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Designing a Better User Interface with a Context Path: An Empirical Study on User Learning Styles

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Abstract

This paper primarily examines the differences between how various users with different learning style preferences interact with computers in the global hypertext information network of the World Wide Web. Is it possible to design user interfaces that are equally effective for all the various computer users? This study was undertaken with two main goals in mind. Two aspects of research findings from empirical studies on usability of user interfaces on the World Wide Web are that: (1) it examines users who have varied styles of learning from visual, audio, to kinesthetic and their interactions with various user interfaces; and (2) it compares task performance, confidence, and satisfaction among various user interfaces on the Web. Implications of these results for various interfaces are discussed.

Introduction

User interface is an essential element of computer systems. Many aspects of its use are not well understood. Understanding the potential, the design, and the application of user interface requires an understanding of several diverse fields; these include human factors, graphic design, cognitive science, and so forth.

A majority of web activities involves the “browsing and searching” activity. Browsing success depends on the ability of users to navigate the systems. Navigation as a browsing strategy refers to the ongoing observation of environmental attributes, adjustments to the mental problem representation based on these observations, and the resulting behavioral actions (Marchionini 1995). Sometimes, disorientation problem may occur while searching for information, especially in the systems that offer no navigational cues. Therefore, users easily get lost in the information space. Not only do user interface designers assist users in understanding and recognizing their location in the entire structure, but also in evaluating the usability of user interfaces to produce better results.

Besides user skill levels, users have varied styles of learning and preferences with which they are comfortable (Wan 1995). As the interface on the WWW is visual representations of actual objects or operations, users who have a preference for a visual-oriented environment may react to various user interfaces differently from users who have other types of learning style preferences.

Learning and Individual Differences

Learners differ profoundly in what they do in learning and in their success in any particular learning situation. This is an observable problem today, as it has been for centuries. Individual may differ in their relevant knowledge base and the availability and accessibility of the knowledge specifically required for the task. They may differ also in the amount of experience already acquired in executing the task performance (Snow 1989).

According to Kyllonen and Shute (1989), they have adopted various approaches to the development of learning taxonomies. One way of organizing these approaches is by the categories of (a) *rational*, based on a conditions-of-learning analysis, (b) *correlational*, based on an individual-differences analysis, and (c) *model-based*, from formal computer simulations of learning processes.

In this study, having demonstrated the presence of complex interactions among learner and treatment characteristics, the authors developed a generalized matrix framework referring to Snow’s studies. In Figure 1, three data matrices are arranged along their edges. The L matrix contains scores of persons on learning style preference variables such as a group of visual learning style preference subjects, a group of auditory learning style preference subjects, and a combination of visual, auditory, and kinesthetic learning style preference subjects. The T matrix contains scores of treatment on treatment variables. The O matrix contains outcome criterion scores of persons in treatments. Also illustrated are two factors: O_p can be thought of a particular column in O or as the mean of all columns. The predictions of average score from L can be implied that they are the traditional main effects for learning style preference variables regardless of treatment distinctions; this is the typical predictive validity study, as conducted by differential psychologists. O_r can be thought of a particular row in O or as the mean of all rows.

The predictions of average treatment difficulty from T can be implied that they are the traditional main effects for treatment variables regardless of person differences.

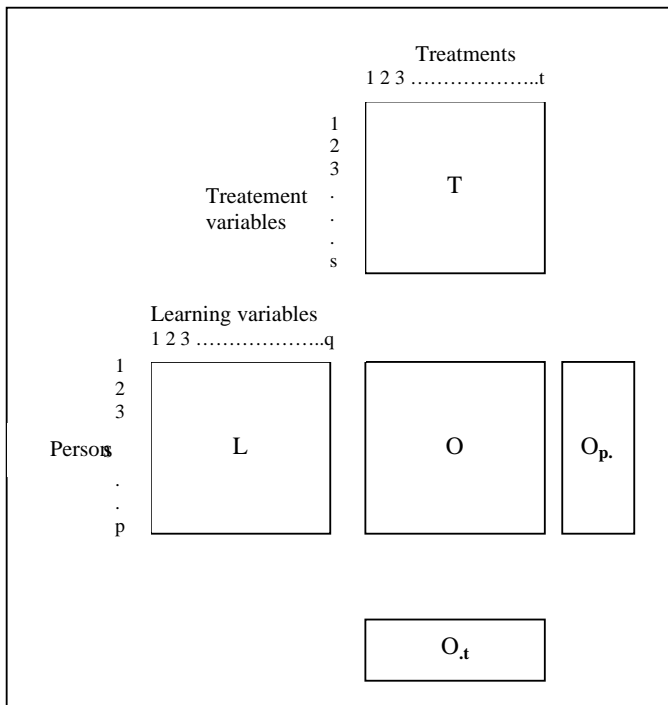


Figure 1. A Three-Matrix Framework for Multivariate Analysis

reached previously (analogous to leaving a bookmark in a printed text). The backtracking facility is one of the most important navigation facilities, especially for novice users (Nielsen 1990). Users frequently depend on backtracking to save them when they are in any kind of trouble. A context path can take users back to the general locations in the hypertext where they visited previously. As reported by Pitkow and Kehoe (1997), the most frequency of strategies that users use when browsing the Web involves bookmark which is over 80% of the cases. In addition, backtracking facilities need to be simple and consistent, so that users can always rely on them as a lifeline to get out of trouble (Nielsen 1990). The idea underlying user interface element is to enhance user performance (speed and accuracy), confidence, and satisfaction in browsing the WWW, and reducing navigation effort while alleviating and reducing cognitive overload.

Statement of Hypothesis

H₀: There is no difference among five different types of user interface elements -- traditional plain hypertext, an index, an imagemap, an index with a context path, and an imagemap with a context path -- with respect to the speed (or time to complete task), the accuracy (or the correctness of responses), the confidence during searching for information, and satisfaction with various user interface designs, when the subjects differ in certain characteristic such as learning style preferences.

H₁: There is a difference among five different types of user interface elements -- traditional plain hypertext, an index, an imagemap, an index with a context path, and an imagemap with a context path -- with respect to the speed (or time to complete task), the accuracy (or the correctness of responses), the confidence during searching for information, and satisfaction with various user interface designs, when the subjects differ in certain characteristic such as learning style preferences.

Research Design

Different types of user interface elements were evaluated using four measures of effectiveness as dependent variables: speed, accuracy, confidence, and satisfaction between traditional plain hypertext and four different types of user interface techniques -- (1) an index, (2) an imagemap, (3) an index with a context path, and (4) an imagemap with a context path -- on the Web-based systems. The two-phase study involved fifty first-year students at The Washington University. During phrase one, students completed learning style inventory to identify the style of learning preference.

The independent variable, learning style preference variable was measured by using the Learning Style Inventory adapted by Suessmuth (1985) from Knaak (1983). Three categories of subjects were tested: a first group of visual learning style preference subjects, a second group of auditory learning style preference subjects, and a third group of a combination of visual, auditory, and kinesthetic learning style preference subjects. The dependent variable data were collected using an experimental design with students randomly assigned to each type of user interface and to each set of task conducted during the second phrase of the study.

Context Path: An nth User Interface Element to Assist Navigation

One of the advantages of user interface elements is that it can help reduce the cognitive loads associated with the process of navigation (Berghel 1996). Humans require seeing the whole picture. They do not need all the details in order to investigate if they have an overall view of the subject. In addition, our "smartness" comes about because we can store large amounts of information as external representations, rather than relying on our limited internal information storage and processing. The powers of the machine and the powers of the person complement one another, leading to the possibility that the combination will be more fruitful and powerful than either alone (Norman 1993).

As mentioned by Hoffman et. al 1996, a majority of web activities involves the searching task. We need to design a Web that can provide users with a way of seeing where they are with respect to the entire web structure (Hinrichs and Morris 1996). The author proposes a context path to let the user see the associations that provides navigational cues, hierarchical data structures, and backtracking to the previous locations.

A context path is a user interface element that is composed of a series of textual buttons. It contains a directional path of direction which the user controls. It can be a facility to backtrack, enabling the user to return to a stage of the browse

Results: Effect on User Performance

Analysis of variance was utilized to analyze user performance, confidence, and satisfaction. At the 0.05 level, in term of the main effects for treatment variables regardless of individual differences, there was statistically significant difference in user performance among different user interfaces. But, there was no statistically significant difference in user learning style preferences alone. In Figure 2 and 3, the study showed that user performance in completing the tasks was faster and more accurate in the user interface with navigational cues (a context path) – Interfaces 4 and 5. Upon analysis, there were no statistically significant differences in attitude and satisfaction. However, the majority of users were found to be more satisfied and confident with the user interface which includes a context path.

Finally, the results of the study indicate that the user interface design provides a holistic representation of the screen content, a directional cue, and a facility to backtrack to the previous locations, therefore navigation through the “Web” can be improved. It also avoids disorientation and discouragement in exploration and usage. To what extent the interpretations of learning are in the form of complexity of user

performance. As we come to understand how learning occurs, we will be able to produce better user interface design.

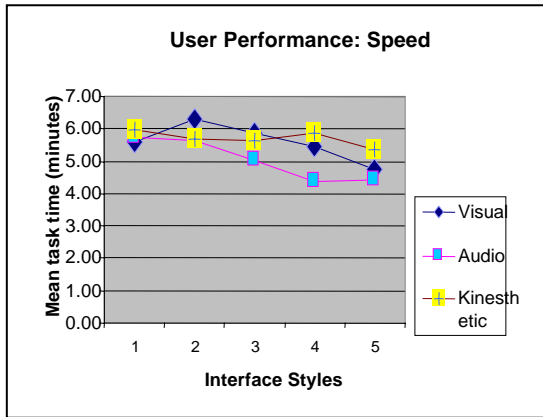


Figure 2. The Effect of User Interface Design and Learning Style Preferences on Average Task Time

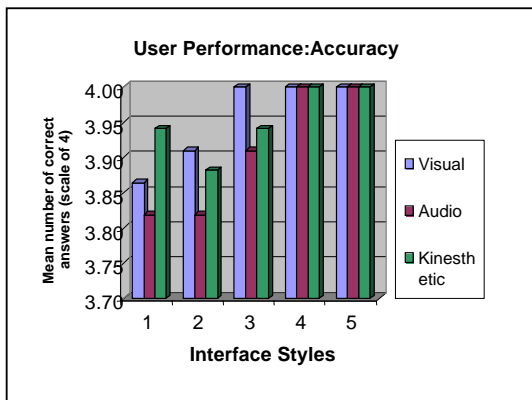


Figure 3. The Effect of User Interface Design and Learning Style Preferences on Average Number of Correct Answers

References

- Morris, M. and R. Hinrichs. *Web Page Design: A Different Multimedia*, SunSoft Press/ Sun Microsystems, Mountain View, California, 1996.
- Norman, D. *Things That Make Us Smart*, Addison-Wesley, Reading, MA, 1993.
- Snow, R. “Aptitude-Treatment Interaction as a Framework for Research on Individual Differences in Learning,” in *Learning and Individual Differences: Advances in Theory and Research*, P.L. Ackerman, R.J.Sternberg, and R. Glaser (eds.), W.H. Freeman and Company, New York, 1989, pp. 13-59.

Full references are available upon request from the author.