Attorneys Interacting with Legal Information Systems: Tools for Mental Model Building and Task Integration

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This paper reports (1) on the results of a user study and (2) search-history-based user interface tools developed based on the results of the study. The study examined legal information seekers' use of their memory and externally recorded search histories in searching for and using information. The results reported here focus on mental model development and task integration across searching for and using information. The interface tools described support the creation of external representations of mental models through organizational schemes, user notes and annotations, and search plans; and they provide transition paths to information use.

The research described is part of a dissertation (Komlodi 2002) that examined the use of search histories in legal information seeking and derived interface design recommendations for information storage and retrieval systems. Computers can automatically record human-computer interaction events, allow the user to manipulate this information, and provide it back to the searcher through the user interface. In order to understand how this information can best support information seekers, the role of their internal and external memory processes was examined using qualitative research methods (observations, interviews, participatory interface design sessions). The data collected was analyzed to identify potential task areas where search histories can support information seeking and use. The results show that many information-seeking tasks can take advantage of automatically and manually recorded history information, including mental model building of a topical area, the integration of searching for and using information, and integrating these into larger tasks contexts. Results of the study from the legal user group presented evidence of the usefulness of search histories and history-based interface tools. Both user manifestations and researcher observations revealed that searchers need history information in information seeking. These findings encouraged the design of user interface tools building on search history information: direct search history displays, history-enabled scratchpad facilities, and organized results collection tools were proposed to support users in their information seeking.

1. Introduction

In our continuous search for information, we use many different tools and skills. We interact with people and objects, both physically and virtually while looking for information, and continuously learn about our needs, about the sources and information available, and our environment. Throughout the process of searching, especially with complex information-seeking tasks, we must keep track of our progress, strategize, and maintain information for reuse. We use our memory to bridge across different information sources and activities, but human memory is limited and selective. In some cases, information seeking sessions are interrupted (Lin 2000); searchers will have return to the task, remember details, and continue it. Searchers create external memory aids to support their memory and to keep track of progress, plan steps, and collect information: they take notes, print out and photocopy information, borrow and buy documents. Spink and Goodrum (1996) examined the notes search intermediaries took while searching and found that they frequently create notes in searching; an average of 20 notes were created per search.

Computer systems can take the burden off the searcher by recording searcher actions and other information automatically and by providing easy means for user notes and annotations. This information can be reused to enhance human memory in various ways, it can be presented to the user through action history displays; new user tools (such as a search result collection tool) can be developed; the search system can use this information to compare present and past actions and display similarities and differences.

The goal of this research is to understand search histories and their role in human information seeking and to identify potential application areas for history information to enhance information-seeking user interfaces. This paper reports results related to a specific application of search

history information and history-based tools: supporting mental model development and task integration. This assessment involved an investigation of how histories were used in searching; what elements of search sessions were important for the user to be saved; and what interface techniques were most appropriate to support effective use of histories and successful information seeking.

Building on a theoretical framework developed from the literature and initial exploratory studies, we used interviews, observations, and participatory design sessions to examine information-seeking behavior and to develop a descriptive framework through several iterations. This resulted in a search history framework consisting of six facets:

(1) Scope
(2) Context
(3) Search history use
(4) Search history and results management
(5) Search history data
(6) Interface design

The paper presents results on two major task areas where search histories can support searchers, focusing on facets 3 and 4:

(1) the development of a mental model of a legal area and
(2) integrating search and information use within the user's larger task context.

The paper then sketches two interface tools to support these tasks.

Facets 1-2 define the outside parameters that position the study; these are described here. Facets 3-6 are concerned with what users actually do and are described in the results and interface tools sections of the paper.

2. Scope and context
2.1 Facet 1: Scope
The scope of search history information (facet 1) can in turn be defined along four dimensions represented in Figure 1. The Time Span describes the amount of time included in the history record and provided to the user; the study focused on history records from the same session. Task span refers to the type of user tasks and actions included in the history record. Along this dimension, the study focused on search. The two remaining dimensions describe the number of systems and the number of users; the study focused on the search actions in a single system by an individual user (although multiple databases). Although the study focus was narrowly defined (top left cell of the table), interesting results surfaced on how a system incorporating search history could support future planning (Time Span) and integration of searching with information use (Task Span), including building a mental model of the legal area. This paper reports those

findings, sometimes describing system functions beyond search history as these were mentioned by participants. Although very interesting implications for collaborative use emerged as well, these are not reported here due to space limitations.

Time Span					
T a s k **S p a n**		**Current session**	**Several sessions**	**Lifetime**	**Future, planning**
	Search	**X**	X		X
	Search & Info Use	X	X		X
	All Tasks				
Individual/multiple systems					
Individual user/multiple users and collaboration					

Figure 1. Scope of search histories.

2.2 Facet 2: Context
The context selected for this study is the legal domain. Practicing attorneys and law librarians searched Westlaw, a legal information system with close to 15,000 databases (January 2002). Legal information seekers participated in the study. The domain of legal information can be defined by a limited set of content types, user types, and task types. Searching for information is at the heart of the legal field; thorough legal research is one of the professional responsibilities of legal practitioners and one of the critical skills lawyers employ on behalf of their clients. Legal information seekers often search for information on the same or similar topics over an extended period of time, potentially building on previous experience. Both of these attributes of the area made it a good candidate for the application of search histories.

3. Related research: Legal information seeking
Legal information seeking supports building a legal argument in the case at hand. This section reviews two important studies that shed light on how lawyers search for and use information.

Sutton (1985) describes how attorneys build a mental model while searching for information. He criticizes earlier studies for defining relevance as pure topicality. He steps back and defines relevance for legal research as a first step in evaluating legal information. He characterizes relevance as a function of the mental models or conceptual maps of the

law constructed and maintained by attorneys:

> "A relevant case is one that plays some cognitive role in the structuring of a legal argument."

Sutton's definition of relevance in the legal information field builds on the event space of the case, placing other similar cases in this space. Sutton describes legal practitioners' development of cognitive maps of law as having three levels:

(1) base-level modeling of the contours of the event space;
(2) context-sensitive exploration of the space and populating the relevant subsector;
(3) disambiguating the subsequent model.

He also describes these levels in terms of information-seeking activities, sources, and tools used. The first level is often accomplished through training, and learning about the general issues of an area of the law. The second level, "context-sensitive exploration", focuses on a particular issue, how the legal principle has been applied to the facts of the reported case. The third level describes the process of disambiguation among the results retrieved by the attorney's searches. In this process, cases in the event space are evaluated based on their juristic status and treated according to their status. If their jurisdiction does not require their use in the attorney's litigation, they are removed or their influence diminished. The cases are Shepardized (their subsequent history checked to see whether they were challenged, upheld, or overturned) in order to examine their current status, and the results of this are also taken into consideration when deciding the impact of each case. At the end of this process the mental model is finalized for the time being. Sutton remarks that the three processes are going on in parallel in real-life information-seeking situations. The mental model building described in this paper focuses on the second and third levels, in which the attorney starts out with a picture of the legal area, explores the conceptual space with the help of this model, updates the model and then uses it to judge new results and update it with new information found.

Marshall et al. (2001) described a study of law students preparing for a Moot Court competition where students practice case litigation against other student teams. They examined students' information-seeking and reading activities, including annotation techniques, in order to test and design an e-book technology, XLibris. They found that law students' information seeking is carried out in many physical contexts; students often change place while looking for and processing information because resources are distributed. Link- or citation-following is a frequently used technique in legal searching, while text searching is less frequent. They point out that annotation techniques are taught to law students, and often different annotations are used to prepare a document for different purposes. Re-reading and re-annotations are frequent in the legal field; often annotations are overwritten or selected annotations are marked for a second time.

Annotations vary in importance and usefulness.

Documents collected for the Moot Court trial are organized according to the tasks and purposes they will be used for. At the same time, as students got closer to writing documents of their own, their organization schemes became closer and closer to their writing objectives. Organization schemes changed through the process of working with the documents; reorganizing them was a way to conduct work. Organization schemes were activity-based and changed several times during the study. Marshall et al. suggested flexible organization tools that allow reorganization easily. Students also often created reminders and plans through annotations on document printouts and later used these plans to guide their further research. The end product of this process is a brief with a discussion of the main legal issues accompanied by relevant quotes from cases. The students mentioned that they would have liked an easy way to locate quotes that they saw while reading documents. Writing briefs can also prompt students to look for more materials based on ideas they got while writing. Marshall et al. found that students changed between activities very frequently, and thus suggested a "document laptop" to serve their needs as opposed to a single e-book device.

The redesign suggestions for XLibris focused on the following areas: navigation, retrieval, annotation, and organization. In navigation, better backtracking tools were needed for navigating among gathered documents and frequent link-following as a search technique. To support link following, smooth integration with Web documents was added to the e-book device. Keyword-based search facilities were added to enable search through gathered documents at the passage level. Improvements to the annotation tools included the ability to easily re-annotate previously marked documents and also the ability to annotate previous annotations without having to go back to the original document, thus supporting thinking. Further a notebook feature was added where users could collect clippings and annotations. More flexible organization tools were also added to the original design: workspace labeling and divider pages were introduced. Three areas were identified where the new "document laptop" can support users:

(1) immediate access to current legal materials through wireless access and highly portable devices,
(2) ability to re-retrieve previously seen materials,
(3) ability to suspend and resume tasks.

The results of this study (Marshall et al. 2001) are very important for the current study, as many of the research questions looked at and the results found are similar. Although Marshall et al. approached the problem from the point of view of reading and annotations, while this study (Komlodi 2002) started from an information-seeking

viewpoint, both studies expanded the focus to other tasks, signaling the importance of task integration across computer applications and physical workspaces. Marshall et al. felt that their most important finding was the move from a dedicated e-book device exclusively for reading to an integrated "document laptop" that combines other activities with reading. Both studies, proceeding simultaneously, found similar activities in terms of looking for information, processing information for reuse, and document writing and other information use.

4. Methodology

Since this study explored a new area of searcher behavior not examined thoroughly previously, it used qualitative methodology.

The full study consists of three phases (Figure 2), Phase 3 is in the planning stage. Preceding the study proper, we carried out initial exploration of the topic through literature review, interviews with reference librarians in a special library, and an analysis of usability testing videos of the Westlaw legal information system. These preliminary data collection efforts led to the conclusion that search histories can enhance information seeking and that current tools need improvement to satisfy user needs. Based on these findings, we developed and initial search history framework and designed an iterative methodology including data collection on user behavior, search history framework development, and interface design in all three phases:

(1) **Phase 1:** data collection through observations of and interviews with attorneys and law librarians;
(2) **Phase 2:** iterative participatory interface design and evaluation sessions with attorneys and law librarians;
(3) **Phase 3:** interface development and formal evaluation.
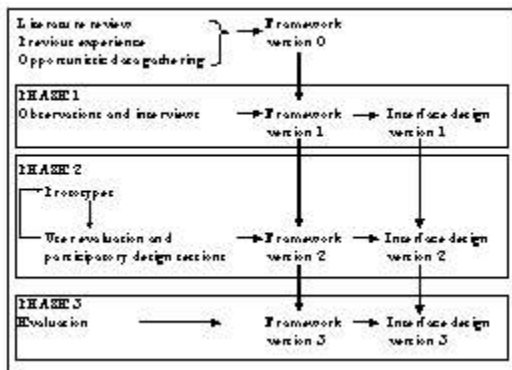

Figure 2. Research plan.

Eight attorneys were involved in the observations and interviews conducted by the first author. Another eight interviews with expert legal information specialists from Halvorson (2001) were generously made available for this study by T. R. Halvorson. The first groups was asked to search the Westlaw databases for a topic of their choice. The problem had to be subject-oriented and

involve several linked questions. While searching, participants were asked to think aloud. After the search, they were interviewed about the search session and about their memory and history use in general. In the Halvorson interviews, participants were interviewed about their information-seeking practices, many of which involved the use of history mechanisms. Transcripts of think-aloud sessions, interviews, and observation notes were coded using the search history framework and analyzed; the results then informed the design of interfaces. The interfaces were used in the participatory design sessions, and further interfaces were designed by participants. The transcripts from these sessions were also analyzed and they informed the framework.

5. Results and discussion
5.1 The whole process
The results of the study indicate that search history information is used for many different purposes in information seeking. The types of tasks search histories can support are organized around the areas shown in Figure 3.
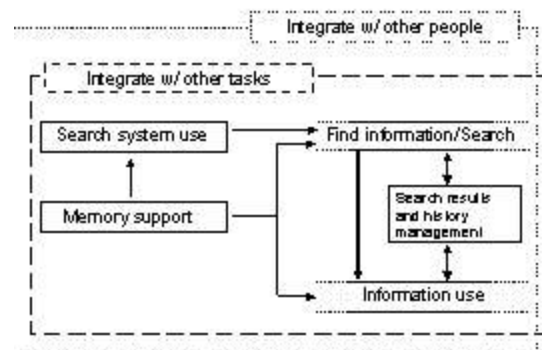

Figure 3. Functions of search history.

Memory support is the most basic function of search histories. Activity information is recorded and provided to the user, removing from the user the burden of remembering all activities and items. Other search history uses build on memory support. In order to find information in computerized systems, searchers must be able to use the application interface; in a search history, the user can go back to see "how did I do this before". Finding and using information build on memory support and search system use, but also introduce new history-based interface functions. Users search for information in order to use it for other tasks; integration of searching with other tasks is, therefore, an important function that can be supported by search history information. Methods to integrate search with other user tasks can also be supported by search history information. Finally, the even larger context of information seeking involves collaboration with others, where search histories can help with transferring information between

team members.

The study observed the entire information-seeking and use process from query formulation and source selection to executing the search and making relevance judgments to using information. This paper reports on the findings related to the second half of the process, using information after it was found: Search results and search history management (5.3), Information use (5.4), and Integration with other tasks (5.5). These three areas concern the potential of search histories for providing a link between finding and using information, taking advantage of the physical unity of the same workstation now used for previously separated actions. These three task areas all involve mental model development (5.2) as a common theme. Searching for information builds on the initial mental model of the searcher; finding, interpreting, and applying information contribute to the mental model; the model is updated in light of the new information. Each of these areas are discussed in the following sections. To provide a context and illustrate the continuity of mental model building and task integration, first a summary of the first part of the search process is described. See the first author's dissertation (Komlodi 2002) for detail.

5.2 Searchers' mental models and knowledge structures

As described by Sutton, the first level of building a mental model of a legal area happens through training; the attorney builds a general picture of the issues involved in the topical area of the law. Participants in the study all had a basic understanding, a preliminary mental model, of the legal area and represented the second and third levels of mental model building: searching for and interpreting information.

Users often represent their knowledge structures in three simplified physical formats:

- an outline of topical areas and issues in a document to be written;
- search planning notes (usually created pre-search);
- an organizational structure for storing documents.

These external representations can be used as a starting point in searching, they can be built into planning notes and checklists to guide the search or into "shopping cart" organizations, and then later applied to searching. These organization schemes are often refined during the search as searchers learn from the search results and reflect their new knowledge. Providing a tool based on earlier activities (activity histories) that are updated as the search progresses can help users refine their knowledge structures about an area. Structure should be complemented with notes, annotations, verbal explanations, and links to search results in order to better represent the user's knowledge in a reusable format. Tools to support these functions include:

- a tool to record organizational schemes;
- a tool to plan the search (extend search history into the

future);
- a tool to take notes and create annotations to represent new knowledge.

Organizing can start much earlier than the search itself, it can start from the initiation of the project or the information seeking task, including the planning stages, as the major categories can take shape at this stage and need to be recorded.

> Participant 8: In the same way if you had a document management handler, say straight from, I guess I sort of do that, I could have been creating this system, but it would be nice if from Westlaw you would have your own set thing all ready to go, something like you create in your inbox or folders. Maybe you would get a questionnaire form at the beginning of your research where you would want to start setting up something like that, then you would be able to just click on the folder in the download section and just drop into there.
> Interviewer: So sort of a set of topics before you start.
> Participant 8: Yes, possibly. It would also keep you an outline for your search so that you won't go off on some of tangents. I guess then you would do your search outline by how you set up your folders. Which may be helpful.

Attorneys interviewed in the study developed elaborate paper-based research filing systems that they meticulously maintained and kept up-to-date. The organization structure of these files represented the structure of how they thought about legal areas in light of their practice area. The clusters changed over time based on the tasks of the attorney and changes in the practice of the legal issue. This is a good indication of the usefulness of physically representing internal knowledge structures for document management purposes. However, this external representation can also be helpful in learning about an area through visual representation. Presenting relationships between documents and result sets can help searchers build mental models of legal topical areas.

5.3 Search history and search results management

This section describes some of the current practices and recommendations for search results management. Management activities encompass what happens between finding and using information, how the results from information seeking are interpreted and integrated into existing structures and then used, and how search histories may help searchers during this task.

XXX: summary of this section here

5.3.1 Searching and browsing within sets of documents

The result set can be defined as all information returned to a query, or clusters of documents created by the system or

the user, or information found when browsing, e.g. all the cases linked from one case, or user-selected items and sets. The set can include the searcher's own documents. In order to use the information found, searchers need tools to examine the result set. Study participants often described the need for manipulating this set, searching within it, reordering it, or comparing it to another set. Even when they could have achieved the same result through the formation of a more complex Boolean query (such as AND-ing another phrase in order to search for it within the set), they would refer to it in terms of set manipulation techniques (such as search within the result set), as in the following example:

Participant 1: So it would be nice to be able to search through these cases for your terms.

Providing a good overview of the information returned is very important, and so are functions that allow users to manipulate the result set to find out more about it, reorganize it, and find specific information in it. The following two sections describe two of these functions, where saving the result set locally in a history allows users to further manipulate it.

5.3.2 Search within document
Documents returned to queries are examined during searching to make an initial decision about their relevance. The depth of this examination varies based on time available, pricing structure of the database, the domain knowledge of the searcher and other factors. Searching within documents can help with this examination. Many participants mentioned this function as an important need.

5.3.3 Compare results and document content
Comparing actions and result sets is an often-used tactic in searching, results gathering, and information use. Study participants compared or wanted to compare individual documents and result sets in order to make results gathering easier or to discover relationships between topics and documents.

Participant 1: It would have been nice at some point, I think it would be helpful to be able to compare search results from one search with search results from another. Especially since I have different issues, especially the school board issue and the separation of church and state issue, they are very closely related, but on the other hand they are not exactly the same. And some cases will appear in both I would assume and some cases won't.

To perform this task without system support, users had to remember or lay out the items next to each other.

Recorded information can be used to point out overlaps or repeating results or actions within the session. Showing overlaps between results sets, differentiating documents that have been returned before, can help users to understand the relationships between sets. Understanding relationships in turn helps with

mental model building. Showing overlap also helps with collecting results, avoiding repetitive actions such as reading or saving the same case twice by accident.

5.3.4 Saving and recording search results
Saving results is one of the most important features of search systems, as it provides the link between finding information and using it. This should be easy and flexible for users. Search histories are very well suited for this task, as they naturally keep track of events in sequence. Study participants described varied techniques they use for saving results. They take notes on paper, type in word processing packages, copy and paste text and URLs, and print screens and text, email documents and text, or save it to a disk. In addition to results, they would save context information, reminders about why they thought a certain item was important, and their personal markings and comments, as in the following example:

Participant 4: Earlier there was no way to save your Westlaw searches. By printing out your search history, your terms, connectors, and everything, instead of trying to recreate the wheel, you would know. It was a lot easier; I used to highlight my search history. When you go back and you want to update you can actually see like the dates of the cases, and all that information. So it's a good … it's a roadmap.

When saving search results, whether whole documents or pieces of documents, it is important to preserve the link to the original query (saving the context) and to the source. This will help with continuing the search or using the information.

5.3.5 Results gathering
Gathering results from searching and browsing and preparing and personalizing these results serves as a bridge between finding and using information. Users physically move the information found from the search environment into the use environment. In traditional library settings, the searcher would check the catalog (card or online), walk to the shelves and retrieve the document or request the document from a librarian, make photocopies or borrow the document, read it in the library and prepare notes or transport it to her office for reading and interpretation. Finally the notes or the new knowledge turn into a new document or new information through the use of the information found.

In the context of this study, participants used their own computer for both finding and using the information. Tools to transport documents from the search environment into the use environment are present, but in their early development. To make up for this, searchers often used copy and paste to move information between applications.

Searchers gathered their resulting documents along topical and task-related clusters. As was mentioned above, attorneys keep large amounts of paper files, including research files that contain records of searches executed and documents used. These are either organized by client ID or in the research files by topical area. Often the documents would be preserved in two copies: one in the client file and another in the research files. This dual organization by task and topic can be easily preserved in computerized systems and also complemented by other attributes.

Searchers often must integrate results from multiple sources. Here search histories can be very beneficial in keeping track of what sources have been searched and collecting the results across many sources. A similar task is searching through meta-search engines, where the user enters one query and the systems sends it to multiple systems, presenting the results in an integrated way. Searchers often augment systems to keep track of multiple sources, which also shows the need for a tracking tool.

> Participant 7: So now I have my Word document and I might go through it and highlight. So it looks like I printed from ten different sources, so this is just to give me an idea. I guess that's what I would do and now I would stop and review this, and then look at doing a more detailed search.

Saving results occurs throughout the search process. An initial collection can be created from promising documents, and later reexamined in the light of new findings. Delayed relevance judgments can change saving decisions later down the road. The gathering tool to be described later supports saving throughout the search in an organized way.

5.3.6 Building personal collections
Attorneys build their own personal research files or collections from the results of their searching, as discussed earlier. As they usually work in one selected and often limited area of law, they can define the limits and outline of their area and build up the recorded research around these. They save pertinent documents returned to them by queries or found while browsing in the system. They organize and often annotate these and need to keep their files updated. If a topic comes up that they have worked with earlier, they may first look in their own research folder; they answer short questions from their personal research files instead of searching in a database. It is often quicker to go to their personal research files than going to a database. Their research files also reflect their personal history with the topic, it is in a way a personal database on the topic.

> Interviewer: How do you use this research file?
> Participant 4: So the next time I'm doing, writing a variable life insurance prospectus, and this particular client wants to extend the … there is a certain period of time, free look period, and your state says that a 15-day period, the self-regulatory organization says it's a 15-day period. The life insurance company says I'll give them 30 days. Does that impact

anything else? I'll go and look at my free look file.

The collection tool should be integrated with the search and make saving information into the user's personal collection a seamless process. For example, it should support placing new information into the existing organizational scheme and automated indexing.

An integrated search history enriches personal files by keeping track of where each item came from, what context it has been found in, where what pieces have been quoted, when a case was Shepardized with what results.

5.3.7 Organizing search results
Participants saw organizing search history information and especially search results as a very important topic and discussed it in a large portion of the interviews. Searchers manipulate search history information through organizing it; they shape it more to their needs and liking; thus preparing it for retrieval and reuse.

The organization scheme can be developed by the searcher or taken from somewhere else. Classification systems of information resources can serve as one source of the organization scheme. The topic or subject descriptors assigned to documents, result sets, or whole searches are created by the searcher or taken by the searcher from the case text. These are usually highly personalized in the way they are used and are different for each individual depending on the kinds of topics they work on. Task-oriented organizational schemes are also used by attorneys to organize their search histories and results, topical and task-oriented schemes may get mixed in attorneys' current organization schemes. The organization schemes are good representations of searchers' mental models of a legal area. They define issues and topics and sometimes hierarchical relationships among them.

Organizing is closely related to annotating (described below in the interface tool section); if something is saved and put in a certain place, there is a need for an annotation so that when the searcher comes back to it, it will be obvious why it was saved. But without a good search history system in place, sometimes the annotation is in paper form while the search history is on the computer.

5.4 Information use. Interpretation. Notes and annotations.
Interpretation involves reading the documents found, often rephrasing them in some form, assigning meaning to them through linkages to current knowledge, and recording the process and the results in order to build them into the knowledge network and mental model of the searcher. Interpretation leads to the development of mental models

through the integration of new information with the knowledge of users.

The process of interpretation and learning about a topical area is cumulative; past knowledge forms the basis of handling new information. Interpreting and integrating search results with old knowledge will eventually lead to the answer to the information problem. However, for the answer to emerge and crystalize, the results of the mental activity of interpretation must be recorded, newly found documents must be linked to specific elements of the mental model representation, and new knowledge must be integrated into the mental model; otherwise the answer may be lost by the end of the process. Systems should provide tools to link interpretations with documents or document sets that were saved as part of the search history. Search history also enables searchers to revisit results and add interpretations later. Recording results is a good foundation for recording their interpretation by the user and their linking to current knowledge.

Typically end-user searching is integrated with interpretation. The process of reading while searching helps them learn more about the topic and thus form better queries or decide what the most appropriate next step is. In another searching task, it also helps with determining when it is time to stop searching. Reviewing the record of accumulated interpretations helps users decide whether they have found a solution to their problem yet or not.

Tracking the searcher's interpretations is important but challenging. Often days or weeks after the search was completed, the user needs to remind herself or to explain to somebody what happened, why he made certain decisions and what the results meant. Recording the thinking of searchers is a more complex task than recording their actions. Actions, such as open, save, and edit query can be automatically recorded by the system, but thinking can only be recorded if the user explicitly enters written/typed/spoken notes and annotations.

Notes made while searching are good reviews of new knowledge learnt from the searches and can serve as the preliminary notes for a new document. To support their memory externally, searchers wrote down information in order to reformulate it and interpret it in the act of writing. In order to answer a question, this participant needed to reformulate information found, possibly in writing:
XXX: include what was said before, this way it sounds bad
> Interviewer: So, that means that when you read something you want to reformulate it to make that answer?
> Participant 4: Yes, you need to understand how that fits into what the question is and is that going to get me to an answer.

Systems should make it easy to enter notes and annotations linked to search histories, which includes recording interpretation and the user's thinking. Taking notes helps with interpretation by allowing users to reformulate what they found and link it to their current knowledge. In the words of one of the participants, the information found is a tool to help users form an answer through interpreting and thinking about the information. What the searcher thinks about the information is the actual answer. Thus the user's thinking should be recorded in order to be used in future work, as illustrated in the quotes above.

User notes can also help searchers learn new information.

> Participant 4: Notes are crucial, because most people can't remember all the thought that went into their projects. You do research so that you can give somebody an answer.

User notes are usually the first version of the document, they need to be easily transferred to a word processor, even if they are not used word for word in writing.

> Interviewer: When you take notes when you are searching, how do you use those notes later on?
> Participant 2: I usually use them when I'm writing the brief, I'll refer to the notes...

Building a mental model of an area is tightly related to interpretation. A mental model of the topic is in a sense the final outcome of the searching phase, the result of interpretation and the first step of using the information. By being integrated into the knowledge structures of the user, the new information becomes available for reuse in future work. Mental models are one way to think about knowledge representation in memory. Searching stems from an information problem, which means that there is a gap or other discrepancy in our knowledge (and knowledge representation) that we need to attend to. Interpretation in searching aims at applying new information found to the original state of our knowledge representation and fix the discrepancy. A record of what information the user encountered and how she reacted to it can help in externalizing her model of an area and thus updating her knowledge representation. Recording search histories and allowing users to manipulate them can help with:

(1) recording and preserving results of interpretation (discussed above),
(2) the heavy processing of information helps transfer it from working memory to long-term memory (LTM), and integrate it with pre-existing knowledge structures, thus building a mental model.

Often typed annotations and user notes serve as a behavioral counterpart to interpretation and mental model building. The notes can have a temporary role in helping the user form a correct mental model, by the end of which process they lose their significance and can be made inactive. XXXfixthissentenceIn this sense, flexible model building tools can support the interpretation steps of searching.

Participant 1: Typed annotations, I forget things all the time.
Interviewer: But you wouldn't keep it, you would keep it for a session but not…
Participant 1: Yes, I wouldn't keep it, just the way I work is, by the end of the session, I'll cement it into my thinking, hopefully.

Assigning categories from the user's organizational scheme to documents or document sections also is a kind of interpretation activity. Categories describe the user's knowledge of an area, usually the topical area of the information seeking. Assigning categories to results acts as a kind of rephrasing of the information in the documents in terms of the pre-existing categories of the user, linking the document to a topical area or a problem/task.

The need for very flexible tools for rearranging physical representations of knowledge structures arose. Representing previous versions of the mental model allows the user to reflect on the change to it, thus reinforcing learning. The improved mental model will in turn help users to further develop the search.

5.5 Integrate with other tasks

Searching for and finding information is only a means to an end; integrating searching with other steps is very important, and systems should support it. Since many of the tasks are now carried out using a computer, it is easier to help users transfer information from one state to next, from one application to the next, and from one task to the next. The system participants used did not support integration with other tasks; searchers and participants created individual solutions for bridging the gap between finding and using information. The interface tools proposed (scratchpad and organized results collection tool) offer solutions to bringing information use closer to information seeking. History tools can arch over multiple applications, helping the searcher create a continuity of actions.

5.5.1 Integration of search with writing

Legal proceedings involve the creation of many written documents. Attorneys use search results and their new knowledge to write new documents. Information use is often embodied in the writing of these new documents, although it starts during searching when attorneys learn from the results found. The documents, information, and knowledge gathered while searching must, in the end, transfer into the documents written by the attorney.

Writing often starts with saving quotes and other information from results, often linked to specific legal issues, through simply copying or copying with annotations. As in the example below, copying can help form the link between finding information and saving it in a form that leads to a document written by the searcher.

Interviewer: Do you print whatever you read?
Participant 8: No, I'll take another first cut online, on the screen. And then what I often do is, when I have electronic versions, I will actually cut and paste from those electronic versions into one document, organized by headings, as if I was, you know, bring the citations in there, I'll bring all the necessary stuff and then I'll actually sometimes use that starting to formulate my argument and I'll may then cut out quotes and use them as block quotes and then build up information around it and then take away parts of the case.
Interviewer: so that's why you said you would need some kind of cut and paste facility between documents.
Participant 8: Yes, that would be helpful.

A search-history-based results gathering tool facilitates organizing results and integrating result documents into new documents. Participants often arranged documents in clusters under various topical headings, which helped them make sense of the documents and also monitor the progress of the search. These topical groups represent the attorney's mental model of the legal area; they later form the structure of the writing or the organizational scheme of the attorney's research files. The organization scheme for arranging documents found overlaps with the organization of the document to be written in the following example:

Interviewer: The clusters of documents or groups of documents were also ranked high. When you find cases, would you want to group them into your own categories and keep them like that?
Participant 2: Yes, I think so, particularly if I were writing a brief, I would probably, I might want to break it down into how I was going to divide up the brief and which case is going into what subject area, so that would be helpful.

As described in the last quote, participants used search results to cite sections of them. With searching and writing carried out in the same environment, it is easier to copy and paste between source and destination. Collecting text sections and inserting them into documents is an important functionality to support. One of the participants discussed his methods for copying and pasting:

Interviewer: Do you ever use it for more searching, whatever you put into MS Word, do you reuse that later on in your searching?
Participant 5: Like whatever I save? Well, no, what I'll do is I'll cut and paste from Lexis and I'll use that if I'm going to cite from that case, as the court stated blah blah, saves me to manually type it in there. Sometimes it also may be easier to email it to myself or I can email it to myself at home and read it, print it out from Word or my email software and read it at my leisure

The system can set up two-way links automatically between the case where the cite came from and the document(s) where it is used. First, the citation to the case can be automatically carried over to the document written by the attorney. This functionality is currently available through a Westlaw add-on to MS Word. On of the participants highlighted the importance of carrying the citation over to the document when writing to avoid having to go back later:

Interviewer: One thing I noticed is that you are not saving the citations of where that thing came from.
Participant 7: I would have to put that in, I would have to make sure that I highlight it, or write it in by hand. At this point I'm not writing a paper on it, I'm just appraising myself of what this law is, so at this point, for example, this is from the [bl] Government Contract Litigation Reporter, if I was going to write a paper then I would need to cite it, I would definitely include that, but I'm just trying to come up to speed so I'm not concerned about that.

Second, when quotes are copied from cases, the cases can 'remember' (documents or interfaces tool having memories or histories) that they were copied from, and the system can represent this information the next time the user looks at the same case. The case can display information regarding when and how it was used before, possibly with a link to the document where it was used. This can help create a continuity between work on similar legal issues and facilitate the reuse of the attorney's own work.

Keeping the links between the cites and the cited document including the source and the steps that led to the identification of the document can help any future work with the document. It can also be helpful in future citation checking tasks, in reusing the document or sections, in case the citations are questioned, etc.

This section so far has discussed the path from searching to document writing. Conversely, the documents and user notes can also help with further searching. A quote with a citation included or a link from a quote to the query that brought it back can serve as the starting point for new research on the topic or for updating earlier research. Displaying the document draft while searching can also serve as a reminder or even a search action plan. Fast and easy transitions between searching and writing are important and are the link between information seeking and use. Computer displays can smooth this transition.

5.5.2 Reuse document building blocks
As attorneys specialize in areas of the law, they become experts on certain topics. They often write about the same topic for different purposes, or in different documents. Reusing portions of documents that were already written on the same topic is a natural way to speed up work. The system can support this by examining previous documents and identifying similar sections in different documents (documents that came from external databases and/or the user's own documents). Integrating documents found in a search and documents written by the attorney can be supported.

Participant 8: I would like to have something that would allow me to cut and paste in between the resources, building blocks for documents. Lawyers often use, reuse their work. When you build a memo on a subject, some of your information may still be relevant to a memo on another subject. Or it could be relevant to a memo on the same subject for a different client and you don't want to reinvent the wheel, it's a starting point, you may have to go back and check things for their current status and add things for the specific needs of the client, but you want to …, a lot of your value is the fact that you are supposedly an expert in an area and within that you need to write your expertise down. So you have the normal cut and paste, but there may be ways that you could have coded certain paragraphs and then you can build a document from an archive of coded typed resources.

6. Proposed interface tools
This section describes user interface specifications developed based on the findings of the user study. Bits and pieces of the functionality described already exist in various software packages, such as word processors, file manager packages, or diagraming tools, but there is no unified tool that supports searching for and using information in an integrated package as proposed here.

6.1 Scratchpad tool
The first interface tool suggested based on the data collected resembles the information retrieval whiteboard described by Spink and Goodrum (1996). It is termed "scratchpad" in this study, as it allows the user a flexible space where various search and information use tasks can be carried out. The tool supports three main task areas:
(1) Interpretation;
(2) Information use and document writing;
(3) Task management.

The functionality supporting these task areas overlap, thus the required interface functions are presented in one group and not by use area. This tool includes:

(1) full-text editing in text objects, creation of text in the form of notes, annotations, document outlines, and document full text;
(2) modeling tools, tools to create knowledge models through text, diagrams, and graphical markings, including outlining and concept mapping tools;
(3) tools to create tasks and reminders, possibly formalized into plans, and monitor progress on them;
(4) tools to easily copy text and other objects within and outside the Scratchpad tool while maintaining links

between source and destination;

(5) tools to easily assign categories from the user's organizational scheme;

(6) tools to easily establish links between all these elements;

(7) tools to save and share the results of all these actions.

Taking notes, creating annotation, and writing new documents while searching are important tasks for the user. Annotations are notes linked to specific objects. Searchers often take free-flowing notes as well. Providing tools to create and manipulate outlines for new documents, link findings to these, and start writing the documents while searching for information helps searchers integrate tasks that are carried out using the same computer, but now are separated by having to use different applications.

Tools to create graphical knowledge models or concept maps to represent relationships of issues and the structure of a conceptual space are needed to support interpretation. Tools to support this exist in different software packages, such as in qualitative data analysis systems. Spink et al., in their study on reference librarians' searching notes found that searchers use many graphical elements in their notes. The roles of graphical markings are many, from creating models to emphasis and showing relationships. Flexible graphical marking should be available in the scratchpad tool. A general diagram tool with "concept holders" and relationship markers can satisfy this requirement. The searcher should be able to copy and paste search history and result elements into this knowledge model, preserving the links between source and destination as described earlier. Graphical drawing, marking and highlighting tools should also be available to help the process of modeling. Linking search results, documents, and text segments to these models and notes can help searchers integrate findings into old knowledge structures and transition them into new documents.

Another important application area the scratchpad tool can support is the management of the searcher's own tasks. Many searchers start a topical exploration task by taking notes before going online to interact with information systems, as described above. These notes can be taken in the scratchpad tool and should be easily converted into checklists of actions to complete. Checklists and future actions can also be inspired by the new information the searcher finds through searching. Search result lists, queries and other search history elements should be easy to transfer into checklists of planned actions. Information transfer between user notes and the search system should be smooth, the searcher should be able to drag and drop a part of his notes into the search system's query text box and create queries. These checklists can be integrated into the time-based search history display by creating a "future" section. Later the system can compare planned actions to the ones being executed and automatically signal completion. Alternatively, the system can support users in checking off actions completed manually and display progress against plans to help the evaluation of actions.

In collaborative environments, the scratchpad tool can help with task delegation and information sharing through saving and sharing information recorded in the scratchpad along with the search history. Task delegation is supported through personal information management packages such as Microsoft Outlook, however here the task management aspects are integrated with the search system. The tool should include a 'task' object in the form of checklists that can be assigned to various team members to facilitate collaboration. Annotated search histories with tasks attached can be saved and sent to team members as a way to assign tasks to others.

The scratchpad tool takes search histories a step further: it attempts to help the searcher record thinking and information use in addition to just searching for information. It uses interaction history in helping searchers integrate new knowledge into old knowledge structures and thus further develop their mental models of the legal area. It allows them to create new products and documents from this process, thus bringing searching and information use closer together.

6.2 Other interface tools

In addition to the scratchpad tool, two other areas of user interfaces were described:

(1) search history presentation and manipulation;

(2) organized search results collection tool.

The most basic use of search histories in user interfaces is to provide a direct search history display. Search histories are composed of user actions, objects such as documents and other types of information, and relationships among these. In describing direct search history displays, this section first discusses the history representations themselves, and then comments on tools to manage these.

Search history displays can range from a simple list of search steps to an interactive manipulable display of results and steps. Presenting the search history to the user as it is being built makes the user aware of the recording and creates an opportunity for her to stay in control of it. It also provides added functions to search systems, such as easy redo and undo functions. Some of the important design considerations for search history displays include:

(1) Align search history with user tasks;

(2) Provide previews, overviews, and zooming to preserve screen real estate;

(3) Show reasons for actions;

(4) Show use on documents;

(5) Present structure of history, including overlaps, repetitions, and other relationships.

The user should be able to manage and manipulate the search history presented on the user interface. Some of the functions needed include deletion, saving, sharing, marking,

and annotating histories.

The organized search results collection tool includes tools to support the management of result set and the collection and organization of search results. Comparing and combining result sets can help searchers to limit their findings and select documents and information for later use, along with noting what the relevance and purpose of the documents are. After selection, users need to save, annotate, mark, organize, and prepare information found in searches for future research. This tool is suited for search intermediaries more, where the goal is to prepare a result set for use by someone else. For a more detailed description of the interface tools, please see Komlodi 2002.

7. Conclusion

Users use search history. If the system does not provide it, users create pieces of it. But a larger picture emerged from the observations of user actions and from user comments in our study. At least in the legal domain, users' work forms a holistic whole. A lawyer's work consists of a number of functions. At the core is building a mental model of a legal area in general and of the case at hand specifically. Driven by this mental model, feeding into it, and using it are the functions of searching for information, organizing and interpreting the results, keeping organized research files, and preparing briefs and other legal documents, the culmination of all this work. These functions are tightly interwoven and form an integrated whole. The different activities go on simultaneously and interact with each other. A preliminary outline of issues in a case serves as a road map to guide a search, the search results are integrated into the outline, the mental model, which is modified to take account of the search results. Results, or quotations from them, are saved, slowly growing into a raw version of a brief that is then refined. New legal issues or other points of needed information emerge during writing, prompting further development of the search.

To be optimally effective in supporting a lawyer's work, information systems must mirror the holistic nature of this work. Rather than having separate applications for searching, managing personal research files, task scheduling and personal information management, and writing, the lawyer should be supported by one integrated environment. Within such an environment, the system should keep track of user actions and their results and use this expanded history to support the user's work as illustrated in the examples in this paper.

The ethnographic collection of data on how lawyers search and use the results and the collection of users' own ideas through participatory design sessions form the basis for designing such a new generation system. This paper illustrates through an example how this approach can lead to innovative user support tools. Good systems evolve from blending empirical work analysis and participatory design with designers' ingenuity.

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