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User Errors in the Networked Environment

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"THE EFFECTS OF TRAINING NOVICE USERS IN DEVELOPING STRATEGIES FOR COGNITIVELY EVALUATING APPROPRIATE RESPONSES TO ERRORS WHEN LEARNING TO USE THE INTERNET"

Introduction

As users learn to use a new application of computer technology, they frequently make errors (Greif, 1990; Lazonder and Meij, 1995; Norman, 1983). Systems and interfaces should be designed to minimize the chance of making an error. When an error is made, the system should maximize the user's understanding of the error, and make it easy for users to recover from the error (Bagnara and Rizzo, 1989; Booth, 1991; Lewis and Norman, 1986; Norman, 1991; Senders and Moray, 1991; Shneiderman, 1998). Even if a system is designed to follow all of these design principles, it is virtually impossible for users, especially novice users, to avoid making errors (Arnold and Roe, 1987; Greif, 1990; Lazonder and Meij, 1995).
Novice users are especially prone to making errors (Arnold and Roe, 1987; Carroll, 1990; Greif, 1990; Lazonder and Meij, 1995). When novice users make an error, they frequently become frustrated. (Arnold and Roe, 1987; Carroll and Mack, 1984). Novice users spend a large portion of their time trying to recover from errors (Carroll and Carrithers, 1984). These errors are stressful to users (Frese et al., 1990), who tend to blame themselves for errors (Carroll and Mack, 1984; Lewis and Norman, 1986). When novice users learn tasks in a networked environment, such as the Internet, the probability for making errors increases. There is an increased level of complexity, with all of the network connections and protocols, and there are many new opportunities for errors that can occur.

**Errors**

What is an error? A very simple definition of an error, from Booth, is "an inappropriate action" (Booth, 1991). Frese and Altmann view errors as actions that were avoidable, and violated a rule (Frese and Altmann, 1989). Lewis and Norman define an error as "something that the system cannot respond to" (Lewis and Norman, 1986, p.411). These definitions look at errors from the point of view of the system. The term "error" itself assigns blame to users (Lewis and Norman, 1986), not the system. This is a problem, especially since novice users tend to blame themselves for errors (Carroll and Mack, 1984; Lewis and Norman, 1986). Therefore, as Arnold and Roe emphasize, it is necessary to look at an error, not from the point of view of the system, but from the point of view of users (Arnold and Roe, 1987). In that line of thinking, Norman defines an error as when the desired actions of users are not carried out. Arnold and Roe provide a good operational definition of an error, which is "when a user's intention or goal is not attained" (Arnold and Roe, 1987, p. 204). Even if a user's goal is not attained, these error experiences can become opportunities for learning (Booth, 1991; Frese and Altmann, 1989).

**Training Methodologies**

Different training methods address user errors in different manners. Traditional training methods for new users typically involve giving users a list of specific steps to follow
in order to learn a task (Carroll, 1984; Wendel and Frese, 1987). Traditional methodologies for teaching novice users how to use computer applications focus on avoiding user errors (Frese and Altmann, 1989). The assumption of these training methodologies is that users do not make errors (Carroll, 1990). However, this is unrealistic, since it is virtually impossible to avoid errors when learning new tasks. (Arnold and Roe, 1987; Carroll, 1990; Greif, 1990; Lazonder and Meij, 1995). Typically, novice users make insignificant errors, but are not instructed on how to recover from these errors (Carroll, 1984; Carroll, 1990; Carroll and Mack, 1984; Lazonder and Meij, 1995). Users then become frustrated; and many times they subsequently cannot recover from the error sequence (Carroll and Carrithers, 1984; Carroll and Mack, 1984).

Error Training

In contrast, a new methodology for training novice users, called error training, instructs users in cognitive strategies for responding to errors, and trains users through exploration (Frese and Altmann, 1989; Frese et al., 1991). Making an error is a natural part of learning a new computer task, and error training tries to capitalize on those experiences (Frese and Altmann, 1989). Booth suggests that when users make errors, it can be a learning experience for them (Booth, 1991). Furthermore, errors are commonplace in the work environment, and users need to be able to respond to errors (Frese and Altmann, 1989). Traditional training methodologies view errors as something to be avoided, whereas error training views errors as an opportunity for learning (Frese and Altmann, 1989).

There is a growing body of literature on error training. Recent studies (Frese, Brodbeck, Heinbokel, Mooser, Schleiffenbaum, and Thiemann, 1991; Dormann and Frese, 1994), support error training as an alternative method of training. In these studies, one group of subjects is given traditional training for a new task, while the other group of subjects is given error training. Results in both studies demonstrate that the subjects who receive error training have higher performance levels than the subjects who receive traditional training. In the 1991 study, frustration levels are measured, and the group that receives error training becomes less frustrated than the group that receives traditional training. How does error
training work? Error training consists of two related techniques.

Cognitive Strategies

The first technique of error training is to teach users cognitive strategies for responding to errors (Frese et al., 1991). Users are instructed in strategies that lower the frustration incurred when making errors (Frese et al., 1991). These strategies also help users to view errors as an opportunity for learning (Frese and Altmann, 1989; Frese et al., 1991). The ability to respond cognitively to errors is a major difference between most novice and experienced computer users (Norman, 1983; Somekh and Davis, 1997). Novice users frequently become frustrated when they make an error, while expert users do not (Arnold and Roe, 1987; Carroll and Mack, 1984). Novice users tend to blame themselves for errors and are therefore reluctant to attempt new tasks (Carroll and Mack, 1984; Lewis and Norman, 1986). Errors intimidate novice users more than expert users, who are confident in their abilities (Carroll, 1990). Expert users are more likely than novice users to be confident that they can identify a solution (Somekh and Davis, 1997). When expert users cannot identify a solution, they are more likely to blame a manual or a program, before they blame themselves (Carroll, 1990). Error training provides novice users the opportunity to approach a computer task much as an expert would, by being confident in their ability to respond to errors (Somekh and Davis, 1997).

Exploration

The second technique of error training is to encourage users to explore their task environment (Dormann and Frese, 1994). Instead of giving users a step-by-step list of how to perform a task, a more general overview of the environment is provided (Dormann and Frese, 1994). Using this background knowledge, users explore their task environment. In doing so, users are encouraged to be active learners, which more closely models how novice users naturally tend to approach new tasks (Wendel and Frese, 1987).
Another advantage of an exploratory method for learning a task is that users possibly can find a better way to perform the task (Frese and Altmann, 1989; Senders and Moray, 1991). Exploration can benefit users because it has "...the additional effect of eliciting positive emotional feelings and self-evaluations of competence and efficacy" (Greif, 1990, p.236). Senders and Moray agree with this assessment, stating that "The more errors we make the better we can deal with them." (Senders and Moray, 1991, p. 113). This means that exploration encourages confidence in the users' cognitive ability to respond to errors.

**Purpose**

The purpose of this dissertation is to study the effects of training novice users in developing strategies for cognitively evaluating appropriate responses to errors, when learning to use the Internet. The Frese et. al., 1991, and Dormann and Frese, 1994, studies focus on training novice users in word processing and statistical software. This dissertation extends their work to the networked environment, by focusing on novice users learning to use the Internet. In switching from stand-alone computers to the networked environment, the training methodologies are modified for network-based tasks.

**Research Questions**

The specific research questions to be addressed in this dissertation are:

1. Is training novice users in developing strategies for cognitively evaluating appropriate responses to errors ("error training") more effective than traditional training methodologies, in training novice users to use the Internet?

2. How does networked computing change the effectiveness of "error training"?

3. Are novice users who receive "error training" more confident than novice users who receive traditional training?
References


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