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Choosing a Fit Technology: Understanding Mindfulness in Technology Adoption and Continuance

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Choosing a Fit Technology: Understanding Mindfulness in Technology Adoption and Continuance

Abstract

Mindfulness is an important emerging concept in society. This research posits that the user's mindful state when adopting a technology is a crucial factor that determines how the technology will fit the task context at the post-adoption stage and thus has profound influence on user adoption and continued use of technology. Based on the mindfulness literature, this research conceives of a new concept, namely mindfulness of technology adoption (MTA), as a multifaceted reflective high-order factor. An MTA-TTF (task-technology fit) framework is then developed and integrated into the Cognitive Change Model to develop a research model that delineates the mechanisms through which MTA influences user adoption and continued use of technology. The model was examined by a longitudinal study of students' use of wiki systems. The results suggest that a mindful adopter is more likely to perceive a technology to be useful and to choose a technology that turns out to fit his/her tasks. Hence, mindful adopters are likely to have high disconfirmation, perceived usefulness, and satisfaction at the post-adoption stage. The findings have significant implications for IS research and practices.

Keywords: Mindfulness, task-technology fit, user adoption and continuance of technology, longitudinal study.

Introduction

Mindfulness is receiving an increasing amount of attention in society. It has proven benefits in improving health and decision-making (*TIME* magazine, February 2014). This research aims to introduce the concept of individual level mindfulness to the IS literature, believing that mindfulness should play an important role in user adoption and continued use of technology. This is an important topic in light of the fact that people often adopt a technology in a less mindful manner, ignoring their own local contexts, and/or applying social rules rather than their

own information when adopting a technology (Fiol & O'Connor, 2003; Nass & Moon, 2000; Sun, 2013). As a result, an adopted technology often turns out to be a bad fit in local contexts at the post-adoption stage (Abrahamson, 1991). Mindfulness, broadly defined as a state of alertness and lively awareness (Langer, 1989b), can be a crucial factor at the adoption stage for choosing a technology that will be a good fit after adoption. In a mindful state, a person is consciously aware of the context and carefully evaluates the specific qualities of the technology in relation to alternative technologies. A mindful person also scans the environment more thoroughly and thus makes more discriminating decisions that best accommodate his/her own context (Fiol & O'Connor, 2003). As a result, we believe that mindfulness can help people make more rational adoption decisions, which manifests as task-technology fit during the post-adoption stage.

The necessity of this research lies in the fact that the existing literature on user adoption and continued use of technology —as can be represented by the expectation-confirmation theory (ECT) related literature (e.g., Bhattacherjee, 2001; Bhattacherjee & Premkumar, 2004)— has not been sufficient in dealing with the rational aspect of adoption decision-making. ECT-related research somewhat assumes that users always make the best use of their information at the adoption stage to form user beliefs and choose the technology that best fits their context (i.e., efficient-choice assumption) (Abrahamson, 1991). The fact that people may not always form realistic and well-founded beliefs is largely under-studied. This research aims to bridge this gap by decoding how people can make mindful adoption decisions and how such decisions can lead to adopting a technology that better fits the user's local context at the post-adoption stage. Specifically, this research attempts to answer a research question: *How can mindfulness help individual users adopt an information technology that best fits their local contexts and that they are more likely to continue using?*

It is important to study mindfulness at the adoption stage given the potential waste of time and resources —which sometimes could be substantial and irreversible (i.e., sunk costs)— if an

adopted technology turns out to be a poor fit at the post-adoption stage. Choosing a fit technology can also help avoid opportunity costs (the missed opportunity to reap the benefits of a more efficient technology) and user regret (Loomes & Sugden, 1982).

To approach the research question, we first develop a new concept of Mindfulness of Technology Adoption (MTA). It then leads to a framework of MTA-TTF (task-technology fit) based on the mindfulness and TTF literature. We then synthesize the MTA-TTF framework and ECT-based Cognitive Change Model (Bhattacherjee & Premkumar, 2004) to develop a research model that delineates the influence of MTA on user adoption and continued use of technology. The research model is examined in an empirical study of students' use of wiki systems.

This research contributes to IS research in several ways. First, this research systematically conceptualizes a new concept, MTA. Existing IS research has studied mindfulness primarily at the organizational level (e.g., Butler & Gray, 2006; Fichman, 2004; Swanson & Ramiller, 2004). Yet, mindfulness has rarely been applied to studying technology adoption at the individual level. This research bridges this gap by systematically conceptualizing MTA at the individual level as a multi-faceted reflective second-order construct. Second, this research proposes an MTA-TTF framework, which complements ECT and contributes to IS continuance literature. Specifically, the MTA-TTF framework entails the rational sphere of user adoption decision-making; whereas ECT entails the attitude/behavior sphere (Dishaw & Strong, 1999). This distinction is necessary because people may adopt a technology that they do not like because it fits the task. A combined view of both the rational and attitude/behavior aspects can help us obtain a more comprehensive view of user adoption and continued use of technology. In addition, the MTA-TTF framework enriches the general research on mindfulness. Third, this research also contributes to IS research in methodology. We systematically developed a scale for measuring the four-dimensional construct of MTA, which can be used by future IS researchers.

Theoretical Background

Mindfulness

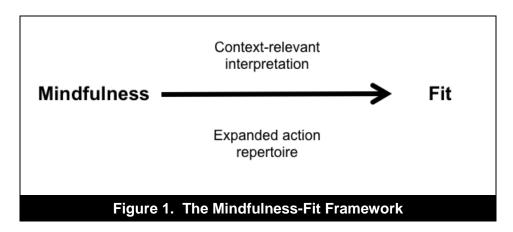
"We're in the midst of a popular obsession with mindfulness as the secret to health and happiness — and a growing body of evidence suggests it has clear benefits."

- Source: *TIME* magazine (February 2014)

As put forward in the above quotation from TIME magazine, mindfulness is emerging in many fields — such as clinical research, education and learning, marketing, management, organizational behavior — as a key to making optimal decisions and to achieving long-term benefits (Baer, 2003; Brown & Ryan, 2003; Dane, 2011; Fiol & O'Connor, 2003; Langer, Hatem, Joss, & Howell, 1989; Langer, 1989a; Levinthal & Rerup, 2006; Shapiro, Carlson, Astin, & Freedman, 2006; Weick, Sutcliffe, & Obstfeld, 1999). A growing amount of empirical evidence has proven that mindfulness has positive influences on physical and psychological well-being, interpersonal relationship quality, work performance, and behavioral regulation (Baer, 2003; Brown & Ryan, 2003; Dane, 2011). Appendix A summarizes a literature review on mindfulness. Originating from philosophy and religious studies, mindfulness is "a state of alertness and lively awareness, which is specifically manifested in typical ways" (Langer, 1989b, p.138). Furthermore, Langer (1989a: 1997) articulated four dimensions of mindfulness: (a) active information seeking and processing, (b) constant creation of new categories, (c) awareness of local specifics, and (d) openness to multiple perspectives. More recently, Dane (2011) summarized existing research on mindfulness and defined mindfulness as a state of consciousness in which attention is focused on present-moment external (environmental) and internal (intrapsychic) phenomena.

An examination of existing research on mindfulness (Appendix A) has suggested a generic framework of mindfulness and fit, as depicted in Figure 1. The fit described in the framework can be mental or physical fit (e.g., Alexander, Langer, Newman, Chandler, & Davies, 1989;

Brown & Ryan, 2003) or fit with the dynamic job environment (e.g., Dane, 2011; Hülsheger, Alberts, Feinholdt, & Lang, 2013).



Mindfulness can lead to fit through two mechanisms: context-relevant interpretation of information and expanded action repertoire. Individuals engaging in context-relevant interpretation are reluctant to simplify interpretations of real-time information. As a result, the information scanned mindfully is more likely to be "focused on details relevant to current organizational conditions." (Fiol & O'Connor, 2003, p.62). A mindful person will actively process information relevant to the current contexts regardless of its degree of consistency with prior experience (Louis & Sutton, 1991). Such a relevant information scanning fosters a better alignment between the decision and the context (Fiol & O'Connor, 2003). Mindfulness is believed to cause a fundamental shift in perspective and subsequent positive outcomes through self-regulation, values clarification, cognitive, emotional, and behavioral flexibility, and exposure (Levinthal & Rerup, 2006).

Second, mindfulness can also lead to fit with the context through an enlarged action repertoire (Fiol & O'Connor, 2003). Mindfulness helps the development of an expanded action repertoire that can be readily employed to match changing environments (Dane, 2011; Fiol & O'Connor, 2003; Shapiro et al., 2006). In studying organizational mindfulness, Levinthal and Rerup (2006) argued that "organizational life is filled with special cases that have to be fit to a given repertoire

of actions. Because an organization's environment is likely to provide stimuli that are far more varied than the categories associated with a given set of routines, the response to defined stimuli (e.g., the routine) needs to be flexible and adaptive." (p. 507). Similarly, technology users are living within an ever-changing environment. Mindfulness can help them react to the changing contexts at work and adapt their system use for the new tasks to achieve better task-technology fit (Sun, 2012). For example, Dane (2011) argued that in dynamic environments, mindful lawyers can determine when and how to employ their arguments and other persuasive tactics. In short, mindfulness "fosters a rich action repertoire with which to successfully greet the unknown" (Fiol & O'Connor, 2003, p.59).

Mindfulness has been studied in the IS field (e.g., Butler & Gray, 2006; Goswami, Teo, & Chan, 2008; Swanson & Ramiller, 2004; Vidgen & Wang, 2009). Existing IS research on mindfulness focuses primarily on the organizational or team level. Swanson and Ramiller (2004) laid out the foundation for systematically introducing and defining "mindful innovation in IT" and proposing several directions for studying this topic. Based on case studies of two software development teams, Vidgen and Wang (2009) argued that "collective mindfulness" at the team level characterized agile development teams. Fichman (2004) considered mindfulness a new concept in IS research and developed a conceptual framework in which mindfulness can be leveraged to ensure high innovation quality and positive performance outcomes. Goswami et al. (2008; 2009) studied the mechanisms through which managers' mindfulness influences organization's adoption of technology.

To date, little is known with regard to the influence of mindfulness on making technology adoption decisions at the individual level. Sun and Fang (2010) conceptualized mindfulness at the individual level and developed a model of mindfulness in technology adoption. In that model, mindfulness is argued to reduce uncertainty and to influence users' perceived usefulness of and intention to use a technology. Their model, however, is limited to showing mindfulness'

influences on adoption decision-making but yields little insight into the influence of mindfulness at the post-adoption stage. Roberts et al. (2007) studied mindfulness as a state in the post-adoption system use context. They focused on users' mindfulness when using a particular application after adoption. For example, "mindful individuals may create multiple uses of a specific application, even uses unintended by the original designer." (p.3). To date, little if any research has been done to systematically develop a rich concept of mindfulness of technology adoption and explicitly investigate how it influences user beliefs and behavior at the post-adoption stage. This research aims to bridge this gap by system developing a concept of mindfulness of technology adoption and studying its distal influence on post-adoption user beliefs, satisfaction, and behavior.

Mindfulness of Technology Adoption (MTA)

Consistent with Dane's (2011) definition, this research defines mindfulness of technology adoption (MTA) as a psychological state of consciousness in which a person focuses on and is aware of the issues surrounding a technology adoption decision. MTA means that a person investigates the technology being considered in great detail and in relation to local contexts and alternative technologies. Corresponding to the four dimensions of mindfulness suggested by Langer's (1989a; 1997) original work on mindfulness, we conceive MTA as multi-faceted with four dimensions (Table 1).

<u>Engagement with the Technology.</u> Being mindful, a person is engaged with the technology being considered by actively gathering information about it, and exploring it in greater detail. A mindful adopter is more likely to scan for information about the technology, and scan more thoroughly at the function and feature level. Such a detailed investigation affords the user a comprehensive understanding of the technology.

Table 1. Four Dimensions of MTA

Mindfulness of Technology Adoption								
	1	.						
Engagement with the Technology	Technological Novelty Seeking	Awarenes Local Cont		Cognizance of Alternative Technologies				
Dimension (Langer's original dimensions are in parenthesis)	Definition			Example				
Engagement with the Technology (active information seeking and processing)	The degree to which a pe seeks information about the being considered in terms functionalities.	functional	explores the lity of Open Office in ail when adopting it.					
Technological Novelty Seeking (constant creation of new category)	The degree to which a pe a technology with existing so that he/she is more aw uniqueness of the technology considered.	technologies are of its	person co Excel, wh with, to fig	opting SPSS, a compares it with lich he/she is familiar gure out how SPSS at from Excel.				
Awareness of Local Contexts (awareness of local specifics)	The degree to which a pe about how the technology local specifics and his or I	Instead of the popular Oracle Database 12c, a person decides to use MS Access for his small business.						
Cognizance of Alternative Technologies (openness to alternative technologies)	The degree to which a pe of the alternative technolo the advantages and draw technology being conside	ogies regarding backs of the	IBM Cogr analytics also awar	nsidering adopting nos as a business solution, a person is re of other alternative such as Tableau and				

<u>Technological Novelty Seeking.</u> Mindfulness is also about constant creation of new categories (Langer, 1989a). Mindfulness in technology adoption means a person consciously compares a technology with existing technologies so that he/she is more aware of its uniqueness and accordingly creates a new category for it in relation to existing technologies. For example, a mindful person is more likely to realize how local folders are different from the ones stored in cloud computing applications (e.g., Dropbox or Google Drive). Understanding the nuanced difference, he or she creates a relevant yet distinct category for folders on the cloud such that these folders can organize files (like local folders) for sharing (uniqueness of the new category).

Awareness of Local Contexts. A technology is designed for specific tasks and for certain technical environments and represent certain work domains (Burton-Jones & Grange, 2013). A person's local specifics are often complex, including his/her own needs and learning ability, the availability of technical support, compatibility with existing technologies, and peers' reaction to it, among other issues. Realizing these issues is crucial for a person to achieve high alignment between the technology and his/her work. A less mindful adoption decision ignoring local specifics may lead to a waste of investment due to misalignments between the technology and the local context. Being aware of local contexts means that the adopter thinks about how the technology may help his/her work or change the way work is done. At the same time, being aware of local contexts also means that the user is aware of the inconveniences the adopted technology may bring to his/her work.

Cognizance of Alternative Technologies. When being mindful in adopting a technology, a person is aware of alternative views regarding this technology, e.g., both advantages and disadvantages of it in comparison to alternative technologies. Such a balanced and flexible view about a technology helps the adopter develop realistic expectations. For example, a person may hold a belief that Oracle database is more powerful in functionality than other database management systems (DBMSs) due to Oracle's large market share and wide acceptance in organizations. However, after mindfully comparing Oracle and other DBMSs (e.g., MySQL, SQL Server, and Microsoft Access), he/she may choose Microsoft Access, which is sufficient for his or her needs. After going through the process of comparing Oracle and alternate DBMSs, the person is more realistic about the pros and cons of each DBMS. As a result, he/she is more open to the technology alternatives and will avoid making an uncritical conclusion based on bandwagon effects (Fiol & O'Connor, 2003). Therefore, mindfulness is important to avoid overestimating, as well under-estimating, the advantages and disadvantages of a technology.

We conceive of MTA as a reflective second-order construct in this study. In general, psychological states influence behavior (Ajzen & Fishbein, 1980). Thus, MTA (as a psychological state) should influence its behavioral sub-constructs. According to Jarvis, Mackenzie, Podsakoff, Mick, & Bearden (2003), such a causality means that MTA should be modeled as a reflective second-order construct. That means, a person's mindful state should be reflected by his/her behavior as captured by its four sub-constructs.

MTA is essentially different from similar concepts that have been studied in IS research such as cognitive absorption and flow. In IS research, cognitive absorption has been defined as "a state of deep involvement with software" and has five dimensions (temporal dissociation, focused immersion, heightened enjoyment, control, and curiosity) (Agarwal & Karahanna, 2000, p.673). Flow, on the other hand, refers to "the state in which people are so involved in an activity that nothing else seems to matter" (Csikszentmihalyi, 1990, p.4). Both concepts have received a lot of attention in IS research (e.g., Csikszentmihalyi, 1975; Csikszentmihalyi, 1990; Ghani, 1995; Koufaris, 2002; Novak, Hoffman, & Duhachek, 2003; Novak, Hoffman, & Yung, 1998; Pace, 2004; Saade & B., 2005; Zhang, Li, & Sun, 2006). Similar to mindfulness, both cognitive absorption and flow theorize about an individual's deep involvement in the present moment. However, one attribute that distinguishes mindfulness from cognitive absorption and flow is the attentional breadth (Dane, 2011). Cognitive absorption and flow suggest people are deeply engaged in an event while largely ignoring environmental stimuli. Mindfulness, in contrast, proposes people are aware of a wide range of stimuli, both external (environmental) and internal (intrapsychic) (Dane, 2011). Also, MTA is, by definition, an important factor in the adoption decision, whereas cognitive absorption and flow are more influential during the post-adoption stage at which they require a certain level of familiarity with and control over the activity (Chen, Yen, Hung, & H., 2008; Ghani, Supnick, & Rooney, 1991; Lowry, Gaskin, Twyman, Hammer, & Roberts, 2013; Pace, 2004; Siekpe, 2005; Tung, Moore, & Engelland, 2006).

MTA as a State Variable

Mindfulness can be conceived as both a trait and state variable (Butler & Gray, 2006; Dane, 2011). While it is surely valuable to study trait mindfulness as prior research has done (e.g., Brown & Ryan, 2003), this research studies MTA as a psychological state in light of the fact that we are interested in how mindfulness influences particular adoption decisions at a specific moment (i.e., when the technology is adopted). An adoption decision is often made in a specific context. Hence, context-specific state variables are more relevant (Thatcher & Perrewe, 2002; Webster & Martocchio, 1992). A person who is generally mindful may not necessarily be mindful at the particular moment when a decision is made. Hence, considering a person's mindful state during decision-making is more relevant to studying the influence of mindfulness on a particular decision-making process. This focus is also consistent with many prior studies on decision-making in uncertain environments (Dane, 2011; Fiol & O'Connor, 2003; Langer et al., 1989; Langer, 1989a).

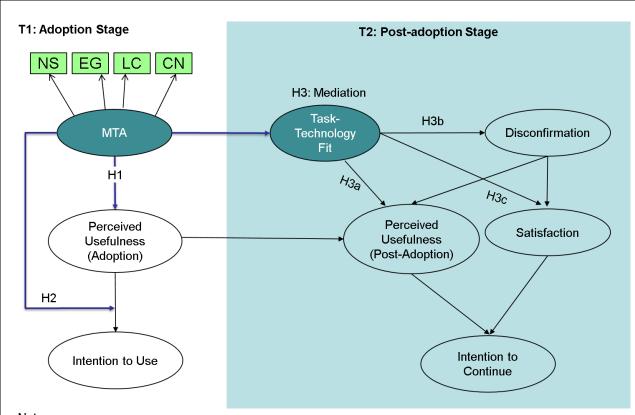
It is important to note that although mindful states are temporary, they may have distal influence on later evaluations and behavior. A user's overall evaluation of a system is determined largely by the most salient past experience and the most recent experience, i.e., the peak-end rule (Fredrickson, 2000; Kahneman, Fredrickson, Schreiber, & Redelmeier, 1993). In other words, a temporary but salient experience can later influence a person's overall evaluation. Indeed, it has been reported that higher levels of mindfulness induced by training continued to influence user behavior one month later (Jensen, Dinger, Wright, & Thatcher, 2013).

Research Model and Hypotheses Development

Base Model – CCM and the Mindfulness-Fit Framework

A research model (Figure 2) about the influence of MTA on user adoption and continued use of technology is developed by incorporating the mindfulness-fit framework into the Cognition Change Model (CCM) (Bhattacherjee & Premkumar, 2004). Stemmed from expectation-confirmation theory (Oliver, 1980), CCM delineates what determines users' continued use. At

the adoption stage, one's perceived usefulness about a technology determines his/her intention to use it. Later, with new information and direct experience with the technology, a post-adoptive user perception is formed, which may deviate from the prior beliefs. Such deviation (i.e., disconfirmation) will update user's perceived usefulness (post-adoption) and influence user satisfaction, which in turn influences one's intention to continue to use the technology.



Note:

NS: Technological Novelty Seeking, EG: Engagement with the Technology LC: Awareness of Local Contexts, CN: Cognizance of Alternative Technologies

Mediation:

H3a: MTA→Task-technology fit→Perceived Usefulness (Post-adoption)

H3b: MTA→Task-technology fit→Disconfirmation H3c: MTA→Task-technology fit→Satisfaction

Control Variables: Age, Gender, Education, Internal Self-Efficacy

Figure 2. Research Model

CCM provides an appropriate vehicle for this research for two important reasons. First, the longitudinal nature of CCM is necessary for studying the distal influence of MTA given that, as emphasized earlier, it often takes time for the benefits of information technology to unfold. Second, the constructs in CCM — such as disconfirmation, perceived usefulness (post-adoption), satisfaction, and intention to continue¹ together with task-technology fit— can serve to assess whether MTA helps select an optimal technology that the user will continue to use, which is the central motif of this paper.

To integrate the generic mindfulness-fit framework into CCM, we capture a domain-specific fit concept: task-technology fit (TTF) in light of the fact that domain-specific factors tend to own more predictive power than general factors (Davis & Yi, 2012; Webster & Martocchio, 1992). Defined as "the degree to which a technology assists an individual in performing his or her portfolio of tasks" (Goodhue & Thompson, 1995, p.216), TTF has been found essential in explaining system use and task performance at both individual and team levels (e.g., Dishaw & Strong, 1996; Fuller & Dennis, 2009; Goodhue, 1998; Goodhue & Thompson, 1995; Wells, Palmer, & Patterson, 2004). It captures "correspondence between task requirements, individual abilities, and the functionality of the technology" (Goodhue & Thompson, 1995, p.218). IS research has shown that performance will be higher when there is alignment between technology capacity and task requirement (Dennis, Wixom, & Vandenberg, 2001; Dishaw &

¹ Attitude was dropped from the original CCM because of its conceptual closeness to satisfaction. Satisfaction and attitude are highly correlated in Bhattacherjee and Premkumar's study. Also, removing attitude is consistent with prior research on technology acceptance. For example, Venkatesh et al. (2004) excluded attitude in their unified theory of acceptance and use of technology (UTAUT), arguing that attitude is not a significant antecedent of behavioral intention when performance expectancy and effort expectancy are present. Acknowledging that the role of attitude is important in certain environments (Venkatesh, Morris, Davis, & Davis, 2003), we excluded attitude in this research in order to focus on studying mindfulness.

Strong, 1999; Lim & Benbasat, 2000; Shaft & Vessey, 2006; Zigurs & Buckland, 1998). As TTF in general antecedes user usefulness beliefs, utilization and performance (Dishaw & Strong, 1999), we position TTF before perceived usefulness, disconfirmation, and satisfaction at the post-adoption stage.

Hypotheses Development

Drawing on the MTA-TTF framework and CCM, we argue that MTA impacts factors at both adoption and post-adoption stages. At the adoption stage, MTA will influence users' perceived usefulness belief formation and how perceived usefulness influences intention to use. At the post-adoption stage, MTA has a distal effect on post-adoption factors including perceived usefulness (post-adoption), disconfirmation, and satisfaction, through the mediation of TTF.

Impact of mindfulness at the technology adoption stage

Consistent with the CCM, this research conceptualizes perceived usefulness as a user belief. We further distinguish perceived usefulness at the adoption stage (PUA) and perceived usefulness at the post-adoption stage (PUP) respectively. PUA is defined as the degree to which a person believes that using a particular technology being considered for adoption will enhance his performance. It has been well understood in the user technology acceptance literature that a person's perceived usefulness of a technology has a significant influence on his/her intention to use that technology at the adoption stage (Davis, 1989; Sun & Zhang, 2006; Venkatesh & Davis, 2000; Venkatesh et al., 2003).

This research posits that MTA enhances PUA in the following ways. First, a mindful person is more likely to explore and uncover additional features of a technology (Hiltz & Turoff, 1981; Kay & Thomas, 1995). Such an in-depth understanding of the system can enlarge his/her action repertoire with regard to what the system can do for his/her work and thus enhances PUA of the system. Moreover, a mindful person is more likely to appreciate the unique value of the technology, beyond what has been done using existing systems. Such an understanding of the

novelty of the technology also contributes to enhancing perceived usefulness. Second, MTA can enhance PUA through a thorough scanning and awareness of one's social environment. A person's social environment can influence his/her perceived usefulness (Venkatesh & Davis, 2000). Users are located in certain social environment and thus care about how others think about their adoption and use of a technology. Mindfulness facilitates a thorough scanning and elaboration of the environment and accordingly enriches ones' awareness of the social contexts, which in turn increases perceived usefulness (Moore & Benbasat, 1991; Venkatesh & Davis, 2000). Combining the above argument, we hypothesize that:

H1: MTA is positively related to perceived usefulness (adoption).

In a mindful state, people will expand their information repertoire and scan from a wider variety of sources (Dane, 2011; Fiol & O'Connor, 2003). Also, mindful people are more attuned to their internal processes and states (Epstein, 1995). In this mindful state, individuals will be "back in touch with their own wisdom and vitality" (Kabat-Zinn, 1994, p.4), which will keep them calm and open-minded so that they may be more attuned to their own thoughts, beliefs, and emotions (Dane, 2011; Kabat-Zinn, 1994; Kabat-Zinn, 2003). Scholars have applied such therapeutic introspection approaches in education to train people to maintain attention and to control their mental process to help develop confidence and self-esteem (Hyland, 2009). For example, mindfulness is suggested as a means for learning math. People often have rigid perceptions of their own mathematical ability. However, individuals in the mindful state can overcome mind rigidity, and reevaluate their quantitative skills and regain confidence (Quinnell, Thompson, & LeBard, 2013).

Also, mindful people tend to be more confident in their beliefs (Langer & Imber, 1980). Such confidence will result in more weight to their beliefs about a technology when they are making the adoption decision. People give more weight to credible information when they are evaluating

information among various sources (Anderson, 1971; Anderson, 1981; Littlejohn, 2002). Mindful people know that their information is collected through a thorough scanning of the environment and exploration of the technology. As a result, their information about the technology is more likely to be accurate and relevant to their use context. Mindful adopters also know more about how the technology to be adopted is different from the technologies he/she has and alternative technologies, and how it may fit the task context. Such user beliefs mindfully formed are more likely to carry heavier weights in influencing users' intention to use the technology (Anderson, 1981; Littlejohn, 2002). That is, mindful people tend to pay more attention to and rely on their own beliefs about a technology. Therefore, we hypothesize that:

H2: MTA will positively moderate the relationship between perceived usefulness (adoption) and intention to use so that this relationship is stronger when MTA is higher.

Impact of mindfulness at the post-adoption stage

We propose that MTA influences post-adoption user behavior through TTF. By definition, TTF is influenced by both task characteristics and technology characteristics (Dishaw & Strong, 1999; Goodhue & Thompson, 1995; Zigurs & Buckland, 1998). A task can be viewed as the behavior needed to achieve stated goals using available information and via some processes (Zigurs & Buckland, 1998). A technology represents certain work domains for which it is designed to support (Burton-Jones & Grange, 2013) and usually has a range of features as the functional building blocks that are designed to achieve different types of tasks (Griffith & Northcraft, 1994; Jasperson, Carter, & Zmud, 2005).

Drawing on the MTA-TTF framework, MTA is argued to lead to higher TTF at the post-adoption stage through two mechanisms: context-relevant interpretation of the technology and expanded action repertoire (Figure 1). First, MTA can help overcome a person's impulse to imitate others decision at the cost of his/her own local context (i.e., the bandwagon effects) so that a mindful

adopter can make discriminating choices that best fit his/her own circumstance (Fiol & O'Connor, 2003). Second, a mindful adopter is more likely to be aware of more system features and to have a wider view of the system's potential for accomplishing a variety of tasks (i.e., enlarged action repertoire). Such preparedness better equips a user to be more flexible and adaptive when encountering unexpected events (e.g., new tasks) at the post-adoption stage. This leads to better alignments between the technology and the task, i.e., TTF (Ahuja & Thatcher, 2005; Barki, Titah, & Boffo, 2007; Boudreau & Robey, 2005; Jasperson et al., 2005; Saga & Zmud, 1994).

In turn, TTF has significant effects on post-adoption factors including perceived usefulness (post-adoption) (PUP), disconfirmation, and satisfaction. First, TTF positively affects PUP. TTF allows users to accomplish their task more effectively, efficiently or at a higher quality (Dennis et al., 2001; Goodhue & Thompson, 1995; Vessey, 1991; Vessey & Galletta, 1991; Zigurs & Buckland, 1998), so that users are more likely to perceive this technology to be useful at the post-adoption stage (Davis, 1989). This relationship has been widely applied and has received a large amount of empirical support in various contexts such as e-education (D'Ambra, Wilson, & Akter, 2013; Goodhue, Klein, & March, 2000; Larsen, Sørebø, & Sørebø, 2009), software maintenance (Shaft & Vessey, 2006), group support decisions (Dennis et al., 2001; Fuller & Dennis, 2009), and healthcare (Bhargava & Mishra, 2014).

Second, TTF positively affects disconfirmation. Disconfirmation refers to "the extent to which subjects' pre-usage expectation of technology usage is contravened during actual usage experience" (Bhattacherjee & Premkumar, 2004, p.237). The disconfirmation is resulting from an update of new/primary information on the initial beliefs (i.e., PUA) that were previously formed (Bhattacherjee, 2001; Sun, 2013). The degree to which expectations are exceeded is called positive disconfirmation; on the other hand, negative disconfirmation refers to an experience that is worse than expected (Brown, Venkatesh, & Goyal, 2014). Prior research has

suggested a positive relationship between TTF and disconfirmation. For example, Lin and Wang (2012) empirically proved that a person's perceived fit of an online learning system leads to a positive confirmation. The rationale is that TTF encourages a person to explore more of a technology and thus is more likely to result in beyond-expectation experience, e.g., high disconfirmation. This is somewhat consistent with the existing evidence suggesting that TTF fosters system utilization (Fuller & Dennis, 2009; Goodhue & Thompson, 1995; Larsen et al., 2009). That is, when a person perceives a technology to fit the task, he/she is more likely to use it and have more opportunities to fully realize the system's potential. This expanded use leads to more positive confirmation of early expectations.

Third, TTF positively affects satisfaction. Satisfaction is closely associated with performance; indeed it has been considered by researchers to be a core part of performance (Benbasat & Lim, 1993; Dennis & Kinney, 1998; Dennis et al., 2001). TTF has been argued to lead to satisfaction, especially when people adapt the system (Dennis et al., 2001). Task-technology fit better actualizes the technology characteristics in response to task needs, so users will evaluate the system favorably and be satisfied (Ip, Lau, Chan, Wong, Wong, & So, 2008; Kim, Chung, Lee, & Preis, 2015; Lin, 2012).

Taken together, prior research suggests that MTA can influence post-adoption user beliefs and satisfaction through TTF. Therefore, we hypothesize that:

H3: TTF mediates the influence of MTA (adoption stage) on post-adoption (a) perceived usefulness, (b) disconfirmation, and (c) satisfaction.

Methodology

To examine the hypothesized relationship, we conducted a longitudinal study on students' adoption and continued use of wiki systems. Students' adoption of wiki systems is an ideal context for this research. As mentioned earlier, mindfulness matters when uncertainty exists.

Uncertainty is present when "a framework for interpreting a message is available, but there is a lack of information to process" (Dennis & Valacich, 1999, p.1). In this study, student respondents knew that wiki systems could be used as a tool for individual or collaborative tasks but they had little information about the wiki systems. Students were generally uncertain about the adoption of a wiki given multiple wiki systems available on the market; therefore mindfulness should play a role in affecting their adoption decision. In addition, we designed some tasks that the subjects could complete with the wiki. Specifically, the subjects were encouraged to develop a personal learning wiki system to organize and manage the learning material in the courses. They could choose either PBworks or Google Sites to do this, and they were free to switch between them. Therefore, using a wiki system is critical for the subjects to achieve class objective; such criticality induces mindfulness.

The study included two surveys, with a four-week interval in between. We designed a one-month interval because Jensen et al. (2013) proved that training-induced mindfulness still has influence on user behavior one month later. The first survey was administrated at the adoption stage (T1) where students were instructed to choose between two wiki systems: PBworks and Google Sites, for complete class assignments. Both wiki systems have similar features that allow users to create a workspace, post text and multimedia as wikis, and invite people to the workspace for collaboration. The use of two systems stimulates subjects' awareness of alternative technologies, which is essential for mindfulness. At the beginning of the survey, subjects' prior experience on these two wiki systems was measured. They were then asked to go through a list of features of PBworks and Google Sites for more background knowledge for the adoption choice. In addition, URLs for both tools were provided so that the subjects were able to further investigate both tools if they wanted ("engagement with the technology" of MTA). They were then required to make a decision regarding which tool they would use. Then, the respondents completed the rest of the survey on their mindfulness, perceived usefulness

(adoption), and intention to use. We also collected subjects' demographic data such as age, gender, and education level. The second survey was administered four weeks after the first survey (T2) to measure task-technology fit, perceived usefulness (post-adoption), disconfirmation, user satisfaction, and intention to continue. We only included respondents who have used the wiki system before the second survey.

Students in two large information systems courses were invited to participate in the longitudinal study. Bonus course credits were offered as incentives but the respondents could drop out from the study at any time. At T1, 204 out of 221 students participated in the study (92.31 response rate). At T2, 183 students completed the second survey, representing an overall response rate of 82.81%.

After removing those who did not use PBworks or Google Sites after the first survey, the final sample contained 176 valid responses. Table 2 shows the demographic characteristics of the sample. A wave analysis was conducted to test the nonresponse bias (Armstrong & Overton, 1977). The results indicated that non-response bias should not be a concern for this study.

Table 2. Demographic characteristics of the sample						
		Frequency	Percentage			
	18-20	34	19.32%			
	21-25	119	67.61%			
۸۵۵	26-30	12	6.82%			
Age	31-35	6	3.41%			
	36-45	4	2.27%			
	>46	1	0.57%			
Candar	Male	101	57.39%			
Gender	Female	75	42.61%			
Highest	High school	1	0.57%			
Education	Associate degree	1	0.57%			
Level	Bachelor degree	63	35.80%			
Currently Pursuing	Master degree and above	111	63.07%			
	Total:	176	100%			

Whenever possible, previously validated measures were used (see Appendix C for the measurement items). Kim and Malhotra's (2005a) instruments were adapted to measure perceived usefulness at adoption and post-adoption stage. Intention to use, satisfaction, disconfirmation, and intention to continue were measured by the original measures from CCM (Bhattacherjee & Premkumar, 2004). Similarly, perceived task-technology fit measure was revised and adapted to the context of this research from previous studies (Larsen et al., 2009; Lin & Huang, 2008).

Because the field lacks of comprehensive MTA measures, we developed an instrument for MTA following Moore and Benbasat's (1991) procedure (see Appendix B for the details of instrument development). Consistent with the conceptualization of MTA, the instrument consists of 13 items for the four dimensions: Technological Novelty Seeking (NS, 3 items), Engagement with the Technology (EG, 3 items), Awareness of Local Contexts (LC, 3 items), and Cognizance of Alternative Technologies (CN, 4 items). The four dimensions are reflective first-order constructs of the reflective second-order MTA because again, MTA as a psychological state should influence its behavioral sub-constructs (Jarvis, MacKenzie, & Podsakoff, 2003).

Data Analysis and Results

Partial Least Square (PLS) was utilized to accommodate the complexity of the model (Chin, Marcolin, & Newsted, 2003; Fornell & Bookstein, 1982; Lohmoller.J., 1989). The statistical significance of the path coefficients was estimated using the bootstrapping method (Chin et al., 2003). To test the moderating effects of MTA, we referred to the product-of-sums approaches (Goodhue, Lewis, & Thompson, 2007). Specifically, the variable scores of the moderating factor (MTA) and independent variable (PUA) were multiplied to generate the interaction factor: MTA x PUA, which was then linked to the dependent variable (IU).

Measurement Model

In Table 3, we see that the four dimensions of MTA have relatively large standard deviations, suggesting the effectiveness of our manipulations, i.e., allowing subjects to seek external information and choose between two wiki systems.

To assess the measurement model, the reliability, convergent validity, and discriminant validity were examined. The reliability of the scales was evaluated by composite reliability and Cronbach's Alpha; both need to be 0.70 or higher in order to demonstrate sufficient reliability (Bagozzi & Yi, 1988; Bearden, Netemeyer, & Mobley, 1993; Nunnally & Bernstein, 1994). Table 3 shows that all composite reliability values and Cronbach's alpha meet this criterion.

Table 3. Descriptive Statistics							
	No. of Items	Mean	Std. Dev	Composite Reliability	Cronbach's Alpha	Average Variance Extracted	
Mindfulness - Technological Novelty Seeking	3	4.65	1.17	0.83	0.70	0.63	
- Engagement with the Technology	3	4.17	1.48	0.89	0.82	0.73	
- Awareness of Local Contexts	3	5.29	1.38	0.92	0.88	0.80	
- Cognizance of Alternative Technologies	4	4.32	1.35	0.88	0.80	0.71	
Perceived Usefulness (Adoption)	4	5.00	1.29	0.96	0.94	0.85	
Intention to Use	3	5.02	1.29	0.94	0.91	0.85	
Task-Technology Fit	5	4.70	1.09	0.92	0.89	0.70	
Perceived Usefulness (Post-Adoption)	4	4.47	1.24	0.95	0.93	0.83	
Disconfirmation	4	4.56	1.04	0.94	0.91	0.79	
Satisfaction	4	4.70	0.98	0.94	0.92	0.81	
Intention to Continue	3	4.56	1.22	0.97	0.95	0.91	
Internal Self-Efficacy	3	5.80	2.06	0.91	0.84	0.76	

To assess the convergent validity, item loadings and average variance explained (AVE) were examined. Item loadings should be greater than 0.707 and AVEs should be larger than 0.50 (Barclay, Higgins, & Thompson, 1995; Fornell & Larcker, 1981). Appendix D shows the items loaded well on their associated factors. CN2 was not loaded well and thus was dropped from

further analysis. Table 3 shows that all AVEs in this study were larger than 0.50, suggesting that most variances in the constructs are captured by the indicators rather than denoting measurement errors (Barclay et al., 1995). Two criteria were examined to assess the discriminant validity. First, the square root of the AVE should be greater than the variance shared among the construct and other constructs (i.e., correlations) (Compeau, Higgins, & Huff, 1999). This is satisfied, as shown in Table 4. Second, items should load more highly on their associated factors than on other factors. Appendix D showed that this criterion was also met.

Table 4. Square Roots of AVEs and Correlations †															
	NS	EG	LC	CN	PUA	IU	TTF	PUP	DC	SAT	IC	SE	AGE	EDU	GEN
NS	0.79														
EG	0.37	0.86													
LC	0.41	0.42	0.89												
CN	0.29	0.34	0.41	0.84											
PUA	0.42	0.35	0.62	0.26	0.92										
IU	0.44	0.30	0.63	0.24	0.75	0.92									
TTF	0.26	0.14	0.17	0.12	0.34	0.28	0.84								
PUP	0.32	0.29	0.37	0.32	0.44	0.42	0.66	0.91							
DC	0.26	0.20	0.25	0.17	0.40	0.36	0.60	0.69	0.89						
SAT	0.18	0.16	0.18	0.21	0.30	0.29	0.54	0.58	0.66	0.90					
IC	0.03	0.03	0.16	0.06	0.13	0.28	0.28	0.47	0.43	0.53	0.95				
SE	0.33	0.08	0.32	0.11	0.41	0.52	0.12	0.12	0.11	0.08	0.03	0.87			
AGE	0.21	0.19	0.11	0.17	0.12	0.10	-0.05	0.00	0.09	0.03	-0.06	0.15	NA		
EDU	0.22	0.22	0.40	0.24	0.31	0.41	-0.02	0.10	0.10	0.05	0.10	0.17	0.33	NA	
GEN	-0.17	-0.04	-0.22	-0.26	-0.16	-0.23	-0.21	-0.16	-0.21	-0.23	-0.13	0.11	0.12	-0.15	NA

NS: Technological Novelty Seeking (MTA)

LC: Awareness of Local Contexts (MTA)
PUA: Perceived Usefulness (Adoption)

PUP: Perceived Usefulness (Post-Adoption)

IC: Intention to Continue

EG: Engagement with the Technology (MTA)

CN: Cognizance of Alternative Technologies (MTA)

DC: Disconfirmation SAT: Satisfaction

SE: Computer Self-Efficacy EDU: Education GEN: Gender

A high correlation between perceived usefulness (adoption) and intention to use was observed (Table 4). Their cross-loadings were also high (Appendix D). In addition, there exist uncomfortably high correlations and cross-loadings between disconfirmation and satisfaction. High correlations and cross-loadings indicate that items may measure more than one factor in the model and thus may threaten the discriminant validity of a study. However, no construct was

[†] The diagonal Elements (in bold) are the square roots of the variance shared between the constructs and their measurement (AVE).

dropped for several reasons. First, the high cross-loadings in this research still met Gefen and Straub's (2005) criterion of a minimum difference of .10 between item loadings and cross-loadings, and other statistics (the comparison between AVEs and correlations) were also satisfactory. Second, the highly cross-loaded items are drawn from the original CCM, where these items are retained for content validity. The new measures for mindfulness, which are the primary focus of this study, did demonstrate high discriminant validity.

The longitudinal nature of the research model is helpful to overcome potential common method bias. In addition, a Harman's single-factor test² — which is one of the most widely used approaches for assessing common method bias in a single-method research design (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003) — was conducted to further assess the common method bias. This test loads all variables into an exploratory factor analysis and then examines the unrotated factor solution to determine the number of factors necessary to account for the variance in the variables. Common method bias may exist if (1) a single factor emerges from the unrotated factor solution or (2) one general factor accounts for the majority of the covariance in the variables (2003 p. 889). Neither occurred in this study; no single factor accounted for a majority of the covariance (the first factor only explains 30.89% of the variance), indicating that common method bias should not be a concern for this study.

² We also checked the variance of this factor and found that responses to this factor did not co-vary.

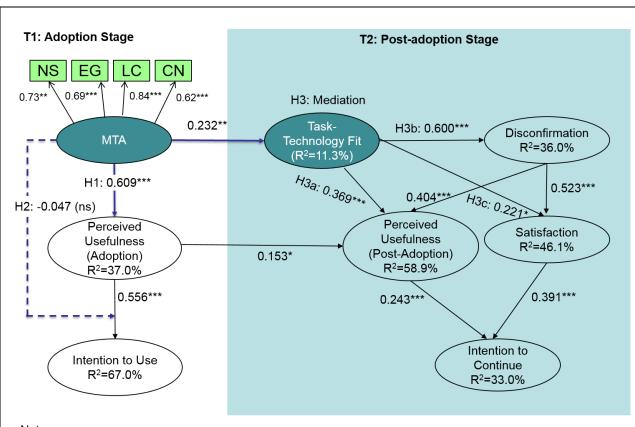
Structural Model

The results of the structural model are presented in Figure 3 with details available in Table 5³. At the adoption stage, mindfulness was positively related to perceived usefulness (H1: b=0.609, t=12.522, p<0.001), supporting H1. The hypothesized positive moderating effect of MTA on the relationship between perceived usefulness at the adoption stage and intention to use, was non-significant (b=-0.047, t=1.726). Thus, H2 was not supported.

For hypothesis 3, we examined how the influence of mindfulness on perceived usefulness (post-adoption), disconfirmation, and satisfaction is mediated by TTF using Preacher and Hayes' (PH) (2010) approach. We employed the bias-corrected (BC) bootstrap algorithm. The BC algorithm does not impose a normal sampling distribution assumption as Sobel's test does and is thus suitable for small sample sizes (Preacher & Hayes, 2008). The results showed that MTA has significant total effects on perceived usefulness (post-adoption) (effect=0.447, t=6.594, p<0.001), disconfirmation (effect=0.306, t=4.232, p<0.001), and satisfaction (effect=0.244, t=3.316, p<0.001). After introducing TTF, MTA still has significant direct effects on perceived usefulness (post-adoption) (effect=0.176, t=2.877, p<0.01), and satisfaction (effect=0.127, t=1.937, p>0.05). The indirect effects of MTA through TTF were 0.137 on perceived usefulness (post-adoption), 0.130 on disconfirmation, and 0.117 on satisfaction. The BC bootstrap 95% confidence intervals (CI) for the three indirect effects were 0.058-0.224 for perceived usefulness (post-adoption), 0.055-0.228 for disconfirmation, and 0.052-0.206 for satisfaction. Since all the three CIs did not contain zero, we

³ We also conducted separate analyses on the two wiki systems. The results on the Google Sites data (n=144) are largely consistent with our results. This somewhat indicates that our results are robust. The sample size of PBworks is too small (n=31) to conduct meaningful analysis.

concluded that the mediated effects via TTF were significant. In summary, TTF has significant partial mediating effects on the relationships between MTA and perceived usefulness (post-adoption), disconfirmation and a full mediating effect on satisfaction. Thus, H3 was supported.



Note:

NS: Technological Novelty Seeking, EG: Engagement with the Technology LC: Awareness of Local Contexts, CN: Cognizance of Alternative Technologies

Mediation:

H3a: MTA→Task-technology fit→Perceived Usefulness (Post-adoption)

H3b: MTA→Task-technology fit→Disconfirmation

H3c: MTA→Task-technology fit→Satisfaction

Control Variables: Age, Gender, Education, Internal Self-Efficacy

ns p>0.05, * p<0.05, ** p<0.01, *** p<0.001

Figure 3. Results of the Structural Model

	Path Logiticient and	
	Path Coefficient and	Hypothesis confirmed?
4T4 > D114 (114)	Significance	
MTA→PUA (H1)	0.609***	Y
MTA*PUA→IU (H2)	-0.047 ^{ns}	N
Mediation		
MTA→TTF	0.232**	
TTF→PUP (H3a)	0.369***	Υ
TTF→DC (H3b)	0.600***	Y
TTF→SAT (H3c)	0.221*	Y
Control Variables		
Age→IU	-0.063*	
Age→TTF	-0.053 ^{ns}	
Age→IC	-0.101 ^{ns}	
GEN→IU	-0.138**	
GEN→TTF	-0.184*	
GEN→IC	0.029 ns	
EDU→IU	0.190***	
EDU→TTF	-0.141 ^{ns}	
EDU→IC	0.094 ^{ns}	
SE→IU	0.277***	
SE→TTF	0.097 ^{ns}	
SE→IC ns p>0.05, * p<0.05, ** p<0.01, *** p<0	-0.037 ^{ns}	

SAT: Satisfaction PUP: Perceived Usefulness (Post-Adoption) DC: Disconfirmation

SE: Computer Self-Efficacy IC: Intention to Continue EDU: Education GEN: Gender

All the significant hypothesized effects have path coefficients above 0.1. The extant literature suggests that path coefficients of this level are reasonable. For instance, Pedhazur (1982) recommended that the suggested lower limit of substantive regression coefficients is 0.05. Along the same line, Compeau & Higgins (1995b) indicated that path coefficients of 0.10 and above are preferable. After conducting a literature search, we find that it is quite common to observe significant path coefficients around 0.1 in top IS journals, including some published within the decade (e.g., Au, Ngai, & Cheng, 2008); Pavlou & Fygenson, 2006; Stewart & Gosain, 2006; Venkatesh, Brown, Maruping, & Bala, 2008; Venkatesh & Ramesh, 2006; Zhu, Kraemer, Gurbaxani, & Xu, 2006). Thus, we believe that the substantiveness of the path coefficients in our research model is quite reasonable.

The model explained a significant portion of the variance in perceived usefulness (adoption) (R²=0.370), intention to use (0.670), perceived usefulness (post-adoption) (0.589), disconfirmation (0.360), satisfaction (0.461), and intention to continue (0.330). We noticed that TTF has a relatively small R-square (0.113). Nevertheless, this should not be a big concern for this research. After all, our model was not intended to identify a comprehensive list of predictors of TTF; but instead to establish a reliable relationship between MTA and TTF. Prior research has suggested that technological and task characteristics are most salient predictors of TTF (Goodhue, 1995). This research aims to test how our focal construct, MTA, influences TTF, which is crucial to our research questions. Also, the fact that MTA and TTF are measured at two points in time may also account for the relatively small R-square of TTF.

Table 6 shows the sizes of the effect of mindfulness factors (i.e., MTA and TTF) on disconfirmation, perceived usefulness (post-adoption), and satisfaction, calculated using Cohen's f^2 formula. In summary, the effect sizes of MTA and TTF on perceived usefulness (post-adoption) and disconfirmation are medium, while it is small on satisfaction. The effect sizes indicate the importance of considering mindfulness factors.

Table 6. Effect Sizes of MTA and TTF						
Dependent Variable	R-Squared with MTA and TTF	R-Squared without MTA and TTF	Effect Size [†]			
Perceived Usefulness (Post-Adoption)	0.589	0.504	0.207 (medium)			
Disconfirmation	0.360	0.160	0.313 (medium)			
Satisfaction	0.461	0.430	0.058 (small)			

[†]Effect size (f^2) is calculated by the formula $(R_{full}^2 - R_{partial}^2)/(1 - R_{full}^2)$. Cohen (1988) suggested 0.02, 0.15, and 0.35 as operational definitions of small, medium and large effect sizes respectively.

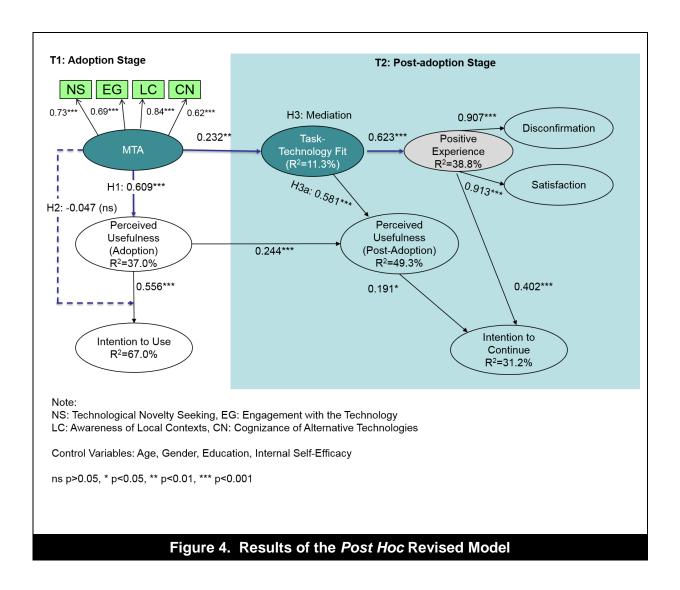
Post Hoc Analyses

As mentioned above, there exist uncomfortably high correlations and cross-loadings between disconfirmation and satisfaction. The lack of discriminant validity of their measures indicates that disconfirmation and satisfaction may actually be related to the same concept. A reflection upon

their definitions and measures suggested that they both reflected a positive experience using a technology. Therefore, a revised model (Figure 4) was examined as a robustness check. In this model, disconfirmation and satisfaction were re-specified, following the procedure set forth by Wetzels et al. (2009), as two reflective first-order factors of a new second-order factor, temporarily named as *Positive Experience*. Consistent with its components (i.e., Disconfirmation and Satisfaction), Positive Experience is believed to be positively influenced by TTF and in turn affects perceived usefulness (post-adoption) and intention to continue. The results are summarized in Figure 4. Both disconfirmation and satisfaction load well on the new Positive Experience construct. The relationships are generally consistent with the original research model. This gives more confidence in the results of this study despite the high correlations between disconfirmation and satisfaction.⁴

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⁴ An alternative approach is to delete one of the highly correlated variables (Tucker & Chase, 1980). Therefore, two additional analyses were conducted to examine models excluding Disconfirmation and Satisfaction respectively. Similar results were observed, further supporting the findings.



Discussion

Major Findings

Mindfulness is an important emerging topic. This research aims to introduce this concept to the IS literature and demonstrate its utility in studying user adoption and continued use of technology. Our results indicate that MTA is influential at both the adoption stage and the post-adoption stage. At the adoption stage, our results confirmed the direct impact of MTA on perceived usefulness: MTA helps enrich a user's understanding of what the technology can do for him/her. We did not confirm the hypothesized moderating effect of MTA on the relationship between perceived usefulness (adoption) and initial intention to use. This may be a result of the

ceiling effect: the main relationship between PUA and intention to use is already very strong as shown in numerous empirical studies (Davis, Bagozzi, & Warshaw, 1989; Sun & Zhang, 2006; Venkatesh et al., 2003) and there is little room to enhance. Still, it is important to study moderating effect because it reveals the contingent nature of the relationship, though moderating effects are in general hard to detect and tend to be incremental (Chin et al., 2003). A larger sample (and thus higher statistical power) and more advanced statistical tools may be of help in future to detect the moderating effects of MTA on the relationship between PUA and intention to use.

MTA has profound distal effects on factors at the post-adoption stage. As hypothesized, MTA has a significant positive impact on users' TTF perception, which in turn influences postadoption factors including perceived usefulness, disconfirmation, and satisfaction. This research suggests that TTF is an important factor when studying mindfulness in that TTF mediates the influence of MTA on post-adoption perceived usefulness, disconfirmation, and satisfaction. Beyond its indirect effects through TTF, our empirical results suggest that MTA has direct influence on perceived usefulness, disconfirmation, and satisfaction. This indicates that the effects of MTA at the post-adoption stage are more profound than the TTF mechanism. That is, MTA may influence post-adoption user behavior through other factors. For example, user appropriation of a system is proposed to moderate the effect of TTF on performance (Dennis et al., 2001). Thus, user appropriation may be a potential factor that could further clarify the influence of MTA on post-adoption user behavior. MTA may induce more post-adoption user appropriation behavior such as exploring new features and repurposing features for unintended tasks (Sun, 2012), which may in turn increase perceived usefulness, positive disconfirmation, and subsequently user satisfaction with the system. In short, the empirically observed direct effects of MTA on post-adoption user behavior beyond the mediation of TTF indeed reveal promising opportunities for future research.

When examining the results carefully, we encountered a paradox that the overall perceived usefulness (4.47) is 0.52 lower than what it was (5.00) at time 1 with an overall positive disconfirmation. According to Bhattacherjee and Premkumar (2004), perceived usefulness (post-adoption) (PUP) should be higher than perceived usefulness (adoption) (PUA) in positive disconfirmation groups and lower for negative disconfirmation groups. Our results echo an ongoing debate regarding the different approaches to measuring disconfirmation (Brown et al., 2014; Edwards, 2002; Irving & Meyer, 1999; Venkatesh & Goyal, 2010). In this research, we followed CCM and adopted the direct measure of disconfirmation for its higher reliability and lower expectation bias (Bhattacherjee & Premkumar, 2004; Yi, 1990). We discuss this issue in detail in Appendix E.

Limitations and Future Topics

Although students are typical users of wiki systems, the findings of this research are limited to educational use of technology. This somewhat limits the generalizability of the findings to other contexts such as employees' use of a complex technology (Compeau, Marcolin, Kelley, & Higgins, 2012). Showing that mindfulness can have significant effects on an adopter's post-adoption beliefs and satisfaction, this research creates an encouraging point of departure for future research to investigate mindfulness in other organizational and technological contexts.

The measures adapted from CCM can be improved. We observed a high correlation and cross-loadings between disconfirmation and user satisfaction. Actually, similar high correlations were also found in the original work on the Cognitive Change Model (see Table 2 in Bhattacherjee & Premkumar, 2004). Our *post hoc* analysis suggested that disconfirmation and user satisfaction may reflect the same construct of positive experience. Future research can either develop better instruments for disconfirmation and user satisfaction or instead re-conceptualize them as two facets of the same construct.

Several future topics emerged in the course of this research. An interesting future topic would be to study mindful non-adopters or abandoners: people who decide not to adopt a technology or who abandon it after using it for a while. Also, this research stresses mindfully choosing a technology in that we allowed the respondents to choose between two systems. This is different from a selection between adoption and non-adoption of a technology. It would be interesting and practically relevant to study mindful non-adopters. Non-adopters can be either mindful or mindless. A mindful person may rightly choose not to adopt a technology, or a mindless person may mistakenly decide not to adopt a technology and accordingly miss the opportunity to improve.

Also, it is always hard to abandon a technology at the post-adoptive stage because of factors such as inertia and sunk costs (Polites & Karahanna, 2012). But the merits of mindful abandonment is that it prevents further sunk costs and helps the user reap benefits from a better alternative technology. So a promising topic would be how mindfulness helps overcome user inertia and facilitates the switch from an old system to a new system.

Another future topic would be to investigate mindfulness as a personal trait. Medical and physical research (Brown & Ryan, 2003; Dane, 2011) had shown that some people are more predisposed to be mindful than others, indicating that mindfulness could be a personal trait. Also related to this, future research may investigate how individual factors, such as personal innovativeness in IT (Agarwal & Karahanna, 2000; Agarwal & Prasad, 1999) and computer self-efficacy (Compeau & Higgins, 1995a; Compeau & Higgins, 1995b), may influence mindfulness.

How to induce mindfulness is another promising topic. State mindfulness can be propagated through training or other experience as has been shown in the mindfulness literature (Langer et al., 1989; Lieberman & Langer, 1997). Langer (1989b) pointed out several conditions that encourage mindfulness —such as how information is presented. Lieberman et al. (1997) also showed that a learner's mindfulness can be enhanced when being asked to make material

meaningful to themselves. In addition, prior research has argued that work-related factors can also trigger mindful thinking (Jasperson et al., 2005; Louis & Sutton, 1991). The attributes of a technology are of particular interest. For example, a highly restrictive technology constrains people to specified structures of using the technology and may force individuals to be in a mode of using the system less mindfully (Silver, 1988; Weick et al., 1999). Such design features associated mindfulness or mindlessness should receive attention, given their apparent practical implications.

Another promising future topic is mindful system use, which is essentially different from mindful adoption studied in this research. Mindfulness can be a continuous practice (Shapiro et al., 2006). Studying post-adoption mindful use may have implications for IS research on active as well as automatic and habitual system use (Kim et al., 2005; Limayem et al., 2008). It may also have implications for studying the performance impact of system use. For example, Swanson et al. (2004) argued that mindful organizations tend to be resilient, "favoring improvisation over planning, adaptation over routine" (p. 561). Similarly, at the individual level, mindful users may be more inclined to adapt their system use, resulting in larger deviations from routine use.

Contributions

This study contributes to IS research and practice in several ways. First, we systematically conceptualize mindfulness of technology adoption (MTA). This research is one of the first attempts in IS research to systematically investigate mindfulness in the context of individual's technology adoption, a growingly important yet under-studied concept. Different from previous research (e.g., Roberts et al., 2007; Sun & Fang, 2010), this research conceives of MTA as a reflective high-order construct. We develop an instrument for measuring the high-order mindfulness in adopting technology and thus also contribute to IS research methodologically.

Second, this paper develops a research model that integrates MTA into CCM to delineate how MTA leads to post-adoption task-technology fit, indicating that MTA can help select a

technology that better fits local task contexts. This model adds the rational factors (i.e., MTA and TTF) to complement CCM and accordingly changes the original meaning of CCM. Specifically, CCM has been focused on the factors that influence users' intention to continue using a technology whereas our model emphasizes how mindfulness helps to choose a fit technology, or in other words, a "right" technology.

This new model contributes to study of post-adoption system use. A significant amount of attention has been paid to studying post-adoption system use from various perspectives (e.g., Bhattacherjee, 2001; Burton-Jones & Straub, 2006; Guinea & Markus, 2009; Jasperson et al., 2005; Kim, 2009; Kim, Malhotra, & Narasimhan, 2005; Limayem, Hirt, & Cheung, 2008; Sun, 2012; Sun, 2013). It is appealing to study the connection between factors at the adoption and post-adoption stages respectively, such that we can predict post-adoption system use as early as at the adoption stage. Doing so helps prevent wasted resources and increases the likelihood of choosing the technology that most benefits the user. Previous research has suggested several mechanisms through which factors at the adoption stage influence post-adoption system use — e.g., the memory processing mechanisms (Kim, 2009) and the expectation-confirmation mechanism (Bhattacherjee & Premkumar, 2004). This research proposes another one: the mindfulness-fit mechanism. People who made the adoption decision mindfully tend to achieve better task-technology fit at the post-adoption stage, which in turn leads to continued use of the technology.

Third, this research also contributes back to the mindfulness literature. We would like to highlight the new mindfulness \rightarrow fit framework: mindfulness increases fit through context-relevant interpretation and enlarged action repertoire. Applying this generic framework to technology adoption and diffusion context forms the MTA \rightarrow TTF framework. The confirmed significant relationship between MTA and TTF suggests that the mindfulness literature can explicitly consider fit as a measurable outcome of mindfulness. Indeed, the concept of fit may much

enrich the contemporary mindfulness literature. For example, Dane (2011) argued that two factors —dynamics of the environment and expertise— moderate the influence of mindfulness on performance. The generic framework of mindfulness and fit suggests that Dane's model may explicitly include environment-fit and expertise-fit in the model to better explain how mindfulness influences performance.

Finally, this research contributes to practice by providing advice to technology adopters and designers. Specifically, adopters are advised to try to be mindful by looking for more information about the technology, seeking novel aspects of the new technology in relation to existing technologies, being aware of own needs and local use contexts, and being aware of alternatives. Designers are advised to develop systems that can facilitate users to make mindful decisions. For instance, the four aspects of mindfulness can be used as principles to guide the design of better decision aid systems (Wang & Benbasat, 2009).

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Appendix A. Summary of the Literature Review on Mindfulness

Study	Area	Definition of Mindfulness or Similar Concepts	Major Findings				
(Baas, Nevicka, & Velden, 2014)	Individual creation activity	Adopted from Brown and Ryan's (2003) definition, mindfulness is defined as a state of conscious awareness resulting from living in the moment.	Mindfulness can foste creativity. In particular, the ability to observe and attend to various stimuli consistently and positively predicted creativity.				
(Brown & Ryan, 2003)	General human well being	An enhanced attention to and awareness of current experience or present reality. Mindfulness is considered inherently a state of consciousness.	Developed the Mindful Attention Awareness Scale (MAAS). Both dispositional and state mindfulness can predict self- regulated behavior and positive emotional states. In addition, increases in mindfulness over time relate to declines in mood disturbance and stress.				
(Butler & Gray, 2006)	Use of complex Information to achieve reliable performance.	Adapted Langer's definition, mindfulness was defined as a way of working characterized by a focus on the present, attention to operational detail, willingness to consider alternative perspectives, and an interest in investigating and understanding failures. Mindfulness was studied at both individual and organizational levels.	Mindfulness was discussed at individual and collective levels. It was argued that mindfulness should be considered when designing and implementing information systems in order to achieve reliable performance.				
(Dane, 2011)	General management: how mindfulness influences task performance in the workplace.	A state of consciousness in which attention is focused on present-moment phenomena occurring both externally and internally.					
(Fichman, 2004)	IT innovation	An organization innovates mindfully to the extent that it attends to the innovation with reasoning grounded in its own facts and specifics.	Mindful organizations are more likely to make sound judgments about whether to adopt an innovation, when, and how best to manage the assimilation process.				
(Fiol & O'Connor, 2003)	Bandwagon behavior and managerial decision-making	Adopted from Langer's definition, mindfulness was defined as a state of alertness and lively awareness that is manifested in active information processing, characterized by the creation and refinement of categories and distinctions and the awareness of multiple perspectives.	This conceptual paper argues that mindfulness can help expand scanning of context relevant information and accordingly make discriminating decisions in the face of bandwagons.				
(Gosain, 2004)	Enterprise information systems	Not defined explicitly, mindfulness was referred to collective mindfulness as in Weick et al.' (1999) and Fiol and O'Connor's (2003) research.	This conceptual paper argues that organizations are prone to lack of mindfulness. Enterprise information systems make organizations, which are prone to lack of mindfulness, may result in acquiescence to institutional pressures.				

(Goswami et al., 2008)	RFID adoption by organizations	Adapted from Langer's definition, managerial mindfulness refers to a cognitive ability or cognitive style that characterizes active information processing and is reflected by openness to novelty, alertness to distinction, sensitivity to different contexts, awareness of multiple perspectives, and orientation in the present	The findings show that managerial mindfulness can lead to recognition of learning option and recognition of staging option when making decisions to adopt RFID.
(Grossman, Niemann, Schmidt, & Walach, 2004)	Stress reduction and health	Mindfulness is characterized by dispassionate, nonevaluative and sustained moment-to-moment awareness of perceptible mental states and processes.	The results of the meta-analysis suggest that mindfulness-based stress reduction helps patients in a broad range of individuals to cope with their clinical and nonclinical problems.
(Hülsheger et al., 2013)	Job satisfaction at work	A state of consciousness in which individuals attend to ongoing events and experiences in a receptive and non-judgmental way	Mindfulness can reduce emotional exhaustion and improves job satisfaction.
(Langer, 1989b)	Human well-being	A state of alertness and lively awareness, which is specifically manifested in typical ways active information processing, characterized by cognitive differentiation: the creation of categories and distinctions.	Mindlessness may severely limit human performance and even have a negative impact on physical health. Mindfulness can help enhance health and task performance.
(Langer et al., 1989)	Student learning	Same as (Langer, 1989a)	Instruction presented in an absolute manner led to mindless use of the learning information. In contrast, instruction presented in a conditional manner was better able to creatively deal with the information. Conditional instruction can provoke mindfulness.
(Langer & Imber, 1980)	Individual perception of deviance	A cognitively active state characterized by conscious manipulation of the elements of one's environment, in which case the individual questions old categories or constructs new ones.	Mindful subjects were more able to detect deviant characteristics.
(Levinthal & Rerup, 2006)	Organizational learning	Adopted Langer's (1989a) and Weick et al.'s (1999) definitions.	Mindfulness complements less- mindfulness through repertories of action, processes for sustaining mindfulness, enactment of routines, and encoding of ambiguous outcomes.
(Roberts et al., 2007)	System use context	Continuous refinement of expectations based on new experiences, appreciation of the subtleties of context, and identification of novel aspects of context that can improve foresight and functioning.	This paper developed a 16 item measurement for mindfulness.

(Swanson & Ramiller, 2004)	Organizational innovation with information technology	Relying on Weick et al.'s (1993) definition of mindfulness at the organizational level, mindfulness is "an organizational property grounded in, although not reducible to, the minds of participating individuals through a process of heedful interrelating." (p.555)	This conceptual article clarified major concepts needed for understanding the role of mindfulness in organizational innovation with information technology. It discussed the various aspects such as innovation process of organizational innovation with information technology and how mindfulness can be integrated in these processes.
(Shapiro, 2009)	Psychotheraphy and psychoeducational settings	Mindfulness is both an outcome and a process. It is an awareness (mindful awareness as an outcome) that arises through intentionally attending in an open, accepting, and discerning way (mindful practice as a process) to whatever is arising in the present moment.	A research agenda to outline future research direction on mindfulness: 1) mindfulness operationalization; 2) multidimensional mindfulness across cultures; and 3) mindfulness-based intervention mechanism.
(Sternberg, 2000)	Social science	Cognitive ability view: Mindfulness is similar to abilities such as openness to novelty, alertness to distinction, sensitivity to different contexts awareness of multiple perspectives and orientation in the present. Personality trait view: Mindfulness is similar to "openness to experience" which is one of five key characteristics in personality. Cognitive style view: The mindfulness developed by Langer is measuring more on cognitive styles and personality than on cognitive abilities. Cognitive style is a preferred way of viewing the world in general and specific problems in particular.	Three integrated views on mindfulness: (1) cognitive ability (i.e., memory or intelligence); (2) personality trait (i.e., extraversion or neuroticism); and (3) cognitive style (preferred way of thinking). This paper concludes mindfulness is inclined to be a cognitive style although it possesses all of these three characteristics.
(Sun & Fang, 2010)	Technology acceptance	Mindfulness in technology acceptance (MTA): A vigilant state of mind of a person that allows him/her to examine the technology being considered more comprehensively and context-specifically	Mindfulness influences people's technology adoption by reducing uncertainty, enhancing perceived usefulness of the technology, thus people are more willing to use the technology.
(Vidgen & Wang, 2009)	Agile software development	Collective mindfulness (Butler & Gray, 2006): more than the sum of individual mindfulness	Collective mindfulness helps teams to be more self-organized and self-disciplined, so it is a valued capability for agile teams.
(Weick et al., 1999)	Organizational behavior in high reliability organizations	Collective mindfulness: Adopted Langer's [1989b] definitions and contextualize it to be the awareness to potential catastrophe and discovery and correction of unexpected events.	Collective mindfulness creates awareness on discriminatory detail and facilitate error correction and discovery.
(Weick & Roberts, 1993)	Organizational behavior for organizations pursuing high operational reliability (i.e., aircraft carrier)	Collective mind: A pattern of heedful interrelations of actions in a social system	Collective mind can help reduce organizational errors through contributing, representing and subordinating.

Appendix B: Development of MTA Measurements

We followed Moore & Benbasat (1991) to develop the instrument for measuring mindfulness in technology adoption (MTA). Based primarily on Langer's (1989a) work, we conceptualized MTA as having four dimensions: Engagement with the Technology (EG), Technological Novelty Seeking (NS), Awareness of Local Contexts (LC) and Cognizance of Alternative Technologies (CN). To ensure content validity, the researchers developed fifteen new items (three for EG, three for NS, four for LC and five for CN) to cover the four dimensions based on a thorough review of the mindfulness literature.

We recruited eight Hong Kong doctoral students who have no prior exposure to this mindfulness study to do card sorting exercises. They were randomly assigned to two groups, with four people in each group. In the first round card sorting, four judges were asked to sort the fifteen items into groups and provide group labels. The judges could also put an item in a "too ambiguous/doesn't fit" category if they were uncertain about what it meant. This step aims at minimizing the possibility of "interpretational confounding" which occurs when an individual assigns empirical meaning to an unobserved variable rather than estimating unknown parameters and assigning the variable deductively (Burt, 1976). The labels proposed by the judges were generally consistent with what we designed for the items as the overall hit ratio was 90% (83% for EG, 80% for CN and 100% for NS and LC). After the first round, we dropped three items which were considered to be ambiguous.

In the second round of card sorting, another group of four judges were asked to sort the remaining items into five categories (four given categories plus an "N/A" category). The overall hit ratio increased to 93.75% (83.33% for EG, 91.67% for CN and 100% for NS and LC) and the Cohen's Kappa (Cohen, 1960) was 0.8. Thus we confirmed 12 items for the MTA (three for each dimension respectively).

We tested the final 12 items with a sample of 800 doctors from Hong Kong Hospital Authority and received 135 completed responses (16.9%). After initial screening on reliability, we had 131 valid responses in total. The overall analysis result of the pilot test was satisfactory. All items loaded with their corresponding constructs. All of the loadings exceed .90 which was far above the threshold at 0.71 (Comrey, 1973). The average variance extracted (AVE) was greater than 0.50 for all constructs, implying satisfactory convergent validity (Fornell & Larcker, 1981), and the square root of the AVE of each construct was much larger than the correlations of the specific construct with other constructs, suggesting satisfactory discriminant validity (Chin, 1998). Cronbach's Alpha of each construct is exceeding of 0.90 and provided strong evidence on construct reliability.

On the basis of these 12 items, we further added one items (CN1 in Appendix C) for the specific adoption context. Therefore, we put these 13 measurements (three for NS, three for EG, three for LC and four for CN) into testing in this study.

Appendix C: Measures

We have adapted and created measurements as follows. Other than Satisfaction, Disconfirmation and Internal Self-Efficacy, whose scales are specified believed, all other factors use a seven-point Likert scale, where 1 indicates "strongly disagree," 4 indicates "neutral," and 7 indicates "strongly agree."

Measures at Time 1

Prior Experience (Kim & Malhotra, 2005b)

How long have you been using PBworks/Google Sites?

(Never used it before, less than 3 months, 3 to less than 6 months, 6 to less than 12 months, 1 to less than 2 years, 2 years or more)

Mindfulness (Self-developed)

Technological Novelty Seeking (NS):

- NS1. I paid attention to differences of this new technology from any other technology I previously used.
- NS2. I tended to figure out how this wiki tool was unique in relation to the tools that I am currently using (word processing tool).
- NS3. I was mindful about how this wiki tool differed from similar tools (e.g., word processing tool) I had used.

Engagement with the Technology (EG):

- EG1. I was engaged in investigating this wiki tool when making the adoption decision.
- EG2. I gathered factual information about this wiki tool before making the adoption decision.
- EG3. I got involved in exploring this wiki tool before I adopted it.

Awareness of Local Contexts (LC)

- LC1. When making the decision to adopt this wiki tool, I thought about how this wiki tool might help my study.
- LC2. When making the decision to adopt this wiki tool, I thought about how this wiki tool might change the way my study was done.
- LC3. When making the decision to adopt this wiki tool, I thought about how this wiki tool may be compatible with my assignment requirements.

Cognizance of Alternative Technologies (CN):

- CN1. I attended to alternative views regarding the wiki tool before making the adoption decision.
- CN2. I was aware of other tools than this wiki tool before deciding to adopt it.
- CN3. I paid attention to equivalent tools to fulfill my needs before deciding to adopt this wiki tool.
- CN4. I thought about alternative tools to address my demands when deciding to adopt this wiki tool.

Perceived Usefulness (Adoption) (PUA) (Kim & Malhotra, 2005b)

- PUA1. I think this wiki tool would allow me to accomplish my study assignments more quickly.
- PUA2. Using this wiki tool could help improve the quality of my study.
- PUA3. This wiki tool would give me greater control over my study.
- PUA4. Using this wiki tool would enhance my effectiveness in my study.

Intention to Use (IU) (Bhattacherjee & Premkumar, 2004)

- IU1. I plan to use this wiki tool for my study.
- IU2. I intend to use this wiki tool for my future work.
- IU3. It is very likely that I will use this wiki tool in the near future.

Internal Self-Efficacy (SE) (Thatcher, Zimmer, Gundlach, & McKnight, 2008) (measured on a 10-point Likert scale, where 1 indicates "Not At All Confident," 5 indicates "Moderately Confident," and 10 indicates "Totally Confident.")

- SE1. I could use this wiki tool to facilitate my work if there was no one around to tell me what to do.
- SE2. I could use this wiki tool to facilitate my work if I had never used a wiki system like it before.
- SE3. I could use this wiki tool to facilitate my work if I had only the online help for reference.

Measures at Time 2

Perceived Task-Technology Fit (TTF) (Larsen et al., 2009; Lin & Huang, 2008)

In helping me to perform the assigned task(s),

- TTF1. The functionalities of the wiki tool were very compatible with the task.
- TTF2. The functionalities of the wiki tool made the task easy.
- TTF3. Using the wiki tool fit with the way I work.
- TTF4. Using the wiki tool fit with my educational practice.
- TTF5. In general, the functionalities of the wiki tool were best fit to the task.

Perceived Usefulness (Post-Adoption) (PUP) (Kim & Malhotra, 2005b)

- PUP1. Using this wiki tool helps me accomplish tasks more quickly.
- PUP2. Using this wiki tool improves the quality of the work I do.
- PUP3. Using this wiki tool gives me greater control over my work.
- PUP4. Using this wiki tool enhances my effectiveness in my work.

Disconfirmation (DC) (Bhattacherjee & Premkumar, 2004) (measured on a 7-point Likert scale, where 1 indicates "much worse than expected," 4 indicates "neutral," and 7 indicates "much better than expected.")

Compared to my initial expectations, the ability of this wiki tool

- DC1. to improve my performance is
- DC2. to increase my productivity is
- DC3. to enhance my effectiveness is
- DC4. to be useful for my work or study is

Satisfaction (SAT) (Bhattacherjee & Premkumar, 2004)

All things considered, I am_____ with my use of this wiki tool.

SAT1: 1 "Extremely displeased" —— 4 "Neutral" —— 7 "Extremely pleased"

SAT2: 1 "Extremely frustrated" —— 4 "Neutral" —— 7 "Extremely content"

SAT3: 1 "Extremely terrible" —— 4 "Neutral" —— 7 "Extremely delighted"

SAT4: 1"Extremely dissatisfied" —— 4 "Neutral" —— 7 "Extremely satisfied"

Intention to Continue (IC) (Bhattacherjee & Premkumar, 2004)

- IC1. I intend to use this wiki tool in the near future.
- IC2. I plan to use this wiki tool in the near future.
- IC3. I predict that I will use this wiki tool in the near future.

Appendix D: Loadings and Cross-loadings*

	NS	EG	LC	CN	PUA	IU	TTF	PUP	DC	SAT	IC	SE
NS1	0.75	0.34	0.30	0.22	0.30	0.32	0.22	0.24	0.20	0.14	0.01	0.16
NS2	0.84	0.27	0.38	0.23	0.41	0.40	0.25	0.28	0.26	0.16	0.03	0.39
NS3	0.79	0.28	0.29	0.25	0.28	0.33	0.14	0.25	0.16	0.13	0.02	0.22
EG1	0.39	0.87	0.44	0.30	0.29	0.30	0.14	0.26	0.22	0.14	-0.01	0.14
EG2	0.27	0.87	0.38	0.32	0.35	0.28	0.11	0.25	0.17	0.16	0.05	0.02
EG3	0.28	0.83	0.24	0.27	0.24	0.19	0.10	0.24	0.12	0.09	0.03	0.04
LC1	0.37	0.45	0.92	0.41	0.58	0.56	0.17	0.35	0.26	0.20	0.16	0.27
LC2	0.40	0.41	0.92	0.41	0.58	0.59	0.12	0.37	0.21	0.18	0.19	0.24
LC3	0.32	0.26	0.84	0.26	0.50	0.55	0.17	0.25	0.20	0.09	0.06	0.36
CN1	0.26	0.38	0.40	0.80	0.22	0.29	0.02	0.20	0.06	0.12	0.03	0.15
CN3	0.26	0.21	0.32	0.87	0.25	0.21	0.11	0.30	0.19	0.20	0.06	0.10
CN4	0.22	0.26	0.31	0.86	0.18	0.09	0.17	0.31	0.19	0.23	0.05	0.02
PUA1	0.35	0.35	0.57	0.23	0.92	0.69	0.31	0.40	0.36	0.25	0.11	0.38
PUA2	0.41	0.27	0.59	0.22	0.95	0.73	0.37	0.45	0.38	0.30	0.15	0.43
PUA3	0.38	0.34	0.55	0.24	0.90	0.65	0.29	0.35	0.34	0.26	0.09	0.33
PUA4	0.41	0.32	0.60	0.27	0.92	0.69	0.28	0.41	0.40	0.28	0.15	0.36
IU1	0.42	0.31	0.66	0.27	0.74	0.91	0.23	0.37	0.32	0.28	0.21	0.47
IU2	0.41	0.30	0.54	0.21	0.70	0.94	0.30	0.41	0.38	0.31	0.32	0.49
IU3	0.38	0.22	0.54	0.17	0.61	0.91	0.23	0.36	0.30	0.19	0.24	0.47
TTF1	0.16	0.06	0.08	0.00	0.12	0.10	0.82	0.50	0.44	0.44	0.20	0.08
TTF2	0.20	0.16	0.10	0.12	0.25	0.11	0.81	0.62	0.49	0.40	0.20	0.06
TTF3	0.25	0.12	0.19	0.10	0.40	0.32	0.87	0.60	0.60	0.51	0.25	0.12
TTF4	0.23	0.13	0.12	0.13	0.28	0.29	0.82	0.46	0.46	0.39	0.24	0.14
TTF5	0.24	0.11	0.19	0.13	0.34	0.31	0.85	0.59	0.50	0.48	0.28	0.10
PUP1	0.31	0.35	0.32	0.31	0.37	0.37	0.58	0.90	0.63	0.57	0.42	0.08
PUP2	0.30	0.22	0.33	0.28	0.45	0.38	0.62	0.91	0.61	0.52	0.43	0.12
PUP3	0.26	0.24	0.32	0.25	0.33	0.36	0.60	0.89	0.58	0.47	0.43	0.10
PUP4	0.30	0.26	0.36	0.31	0.45	0.40	0.61	0.94	0.67	0.56	0.43	0.13
DC1	0.26	0.20	0.20	0.14	0.33	0.34	0.52	0.62	0.88	0.53	0.36	0.10
DC2	0.25	0.20	0.25	0.14	0.36	0.33	0.51	0.61	0.88	0.60	0.37	0.09
DC3	0.22	0.17	0.18	0.13	0.36	0.27	0.52	0.61	0.91	0.59	0.38	0.08
DC4	0.19	0.15	0.26	0.19	0.37	0.34	0.58	0.60	0.88	0.61	0.42	0.11
SAT1	0.18	0.15	0.21	0.19	0.28	0.28	0.49	0.54	0.62	0.91	0.51	0.09
SAT2	0.12	0.13	0.14	0.16	0.29	0.25	0.49	0.54	0.60	0.90	0.40	0.08
SAT3	0.18	0.11	0.14	0.19	0.26	0.27	0.40	0.46	0.54	0.88	0.51	0.09
SAT4	0.17	0.17	0.15	0.22	0.23	0.22	0.54	0.57	0.60	0.91	0.46	0.02
IC1	0.01	0.03	0.14	0.04	0.11	0.25	0.27	0.45	0.43	0.52	0.95	0.02
IC2	0.04	0.02	0.19	0.08	0.16	0.27	0.30	0.48	0.42	0.50	0.96	0.03
IC3	0.02	0.02	0.12	0.04	0.11	0.27	0.24	0.42	0.37	0.48	0.94	0.03
SE1	0.29	0.05	0.21	0.11	0.34	0.43	0.09	0.10	0.04	0.04	0.06	0.84
SE2	0.29	0.07	0.28	0.11	0.33	0.48	0.07	0.08	0.05	0.07	0.01	0.91
SE3	0.28	0.09	0.35	0.07	0.41	0.44	0.15	0.14	0.19	0.09	0.00	0.86

NS: Technological Novelty Seeking (MTA) LC: Awareness of Local Contexts (MTA) PUA: Perceived Usefulness (Adoption) PUP: Perceived Usefulness (Post-Adoption)

IC: Intention to Continue

EG: Engagement with the Technology (MTA) CN: Cognizance of Alternative Technologies (MTA) TTF: Task-Technology Fit SAT: Satisfaction IU: Intention to Use

DC: Disconfirmation

SE: Internal Self-Efficacy

The highest loadings for each measure are highlighted in bold.

Appendix E: Measurement Issues of Disconfirmation

We found that the overall perceived usefulness (4.47) is 0.52 lower than what it was (5.00) at time 1 with an overall positive disconfirmation. To examine this issue, we follow Bhattacherjee and Premkumar (2004) in conducting a sub-group analysis by dividing the sample to four sub-groups: 1) higher perceived usefulness (adoption) (PUA) (higher than the overall sample mean 5.00), positive disconfirmation (higher than neutral value at 4); 2) higher PUA, negative disconfirmation; 3) lower PUA, positive disconfirmation; and 4) lower PUA, negative disconfirmation. The results of the sub-group analysis are summarized in Table E1.

Table E1. Sub-Group Analysis Results								
	High Exp	pectation		Low Expectation				
	Positive Disconfirmation (Group 1)	Negative Disconfirmation (Group 2)	Overall sample	Positive Disconfirmation (Group 3)	Negative Disconfirmation (Group 4)			
Number of observations	60 (34.9%)	13 (7.6%)	172	56 (32.6%)	43 (25%)			
PUA: Perceived Usefulness (Adoption)	6.12	6.42	5.00	4.39	3.81			
PUP: Perceived Usefulness (Post-Adoption)	5.21	4.44	4.47	4.67	3.23			
Difference: PUP-PUA	- 0.91	- 1.98	-0.53	0.28	- 0.91			
Disconfirmation	5.26	3.81	4.56	4.93	3.28			
Satisfaction	5.18	4.06	4.70	4.95	3.86			

According to Bhattacherjee and Premkumar (2004), the perceived usefulness (post-adoption) (PUP) should be higher than perceived usefulness (adoption) (PUA) in positive disconfirmation groups (Groups 1 and 3) and lower for negative disconfirmation groups (Groups 2 and 4). But in our study, we find that the PUP of group 1 are unexpectedly 0.91 lower than PUA. The reason may lie in Group 1's unrealistic high initial expectation (i.e., PUA mean: 6.12), thus its PUP has little room to increase at time 2 (i.e., ceiling effect). Moreover, PUP of Group 1 is still the highest (5.21) across all the four groups and is well above the neutral value 4. In addition, its mean of disconfirmation and satisfaction are also the highest across all four groups. Therefore, it is reasonable to consider Group 1 are positively disconfirmed.

The paradox we see in this research that — that a positive disconfirmation exists when later belief is indeed lower than early belief — resonates the ongoing debate regarding how to operationalize disconfirmation (Brown et al., 2014; Edwards, 2002; Irving & Meyer, 1999; Venkatesh & Goyal, 2010). Prior research has operationalized disconfirmation using either the difference score (later beliefs - initial beliefs) or the direct measurement of disconfirmation (for a detailed review, please see Brown et al. 2014). The use of difference score approach may suffer from confounding and ambiguous results and oversimplifying the complex relationship between expectations and experience (Edwards, 2002). As a result, researchers have used the direct measurement of disconfirmation approach, as in the CCM and this research, to overcome the drawbacks of the difference score approach. Nevertheless, the direct measurement of disconfirmation also has problems such as recall bias (Brown et al., 2014; Irving & Meyer, 1999). In this research, we followed CCM in adopting the direct measure of disconfirmation for its higher reliability and lower expectation bias (Bhattacherjee & Premkumar, 2004; Yi, 1990). The paradox we see in this research reflects the essential difference between these two approaches. We believe that the difference score approach may be over-simplistic in light of the fact that disconfirmation may be more than belief differences. This is indeed an interesting topic for future research.