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The Effect of Feedback on Change in Post-Adoption Use of Information Systems

Research-in-Progress

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Abstract

Research suggests that over time Information Systems (IS) behavior can become routinized, making it difficult to extend one's use of an IS or improve work processes. To disrupt habitual IS use behavior and its inertial consequences, one of the key behavioral modification tools used in organizations is feedback. However, we know little about how feedback impacts changes in individual use of IS in organizations. This paper examines the role of the feedback environment (i.e. valence, amount, quality and timing of feedback) on variations in IS use, i.e., experimenting with different ways of using an IS for one's work. As a first step, this study proposes a conceptual model of feedback in IS use, grounded in Generalized Darwinian principles of evolutionary change. Using data from 86 users of Learning Management Systems, the preliminary results suggest the importance of various feedback mechanisms for encouraging variations in how IS is used by individuals.

Keywords: Feedback, Change, Variation, Post-Adoption, Use, Information Systems

Introduction

IS post-adoption use can be defined as a myriad of feature adoption decisions, feature use behaviours, and feature extension behaviours made by an individual user after an IT application has been installed, and used to accomplish ones' work activities (Jasperson, Carter, & Zmud, 2005). However change in post-adoptive behaviors, such as extending one's use of an IS, tends to diminish over time as feature use becomes routinized within ongoing work activities (Benlian, 2015). Such routinisation results in standardization of IS use in employees' work processes (Li, Hsieh, & Rai, 2013). These routinized behaviors may also impact individual cognitions that determine and change post-adoptive behaviors such that these too are stabilized (Jasperson et al., 2005). As IS use becomes more entrenched, it can prove difficult to introduce new options (e.g. a new feature) or improved work processes (Saga & Zmud, 1994). Understanding how users revise their use of an IS is key to addressing this inertia (Benlian, 2015).

This research draws on Generalized Darwinism to understand change in IS use. Generalized Darwinism, as an evolutionary theory, provides a meta-theoretical framework for describing and understanding change by applying a generalization of the basic Darwinian concepts of variation, selection and retention to non-biological domains (Hodgson, 2005). This paper focuses on '*variation*', as it is considered the raw material for evolution to occur, as without variations, selection and retention will cease (Mayr, 1991).

The notion of 'variation' is equally important in IS post-adoption use, as for change to occur users need to experiment with or try different ways of using the IS. These attempts to vary one's use of an IS are key, as failure to do so can result in habitual use behaviors that are suboptimal, as individuals engage in recurring patterns of using select subsets of IS features (Jasperson et al., 2005). Drawing on prior work (Tennant, 2014), this study defines variations (in IS use) as *experiments with* (i) *different ways to do one's work to accommodate the System and/or* (ii) *different ways of using the System to support one's work*.

In the biological domain, feedback is considered instrumental in the evolution process (Robertson, 1991). While change can occur in all interacting populations, this may be driven by direct interactions with others in the population and by feedback from the rest of the system (Volberda & Lewin, 2003). Feedback can also account for alterations in the environment which may control internal or behavioral adjustments (Bickhard & Campbell, 2003).

Similar to the role of feedback in biological evolution, feedback can also play a role in the context of Generalized Darwinism in facilitating variations in IS use. Feedback, in this research, is defined as information pertaining to the appropriateness or correctness of behavior for attaining certain goals (DeRue & Wellman, 2009). Adaptation can be modeled in terms of a change in the probability distribution of possible actions that an individual may engage in at any time, which arises as a result of feedback from what has been tried and the consequences (Nelson, 1995). When persons are introduced to different possibilities in a domain, they can choose to include these in how they work or reject them as ineffective. Feedback is also important in the evaluation process, as persons may attend to feedback from their environment (such as peers and managers) on the appropriateness and outcomes of their actions (Nelson, 1995; Ford & Gioia, 2000), and then decide whether their actions should be changed. Likewise when it comes to IS use, feedback may be a key factor explaining the dynamics of and changing patterns in IS feature use over time (Benlian, 2015). Yet despite the importance of feedback in IS use (Burton-Jones & Grange, 2013; Goodhue & Thompson, 1995), research has rarely considered its role in IS use and by extension the change process.

The results of this study are expected to contribute both to theory and to practice. From a theoretical perspective, while prior models such as Technology Acceptance Model and Task Technology Fit provide insights into IS use, they do not address how users change their use of an IS as they carry out work tasks (Beaudry & Pinsonneault, 2005). Thus there have been calls for research to investigate the process of change further (Fadel, 2012; Sun, 2012). This research seeks to bridge this gap by examining how change occurs with a particular focus on the role of feedback in variations in IS use (Burton-Jones & Grange, 2013; Kim, 2009). From a practical perspective, the findings are expected to shed light on key aspects of the feedback environment that enable change in IS use. A principal argument in organizational behavior literature is that feedback improves performance, as it can regulate individuals' behavior in organizations by providing information about past performance (Ang, Cummings, Straub & Earley, 1993). However, to better understand changes in IS use and to provide more meaningful feedback, it is important to understand the contextual and/or situational characteristics of the different dimensions of feedback and

their effect on behavioral outcomes (Steelman, Levy and Snell, 2004). Through better understanding of the context in which change occurs, organizations can be better equipped to encourage change in IS use by implementing strategies that facilitate feedback, change and consequently, improved IS use.

Generalized Darwinism- Variation

Geoffrey Hodgson and associates proposed a meta-theoretical framework, 'Generalized Darwinism', for describing and understanding change by applying a generalization of the basic Darwinian concepts of variation, selection and retention to the socio-economic domain (Aldrich et al., 2006; Hodgson et al., 2006). Generalized Darwinism argues that Darwin's theory can be applied to all evolutionary processes, that is, the broad class of systems and populations of entities, including all feasible manifestations of development and change (Hodgson et al., 2006) to explain how these change over time.

While noting that all aspects of the change process are important (that is, variation, selection and retention), this paper focuses on 'variation' as a precursor to change. *Variation* is an essential part of the change process, and is often dubbed the 'raw material' for evolution, since if there are no variations, then there are no alternatives to select from (Mayr, 1991), hence change will not occur. In a general sense, applied to non-biological domains, variation can be defined as any departure from routine or tradition (Aldrich, 1999, p. 22), or generating new ways of doing things (Furneaux et al., 2010). Variation therefore plays a crucial role in the evolutionary cycle (Hodgson et al., 2006). The next section examines variations in the context of IS use.

Variations (in IS Use)

Variation is defined as change from current routines (Aldrich, 1999). Variation, in the IS context introduces alternatives in how the IS can be used to accomplish work tasks. It therefore represents a departure from how one currently uses the IS. Based on previous research in which users were interviewed about their use of IS and how this had changed over time (Tennant, 2014), it was found that actions situated within variations in use (that is, change from current routines) included *trying new features*, *modifying use of currently-used features*, *substituting some features* for other features, and finding *new or innovative ways of using various features*. *Trying new features* has a feature exploration focus and involves the use of features that have not been used before (Ke, Tan, Sia, & Wei, 2013; Sun, 2012). *Modifying the use of currently-used features* involves changes in the way in which features are used, which include 'fine-tuning' and revising the current use of features to improve efficiency and outcomes. The latter are similar to concepts of refinement (Levinthal & March, 1981) and exploitation (March, 1991). *Substituting features* refers to replacing currently-used features with other features with similar functions (Sun, 2012). *Innovating with the* IS relates to finding new uses or especially innovative ways of using IS features (Ahuja & Thatcher, 2005). As users engage in variations, they will inherently re-conceptualize their work processes to accommodate the IS. This includes the creation and modification of work processes (Orlikowski, 2000) to improve the fit with the system. This study collectively identifies these varieties in IS use as '*Variations*'. Thus variations are defined as '*experiments with* (i) *different ways to do one's work to accommodate the System and/or* (ii) *different ways of using the System to support one's work*'. The next section will discuss the role of feedback in enabling variations in IS use.

Feedback

As discussed, variations represent the first step in the process of evolutionary change, which in the context of change in IS use represents ways in which individuals vary (or change) how an IS is used in their work (Fadel, 2012; Orlikowski, 2000; Sun, 2012). Thus, variation is an important action within post-adoption IS use that by extension brings about changes in how an IS is used over time to support ones' work. This section discusses the role of feedback in enabling change in IS use through variations in IS use.

Evolutionary feedback is a special case of sequential evolution in which a sequence of traits (or behaviors) has at least one closed feedback loop that is, in which at least one trait affects the evolution of a trait preceding it in the evolutionary sequence of traits (Seaborg, 1999). Evolutionary feedback can at times result in punctuated change or at other times act as a mechanism for stasis (or inertia). Hence evolutionary feedback is a mechanism for punctuated equilibrium (Seaborg, 1999) in which evolutionary change is followed by an extended period of stasis. Applied to the context of IS use, it has been observed

that after a system has been adopted, users will often expand their knowledge and skills with the IS more rapidly in the early stages of feature use. At later stages however growth in IT feature use tends to level off into a period of stasis as non-reflective IT use takes over and becomes routinized and habitualized (Benlian, 2015; Jasperson et al., 2005).

In general terms, feedback is defined as information pertaining to the appropriateness or correctness of behavior for attaining certain goals (DeRue & Wellman, 2009). Feedback can focus on a task or product. In relation to a task, feedback may focus on whether the work is correct or incorrect (Hattie & Timperley, 2007), and may include directions to acquire more, different, or correct information. Feedback can also be aimed at the process used to complete a task (Hattie & Timperley, 2007). Feedback that is directly aimed at the processing of information or the learning process will be vital in executing the task, as it can encourage or inform how to better achieve the task (Hattie & Timperley, 2007).

Feedback can also account for alterations in the environment and may help determine appropriate internal or behavioral adjustments (Bickhard & Campbell, 2003). For example, in the case of IT habit, it is argued that with repetitive use of certain IT features, reflective cognition dissolves over time leading to non-reflective routinized behavior (Jasperson et al., 2005). One way to modify these ingrained habits and initiate new usage goal is to implement some type of feedback mechanism that increases user awareness of their behavior (Norman, 1981; Polites, 2009) leading to change in use.

Once a technology is utilized and its performance effects are experienced there will inevitably be many kinds of feedback (Goodhue & Thompson, 1995). It is purported that the logic of change is for individuals to adjust their IS use in response to the feedback received (Goodhue & Thompson, 1995; Jasperson et al., 2005; Nan, 2011). For example, through their experience of using an IS, users may find that the technology has a better or worse than expected impact on performance, thus changing their expected consequences of use and in turn their future use (Goodhue & Thompson, 1995). When responding to feedback, users can then take actions to improve their use of the system (Burton-Jones & Grange, 2013) which allows them not only to repeat previously learned IT-use behavior sequences, but also to create new ones. As a result, feedback can trigger and influence future IT use behaviors (Ajzen & Fishbein, 2005).

Jasperson et al. (2005) further argues that the logic of the feedback loop being based on reflective consideration, will mean that the user begins the reflection and change process with a pre-existing set of cognitions and then attentively considers and processes surrounding informational cues regarding IS features. With this reflective cognitive process, the user may in turn modify their use intentions which may then direct their future use behaviors. With this recursive process of reflection and based on the strength of confirmation or disconfirmation associated with this technology sense-making process, change can result. Hence, the feedback cycle can in turn lead to increased IT use (Bajaj & Nidumolu, 1998), as individuals not only use features they have used before, but also experiment with other features.

Although IS researchers have alluded to the importance of feedback in changes in post-adoption use, it has not been emphasized in research (Burton-Jones & Grange, 2013; Jasperson et al, 2005). This study seeks to address this gap by examining the impact of feedback on change in use (i.e. variations in IS use). It draws on prior work on feedback and looks at the role of feedback in effecting change in IS use. In particular, this research will examine four aspects of feedback: valence, amount, timing, and quality, referred to hereafter as the *feedback environment*.

Feedback Valence

One aspect of feedback that is likely to impact change is feedback valence. The valence of feedback is defined as the degree to which the feedback is positive or negative (Ilgen & Davis, 2000). Feedback is considered to be *positive* if it is favorable or it agrees with or exceeds the receiver's expectations, and *negative* if it is considered unfavorable or if the receiver interprets the information as less favorable than expected (Smither, London, & Reilly, 2005). Further, in terms of behavioral change, positive feedback is generally considered a deviation-amplifying process, while negative feedback tends to be considered a deviation-countering process which maintains equilibrium situations (Smith, 1986). Positive feedback may cause individuals to change their behavior while negative feedback may indicate undesirable behavior (Becker & Klimoski, 1989; Van den Bossche, Segers, & Jansen, 2010). Thus in the case of IS use, it is expected that positive feedback would encourage users to experiment with an IS and perform variations in IS use, while negative feedback would cause users to refrain from varying their IS use.

Researchers have also considered the effect of neutral feedback. Here neutral feedback is viewed as non-informational (Pan, Hu, Li, & Li, 2009), with some arguing that it can result in improvement, though not as extreme as the effect of positive feedback (Turnbull & Wolfson, 2002). On the other hand, compared with neutral or no feedback, negative feedback can moderately decrease one's perceived competence (Fong, 2014), which may impact their willingness to try new things. It is further suggested that a user may desire feedback in order to verify their own self-view or experiences and to maintain a logical coherence between self-perceptions and the feedback provided by experience, even if the view is negative (Fong, 2014). Thus the outcome of the feedback process, whether positive, negative or neutral, may provide cues to the individual that may trigger information search and reflection on possible changes to their work system (Ford & Gioia, 2000), and hence changes in IT use. Hence this research hypothesizes that:

H1: The valence of the feedback is positively associated with Variations

Amount of Feedback

Amount of feedback refers to the quantity of or how much feedback is given (Becker & Klimoski, 1989). Prior studies suggest that change can vary directly with the quantity of feedback that a person receives (Kolb, Winter, & Berlew, 1968). So with any particular trial, feedback stimuli from the ongoing response are compared with perceptual traces of previous responses, the outcome of which can determine and direct behavior (Adams, Goetz, & Marshall, 1972).

Studies have found that the amount of feedback significantly affects adaptation, where those who receive limited feedback may fall short of complete adaptation such that continued exposure produces no further adaptation (Van Laer, Schwartz, & Van Laer, 1970). When users obtain frequent and regular feedback on their performance and level of IT use, their perceptions of their performance and use may be more accurate. This is because frequency and regularity can help persons to see a phenomenon more clearly, even in the presence of noise (Burton-Jones & Grange, 2013). Given prior findings, which suggest that amount of feedback can affect adaptation, in the context of variations (in IS use), this research hypothesizes that:

H2: The amount of feedback is positively associated with Variations

Timing of Feedback

Timing refers to the interval or amount of time passed between a person's behavior and receiving feedback about that behavior (Ilgen et al., 1979). It is argued, "if the feedback is to be perceived as related to the behavior in question, it must somehow be paired with the appropriate response for the feedback to be meaningful" (Ilgen et al., 1979, p. 353). Hence timing is a key element of the feedback environment.

Examining the effects of timing on one's ability to link feedback with associated behaviors, some contend that the shorter the time interval, the more effective the feedback (Sachdeva, 1996). Indeed, one argument is that lengthy delays between a behavior and receipt of feedback may result in the individual not perceiving the feedback as related to the behavior (Sachdeva, 1996). Furthermore, delay can create a high degree of ambiguity and uncertainty around the feedback message's content (Leboeuf, 1997). Thus compared with delayed feedback, it is felt that immediate feedback provides a better opportunity to reflect on, improve or correct a behavior (Mahoney, Devonport, & Lane, 2008).

In the context of IS use, it is suggested that users may achieve effective use of an IS more quickly when feedback is timely (Burton-Jones & Grange, 2013). When it takes less time for users to understand the consequences of their actions, for example to improve their IT use or performance, one can argue that they are then more likely to undertake or adjust those actions as appropriate. This faster feedback can also help them learn and be more motivated (Burton-Jones & Grange, 2013) in experimenting with the IS. Hence this research suggests that,

H3: The timing of the feedback is positively associated with Variations

Quality of Feedback

Quality of feedback refers to the consistency, usefulness and informational value of the feedback message (Steelman, Levy, & Snell, 2004). High-quality feedback is generally perceived as more useful than low-quality feedback (Steelman et al., 2004), and is therefore more likely to provide an individual with

information that aids in understanding an action or behavior (Peng & Chiu, 2010) and its outcome. Valuable and useful feedback (i.e., feedback quality) also provides support that can help the individual to understand the proper behavior (Peng & Chiu, 2010) corresponding to the task. From the recipient's view, the informational value of feedback plays an important role in whether they accept and are willing to respond to the feedback, thus making feedback quality paramount in relation to variation. Consequently this research posits that:

H4: The quality of the feedback is positively associated with Variations

User Expertise

Research shows that individuals often differ in their IS expertise. For example, in a study of mobile phone use, Ziefle (2002) found that experts were distinctly better at handling tasks faster, and taking fewer detours. Similarly, compared with basic users, advanced users tend to be more innovative and creative in their use of an IS or to use the system in more effective or sophisticated ways (Munro et al., 1997). On the other hand, basic users tend to have limited knowledge of the IS and use the system accordingly (Munro et al., 1997). Advanced users also tend to be more proactive in experimenting with various IS features and more creative in and extending their use of the IS (Marcolin, Compeau, Munro, & Huff, 2000).

As the aim of this study is to better understand the role of feedback on variations in IS use, in this study we will control for the influence of user expertise, so as to assess better the impact that feedback has in this context. Hence, the following hypothesis is also examined:

H5: User expertise is positively associated with Variations

Methodology

A survey approach (using quantitative data) was used to investigate the role of feedback in influencing change in use through variations. Random sampling was used to identify and select the respondents. To date, data has been collected from faculty using a Learning Management Systems (LMS). LMS have many features including file upload and download, discussion forums, assignment submission, quizzes, wikis and reports for managing resource use. It can be used as an informational site or as a complete online learning environment, and is somewhat malleable as faculty can choose the extent to which they use the system to support their work. The LMS as a study context also provided access to a range of user types, making it a useful setting for understanding the role of feedback in the change process.

Early scholars such as Churchill (1979) emphasized that researchers must be exact in delineating what is included in the definition and what is excluded. Thus, for this research, the first step was to conceptualize and delimit the domain of the constructs. The conceptualization of measurement items included defining the constructs of interest and generating a candidate list of items from a domain of possible items representing the construct. In the case of variation, there are no existing items; hence the measurement items were guided by and developed using insights from prior research (Tennant, 2014). To assess feedback, established definitions of key aspects of feedback (i.e. quality, valence, amount and timing) were used to guide instrument development (Illgen et al, 1979, Becker & Klimoski, 1989, Ilgen & Davis, 2000, Steelman et al, 2004, and Smither et al., 2005). The multi-item measures (see Appendix A) used in this study were therefore self-developed using insights from the literature: variation (3 items), feedback valence (3 items), feedback amount (2 items), timing of feedback (3 items), feedback quality (3 items), and user expertise (3 items). All items were measured using 7-point Likert or semantic differential scales, and the constructs modelled as reflective.

As part of the data collection, pre-tests and survey revisions were done to address potential issues with survey design and administration. The pre-test surveys were distributed to 25 faculty users (of LMS) to review and respond to the survey. In some instances, users gave feedback on the content and measures used. Also, a statistical test was done to see how well the items loaded on the respective variables.

Following revisions, the survey was distributed to approximately 200 randomly selected faculty; 86 usable responses were returned, yielding a response rate of 43%. Of the respondents, 67% were male and 33% were female. Respondents also rated their level of expertise with the LMS on 7-point Likert scale ranging from basic to advanced; using their self-ratings, they were then classified as basic (1-2), intermediate (3-5) and advanced users (6-7). Fourteen persons (16%) were basic users, 40 (47%) intermediate users, and 32

(37%) advanced users. Ten (12%) persons had used the LMS for under one year, 43 (51%) had used it or its predecessors for 1-4 years, and 32 (37%) for 5+ years.

Analysis and Preliminary Findings

PLS Graph Version 3.00 and bootstrapping (with 1000 samples) were used to assess the research models. The focus of the measurement model tests was on convergent and discriminant validity (See Table 1). For convergent validity, factor loadings, composite reliabilities and average variance extracted (AVE) were examined. The results showed the factor loadings ranged from 0.927 to 0.994, exceeding recommended thresholds of 0.70 (Chin, 2010). Composite reliabilities (CR) ranged from 0.966 to 0.994 and AVE from 0.905 to 0.983, exceeding suggested cut-offs of 0.70 and 0.50 respectively and indicating a satisfactory level of internal consistency, and convergence of the indicators (Chin, 2010). Discriminant validity was also examined. The results showed each construct AVE was greater than the squared correlation with corresponding constructs, suggesting each construct was distinct from the others (Chin, 2010).

Table 1. Discriminant Validity (Squared Correlations, Composite Reliability and AVE)

	CR	AVE	Variation	FBVAL	FBAMT	FBTIM	FBQUAL	UserExp
Variation	0.972	0.921	1.000					
FBVAL	0.966	0.905	0.226	1.000				
FBAMT	0.988	0.976	0.111	0.219	1.000			
FBTIM	0.994	0.983	0.143	0.135	0.235	1.000		
FBQUAL	0.971	0.918	0.256	0.680	0.283	0.241	1.000	
UserExp	0.976	0.930	0.263	0.101	0.058	0.014	0.102	1.000

Key: FBVAL= Feedback Valence; FBAMT= Amount of Feedback; FBVAL= Timing of Feedback; FBQUAL= Quality of Feedback; UserExp=User Expertise.

Harman's one-factor test (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003) was used to detect common method variance. There was no single factor accounting for more than 49.7% of the variance observed, common method bias was not considered a significant concern.

For the structural model, the results show the feedback environment and user expertise accounted for 0.427 of the variance for variations. For the feedback environment, valence (0.138, $p \leq 0.10$), timing (0.202, $p \leq 0.05$) and quality of feedback (0.176, $p \leq 0.10$) were positively related to variations, supporting Hypotheses H1, H3 and H4. However, amount of feedback (-0.017) was not related to variations; H2 was not supported.

The results also showed user expertise (0.392, $p \leq 0.001$) impacted variation, supporting H5. The analysis also showed that feedback had a moderately-strong impact (f^2=0.26) in the structural model further suggesting its importance in relation to variations in IS use.

Discussion and Conclusion

The development of theories on the role of feedback in IS use is a promising but largely under-researched area. However, it is a direction that is consistent with trends in the behavioral sciences to consider the dynamics by which behaviors emerge and change over time (Davern, 2007). This paper investigates the role of feedback in facilitating change in use of an IS, through variations. It reports the preliminary results on the impacts of four facets of feedback, namely, valence, quality, amount, and timing.

The findings show that feedback valence, quality and timing have significant and positive effects on variations; however feedback amount was not significant. For feedback amount, the findings though unexpected are consistent with studies that found increasing the amount of feedback information may have no effect on learning or performance (Shute, 2007). Research also suggests that the general wisdom of 'the more the better' may not readily apply to feedback, and advises that care be taken in increasing feedback (Van den Bossche et al., 2010). One must therefore "be cautioned against blindly advocating an increase in feedback, particularly in cases where individuals must [then] interpret complex feedback" (Ilgen, Fisher, & Taylor, 1979, p. 355). This indicates that too much feedback can have an adverse effect.

From this study, it appears that the key elements of feedback impacting variations in IS use are valence, quality and timing of the feedback. Consistent with prior work, valence was identified as an important aspect of feedback impacting variation. As such, positive feedback as a deviation-amplifying process may encourage variation, while negative feedback as a deviation-countering process may deter variation, resulting in stasis (Seaborg, 1999; Smith, 1986). Even so, negative feedback may be better than no feedback, for whether positive or negative, it provides information that can direct and motivate behavior (Fong, 2014). The findings also suggest that quality plays a key role in encouraging individuals to experiment with the IS. Indeed, an advantageous feedback environment includes, among other elements, a wealth of information that is high in quality and likely to provide persons with important information (Sparr & Sonnentag, 2008). The findings also suggest that the timing of feedback is important. This is consistent with work that suggests the shorter the time interval between an action and receiving feedback on the action, the more effective the feedback on behavior modification (Sachdeva, 1996). Conversely, it is argued that individuals do not respond well to feedback that is especially delayed (Davern, 2007).

Although understanding the role of feedback is the main goal of this research, given the variation in user expertise among the respondents it was important to control for its influence regarding variation. As expected, user expertise was positively related to variation. But, this was not statistically stronger than feedback environment through valance, quality, and timing; indeed, feedback had a moderately strong impact, providing assurance of its importance in regarding variation.

Altogether the results suggest that as individuals use an IS, managers can help create environments in which they receive useful and timely feedback from peers and others as they experiment with the IS. The system itself can also be a good source of feedback; if users can use a 'test' version of an IS or can 'roll-back' their actions, they can experiment more freely with it and see how well their trials work. While feedback has generated interest in other domains (such as management), there is little research in the IS area. This study is a first step to addressing this gap.

In summary, this study responds to calls for research examining changes in post-adoption use (Jasperson et al, 2005). More specifically, the aim is to evaluate the role of feedback in change in use. Using Generalized Darwinism, this study examines the impact of feedback on variation, which is considered the first and necessary step for change to occur. Key aspects of the feedback environment impacting the change process are identified, namely valence, quality and timing of the feedback. The results so far suggest the importance of feedback for encouraging variation in IS use. At the same time, there are some limitations which may impact the findings. For example, respondents were asked to self-rate their level of expertise; with this there is a possibility of response bias including under- or over-reporting of their level of expertise. Also, the sample size though sufficient for model testing, was relatively small. For this study, the next steps are to extend the research model and data collection, and consider the effects of feedback on retention of variations and change in IS use. Given its significance in explaining IS post-adoption use, future research may also consider the impact of feedback on other types of IS use.

Appendix A

Construct Measures (examples)	
Variation (Overall)	Overall, thinking back to when you first started, how much have you experimented with different ways of using or accommodating the LMS in your job*?* *(None at all/ A Great Amount, Not at all/A Very Great Extent)*
Feedback Valence (FBVAL)	On the whole, the feedback you receive when you experiment with a Variation is: *(Bad/Good, Negative/Positive)*
Feedback Amount(FBAMT)	On average, how much feedback do you receive when you experiment with a Variation? *(A Very Small Amount/A Very Large Amount)*
Timing of Feedback (FBTIM)	On average, how quickly do you receive feedback when you experiment with a Variation? *(Very Slow/Very Quick, Very Delayed/Very Fast)*
Feedback Quality (FBQUAL)	On the whole, the feedback you receive when you experiment with a Variation is: *(Useless/Useful, Worthless/Valuable)*
User Expertise (UserExp)	In general, how would you rate your level of expertise with using the LMS? *(Novice/Expert, Basic/Advanced)*

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