

A Model-based Approach to Usability Evaluation for Digital Libraries

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ABSTRACT

This paper reports an empirical model of user information seeking behaviors in a digital library (DLISP Model), and describes how the model can be used to evaluate the usability of a digital library.

Keywords

Information seeking process model, interaction process, usability evaluation method, digital libraries.

INTRODUCTION

Digital library (DL) usability can be characterized by the capability of a DL to support the various stages of a user's information seeking process. Usability problems are defined here as *users' perceived difficulties during interaction with a system, due mainly to a system's design faults, while pursuing the accomplishment of goals*. Researchers have previously employed a formal model of human computer interaction (e.g., D. Norman's Approximated Theory of Action) as a classification frame of usability problems [1,4]. Because information seeking deals specifically with human-computer interaction, models of information seeking can generate a better understanding of human information behaviors. Current models of the information seeking process, however, fail to incorporate the DL, much less the World Wide Web. Rather, these models reflect query-based information seeking behaviors using stand-alone database systems. Therefore, there is a need for a new, more comprehensive model to serve as a framework to classify usability problems in the DL context.

METHOD

This study chose the Berkeley SunSITE (<http://sunsite.berkeley.edu>), a well established DL whose audience includes not only the general public but extends to DL developers, as the experiment site, where lab-based usability tests were conducted. Four DL-related tasks were

given to twenty graduate students with library and information science backgrounds. Screen capture software was used to record participants' verbal protocol (think-aloud) and behavioral protocol (screen activities) data, and post-search interview sessions were videotaped. A coding scheme of users' physical and mental information seeking behaviors (n=60), usability problem codes (n=51), respectively, were created by using a content analysis method to examine the data that had been collected and assembled into combined logs. In Phase I of this study, the user behavior codes were classified using the Theme-Based Content Analysis method from which stages of the information seeking process emerged. By applying a frequency analysis to observe the presence of transitions between stages, an empirical model of the Digital Library Information Seeking Process (DLISP Model) that demonstrates the dynamic and cyclical nature of the information seeking process in a DL was proposed (see Figure 1). In Phase II of the study, usability problem codes were classified in accordance with the model. The resulting classification table of usability problems (see Figure 2) succeeds in classifying problems at each stage and attributing the corresponding behaviors that accompany those problems at each stage.

FINDINGS

The DLISP Model

The information seeking process involves the following stages: A user recognizes his/her information problem [Recognize Problem]; defines the topic and analyzes the task [Form Task Intention]; initiates the task either with or without prior attempts to familiarize oneself with the system [Determine How to Get In]; selects an information seeking strategy by mentally mapping a concept onto a directory or by formulating a query [Scan via Directory/Search via Query]; executes the action [Execute]; and examines sub-categories or search hit results [Interpret Scan Results / Interpret Search Results]. The user selects a particular sub-system or linked collection [Choose a Source] and if necessary, proceeds by selecting another information seeking strategy within the system. Otherwise, the user draws on the information object to extract

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information and form judgments [Evaluate Information Objects]. The user amends his/her information seeking strategy according to the information problem and/or the task intention [Assess Interaction]. Navigation was defined as an inter-stage transitional movement.

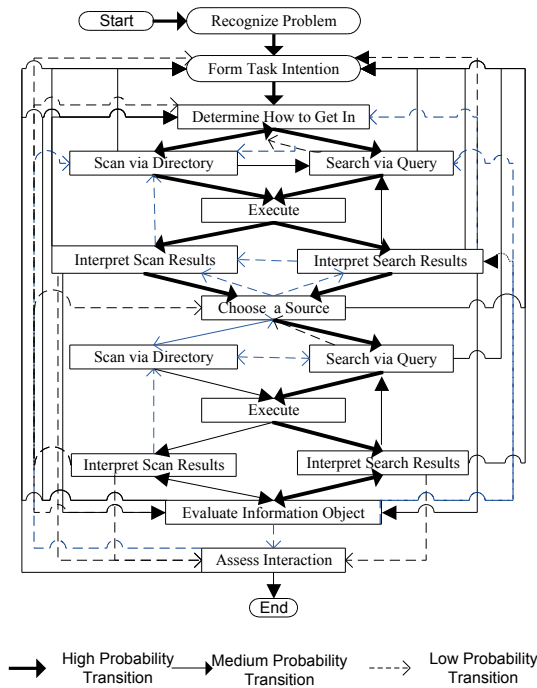


Figure 1. An Empirical Model of Information Seeking Process in Digital Library (DLISP Model)

The DLISP Model also displays high-, medium-, and low-probabilities of transitions among stages. As presented in the Model, users prefer *scanning* to reach an appropriate collection page (mini-homepage), and prefer *searching* to find specific information objects. These findings designate transitions to and from the "Choosing a Source" stage as the critical locus of all transitions throughout the information seeking process. Unlike current query-based information seeking process models that fail to display the tendency of users to switch between the searching and scanning modes, the DLISP Model manifests the "evolving" nature of the information seeking process. Although there are similarities with previous models [e.g., 3], the DLISP Model more accurately portrays aspects of information seeking involving heterogeneous collections and their multiform interfaces [2].

Classification Table

The results showed that 82% of usability problems were classified in accordance with the DLISP Model, suggesting immediate improvements for the DL. The remaining 18% were attributed to global problems (e.g., "lack of consistency throughout the DL," and "too diverse content mingled together") spread across all of the stages, suggesting more fundamental changes in the DL requiring consideration of the entire context of the users' interaction

process. Significantly, 26% of usability problem codes were identified in the Interpret Search Results stage, followed by the Search by Query stage (17%), and Navigation (10%). Overall, the number of user behaviors, the number of usability problem codes, and the total frequency of usability problems were all greater in the Search via Query and Interpret Search Results stages. In other stages, however, users' activities did not result proportionally to usability problems of the DL.

Stage	Behaviors	Usability Problems
Search via Query	Formulate query Examine search syntax	Not enough information on search syntax (how to formulate a query) around the search box
	Learn about search coverage	Search coverage of collection difficult to recognize (within a specific site or the entire DL site)
Manipulate search default	Learn about search default	Different search defaults for each search system Difficulty in understanding the meaning of a search default (or terminology used)
		Limited options for search default (.continued)

Figure 2. An Excerpt of the Classification Table

CONCLUSION

By applying an empirical model of users' information seeking processes in a DL, this study was able to establish the actual events that occur in chronological order when users interact with a DL, and users' perceived difficulties in interacting with the system. Results of this study illustrate the importance of smooth transitions in making use of disparate sources in a DL, and of interaction design in DL usability evaluation. Automatic coding techniques for combined logs data, reducing the financial and temporal costs of this usability evaluation method, would increase the advantages to utilizing this method.

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