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TYING CONTEXT TO POST-ADOPTION BEHAVIOR WITH INFORMATION TECHNOLOGY: A CONCEPTUAL AND OPERATIONAL DEFINITION OF MINDFULNESS

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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, post-adoptive behavior, instrument development

Introduction

Why are some individuals more effective in applying information technology to their work context than others? IS researchers have begun investigating this question by moving beyond intentions to use IT into the realm of post-adoptive behaviors associated with IT-enabled work systems (Jasperson et al. 2005). One perspective which may explain factors leading to effective post-adoptive behavior is mindfulness. Mindfulness refers to 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 (Langer 1989). Recent work calls for the utilization of the concept of mindfulness in IS research (Butler and 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 post-adoptive behavior associated with IT-enabled work systems?* In examining this question we adapt mindfulness (Langer 1989; Langer 1997), a well-established construct in the social psychology literature, to the domain of information systems.

This paper unfolds as follows. First, we review the theoretical background of mindfulness as developed in the social psychology literature and adapt it to the domain of Information Systems (IS) research. Next, we present an empirical

examination of the dimensions of mindfulness in two studies of users of Internet Applications. Then, we report the results of our study. The paper concludes with implications for research and practice.

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 and 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 and Langer 1980). Mindless activity does not imply the absence of all cognitive processing – just the absence of flexible cognitive processing (Langer et al. 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 each apply to the use of information technology. Alertness to distinction refers to 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 and 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, which refers to 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 and Karahanna 2000). Within cognitive absorption, curiosity is defined as the extent to which a specific experience arouses an individual's sensory and cognitive curiosity. 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 and Prasad 1998). Specifically, both PIIT and openness to novelty overlap in that they relate to experimentation. Although related, PIIT and openness to novelty are conceptually distinct constructs. PIIT refers to “the willingness of an individual to try out any new information technology” (Agarwal and 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 and 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 and 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 and 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 et al. 1995). For instance, researchers find that users often implement “workarounds” to achieve greater synergy between technology and task (Boudreau and 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 referred to 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 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 (Agarwal and Karahanna 2000). Because the conceptual considerations discussed earlier lead us to expect differences among the measures, the choice of the cognitive absorption 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 cognitive absorption 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. Table 1 provides examples of items for each dimension of mindfulness.

Table 1. Examples of Mindfulness Items

Dimension	Item
Alertness to Distinction	I find it easy to create new and effective ways of using Internet Applications.
Openness to Novelty	I like to investigate different ways of using Internet Applications.
Orientation in the Present	I often notice how other people are using Internet Applications.
Awareness of Multiple Perspectives	I am often open to learning new ways of using Internet Applications.

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 2 provides the number of items, means, and standard deviations for each construct.

Table 2. 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
MI: Mindfulness, CA: Cognitive Absorption			

Analysis and Results

We utilized confirmatory factor analysis in EQS 6.1 to test three alternative models for dimensionality and convergent validity of the mindfulness constructs. Tests for multivariate kurtosis revealed that our normalized estimate was 42.25, providing evidence that our data was not normally distributed (Byrne 2006). Maximum likelihood techniques, which are commonly used in SEM-based approaches, require multivariate distribution (Gefen et al. 2000). Since our data was not normally distributed, we used the scaled χ^2 statistic (Satorra and Bentler 1988) and corresponding robust fit estimates (CFI and RMSEA) provided by EQS (Byrne 2006). These robust estimates have been used in prior IS research (Swanson and Dans 2000) and are reported to be highly reliable for estimation purposes (Hu et al. 1992).

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 et al. 2003).

We utilized exploratory factor analysis to test for discriminant validity between dimensions of mindfulness and dimensions of cognitive absorption. 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 cognitive absorption, 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.

Table 3 reports findings related to reliability and validity analysis. Our measures for all dimensions of mindfulness and four dimensions of cognitive absorption exceed the prescribed 0.7 threshold for Cronbach’s α (Nunnally and Bernstein 1994). One exception to the reliability threshold is the control dimension of cognitive absorption, which had a Cronbach’s α value of .65.

Table 3. Inter-Construct Correlations and Construct Reliabilities

Construct	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. MI: AD	0.90								
2. MI: ON	0.65	0.91							
3. MI: OP	0.61	0.70	0.89						
4. MI: MP	0.53	0.46	0.46	0.86					
5. CA: TD	0.20	0.18	0.27	0.30	0.95				
6. CA: FI	0.25	0.28	0.32	0.21	0.31	0.81			
7. CA: HE	0.32	0.42	0.44	0.43	0.59	0.41	0.84		
8. CA: CO	0.29	0.33	0.36	0.42	0.39	0.31	0.55	0.65	
9. CA: CU	0.50	0.64	0.55	0.49	0.31	0.36	0.58	0.37	0.95
* Reliabilities are located in the off-diagonal 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 and Karahanna 2000; Agarwal and Prasad 1998). Also, student subjects are generally not different from non-student subjects in non-experimental settings (Gordon et al. 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, one potential application of mindfulness is in the learning phase in the adoption of information technologies. Scholars have recently advanced the notion of mindful learning (Langer 1997). A mindful approach to learning employs the four dimensions of mindfulness: (1) alertness to distinction; (2) openness to novelty; (3) orientation in the present; and (4) an awareness of multiple perspectives. Learning to effectively apply IT to a specific task or context with an openness to novelty and actively noticing differences, contexts, and perspectives makes individuals receptive to changes in an ongoing situation. When mindful, basic skills and information guide behavior in the present, as opposed to running on automatic pilot. Future research should examine the impacts of mindfulness on learning to effectively use IT.

For the practicing professional, understanding mindfulness may help managers identify individuals likely to 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.

References

- Agarwal, R., and Karahanna, E. "Time Flies When You're Having Fun: Cognitive Absorption and Beliefs About Information Technology Usage," *MIS Quarterly* (24:4), December 2000, pp. 665-695.
- Agarwal, R., and Prasad, J. "A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology," *Information Systems Research* (9:2), June 1998, pp. 204-215.
- Allison, P.D. "Missing Data Techniques for Structural Equation Modeling," *Journal of Abnormal Psychology* (112:4) 2003, pp. 545-557.
- Boudreau, M.-C., and Robey, D. "Enacting Integrated Information Technology," *Organization Science* (16:1) 2005, pp. 3-18.
- Butler, B.S., and Gray, P.H. "Reliability, Mindfulness, and Information Systems," *MIS Quarterly* (30:2), June 2006, pp. 211-224.
- Byrne, B.M. *Structural Equation Modeling with EQS*, (2nd ed.) Lawrence Erlbaum Associates, Mahwah, New Jersey, 2006.
- Chanowitz, B., and Langer, E.J. "Knowing More (or Less) Than You Can Show: Understanding Control Through the Mindlessness/Mindfulness Distinction," in: *Human Helplessness*, M.E. Seligman and J. Garber (eds.), Academic Press, New York, 1980.
- Fichman, R.G. "Going Beyond the Dominant Paradigm for Information Technology Innovation Research: Emerging Concepts and Methods," *Journal of Association for Information Systems* (5:8), August 2004, pp. 314-355.
- Gefen, D., Straub, D.W., and Boudreau, M.-C. "Structural Equation Modeling and Regression: Guidelines for Research Practice," *Communications of the Association Information Systems* (4:7), August 2000, pp. 1-77.
- Goodhue, D.L., and Thompson, R.L. "Task-Technology Fit and Individual Performance," *MIS Quarterly* (19:2) 1995, p. 213.
- Gordon, M.E., Slade, L.A., and Schmitt, N. "The "Science of the Sophomore" Revisited: from Conjecture to Empiricism," *Academy of Management Review* (11:1), January 1986, pp. 191-207.
- Griffith, T.L. "Technology Features as Triggers for Sensemaking," *Academy of Management Review* (24:3), June 1999, pp. 472-488.
- Hu, L.T., Bentler, P.M., and Kano, Y. "Can Test Statistics in Covariance Structure Analysis be Trusted?," *Psychological Bulletin* (112:2) 1992, pp. 351-362.
- Jaspersen, J.S., Carter, P.E., and Zmud, R.W. "A Comprehensive Conceptualization of Post-Adoptive Behaviors Associated with Information Technology Enabled Work Systems," *MIS Quarterly* (29:3), September 2005, pp. 525-557.
- Langer, E.J. *Mindfulness* Addison-Wesley, Reading, MA, 1989.
- Langer, E.J. *The Power of Mindful Learning* Addison-Wesley, Reading, MA, 1997.
- Langer, E.J. "Langer Mindfulness Scale," Boston, MA, 2004.
- Langer, E.J., Chanowitz, B., and Blank, A. "Mindlessness–Mindfulness in Perspective : A Reply to Valerie Folkes," *Journal of Personality and Social Psychology* (48:3), March 1985, pp. 605-607.
- Langer, E.J., and Moldoveanu, M. "The Construct of Mindfulness," *Journal of Social Issues* (56:1) 2000, pp. 1-9.
- Langer, E.J., and Piper, A. "The Prevention of Mindlessness," *Journal of Personality and Social Psychology* (53) 1987, pp. 280-287.
- Marsh, H.W., Hau, K.-T., and Wen, Z. "In Search of Golden Rules: Comment on Hypothesis-Testing Approaches to Setting Cutoff Values for Fit Indexes and Dangers in Overgeneralizing Hu and Bentler's (1999) Findings," *Structural Equation Modeling* (11:3) 2003, pp. 320-341.
- Nunnally, J.C., and Bernstein, I.H. *Psychometric Theory*, (3rd ed.) McGraw-Hill, Inc., New York, New York, U.S.A., 1994.
- Orlikowski, W.J., Yates, J., Okamura, K., and Fujimoto, M. "Shaping Electronic Communication: The Metastructuring of Technology in the Context of Use," *Organization Science* (6:4) 1995, pp. 423-444.
- Satorra, A.C., and Bentler, P.M. "Scaling Corrections for Chi-square Statistics in Covariance Structure Analysis," *Proceedings of the Business and Economics Sections, American Statistical Association*, Alexandria, VA, 1988.
- Sternberg, R.J. "Images of Mindfulness," *Journal of Social Issues* (56:1) 2000, pp. 11-26.
- Swanson, E.B., and Dans, E. "System Life Expectancy and the Maintenance Effort: Exploring Their Equilibration," *MIS Quarterly* (24:2), June 2000, pp. 277-297.