PROS, CONS, AND CHANGING BEHAVIOR: AN APPLICATION IN THE USE OF THE KEYBOARD TO ISSUE COMMANDS

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Despite the fact that keyboard issued commands (KICs) are more efficient than other command methods, experienced users often do not adopt them. In order to examine the factors underlying this phenomenon, a study is presented which investigated the relationships between users' level of knowledge with Microsoft Word, the importance they placed on the costs and benefits of using KICs, and how these factors related to the use of KICs in Microsoft Word. Results indicate that benefits are more strongly associated with the actual use of KICs than costs. The application of these findings to the human factors domain and the implication of the results to facilitate the adoption of efficient techniques and behaviors are discussed.

INTRODUCTION

Computer users often do not progress to an expert level of performance even if they have ample experience with a system (Bhavnani & John, 1997; Rosson, 1983). For instance, keyboard issued commands (KICs) are more efficient than other command methods, yet experienced users often do not use them (Lane, Napier, Peres, & Sándor, 2005; Peres, Tamborello, Fleetwood, Chung, & Paige-Smith, 2004). Further, there has been no empirical support for a relation between years of experience with a particular program and its efficient use (Bhavnani & John, 1997; Lane et al., 2005; Peres et al., 2004).

To encourage achievement of expert levels of performance, it is important to understand the reasons why people do not adopt more efficient methods available to them. Toward this end, our goal is to explore the relationships between users' level of knowledge with Microsoft Word, their assessments of the costs and benefits of using KICs, and how these two factors relate to their self-reported use of the keyboard to enter commands in Microsoft Word.

There is a large body of research devoted to the study of decision-making processes. A thorough review of this work is well beyond the scope of this paper, however, decision-making processes are typically thought to be experiential, systematic, or a combination of the two (Slovic, 1987). The experiential system is characterized by holistic processing, the influence of affect, more immediate responses and results in the use of heuristic reasoning. A systematic decision-making process, however, tends to be more analytic, logical, and responses tend to be slower and more deliberate and thus may involve the analysis of the costs and benefits of a particular behavior (Kahneman & Tversky, 1984; Keeney & Raiffa, 1993; von Winterfeldt & Edwards, 1986). Whether decision-makers rely primarily on systematic or heuristic processing is dependant on a variety of factors, including time pressure, familiarity, and motivation. It is conceivable that computer users sometimes use a systematic decision-making process regarding computer usage. The present research was designed to examine how computer users weigh costs and benefits when they apply this approach to their computer usage.

In a similar vein, health researchers have examined the relationship of both costs and benefits to decisions concerning behavior change over time (Dannecker, Hausenblas, Connaughton, & Lovins, 2003; Janis & Mann, 1977; Pollak, Carbonari, Diclemente, Niemann, & Mullen, 1998; Prochaska et al., 1994). This research has found that the weight people give the benefits of a behavior often

influences their adoption of that behavior more so than the weight assigned to the costs. This approach has been valuable for clinicians and researchers attempting to identify methods for facilitating health-related behavior change, however, to our knowledge, this approach has not been applied within the domain of human-computer interaction research. One aim of our research is to apply a similar cost/benefit approach to examining the decision-making behavior of computer users when considering the adoption of more efficient computer interaction techniques. Specifically, it is possible that computer users adopt efficient techniques based on their analysis of the costs and benefits associated with using more efficient methods. Thus, as their assessment of the benefits of using KICs increases and their assessment of the costs decreases, the likelihood of their using KICs may increase.

An additional factor influencing the use of KICs may be individuals' knowledge of the software they are using. Peres et al. (2004) found a slight positive correlation between the number of hours a person used a computer each week and their likelihood of using KICs. A possible explanation for this relationship is that people may gain more knowledge of a program the more hours they use the program. This knowledge increase may translate to a familiarity with KICs and thus an increased likelihood of using KICs. The study presented herein investigated the potential impacts of both knowledge and cost/benefit analysis on the adoption of KICs.

It is important to note that there are likely a variety of factors that may influence the frequency with which people use the keyboard to issue commands, including social factors (Peres et al., 2004), training, availability of alternate methods of interaction, etc. Although these other factors may influence individuals' weightings of pros and cons, these factors may not necessarily influence the relationship between pros/cons and behavior. It is this relationship, and the potential for predicting behavior based on the relationship between pros/cons and behavior, that we are currently examining.

METHODS

To investigate the impact of software-specific knowledge and perceived costs and benefits on KIC usage, a web-based questionnaire was administered to 162 individuals, 109 women and 51 men (2 did not provide their sex) and all participants were active computer users (M = 28.88 hours/week). Due to technical issues, two participant's data were removed from further analysis. The questions participants answered fell into four categories: (1) costs and benefits of using KICs, (2) knowledge of Microsoft Word, (3) self-reported usage patterns for issuing commands in Microsoft Word, and (4) demographic and general computer usage.

Measures

Costs and Benefits: Similar to other studies examining the costs and benefits associated with a behavior change (Janis & Mann, 1977), participants were asked to rate how important a potential benefit (or cost) might be if they were considering a decision to use KICs (For example, a cost would be "Learning keyboard-issued commands would take a long time."). Participants rated the importance of 15 pro statements and 15 con statements using the 5-point scale "1—Not at all important" to "5—Extremely important."

A confirmatory factor analysis revealed two negatively correlated factors, with the con items loading onto one factor and the pro items loading onto the other. Four items were removed from the scales (two items from each scale) based on their loadings onto the factors (see Table 1 for samples of the pro and con items). The revised pro and con scales had alphas of 0.876 and 0.883, respectively, which is appropriate for predictive research (Nunnally & Berstein, 1994). For analysis purposes, a mean rating for the pro and con scales was calculated for each participant.

Knowledge: Twenty items, ranging in difficulty, were used to assess the participants' knowledge of Microsoft Word. Each participant was given a score indicating the proportion of these items he or she answered correctly.

Table 1. Example items from the pro and con scales.

Cons
Learning keyboard-issued commands would take a long time.
Because not all applications use the same set of key combinations for their commands, I may have to learn different key combinations for different applications.
I might issue the wrong command if I accidentally press the wrong key(s).
I would have trouble remembering keyboard-issued commands.
Pros
Using keyboard-issued commands would be faster than using the mouse.
I wouldn't have to move my hands form the keyboards when using keyboard-issued commands.
When I have to really concentrate on my work, it is easier for me to only use the keyboard than to use both the keyboard and the mouse.
Going back and forth between the keyboard and mouse is inefficient.

Use of the Keyboard to Issue Commands: Similar to the technique used by Lane et al. (2005), participants indicated what percentage of the time they used the menu, KICs, and icon methods for issuing 14 frequently used commands. Although there is no way to determine the accuracy of this self-report measure, given the exploratory nature of the work presented here, the self-report measure is appropriate as this work is a preliminary step within a larger program of research.

Table 2 provides descriptive statistics for the dependent variable (KIC) as well as the three independent variables—con, pro, and knowledge.

Table 2. Descriptive statistics for the importance of the pros and cons, knowledge, and the percent of time participants used KICs.

	Mean	Std Dev (St. Err.)	Upper 95%	Lower 95%
Con	2.98	.79 (.06)	3.11	2.86
Pro	3.37	.72 (.06)	3.48	3.25
Knowledge	.53	.17 (.01)	.56	.51
KIC	.30	.27 (.02)	.34	.26

RESULTS

Multiple Regression: To discern how much variability in KICs was due to pros, cons and knowledge, a multiple regression was done with these variables as the predictors and average use of KICs as the criterion. The total variance accounted for was 37.0% (p <.0001). The slopes and associated p values are provided in Table 3. It is meaningful to note that while all three variables are significant predictors of KICs, the absolute value of the slope for pro is higher than the slope for con. To examine if the differences between the slopes for pros and cons were significant, the confidence intervals of the slopes were calculated and are presented in Table 3. The confidence intervals for the absolute value of the slopes do not overlap, providing confirmation that the slopes are indeed significantly different. These results suggest that the pros are more strongly related to actual use of KICs than cons.

Table 3. Slope, p values, and confidence intervals for the multiple regression of KIC onto pros, cons, and knowledge.

Term	Slope	p	Upper 95%	Lower 95%
Con	-4.92	0.0304	- 0.46	- 9.38
Pro	15.42	<.0001	20.35	10.49
Knowledge	2.17	0.0001	3.25	1.09

It is conceivable that knowledge could be a moderator of the relationship between pros, cons, and KIC, so an analysis of the interactions between knowledge and cons, knowledge and pros, and knowledge, pros, and cons with KIC was conducted. None of these relationships were significant (all *p's* > .15), indicating that pros and cons are independent predictors of KIC.

DISCUSSION

While the findings presented are based on a relatively small sample for this kind of exploratory research, the results are nevertheless compelling. That pro statements have a larger effect on the usage of KICs than con statements suggests that people are more sensitive to the benefits of using KICs than they are to the detriments. This finding might be useful in devising motivating factors for training. Given the strength of the relationship between pros and KICs, future work is planned to investigate factors that may influence the users' assessment of the benefits of KICs, specifically, observing others using KICs (Peres et al., 2004).

When considering factors that may be associated with the use of KIC, some of the variables commonly considered are age, typing abilities, familiarity with computers, etc. Previous work has not found a relationship between these variables and the use of KIC (Lane et al., 2005; Peres et al., 2004) and there was no evidence of an effect of these variables in this study as well. Specifically, we examined job title, gender, handedness, age, whether they were a touch typist, typing speed, years using a computer, and hours per week using Word. None of these variables had a significant effect on the relationships investigated (all *p's* > 0.19). Similar to Peres et al. (2004) a relationship was found between the hours per week someone used a computer and their use of KIC, $p = .0008$. Although this relationship is significant, the correlation is small, $r = .26$, indicating that there is a significant relationship but not a large effect. This finding supports the need to explore alternative variables that may have a larger effect on the behavior in question.

Janis and Mann (1977) view the decision to change one's behavior as a comparison of a "balance sheet" of potential gains and losses. This paradigm has been widely applied to study the decision process when considering the adoption of a variety of behaviors, such as those associated with weight loss, drug abuse, exercising, etc. However, all of those behaviors are qualitatively different in their "life scope" than the use of KICs. The results presented here provide some evidence that this paradigm may be quite valuable in the realm of human factors.

In this specific case, we examined the use of KIC among computer users. However, using the keyboard to issue commands, while important, is more of an exemplar behavior for research purposes than an end in and of itself; ideally the information regarding the relationship between pros, cons and actual behavior may be used to facilitate the adoption of efficient techniques and behaviors in a variety of tasks and domains. To further this aim, the author's are currently working on developing a decisional balance index (DBI), a single index calculated based on the exhibited relationships between pros, cons, and behavior. This index should be able to describe the likelihood of behavior change. Future work involves validating and developing norms for the DBI such that it may be used as a diagnostic tool in human factors research.

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