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Internet-based knowledge acquisition: Task complexity and performance

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ABSTRACT

Internet tools used as knowledge retrieval mechanisms can be beneficial for knowledge acquisition (KA). This study applies the concepts of decisional guidance and restrictiveness to three commonly used tools to predict perceived information overload, task quality, and task speed for tasks that differ in complexity. In an experimental setting we find that less restrictive pull systems (i.e., web directories and Google search) increased quality in high-complexity tasks over more restrictive push systems (i.e., listservs) and lowered perceived information overload in both low- and high-complexity tasks. In low-complexity tasks, subjects using predefined guidance (i.e., listservs and web directories) performed better and faster than those using participative guidance (i.e., Google search). In high-complexity tasks, participative guidance provided lower perceived information overload and higher task quality. Implications for research and practice are discussed.

1. Introduction

While knowledge workers can select or re-use information that already exists in knowledge repositories, they may also need to acquire knowledge from external sources [19,34,57]. This knowledge acquisition process (KA) can result in knowledge being used immediately by the organization, or assimilated within an organization for subsequent use [30]. The Internet provides a large variety of knowledge retrieval tools that support KA. However, workers often have difficulties acquiring knowledge from external sources making some KA attempts unsuccessful [9,19]. This is disappointing given the large investment many companies have made on knowledge-related activities. Being able to effectively choose the right Internet tools is an essential step in developing organizational knowledge management capabilities [22,41]. Research that identifies and explains the conditions in which specific Internet tools improve KA can inform this process.

Our research assesses three Internet tools that are commonly applied in the KA process: listservs, web directories, and Google search [18,29,57]. Overall use of these tools is widespread and frequent. Web directories are ubiquitous across the Internet, with large directories such as Yahoo! and the Open Directory Project maintaining millions of entries [70]. In July of 2011 the top 20 open-environment listserv hosts maintained over 190,000 active lists and delivered over 4.3 million messages daily [42]. Google handled 11.2 billion searches in the U.S. market in July of 2011 [11]. While decision support systems are commonly linked to decision performance (e.g., [35,47]), these Internet tools are more commonly linked to search performance (e.g., [33]) and information quality (e.g., [18]). Therefore, we examine their effects on KA task performance, which is an important outcome of knowledge management activities [1].

Our analysis derives from the theoretical implications of each tool's orientation toward facilitating or constraining user behavior (*system restrictiveness*) and the manner in which the tool guides users in the KA process (*decisional guidance*) [58–62]. Restrictiveness and guidance are theorized to influence human performance in using interactive systems to accomplish a task [61]. Empirical tests suggest both factors are important to numerous types of information systems, including recommendation agents [68,69], forecasting decision support systems [52], audit support systems [15], and conceptual data modeling support systems [2]. These findings imply that performance of Internet tools for KA will be influenced by system restrictiveness and decisional guidance. To our knowledge, however, neither factor has been studied previously in the context of Internet tools for KA. This gap in the literature motivates our present research, which is directed toward improving performance of listservs, web directories, and Google search. Important benefits can be gained even if performance is improved only incrementally, due to the massive use each of these tools currently receives.

We analyze how restrictiveness and guidance affect task performance at two levels of task complexity. Task complexity plays a

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particularly influential role in understanding information seeking and information retrieval system performance [12,19,32]. In addition, task complexity has been reported to interact with both restrictiveness and guidance in empirical tests [47,50]. Incorporating two levels of task complexity in our research design will allow us to detect interactive effects in the results.

The paper is organized as follows. We first present the theoretical foundation of the research, followed by development and justification of the research hypotheses. We then present the research method and results. The concluding sections discuss research and practical implications of the findings.

2. Theoretical background

We contend that the KA process is grounded in information seeking behaviors, that these behaviors are supported to a greater or lesser degree by knowledge retrieval tool features, and that the effectiveness of feature support is conditional upon characteristics of the specific task. These ideas are based upon theories of information seeking, system restrictiveness, and decisional guidance, which we discuss in the following sections.

2.1. Information seeking

Information seeking is important for problem solving [69] and knowledge management [44]. It is critical for identifying, defining, and addressing existing problems or opportunities [20,63]. Wilson's [71] information behavior model describes how information seeking behavior "arises as a consequence of a need perceived by an information user, who, in order to satisfy that need, makes demands upon formal or informal information sources or services, which result in success or failure to find relevant information" ([72], p. 251). Success in finding relevant information leads to information use that either fully or partially satisfies the need [71,72]. Other information behavior models including Kuhlthau's [37] stage process model, Leckie et al.'s [38] model of information seeking for professionals, Savolainen's [54] everyday life information seeking model, and Byström and Järvelin's [6] information seeking and retrieval model also describe similar elements of information seeking including an information need, information sources or channels, and information use to complete a task or solve a problem. Consistent with the general notion of information seeking from these models, our research model (see Fig. 1) contains these three basic elements: i) tasks (the need); ii) knowledge retrieval tools (the information source/service); iii) KA task performance (information use that satisfies the need).

Implicit in our model is the idea that some knowledge retrieval tools will support a specific information search better than others based upon their characteristics and the nature of the task. Informed KA requires the information search process to deliver an optimal amount of information. However individuals often find too little or too much information, either of which can have adverse effects on KA [26]. While an appropriately configured knowledge retrieval mechanism that helps users find the right information has been shown to increase satisfaction [10], little research has examined effects of their features on task performance (for some exceptions see [67,75]).

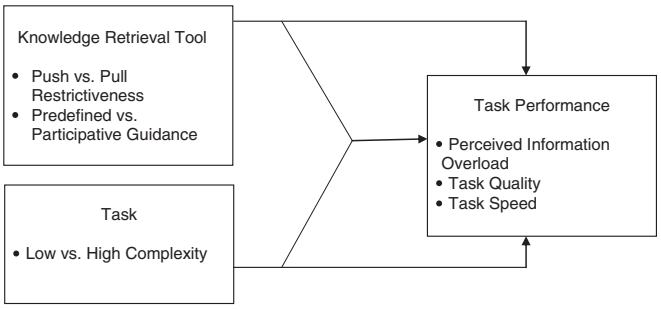

Fig. 1. Research model, including study variables.

2.2. System restrictiveness

Information systems are more or less restrictive based on the degree to which the system's functionality limits the users' decision-making processes [59]. For example, restrictive systems can impose e-commerce decision strategies [69], enforce audit work processes [15], and prevent system designers from entering incorrect relationships [2]. Whether system restrictiveness improves or worsens task performance is conditional on the context in which it is being used. Although users can find highly restrictive systems to be overly constraining, they may find minimally restrictive systems to be difficult and more confusing to use [62].

Researchers suggest that systems are less restrictive when they provide users more control [69]. We study the perceived control associated with using certain Internet tools for locating information, and conceptualize tools with low restrictiveness as those that users perceive as affording them more control over locating information for a specific task, and tools with high restrictiveness as those that users perceive as affording them less control.[2] We examine Internet tools that are designed to *push* information to users (e.g., through listservs) and that are designed for users to *pull* information (e.g., through web directories or Google search). Use of push versus pull delivery can strongly influence users' perceived control [45,46]. Push delivery automatically retrieves information from a repository and delivers it to the user based upon a user-created profile [1,45]. For example, TechRepublic is a popular listserv where users can sign up for various topic-specific newsletters that the listserv will automatically deliver to their email on a scheduled basis. Users perceive lower control over push delivery because the information is sent to them based on membership, rather than for a specific task-related need. In pull delivery, users can actively retrieve information for specific task-related needs [1,45]. Thus while push and pull delivery can provide the same informational content, push delivery is generally perceived to be more restrictive than pull delivery.

2.3. Decisional guidance

Information systems can support users' judgments by providing decisional guidance [60]. Decisional guidance is "the design features of an interactive computer-based system that have, or are intended to have, the effect of enlightening, swaying, or directing its users as those users exercise the discretion the system grants them to choose among and use its functional capabilities" ([61], p. 105). Guidance features can help users, for example, choose appropriate display formats [73], use appropriate statistical methods [52], compare trade-offs among products [68], and use a system development methodology [2]. When applied to the information seeking process, guidance can include navigation approaches that help users find information more easily.

Decisional guidance can be predetermined (called predefined guidance), or generated during system use based on user participation (called participative guidance) or system "learning" (called dynamic guidance) [60]. We focus on predefined and participative

[2] Thus, restrictiveness in our study refers to the users' perceived control associated with using the Internet tools, which have more/less user control (i.e., restrictiveness) designed into them. This is consistent with Silver [58,59] and other researchers (e.g., [15,69]) who explain that it is users' perceived restrictiveness that matters because users may not recognize or use all of a system's features.