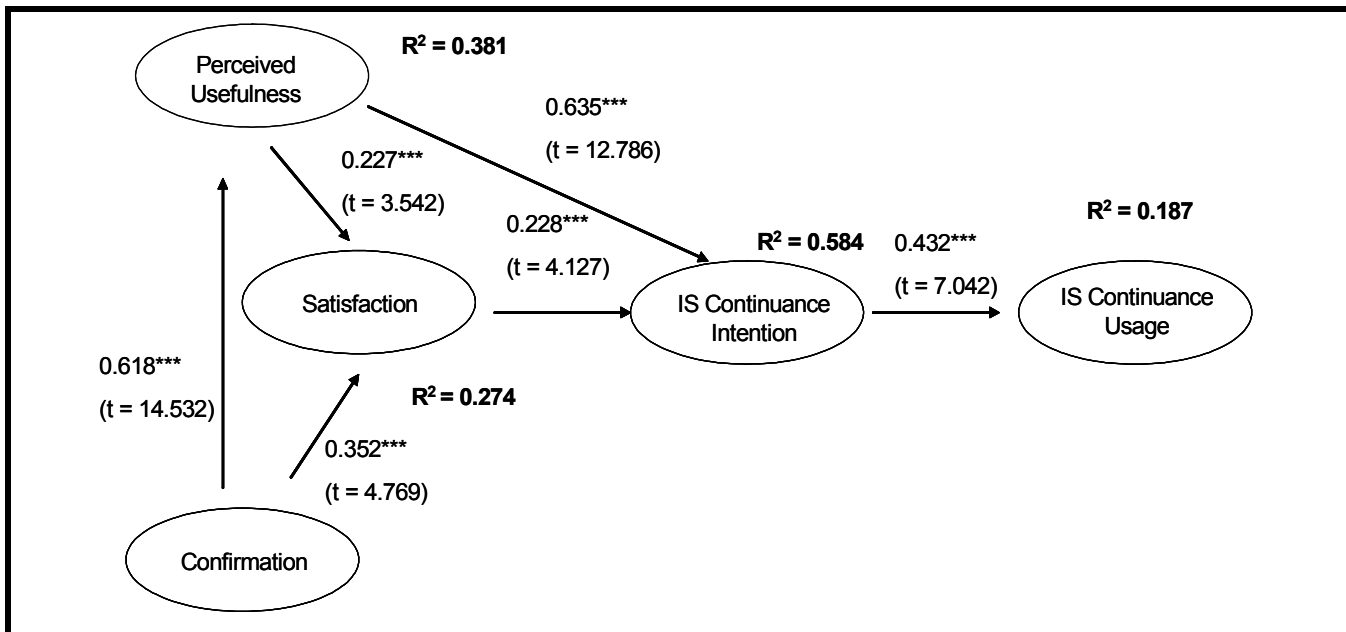


Figure 4. Baseline Model (Without Habit)

Habit as a Direct Effect

Figure 5 illustrates the continuance model with habit having a direct effect on IS continuance usage. The results of our analyses showed that standardized beta for habit and intention of 0.235 and 0.609 respectively, and an R² of 0.211 for IS continuance usage.

Habit as a Moderator

As indicated in Figure 6, our research model accounts for 26.1 percent of the variance in IS continuance usage, 58.4 percent of the variance in IS continuance intention, 22.4 percent of the variance in habit, 27.4 percent of the variance in satisfaction, and 38.1 percent of the variance in perceived usefulness. All

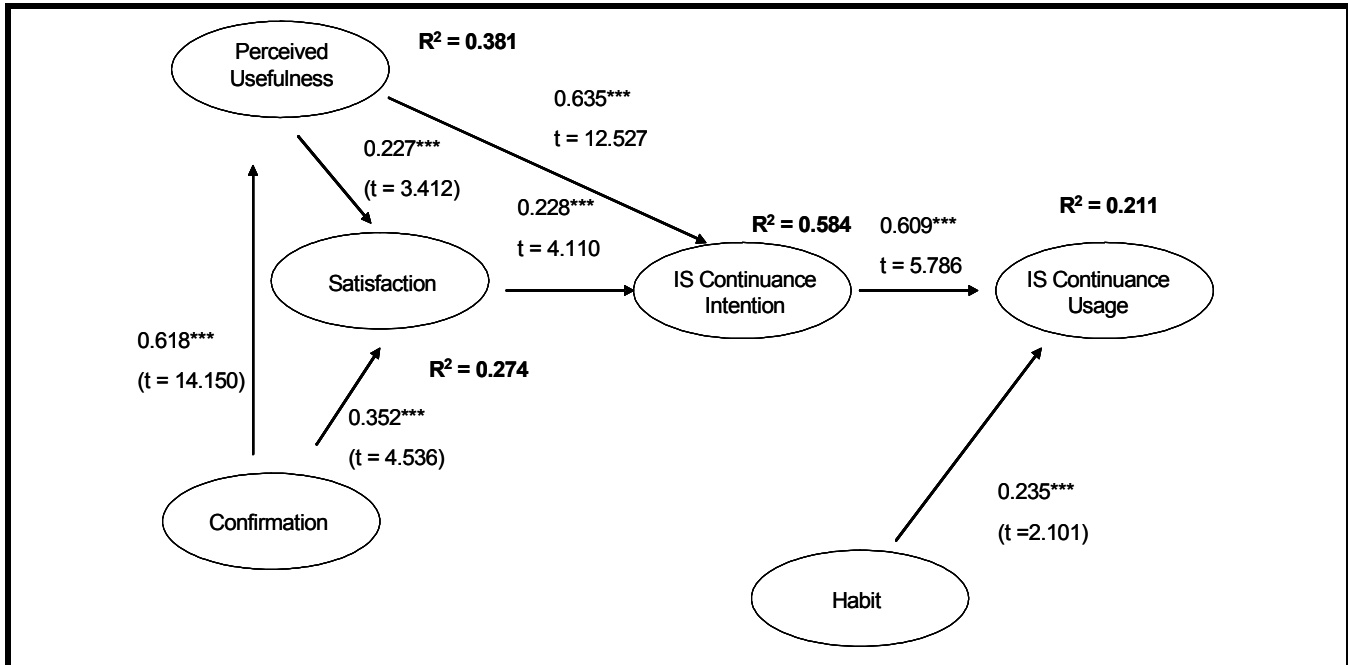


Figure 5. Competing Model: Habit as a Direct Effect

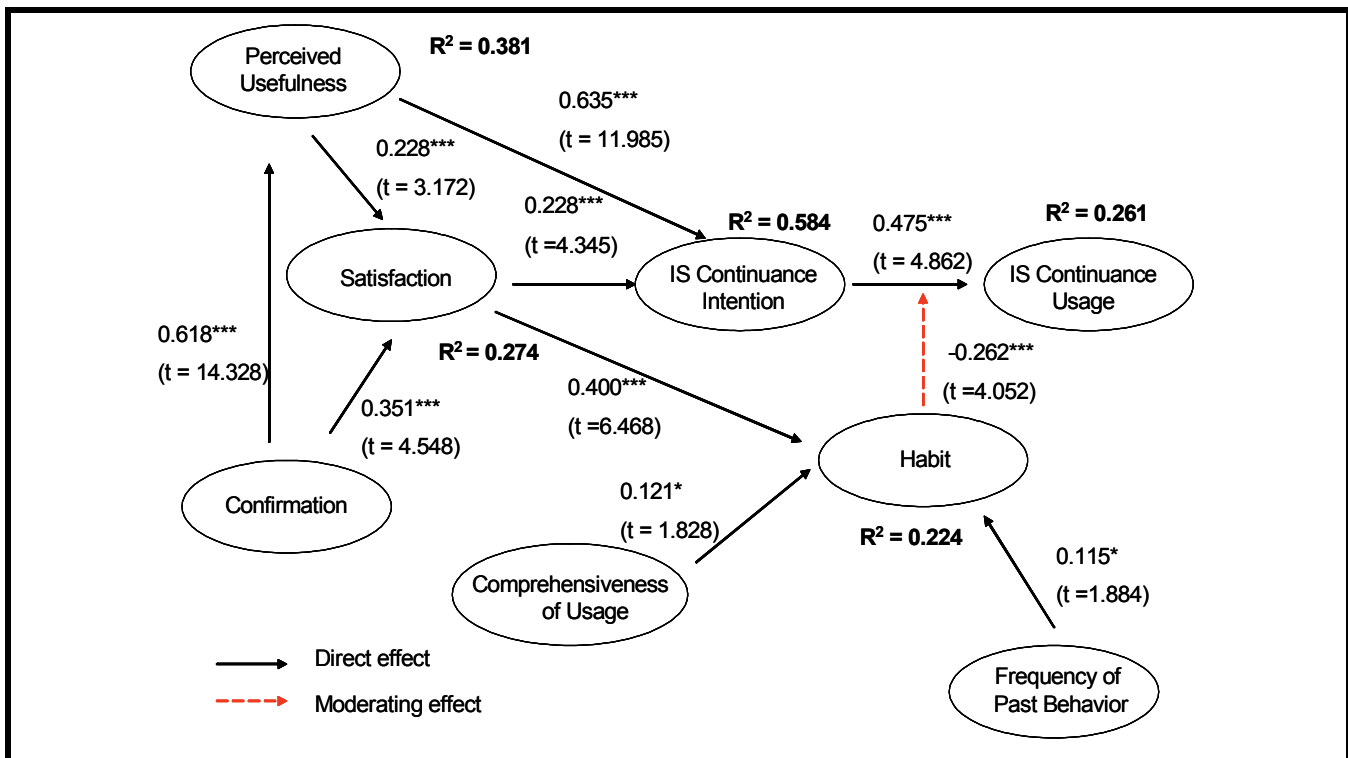


Figure 6. Research Model: Habit as a Moderator

Table 8. Competing Models

	R ²	f-statistics*	f-statistics
Baseline Model (Without Habit)	0.180		0.099
Research Model (Habit as a Moderator)	0.261	0.063	
Habit as a Direct Effect	0.211		

*Note: f-statistics tests the results of two models (i.e., one with and one without the interaction construct; Chin et al. 1996)

path coefficients were significant. When testing for interaction effects using PLS, Chin et al. (1996) recommend following a hierarchical process similar to multiple regression where one compares the results of two models (i.e., one with and one without the interaction construct). One can also compare the R² for this interaction model with the R² for the main effects model, which excludes the interaction construct (see Figure 6). The difference in R-squares is used to assess the overall effect size f^2 for the interaction where .02, 0.15, and 0.35 have been suggested to be considered as small, moderate, and large effects, respectively (Cohen 1988). It is important to understand that a small f^2 does not necessarily imply an unimportant effect. The testing for moderation effects can easily lead to making major mistakes. In this study, we have checked our procedure, data, and interpretation against a check list provided by Carte and Russell (2003). Our analysis passed the tests successfully.

Based on the hierarchical difference test, the interaction effect was found to have an effect size f^2 of 0.063 which represents a medium effect (Chin et al. 2003). The inclusion of the interaction effects (see Figure 6) indicates an equally strong beta of -0.262 increasing the R² for usage to 0.261. The model in which habit is proposed to moderate the link between intention and continued usage possesses a significantly higher explanatory power than the baseline model.

The moderation effect of habit has a significant effect on the relationship between IS continuance intention and IS continuance usage.

Model Comparisons

Finally, to compare the explanatory power of the baseline model, direct effect model, and moderating effect model, we conducted another hierarchical difference test. As indicated in Table 8, the model in which habit is proposed to moderate the link between intention and continuance usage possesses a significantly higher explanatory power than the other two models.

Discussion and Conclusions

Limitations

Despite our careful study design, we cannot claim that the results obtained here will hold equally well in the context of other information technologies. First, the WWW is a very general application that can be put to use for many different purposes. It is thus likely to promote the formation of general habits (Verplanken et al. 1994). Although we expect our model to hold also in the case of more specific applications (e.g., a particular e-mail application, usage of a sales automation application), an empirical confirmation of this assumption is needed. Due to the as-yet largely unexplored differences between general habits (e.g., a habit to use the WWW) and specific habits (e.g., usage of a *particular* e-mail application), it is conceivable that continued IS usage is affected differently depending on the type of habit (general versus specific) in question.

Second, another potential limitation of this research is that the data were collected from university students. Since we investigated WWW usage under the voluntary usage conditions common in university contexts, our results should hold for systems used in organizations with similar usage conditions. While it is often claimed that a university context is very different, in our opinion, this is only partially true. Similar to other (business) organizations, educational institutions, such as universities, are governed by policies and rules (e.g., with respect to what software can be used on campus) and hierarchies. Further, they have their own cultures and sub-cultures, requiring individuals (including students) to be accountable for their own work, as well as that of others (for example, in team work), and so forth. We therefore think that despite the often cited divide between a university context and that of a "normal organization," sufficient similarities exist to warrant the conclusion that the results of this study could bear relevance for other organizations as well. Clearly, more research is needed to confirm the generalizability of the results to other types of organizational settings, that is, those characterized by strictly regulated usage (e.g., where less IS

choices are available, more uniform IS-training is provided, etc.).

A third limitation to the study related to the difference in stability of context. Although we argued above that a stable context is an important antecedent of habit formation, we did not include this variable into our model. As we collected the data in one setting only (university), we controlled only for the effects of this variable. By doing so, we assumed that the single study context represents a stable context for all survey respondents. Future studies need to verify this assumption by focusing on the implications of differences between stable and more volatile contexts to better understand how important the effect of this antecedent is in the context of IS habit formation. Our expectation is that adding the stability of context as antecedent of habit will increase the explained variance of this important variable significantly and thus enhance our understanding of the habit formation process.

Fourth, satisfaction is posited to be positively related to habit in our research model. However, there exists a reciprocal relationship between satisfaction and habit. Future research should incorporate this view into the research model and design.

Fifth, we are using only an interval scale (as opposed to a ratio scale) for our measures. According to Carte and Russell (2003), a meaningful interpretation of the *direct* effect of habit on behavior becomes impossible. Therefore, the limited nature of our data prevents us from concluding that when habit increases, it becomes the main driver of the behavior.

Finally, even after extending Bhattacharjee's (2001b) model considerably, we explain only 26 percent of the variance in IS continuance behavior. Although Meister and Compeau (2002) argue that the typical explained variance of prior research investigating IS usage is around 30 percent, we believe that further refinement of this model is warranted (see the "Implications for Theory and Research" section for possible avenues of future research).

Summary of Findings

This study is one of the first that thoroughly examines the role of habit in the context of IS continuance. Specifically, we introduced a definition of the habit construct tailored to the IS context and explored the various drivers of IS habit formation, partly relying on past research in the area of habits, partly moving beyond extant research to accommodate the specific nature of IS habits. As a result, we identified the following variables as habit antecedents: satisfaction, frequency of prior

behavior, stability of context, and usage comprehensiveness. We further built and tested a theoretical model that integrates the habit construct along with its antecedents into recent work on IS continuance. Habit is proposed to exert a moderator (suppressor) effect on the relationship between intention and continued IS usage behavior. Modeling habit this way means that the stronger the habit, the lesser the prognostic power of intention on the actual behavior. Or, as Ajzen (2002) put it,

the habituation perspective suggests that intention should be a relatively good predictor of later behavior in an unstable context, but in a stable context, where the behavior is presumably under direct control of stimulus cues, their predictive validity should decline (p. 12).

Finally, we compared the explanatory power of our research model with the baseline model. As shown in the "Results" section, our results support the view that IS habit acts as a moderator of the relationship between intention and IS continuance behavior.

Implications for Theory and Research

From the stimulus of the insights from this work, we would like to raise the research communities' awareness with respect to several issues. The first issue concerns the practice of studying technology acceptance by limiting data collection and analysis to the explanation of intention assuming that intention will drive actual behavior in predictable ways (Legris et al. 2003). At least in the case of IS continuance, this is not necessarily true. While we are not questioning the assumption that intention exerts a direct effect on actual behavior (neither in the case of IS adoption nor IS continuance), circumstances might exist under which this effect is partly or even entirely suppressed. In these cases, intention could no longer be regarded as a reliable predictor of actual behavior. This confirms the findings of Warshaw and Davis (1984, 1985a, 1985b), that the relationship between intention and behavior is more complex than previously thought. Consequently, one important implication of our research is to urge scholars studying technology acceptance in general, and/or IS continuance in particular, not to stop at intention, but to include measurements for actual behavior in their methodological design. For one, this practice would prevent scholars from making potentially erroneous conclusions. Further, it would lend additional credibility to the results and conclusions obtained.

Second, we purport that our findings shed new light on research conducted in the past. In various studies on tech-

nology acceptance, authors report that no significant relationship exists between intention and actual behavior (see Dishaw and Strong 1999; Limayem et al. 1999). Apparently, these findings contradict the mainstream view established in the field. It is here that the theoretical relevance of detecting the moderator effect that habit exerts on the relationship between intention and continued usage behavior becomes evident. Commenting on this issue, Rosenberg (1968, p. 91) notes:

Despite the absence of correlation, a relationship may exist and the theory may in fact be supported. A good deal of theoretical confusion may thus be avoided if one takes account of suppressor variables—variables which produce an absence of a relationship, or a weak relationship—when actually a presence of relationship, or a strong relationship, exists.

It follows that contradictory findings in previous studies may neither be due to erroneous theorizing nor methodological weaknesses, but merely reflect the fact that the behavior in question was performed in a habitual way and therefore not (or only partly) under the control of intention. Revisiting these studies by taking a closer look at the usage characteristics of the respondents may produce interesting evidence in support of this idea.

Third, our findings show that the link between intention and continued IS usage is rather complex. Adding habit as a moderator is a first step toward better understanding of this relationship. Future research should continue to explore the nature of this link in order to increase the variance explained in continued IS usage. For example, it would be interesting to know if, in the extreme case, when the suppressing effect of habit is essentially nullifying the effect of intention, the IS habit becomes the main driver of continued IS usage.

Fourth, an additional promising avenue of research may consist of further exploring the process of IS habit formation. Research pursuing this goal would both shed additional light on the antecedents of habit formation and the process itself. Specifically, in this study, we advanced theory with respect to three drivers of IS habit formation: satisfaction, frequency of past behavior, and comprehensiveness of usage. However, since we cannot exclude that there are additional habit antecedents relevant to the IS context, we believe further study is needed. An obvious first step would consist of the incorporating the habit antecedent “stability of context” into the model. Beyond that, other new variables could be identified and added to the model, provided that they increase the variance explained in the habit construct.

Fifth, future studies could answer more precisely the question whether the various antecedents of habit are interrelated in any way. Intuitively, comprehensiveness of usage as well as satisfaction appear to interact with the frequency of usage. Future studies should thus seek to disentangle these effects and test (beyond the direct effect on IS habit), for example, for possible moderation effects of comprehensiveness of usage and satisfaction on frequency of usage. An interesting question in this context would then be how to establish a scale to measure the level of comprehensiveness of usage. One straightforward option may be to count the numbers of features available (at a certain level of specificity) and compare those with the number of features actually used. The problem with such a measurement would, however, be that it does not take into account the relative importance (e.g., for getting a job done) a particular feature may have in the overall usage context of the IS system (or technological device in question). Thus, an important task for future research is to establish a certain type of weighting (e.g., with respect to the importance to their prospective users or the main purpose of the IS) of the individual features to more precisely capture the real meaning of a general, as opposed to a specific, habit.

Sixth, despite the fact that in this study we did not find any major differences in usage behavior across time, it is unlikely that usage behavior won't eventually change. Therefore, future research that pays special attention to changes over longer periods of time might shed additional light on the habit development process and thus on the nature of IS continuance. In this context, ideas derived from structuration theory (see Orlikowski 1992) may be useful as they focus explicitly on the interdependence of developments at different levels of analysis over time, assuming that IS usage is not deterministic but a consequence of the continuous interplay between human agency and institutional context. Further, a structural lens may also serve well in studying the emerging relationship between habit development at the individual level (the focus of this study) and changes in work routines and practices at the organizational level and vice versa.

Finally, beyond the investigation of primarily theoretical issues, we also perceive a need to examine more application-oriented problems. An interesting research project could explore the process of habit formation at different levels of the organization. Lindbladh and Lyttkens (2002, p. 451) found, for example, that “people in lower social positions are more inclined to rely on their habits and are accordingly less likely to change their behavior.” Applied to the context of continued usage of IS in organizations, this insight could lead to a number of interesting studies focusing on the identification and comparison of different habit types across organizational levels.

Table 9. Examples for IS Management Guidelines to Encourage Continued Usage of New Information Systems

Key Finding	Management Goal	Examples of Related Guidelines for Management
IS habit exerts a <i>moderation effect</i> on the relationship between intention and IS continuance behavior.	<ul style="list-style-type: none"> • Evaluation of likelihood that IS users would respond positively to attitude related measures designed to influence their current usage behavior 	<ul style="list-style-type: none"> • Measure strength of usage habits to tailor IS training (by using our 4-item habit measurement scale): to adjust training procedures to level of usage habit.
Satisfactory experiences are key to IS habit development.	<ul style="list-style-type: none"> • Getting IS users quickly into the habit of using a new system (fostering of satisfactory usage experiences) 	<ul style="list-style-type: none"> • Establish attractive incentive schemes to reward system usage. • Link incentive scheme very closely to IS usage behavior (effects should relate directly—objectively measurable, clear unit of measurement) to desired behavior, and have them materialize quickly). • Reiterate advantages of IS usage relating them to palpable sources of satisfaction. • Quiz users about their satisfactory experiences and encourage their spreading throughout the user community.
	<ul style="list-style-type: none"> • Preventing IS users from being discouraged to use a new IS due to usage problems. 	<ul style="list-style-type: none"> • Manage user expectations properly, don't overhype: to avoid unnecessary dissatisfaction with using the IS. • Engage users to help each other (create user-hierarchy): to promote satisfactory experience, avoid the problem of letting reasons for dissatisfaction with the IS linger for too long. • Establish well-working help-desks/customer service sites. • Encourage problem reporting: Preventive measure to avoid spreading of dissatisfactory usage experiences and/or to take care of problems quickly. • Avoid training when IS to be implemented is still in great flux (very likely with package applications): to avoid that early users become annoyed by constant system changes und thus develop negative usage experiences.
The more <i>frequent</i> a particular IS usage behavior has been performed the more likely it turns into a habit.	<ul style="list-style-type: none"> • Getting IS users quickly into the habit of using a new IS 	<ul style="list-style-type: none"> • Time constraints with respect to IS training should be removed: IS training should not be relegated to "after hours" or lunch time. Instead, it should be made an important part of the user's job. In extreme cases, overtime should be paid. • Encourage hands-on training: to promote IS usage. • Ensure easy access to needed facilities (workstations, etc.) to practice IS usage: obviously a new IS can only be used if available and working properly. • Encourage frequent usage through incentives (e.g., monetary) such as prizes and bonuses.
The more <i>comprehensive</i> the usage of an IS, the more likely its use becomes habitual.	<ul style="list-style-type: none"> • Getting IS users quickly into the habit of using a new IS by encouraging them to use the system in as many situations as possible and useful (avoid niche usage) 	<ul style="list-style-type: none"> • Offer training programs instead of one-time training events (avoid overload, encourage practice in between sessions): to permit users to gradually develop their knowledge about the IS while giving them time to practice usage and gaining satisfactory experiences. • Offer training for key applications as well as others: to permit users broaden their horizon with respect to what the new IS could do for them. • Promote experimentation with new (or more advanced) applications/features (e.g., through rewards). • Promote knowledge sharing among users (e.g. through incentive schemes, knowledge contests, self-help groups, etc.): users may inform others about additional useful features in the system.

Implications for Practice

If our findings were to be successfully replicated in organizational settings with other business applications, they could be of value for practitioners for the following reasons. The introduction of new information systems (e.g., e-business applications, customer relationship management, ERP, new communication media) may put management in situations where they are confronted with error-prone, lower than expected, declining usage rates or even complete discontinuance. We believe that management may benefit from understanding the nature of habit and habit formation when faced with situations that call for the promotion of certain IS-related behaviors. Understanding the nature and associated benefits of IS habits will not only urge management to contemplate whether to promote the habitualization of certain behaviors, but will also help it take appropriate action when it comes to creating a habit-conducive environment. As summarized in earlier, habitual behavior tends to be highly efficient and less prone to error. Repetitive IS-related activities that need to be performed quickly but accurately, such as order entry, recording of customer problems/solutions, or payroll processing, represent excellent candidates for habitualization. If triggered automatically, IS usage is also less prone to discontinuance.

Management's typical response to error-prone usage, underutilization, or discontinuance consists of developing rational arguments and persuasion tactics to influence the users' behavior. Such measures generally target rational thinking processes and may thus turn out to be ineffective if the behavior is under the influence of habit. Supporting this point, Verplanken and Aarts (1999) note that in the case of strong habits, it is an ill-fated strategy to provide information. In fact, their studies suggest that the attitude and intention of strong-habit individuals are unrelated to the subsequent behavior. Similarly, Towler and Shepherd (1991-1992, p. 44) argue that habit may present a problem, since if people do not balance the expected benefits and costs of performing particular actions, but rather act as they have done in the past, interventions aimed at changing beliefs may prove ineffective.

To help overcome these problems, we designed a set of common-sense guidelines we believe to be useful under conditions in which IS usage behavior is partly or entirely habitual. The guidelines are derived from the findings of this study and thus are based on the assumption that intention is no longer the main driver of continued IS usage. Instead, they exploit the key insights of this study—the moderating effect of habit on the relationship between intention and IS continuance and the nature of its antecedents—proposing tactics to influence habit development that go beyond the usual attempt to convince IS users with rational arguments to

change their behavior. In Table 9, we offer suggestions and guidelines for IS management, examples of which are based on our findings and key insights.

In conclusion, considering that this study has contributed to a better understanding of IS habit in particular, and IS continuance in general, as well as raising many interesting questions for future research, we hope that it triggers additional theorizing and empirical investigation aimed at a better understanding of IS users' behavior in the later usage phases. As suggested, a refined knowledge in this area may ultimately benefit IS management and users alike in their attempt to cope successfully with the challenges brought about by ever more exciting and versatile IS applications.

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