Constructive System Use

Research in Progress

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Information and communication technologies are so embedded in modern society that we have arrived at the point at which learning to use technology constructively may affect our day to day lives as much as does learning to eat properly. While information systems scholars have studied interesting post-adoption constructs such as continuance intentions and IT-appropriation, research explaining and predicting constructive system-use (i.e., system-use that is both fulfilling and productive) has been scarce. Better understanding constructive system-use would benefit both research and practice – scholars' knowledge of positive outcomes of human computer interactions would expand and practitioners could gain insights toward improving employee productivity in terms of system-use. We pursue this study by developing a theory around user attributes, behaviors, learning styles, and use outcomes.

Keywords: Constructive system use, user attributes, personality traits, adaptive system use, system success

It's not who you are underneath; it's what you do that defines you.

~Batman (2005)

Introduction

Unless you have been living under a rock for the past 30 years, you are well-aware that information technologies (digital tools used to produce and analyze information) are increasingly ubiquitous and pervasive. It is difficult to work in any field without having to learn and use new information technologies (Butler 2006; Lyytinen and Yoo 2002). Even fields such as agriculture, waste management, and construction, which have traditionally involved minimal IT (if any), are finding it darn near impossible to compete and succeed without depending on new IT (e.g., Arebey et al. 2011; Gaskin et al. 2011; Suprem et al. 2013). Thus relevant research questions seem no longer to be about adoption and acceptance, but rather about appropriation and use outcomes (Sun 2012).

We have learned by repeated experience that not all users just "get it" and immediately know how best to use technology and to maximize desirable use outcomes (Nan 2011). Substantial variance in the success of individual system use still remains to be explained. Accordingly, the opportunity exists to explore how certain user attributes (i.e., who you are) and user actions (i.e., what you do) affect use outcomes, and how these effects are dependent, to some degree, on the way individuals process information (i.e., learning style). Because IT is so embedded in nearly all facets of all types of work, exploring such questions could have fairly broad impacts throughout the business world.

This study focuses on an individual level of analysis primarily because the actual human computer interaction most often takes place at this level (rather than at a group level). While group work continues to be a common and even dominant practice for socially driven tasks—such as to coordinate, negotiate, validate, or choose—constructive system use (i.e., generating artifacts) still most often occurs at the individual level. Groups meet to plan and coordinate work efforts, and then disperse to work individually on those productivity-oriented tasks. Thus, a theory of *constructive system use* ought to be theorized at the unit level of the individual.

The literature guiding this study comes from the research on system success (DeLone and McLean 1992, 2003), adaptive system use (Sun 2012), learning styles (Schmeck 1988; Schmeck et al. 1977), and the five factor model of personality (Costa Jr and McCrae 1992). This abundant source of literature primarily provides guidance on our selection of variables and scales and the proposed relationships between these variables. Beyond the foundational literature, this paper offers its own unique contribution of explaining and predicting user success at the individual level by bringing together a concise nomological model of the individual users' traits, actions, and learning styles. Such a model promises both parsimony and fairly thorough coverage of what drives an individual's constructive system use. As such, one may expect a strongly predictive model.

The driving logic of this model suggests that who you are (your attributes) cannot very well explain your performance without taking into account what you do (actions) with those attributes, and how you process information (learning style) as you interact with the system. Thus the model proposes mediating logic (through actions) moderated by learning styles. I next review the pertinent literature before concluding with some propositions for future research to test.

Guiding literature for constructive system use

Dimensions of System Success

My primary focus is on explaining and predicting constructive system-use in the context of information systems interactions. I define constructive system-use as *fulfilling and productive user interactions with the information system*. Building on the DeLone and McLean model of system success (DeLone and McLean 1992, 2003), we propose an interaction with the information system is constructive when the

user perceives increased (1) information quality, (2) system quality, (3) service quality, (4) intention to use, (5) user satisfaction, and (6) net benefits. In order to refine their work, DeLone and McLean (2003) surveyed all the studies that had cited their original model of system success (DeLone and McLean 1992). This survey resulted in the six dimensions of system success listed above. However, in their updated construct of system success, they proposed a clear causal model with relationships between each of the dimensions of system success. In the model I am proposing, each of the six dimensions is part of a combined 2nd order construct of constructive system use. This implies that these variables can occur together as an outcome, rather in a fixed causal order. Consider the use of spreadsheet software as an information system. One could evaluate his/her use of the system as constructive if he/she perceived his/her use to result in good quality of information, system, and service, if they were satisfied with their use, and therefore intended to continue using the system, and if there were positive net benefits. Such outcomes of use could be considered constructive. Modeling constructive system use as a single 2nd order construct implies that the net result of each of the dimensions represents a constructive interaction with the system.

Dimensions of User Attributes

I draw upon the five factor model of personality (Costa Jr and McCrae 1992) to conceptualize the distinct attributes of users that may affect outcomes of system use. The five factor model includes the following personality traits: (1) openness to experience, (2) conscientiousness, (3) extraversion, (4) agreeableness, and (5) neuroticism. These five factors are not intended to be mutually exclusive within individuals, but they are conceptually distinct and cover the broad spectrum of personality traits. An individual user will exhibit certain levels of each of these traits. We model them individually because they are theorized to have separate and distinct effects on user actions. For example, being open to experience may have a stronger positive effect on constructive user actions than conscientiousness has. These five personality traits have been applied broadly in the literature to predict positive outcomes. For example, Komarraju et al. (2011) theorized that openness, conscientiousness, and agreeableness would have a positive effect on student performance (GPA), that neuroticism would have a negative effect, and that extraversion may have either effect.

Dimensions of Constructive User Actions

I draw upon Adaptive System Use (Sun 2012) for four specific actions that exemplify constructively using information systems: (1) trying new features, (2) feature substituting, (3) feature recombining, and (4) feature repurposing. Because Sun (2012) is a fairly recent publication, it has not yet been applied as an antecedent to outcome variables. However, Sun relied upon active versus passive (automatic) thinking in order to explain the benefits of adaptive system use. The key is that when we are adapting we are actively thinking (rather than passively), and active thought results in more innovative and creative uses of systems, which result in more positive outcomes. The constructive system use model offers a first look at adaptive system use as an antecedent to positive system use outcomes.

Learning Styles

I draw upon the learning styles developed by Schmeck et al. (1977) as moderators in this model of constructive system use. The four learning styles Schmeck et al. (1977) developed are (1) synthesis/analysis, (2) methodological study, (3) fact retention, and (4) elaborative processing. Learning styles, like personality traits, have been use broadly to predict positive outcomes. For example, Komarraju et al. (2011) theorized that learning styles would also have a positive effect on student performance, and would mediate the effect of personality traits on performance. I have chosen to use learning styles as a moderator rather than a mediator because the four learning styles are theorized to change the other effects in the model, rather than transfer those effects.

A Theory of Constructive System-use

The theory I am advancing is fairly simple and includes only five propositions. The conceptual model is shown in Figure 1. I next offer some logic for the proposed relationships. The definitions and measures for each of these constructs are available in the Appendix.

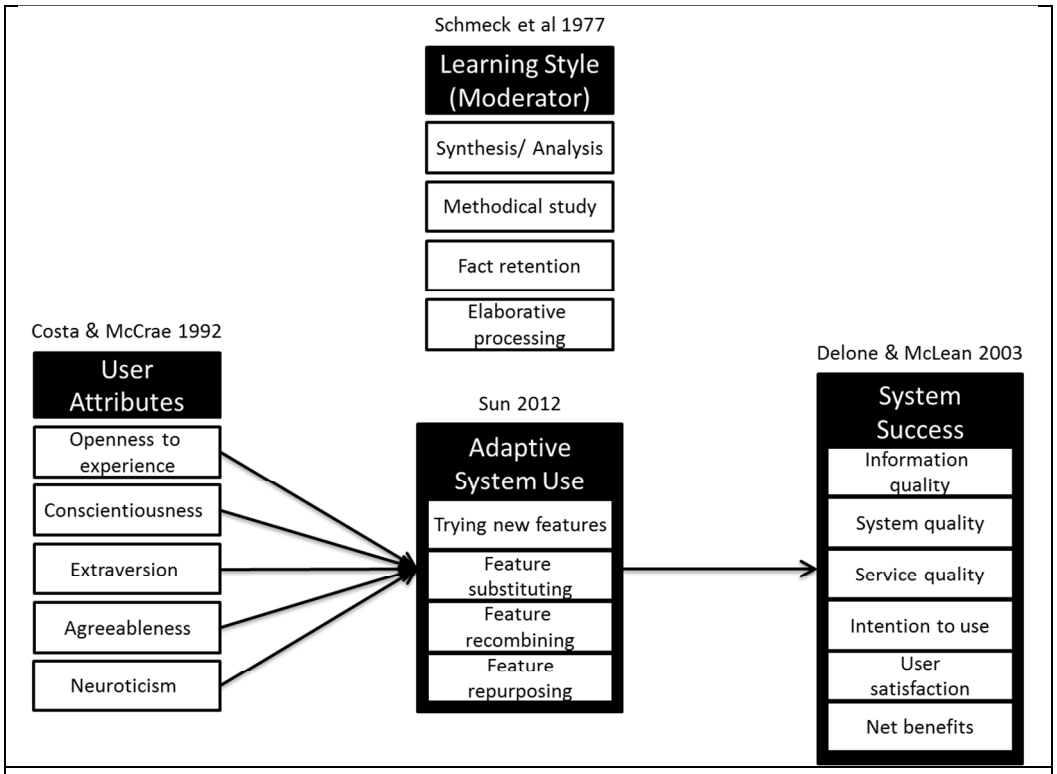

Figure 1. Conceptual Model for Constructive System-use

Attributes and Outcomes

Tall athletes tend to perform better at basketball than short athletes; whereas short athletes tend to perform better at gymnastics than tall athletes. Notable exceptions exist, but the trend is clear and fairly generalizable. Certain attributes simply give individuals competitive advantages, just as in nature, certain attributes enable some species to survive better than others. The same is evident in human computer interactions: certain attributes (such as openness) tend to consistently result in better outcomes. We theorize around a set of user attributes that act as antecedents to constructive system-use outcomes. In the context of system use, we propose

P1. User attributes will affect constructive system-use outcomes.

Attributes and Actions

What and who we are also affects what we do and how we do it (Burke and Reitzes 1981). For example, a plumber approaches a clogged drain in much a different way than does an accountant. Research in human computer interaction has repeatedly provided evidence that user actions vary widely (Beaudry and Pinsonneault 2005; Chin et al. 1997; Dourish 2003). User attributes make up one of the primary drivers of variance in user actions (Nan 2011). Some attributes (such as openness and neuroticism) may have distinct and sometimes opposite effects on system interaction. I theorize around a set of user attributes as antecedents of constructive user actions.

P2. User attributes will affect constructive user actions.

Actions and Outcomes

What we do, and the way we do it, certainly affects the results of those actions. All practical exams are evidence of this effect: All participants are given similar tasks, but the outcomes vary depending on the

approach taken by each participant. The same is evident in human computer interactions. For example, a user who explores and innovates with technology will enjoy outcomes distinct from a user who does not stray from expected modes of use (Agarwal and Prasad 1998). In the case of constructive actions, these should naturally lead to more constructive outcomes.

> *P3. An increase in constructive user actions will be associated with an increase in constructive system-use outcomes.*

Actions as a Mediator

Part of the reason attributes have an effect on outcomes is because of the actions associated with those attributes, which then impact outcomes. We theorize that only partial mediation will exist among these relationships because there is something about attributes (aside from resultant actions) that affect outcomes. For example, the cognitive traits (e.g., unconstraint, path-seeking, flexibility) that are associated with these attributes may, on their own, allow users to realize more constructive outcomes – regardless of actions (Lepine et al. 2000). This is something akin to IQ making a difference in performance – despite actions (although that difference is often mediated by actions) (Stalnaker 1961; Turney 1931).

> *P4. Constructive user actions partially mediate the affect between user attributes and constructive system-use outcomes.*

Learning Styles as a Moderator

The way we choose to process information (i.e., our learning style) should change the way our attributes affect our actions. For example, someone who is a synthesizer/analyzer is likely to be more flexible (adaptive) in their interactions with a system than someone who is methodical or focused on fact retention. Synthesis/analysis implies seeking common themes, bridging concepts, and finding links that are latent; whereas fact retention or methodical study are focused more on the literal, observable information. Thus, those who synthesize/analyze are more likely to look beyond the surface than those who rely on methodical study or fact retention. The moderation comes into play when interacting the learning style with the attribute. For example, the positive effect openness has on adaptive system use will be even stronger for someone who is a synthesizer/analyzer than for someone who is a fact retainer.

> *P5. Learning styles moderate the effects between attributes and actions.*

Discussion

Prior literature has often bypassed actions and theorized directly about the effect of attributes on outcomes. While a few empirical studies have ventured into the exploration of the effects or roles of user actions (see Appendix A of Sun 2012), none (to our knowledge) have explored the role of actions as a mediator between user attributes and use outcomes. This role is critical to understand, because "it's not *who you are* underneath; it's *what you do* that defines [outcomes]."

The propositions in this research in progress are intentionally abstract. For example, the relationships between attributes and actions are more complicated than a single proposition can convey. When this manuscript moves toward more refined theorizing, separate hypotheses will need to be made for the effects each of the attributes has on constructive actions. Similarly, each of the learning styles will have separate moderating effects, and will thus need to be theoretically distinguished.

In this paper I have not included theorizing around any control variables. A review of the literature suggests that variables such as age, gender, education, computer experience, computer anxiety, and computer self-efficacy will need to be controlled for in order to account for potential confounding effects on successful system use outcomes.

Lastly, the system success dimensions will need to be adapted to the context of use. As this model is about individual system use, we would consequently drop the organizational components of the net benefits

dimension. Additionally, if the system under study does not include relevant services, one would drop the service quality dimension of system success. Context is crucial for any study of system success, and may even change the direction of effects. For example, if the study is about spreadsheet software, neuroticism may have negative effects in the model. But if the study is about Photoshop or some other 'artistic' software, perhaps neuroticism will have more positive effects.

Future research on this topic should move toward bolstering the theory development (as it is currently fairly shallow). Once the theory is firmer, data collection efforts should be made to validate the model.

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Appendix: Construct Definitions and Measures

Construct Dimension	Definition	Items source
User Attributes – five factor model of personality (Costa Jr and McCrae 1992)[1]		
Openness to experience	a general appreciation for art, emotion, adventure, unusual ideas, imagination, curiosity, and variety of experience	7 items from (Goldberg 1992)
Conscientiousness	a tendency to show self-discipline, act dutifully, and aim for achievement against measures or outside expectations	7 items from (Goldberg 1992)
Extraversion	breadth of activities (as opposed to depth), urgency from external activity/situations, and energy creation from external means	7 items from (Goldberg 1992)
Agreeableness	a tendency to be compassionate and cooperative rather than suspicious and antagonistic towards others	7 items from (Goldberg 1992)
Neuroticism	the tendency to experience negative emotions, such as anger, anxiety, or depression	7 items from (Goldberg 1992)
User Actions – adaptive system use (Sun 2012)		
Trying new features	Add new features to one's features in use (FIU) and thus expanding the scope of the FIU	4 items from (Sun 2012)
Feature substituting	Replacing features in the FIU with other features with similar functions	3 items from (Sun 2012)
Feature recombining	Using features in FIU together for the first time	4 items from (Sun 2012)
Feature repurposing	Using features in one's FIU in a new way	6 items from (Sun 2012)
Learning Styles – (Schmeck et al. 1977)		
Synthesis/ Analysis	evaluation, organization, discrimination, and extrapolation	18 items from Schmeck et al. (1977)
Methodological study	ubiquitous study methods, systematic, traditional study techniques	23 items from Schmeck et al. (1977)
Fact retention	preference for factual information and retention of details	7 items from Schmeck et al. (1977)
Elaborative processing	visualizing, summarizing, relating, encoding, and applying information	14 items from Schmeck et al. (1977)

[1] Five Factor Model of personality definitions are taken directly from the relevant Wikipedia page: http://en.wikipedia.org/wiki/Big_Five_personality_traits

Constructive System Use – D&M System Success Model (DeLone and McLean 2003)		
Information quality	A perception that the information obtained from system use is useful and accurate	4 items from (Wang 2008)
System quality	A perception that the system and its functionality are reliable and useful	2 items from (Wang 2008)
Service quality	A perception that those servicing the system provide timely, courteous, and reliable assistance	6 items from (Wang 2008)
Intention to use	An attitude toward the system that results in continued use	3 items from (Wang 2008)
User satisfaction	A perception of fulfillment and contentment with the system's ability to meet user expectations	3 items from (Wang 2008)
Net benefits	Total perceived positive outcomes resulting from system use	3 items from (Wang 2008)