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Academic users' interactions with ScienceDirect in search tasks: Affective and cognitive behaviors

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Abstract

This article presents part of phase 2 of a research project funded by the NSF-National Science Digital Library Project, which observed how academic users interact with the ScienceDirect information retrieval system for simulated class-related assignments. The ultimate goal of the project is twofold: (1) to find ways to improve science and engineering students' use of science e-journal systems; (2) to develop methods to measure user interaction behaviors. Process-tracing technique recorded participants' processes and interaction behaviors that are measurable; think-aloud protocol captured participants' affective and cognitive verbalizations; pre- and post-search questionnaires solicited demographic information, prior experience with the system, and comments. We explored possible relationships between affective feelings and cognitive behaviors. During search interactions both feelings and thoughts occurred frequently. Positive feelings were more common and were associated more often with thoughts about results. Negative feelings were associated more often with thoughts related to the system, search strategy, and task. Learning styles are also examined as a factor influencing behavior. Engineering graduate students with an assimilating learning style searched longer and paused less than those with a converging learning style. Further exploration of learning styles is suggested.

Keywords: Searching behavior; Pausing behavior; Affective behavior; Cognitive behavior; Learning style

1. Introduction

Researchers taking the user-centered approach have explored how people think, perceive, behave and feel about information retrieval systems and the interaction process (McCracken & Wolfe, 2004). From a theoretical point of view, researchers have stressed that in studying human interactions with an information retrieval system it is important to find ways to access the underlying thoughts and cognitive processes of the user

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(Ingwersen, 1996). The next step is to understand how users' thoughts interact with and influence their actions and affective states during interaction with an information retrieval system (Dervin, 1983; Kuhlthau, 1993). Many research studies have explored the effects of users' cognitive behavior and affective reactions on their interaction with information systems. However, most of the studies focused on exploring either the cognitive dimension or the affective dimension. Fewer studies have investigated the relationship between cognitive behavior and affective reactions during the information searching process. Our current research is designed to fill this gap by exploring users' affective feelings and cognitive behavior during the interaction with the E-journal system ScienceDirect, and the relationship between their cognitive behavior and affective reactions.

2. Related literature

With the development of the user-centered approach to studying information systems and human–computer interactions, abundant research has been done to study users' behavior as they interact with different kinds of IR systems, from OPACs to Web search engines. Regarded as an inseparable part of observable sensorimotor behavior, the affective and cognitive dimensions of behavior have attracted much attention in recent decades.

Based on the constructive theory and a series of five empirical studies on information seeking, Kuhlthau proposed a six-stage model for the information search process (ISP). The six stages are: initiation, selection, exploration, formulation, collection, and presentation. In the ISP model, information seeking is viewed as a process of construction in which users progress from uncertainty to understanding. Kuhlthau argued that the whole information search process is an integration of three realms of human experience: the affective (feelings), the cognitive (thoughts), and the physical (actions) (Kuhlthau, 1991, 1993).

The cognitive dimension of human behavior was recognized and widely explored in the early stages of information seeking behavior research. Several researchers studied the effects of cognitive style, especially field dependency (as measured through the embedded figures test), on users' reactions to information organization and representation, search strategy, and search performance (Ellis, Ford, & Wood, 1993; Ford, 2000; Ford, Wilson, Foster, Ellis, & Spink, 2002; Ford, Wood, & Walsh, 1994; Palmquist & Kim, 2000; Wang, Hawk, & Tenopir, 2000; Wang & Tenopir, 1998). In the later studies, researchers began to realize that the process of information retrieval may be influenced to a considerable extent by factors other than cognition and technique. Emotion also can play a critical role in the overall effectiveness of the searcher. In a study of children's cognitive and physical behaviors when they used a Web search engine/directory to perform fully self-generated search tasks, Bilal (2002) called for teachers of information literacy skills to incorporate the affective aspects of information seeking into their instruction model.

In their research comparing patterns of children's and graduate students' Web searching behavior, Bilal and Kirby (2002) investigated users' cognitive, affective, and physical behavior as they completed a fact-finding task. The participants' Web activities were captured by video. Children's affective states were captured by exit interviews, and graduate students' affective states were gleaned from the journals they wrote during the Web traversal process. Searching effectiveness, efficiency, and the quality of Web moves made by each user during the search process were measured by the "Web Traversal Measure". The study found that graduate students scored much higher than the children scored in terms of searching effectiveness, efficiency, and quality of their Web moves. Compared with children, graduate students were more capable of recovering from search-related "breakdowns" (Bilal & Kirby, 2002).

Wang et al. (2000) observed how users search for factual information on the Web. They presented a multidimensional model of user–Web interaction as a framework for their empirical design. Twenty-four graduate students participated in the study. The study focused on cognitive, affective, and physical domains during the user–Web interactions in performing factual searches. Cognitive factors included the knowledge and skills needed to interact with the Web to find information, and cognitive style (measured using the Embedded Figures Test (EFT)). Participants' cognitive behaviors during the user-Web interactions were analyzed in terms of their question analysis, search strategies, problems and problem solving, and mental models. Affective factors were measured by the State Trait Anxiety Inventory (STAI) to indicate if the level of anxiety affected searching. They found that affective states changed as a result of interactions with the information system.