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USING INFORMATION TECHNOLOGY MINDFULLY

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Abstract

Although there are numerous explanations of why users behave in specific ways toward information technologies, recent work in social psychology suggests that holistic traits such as awareness and openness are potentially important explanatory variables in technology behavior theories. In this paper, we examine the multi-dimensional construct of mindfulness and its applicability to the domain of IS research. Drawing from the social psychology literature, we adapt the notion of mindfulness and its dimensions – alertness to distinction, openness to novelty, orientation in the present, and awareness of multiple perspectives – to the domain of information systems. In doing so, we place mindfulness within the broader nomological net related to individual level decisions about information technology. Also, we present preliminary explanations for how mindfulness converges with and discriminates from existing constructs in the information systems literature. Finally, we present an initial domain-specific measure of mindfulness and assess the psychometric properties of the proposed measure. Using data collected from 318 subjects with Internet Applications as the target technology, analysis indicates that the operational measures have acceptable psychometric properties and confirmatory factor analysis supports the proposed multi-dimensional structure. Implications for practice and research are offered.

Keywords: mindfulness, user behavior, IT use, instrument development

Introduction

IS researchers have long investigated why, when, and how individuals interact with information technology. In doing so, numerous theoretical perspectives have been employed to investigate IT-use, such as expectation-confirmation theory (Oliver, 1980), theory of planned behavior (Ajzen, 1991), and the theory of reasoned action (Ajzen & Fishbein, 1973). Such perspectives are helpful in explaining intent to accept (Davis, Bagozzi, & Warshaw, 1989; Taylor & Todd, 1995) and continue using IT (Bhattacharjee, 2001), as well as post-adoption behaviors associated with IT (Jasperson, Carter, & Zmud, 2005). Recent work calls for the utilization of the concept of mindfulness in IS research (Butler & Gray, 2006; Fichman, 2004). In response, we conceptualize and operationalize individual-level mindfulness in the domain of information systems. Specifically, we ask, *what are the effects of mindfulness on behavior associated with IT-enabled work systems?* In exploring this question we adapt concepts of mindfulness (Langer, 1989, 1997), a well-established construct in the social psychology literature, to the domain of information systems.

This manuscript is organized as follows. We first review the theoretical background of mindfulness as developed in the social psychology literature and discuss the relevance of mindfulness to IS research. This is followed by an empirical examination of the dimensions of mindfulness in a study of 318 users of Internet Applications using structural equation modeling as an analytical tool. Results of the study are presented and practical and theoretical implications offered.

Theoretical Background

Mindfulness refers to continuous scrutiny and 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 (Langer, 1989). When mindful, an individual experiences a heightened state of involvement or being in the present moment (Langer & Moldoveanu, 2000). A mindful individual interprets the world by continuously creating and using new categories to understand phenomenon (Langer, 1997). Mindlessness is the absence of mindfulness (Sternberg, 2000). Individuals engaged in mindless behavior do not actively construct their environment; instead, these individuals respond to an already constructed environment (Chanowitz & Langer, 1980). Mindless activity does not imply the absence of all cognitive processing – just the absence of flexible cognitive processing (Langer, Chanowitz, & Blank, 1985). When individuals succumb to automatic thought processes and act mindlessly, they often miss vital information or a mind-expanding opportunity. Staying open to new experiences enables individuals to draw new distinctions and rethink old categories when encountering novel situations.

Mindfulness consists of four dimensions: alertness to distinction, openness to novelty, orientation in the present, and awareness of multiple perspectives (Langer, 1997). Alertness to distinction involves developing new ideas and ways of looking at things. Specifically, mindful individuals can distinguish how things are the same or different. Mindfulness also involves an openness to novelty, i.e. the active pursuit of new and various kinds of stimuli. Orientation in the present refers to a heightened level of awareness and involvement in whatever particular situation an individual faces. Finally, mindful individuals invoke multiple perspectives and recognize that each perspective holds value. Thus, they are flexible and open-minded when approaching any particular situation.

The dimensions of mindfulness can each apply to the IS environment. Alertness to distinction is defined as the degree to which an individual develops novel ideas and ways of looking at things. Specifically, individuals alert to distinction exhibit creativity in generating new and effective ideas. Just as mindlessness is the firm reliance on old or present categories, mindfulness is the continual creation of new ones (Langer, 1989). Interestingly enough, these new categories become available for mindless use (Langer & Piper, 1987). Thus, a vicious cycle of mindful and mindless behavior exists around the concept of categorization.

A second dimension of mindfulness is openness to novelty, defined as the extent to which an individual explores and engages novel stimuli. Individuals open to novel ideas and ways of doing things are characterized by curiosity, experimentation, and openness to intellectually challenging ideas. Conceptually, curiosity overlaps with models of cognitive absorption (Agarwal & Karahanna, 2000). Within cognitive absorption, curiosity is defined as the extent to which a specific experience arouses an individual's sensory and cognitive curiosity (Malone, 1981). Cognitive absorption is also characterized by temporal dissociation and focused immersion, or a state of deep involvement with IT. While mindful individuals may be curious and open to novel experiences, they often do not lose track of time or their focus of stimuli outside the immediate IT or task at hand. Thus, dimensions central to cognitive absorption (e.g., temporal dissociation, focused immersion) do not constitute core elements of mindfulness.

Another closely related construct to openness to novelty is personal innovativeness in the domain of information technology (PIIT) (Agarwal & Prasad, 1998). Specifically, both PIIT and openness to novelty share aspects of mindfulness through the notion of experimentation. Yet there is a greater difference between the two constructs than overlap. PIIT is defined as “the willingness of an individual to try out any new information technology” (Agarwal & Prasad, 1998, p. 206). As innovators, individuals who score high on PIIT are also perceived as risk-takers. While mindful behavior is characterized as open to new ways of doing things, mindful individuals are not necessarily prone to risk. Rather, a mindful individual is sensitive to context (Langer & Moldoveanu, 2000). Thus, while such individuals are willing to explore and experiment with IT, they are also constantly aware of how their actions may lead to potential consequences. Also, PIIT is a trait, whereas each dimension of mindfulness is a state of behavior. Finally, PIIT is primarily concerned with the adoption of IT. While early adopters may be willing to try out new information technologies, we do not yet understand their behavior in post-adoption environments. However, when mindfulness drives IT use, theory suggests that it should influence individuals' perceptions and beliefs at all stages of an innovation's diffusion.

Orientation in the present is defined as the degree to which an individual becomes involved in any given situation. Sensitive to their context, mindful individuals attend to the “big picture” and stay aware of new developments. Consider software upgrades. Mindful individuals, potentially engaged and aware of new features of an application (Griffith, 1999), may selectively apply those new features in the optimal manner to the task at hand. Given mindful individuals' sensitivity to the context, their selection of upgrades to implement may vary from one context to another (Sternberg, 2000). Hence, when using IT in general, mindful people may seek to identify applications of

information technologies germane to the specific task at hand. In doing so, we anticipate that they would be more likely to appropriately adapt technologies to a specific context and realize synergies derived from a good task-technology fit (Goodhue & Thompson, 1995).

A fourth dimension of mindfulness is awareness of multiple perspectives, which refers to the extent to which an individual can analyze a situation from multiple perspectives and identify the value of each. Processing information from diverse perspectives enables individuals to apply such information in new ways as well as alternative contexts (Chanowitz & Langer, 1980). Individuals who employ multiple perspectives possess the ability to create innovative solutions to problems and adapt their behavior to take advantage of shifting environments (Langer, 1989). Within the domain of IS, mindful individuals may create multiple uses of a specific application, even uses unintended by the original designer (Orlikowski, Yates, Okamura, & Fujimoto, 1995). For instance, researchers find that users often implement “workarounds” to achieve greater synergy between technology and task (Boudreau & Robey, 2005).

Research Methodology

Study Context and Sample

The approach taken to empirically test the psychometric properties of mindfulness was a field study using a survey methodology for data collection. We collected data from student subjects enrolled at a large state university. Given the nature of the sample, we chose Internet Applications as the target information technology. Internet Applications are defined as a suite of applications that support learning. Specifically, Internet Applications consist of the World Wide Web, Email, and Instant Messenger. Besides being widely used by students, these technologies are appropriate for at least two reasons: one, they are optional technologies that students use of their own accord and not from any mandate, and two, the technologies as a suite exemplify the characteristics of contemporary IT that underscore the importance of the concept of mindfulness. Finally, the technologies are widely available; thus, access is not an inhibitor to technology usage.

Students enrolled in upper-level undergraduate business classes were surveyed. Students were instructed to respond to the survey as candidly as possible, that there were no right or wrong answers, and that we were primarily interested in their use of Internet Applications. A total of 318 surveys were returned. Approximately 20% of our data was missing. To avoid the loss of a large fraction of the sample due to missing data, we imputed missing data using the direct maximum likelihood imputation method in EQS (Byrne, 2006). Maximum likelihood methods have much better statistical properties than conventional methods (e.g., listwise deletion, pairwise deletion, and regression imputation) have under considerably weaker assumptions (Allison, 2003).

In order to establish alternate forms of construct validity for the measure, we identify a number of existing measures for related yet distinct constructs that demonstrate desirable psychometric properties. These measures include the five dimensions of cognitive absorption (CA) (Agarwal & Karahanna, 2000). Because the conceptual considerations discussed earlier lead us to expect differences among the measures, the choice of the CA dimensions as alternate scales to assess convergent and discriminant validity is appropriate. Since PIIT is a trait and mindfulness is a state, we do not test for differences between the two.

Data on mindfulness and CA were collected as part of a larger instrument that measured several other constructs. The items for all measures were distributed randomly throughout the instrument.

Content Validity

All research variables were measured using multi-item scales. Cognitive absorption was measured with the 20-item scale developed by Agarwal and Karahanna (2000). Scales to measure the four dimensions of mindfulness were developed using a multi-stage procedure. First, we adapted Langer’s (2004) 21-item validated mindfulness scale to the IT context. These scales were pilot-tested using a sample of 238 respondents. Results of the pilot test led to further refinement to establish construct validity. The final scales used in the present study consisted of four items measuring alertness to distinction, four items measuring openness to novelty, five items measuring orientation in the present, and three items measuring awareness of multiple perspectives.

All items were scored on a 1-7 Likert scale with “Strongly Disagree” and “Strongly Agree” as the two anchors for the end points of the scale, and “Neutral” was the anchor for the mid-point of the scale. Table 1 provides the number of items, means, and standard deviations for each construct.

Table 1. Descriptive Statistics

Construct	# Items	Mean	Std. Dev.
MI: Alertness to Distinction	4	4.27	1.31
MI: Openness to Novelty	4	4.16	1.11
MI: Orientation in the Present	5	4.30	1.11
MI: Awareness of Multiple Perspectives	3	5.35	1.22
CA: Temporal Dissociation	5	5.39	1.15
CA: Focused Immersion	5	4.32	1.00
CA: Heightened Enjoyment	4	4.99	1.03
CA: Control	3	4.85	0.96
CA: Curiosity	3	4.60	1.12

Analysis and Results

We utilized confirmatory factor analysis in EQS 6.1 to test five alternative models for dimensionality and convergent validity of the mindfulness constructs. The normalized estimate for multivariate kurtosis was 42.25; therefore, we used the robust estimates provided by EQS (Byrne, 2006) for all models tested. Model 1 hypothesizes that a unidimensional first-order factor accounts for the variance among all 16 measurement items. Model 2 hypothesizes that the 16 items form into four uncorrelated first-order factors: alertness to distinction, openness to novelty, orientation in the present, and awareness of multiple perspectives. Model 3 hypothesizes that the 16 items form into four freely correlated first-order factors.

Comparison of Model 1 ($\chi^2 = 817.74$, d.f. = 104, CFI = 0.71, RMSEA = 0.147) and Model 2 ($\chi^2 = 666.83$, d.f. = 104, CFI = 0.77, RMSEA = 0.131) shows that Model 2 is a better-fitting model (lower chi-square for the same degrees of freedom and better fit indices), indicating that a multidimensional model comprising of four uncorrelated first-order factors is superior to a unidimensional first-order factor model. Therefore, support is obtained for multidimensionality of mindfulness.

Further comparison of Model 2 ($\chi^2 = 666.83$, d.f. = 104, CFI = 0.77, RMSEA = 0.131) with Model 3 ($\chi^2 = 275.86$, d.f. = 98, CFI = 0.93, RMSEA = 0.076), which are nested models, indicates that Model 3, four freely correlated first-order factors (unconstrained model), is superior to Model 2 (constrained model), four uncorrelated first-order factors ($\Delta \chi^2 = 390.97$, Δ d.f. = 6, $p < 0.0001$). In Model 3, standardized factor loadings of measurement items on their respective factors are all highly significant ($p < 0.001$), providing support for convergent validity. Model 3 also provides acceptable measures of model fit (Marsh, Hau, & Wen, 2003).

We utilized exploratory factor analysis to test for discriminant validity between dimensions of mindfulness and dimensions of CA. We used maximum likelihood extraction with promax rotation. The analysis identified eight factors with an eigenvalue greater than one, which collectively explained 66.97 percent of the variance. With the exception of the items for the control dimension of CA, all indicators loaded on the latent variables they measured. No items cross-loaded. These results suggest that when compared with related, yet different constructs, the measures for the dimensions of mindfulness exhibit high convergent and discriminant validity.

Although mindfulness may be modeled as a second-order factor that explains all the covariation among the four first-order factors, we contend that mindfulness is best conceptualized as a broad domain with four distinct constructs within it. Thus, we do not expect mindfulness as a second-order factor to fully mediate the relationship of the first-order factors when applied in a theoretical model (Chin, 1998). Future research should examine the dimensions of mindfulness within a greater nomological network.

Table 2 reports findings related to reliability and validity analysis. Our measures for PIIT, four dimensions of CA, and dimensions of mindfulness exceed the prescribed 0.7 threshold for Cronbach’s α (Nunnally & Bernstein, 1994). One exception to the reliability threshold is the control dimension of CA, which had a Cronbach’s α value of .65.

Table 2. Inter-Construct Correlations

Construct	Reliability	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. MI: AD	.90	1								
2. MI: ON	.91	0.65	1							
3. MI: OP	.89	0.61	0.70	1						
4. MI: MP	.86	0.53	0.46	0.46	1					
5. CA: TD	.95	0.20	0.18	0.27	0.30	1				
6. CA: FI	.81	0.25	0.28	0.32	0.21	0.31	1			
7. CA: HE	.84	0.32	0.42	0.44	0.43	0.59	0.41	1		
8. CA: CO	.65	0.29	0.33	0.36	0.42	0.39	0.31	0.55	1	
9. CA: CU	.95	0.50	0.64	0.55	0.49	0.31	0.36	0.58	0.37	1

MI = Mindfulness; AD = Alertness to Distinction; ON = Openness to Novelty; OP = Orientation in the Present; MP = Awareness of Multiple Perspectives; CA = Cognitive Absorption; TD = Temporal Dissociation; FI = Focused Immersion; HE = Heightened Enjoyment; CO = Control; CU = Curiosity

Discussion

This study conceptualizes and adapts theoretical concepts of mindfulness to the domain of IS. We develop measures of dimensions of mindfulness with sound psychometric properties which can be used for future empirical research. Specifically, we show how mindfulness converges with and discriminates from related constructs in IS research. We believe that our work further advances discussion among IS scholars with respect to further adapting strong theoretically-based constructs based in reference disciplines.

Before discussing implications of mindfulness in IS research, it is important that we acknowledge one limitation of our study. We used student subjects to develop our measures for mindfulness. Therefore, our results may not be generalizable to the greater population of non-student subjects. However, prior instrument development research in IS has utilized student subjects (Agarwal & Karahanna, 2000; Agarwal & Prasad, 1998). Also, student subjects are generally not different from non-student subjects in non-experimental settings (Gordon, Slade, & Schmitt, 1986). Future research can examine empirically the effects of mindfulness in a number of diverse contexts.

Individual mindfulness in the domain of information systems has implications for both theory and practice. From a theoretical perspective, concepts of mindfulness can be applied to a variety of research areas, such as technology adoption, post-adoption, usage, and abandonment. For example, scholars propose using mindfulness as a theoretical lens to investigate reliability of information systems (Butler & Gray, 2006).

For the practicing professional, understanding mindfulness may help managers identify individuals likely to carefully consider technology adoption as well as reflectively engage in post-adoption activities. Different intervention types in the workplace may have varying impacts on mindful versus mindless people in the application of IT (Jasperson et al., 2005). Moreover, mindfulness may help explain why users abandon specific types of information technologies. Namely, a mindful individual may realize that a particular information system is no longer applicable to a specific task or work environment. Thus, technology “abandonment” may be a positive behavior.

Conclusion

This study provides a conceptual and operational definition of a broad construct that can shed further light on how individuals interact with information technology. Future research can place mindfulness in the greater nomological network of IS research. By doing so we can explore how mindfulness relates to IT adoption, usage, reliability, post-adoption behaviors, and other IT-related phenomena.

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