A PERSONAL DOCUMENTATION SYSTEM FOR SCHOLARS:

A TOOL FOR THINKING

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This exploratory research focused on a problem stated years ago by Vannevar Bush: "The problem is how creative men think, and what can be done to help them think." The study explored the scholarly work process and the use of computer tools to augment thinking. Based on a review of several related literatures, a framework of 7 major categories and 28 subcategories of scholarly thinking was proposed. The literature was used to predict problems scholars have in organizing their information, potential solutions, and specific computer tool features to augment scholarly thinking. Info Select, a personal information manager with most of these features (text and outline processing, sophisticated searching and organizing), was chosen as a potential tool for thinking.

The study looked at how six scholars (faculty and doctoral students in social science fields at three universities) organized information using Info Select as a personal documentation system for scholarly work. These multiple case studies involved four in-depth, focused interviews, written evaluations, direct observation, and analysis of computer logs and files collected over a 3- to 6-month period.

A content analysis of interviews and journals supported the proposed AfFORD-W taxonomy: Scholarly work activities consisted of Adding, Filing, Finding, Organizing, Reminding, and Displaying information to produce a Written product. Very few activities

fell outside this framework, and activities were distributed evenly across all categories. Problems, needs, and likes mentioned by scholars, however, clustered mainly in the filing, finding, and organizing categories. All problems were related to human memory.

Both predictions and research findings imply a need for tools that support information storage and retrieval in personal documentation systems, for references and notes, with fast and easy input of source material. A computer tool for thinking should support categorizing and organizing, reorganizing and transporting information. It should provide a simple search engine and support rapid scanning. The research implies the need for tools that provide better affordances for scholarly thinking activities.

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INTRODUCTION

The Research Problem

This research is about the scholarly work process as information work or knowledge work, and the use of computer tools to augment the scholar's intellect or thinking for the creation of knowledge. The problem this research focuses on was stated succinctly over 40 years ago: "The problem is how creative men think, and what can be done to help them think" (Bush, 1967, p. 75). I replace "men" with "scholars" for purposes of this research: The problem is how creative scholars think, and what can be done to help them think.

Definition of Terms

The scholarly work process consists of the activities of scholars resulting in knowledge production. Also known as "information work," "knowledge work," and "intellectual work," the scholarly work process involves working with information — collecting, evaluating, storing, retrieving, and organizing information; studying, analyzing, and synthesizing information; creating knowledge from information, often in the form of a publication.

Thinking is what scholars do in the process of transforming information into knowledge. It includes analyzing and interpreting evidence to achieve insight and understanding, to make sense, invent theory, and solve problems. It consists mainly of

organizing information: categorizing, classifying, ordering information to create knowledge.

Scholarly thinking involves specific observable behaviors, including collecting and studying information relevant to a problem or topic, taking notes, and categorizing information and filing it for later retrieval. Scholars also gather, scan, and review information to determine patterns and relationships, plan and develop outlines to display organized knowledge, and write or otherwise present conclusions and results of this scholarly activity.

"Help them think" in the problem statement refers to anything that contributes to any of these scholarly activities, making the activity easier, faster, more effective, or more likely to occur or succeed. To augment thinking means to help, increase, or improve thinking. One way to augment thinking is by providing tools for thinking.

A tool is a device or aid for performing work. Tools that augment thinking include paper and pens, books and filing cabinets, typewriters and computers—external devices to aid memory and reasoning. Such tools expand our ability to think, reason, and remember. This research focuses on information technology tools, specifically computer tools, to augment thinking.

Technologies can augment thinking either by improving performance, allowing people to do things faster and more efficiently, or by improving methods, stimulating and supporting creative activities. Augmentation may make mechanical, routine tasks easier and more efficient so higher-level creative activities become more effective and

productive. Tools that help scholars gather, organize, and visualize information may augment creative thinking and result in invention, discovery, and insight.

A personal documentation system (PDS) is a tool scholars use to organize their information. It is a system for handling information in the individual's personal collection, including the classification, storage, retrieval, and manipulation of notes and bibliographic references. The term "documentation" is used here in the wider sense of the word, meaning not only organizing source documents but extracting and organizing the information the documents contain. The personal documentation system is, potentially, a tool for augmenting scholarly thinking. In this research, I looked at how scholars organized information within a personal documentation system as part of the scholarly work process, including note taking, classifying, storing, organizing, retrieving, and synthesizing information.

Significance

The goal of scholarly work is to advance human knowledge. Tools that help scholars achieve that goal would benefit not only individual scholars, but also people in general as such knowledge is applied to solve problems. To help scholars accomplish their work either more efficiently or more effectively, researchers need to understand the activities of the scholarly work process and discover what kinds of tools augment scholarly thinking.

As researchers, our understanding of scholarly work is limited. We know even less about how scholars think and what might help them think. Studies that have been

conducted on thinking processes have focused mainly on the cognitive processes of students for purposes of improving educational methods.

We do not know much about tools that would augment the thinking involved in scholarly work. The limited research available suggests that organizing and categorizing information are major activities of critical and creative thinking. Tools that improve the scholar's ability to organize information might therefore augment thinking and enhance the production of scholarly knowledge.

Research and development of computer tools have focused on information retrieval systems and improving clerical efficiency. Tools have been developed for the information acquisition and information output stages of scholarly work, for conducting research, collaborating with colleagues, and publishing the results of thinking. The information-organizing stage, the thinking, has been neglected.

In their focus on large, public information retrieval systems, information scientists have neglected to provide "cognitive support" for the "intellectual requirements" of the scholar (Debons, 1991, p. 362). The important advantages of personal documentation systems have been recognized by only a small group of researchers. Even this research leaves a gap, focusing exclusively on bibliographic indexes and neglecting to consider how the scholar organizes and works with the information itself: "There is surprisingly little literature on how individuals actually use the information they need for their [knowledge] work" (Case, 1984, p. 21).

Computerized personal documentation systems for storing and retrieving bibliographic references and notes have generally been inflexible and difficult to use. Costs have outweighed their potential benefits, compared to manual systems. Today's information technology might solve many of the problems scholars have had in the past with computerized personal documentation systems. Analyses of how scholars use such systems could provide a better understanding of scholarly work processes, scholars' user needs and how to meet them, and why current systems have failed to "augment our intellect" as promised.

Research Questions and Approach

The first question is “How do creative scholars think?” Narrowing the focus of Bush’s second question, “What can be done to help them think?” I derived the second research question: “What computer tool features would help scholars think?” This question, of course, cannot be answered directly or completely, even for a carefully delimited subset of scholars and of thinking. Both questions were posed to provide a general direction for the research, not to search for definitive answers. The research was designed with the assumption that partial answers that emerge from exploratory research would be of value.

A review of several literatures related to scholarly work led to the proposal of a framework consisting of major categories of scholarly thinking, the problems scholars have in organizing their information, and potential solutions to those problems. Based on

this framework, specific computer tool features were proposed as the features of a tool to augment scholarly thinking.

A personal information management computer application called Info Select has most of these features. Characterized by its creator as a "random information processor" (Jim Lewis, personal communication), Info Select was designed as a storage place for random information, which the human user then processes through categorization and hierarchical classification. Info Select is both a text processor and an outline processor, with a sophisticated search engine and several additional features the literature review indicated might be important characteristics of a tool for thinking.

This research consisted of multiple case studies of academic researchers using the program Info Select as a personal documentation system to organize information in the scholarly work process leading to the writing of a publishable paper. Observing how scholars used this tool over an extended period of time led to a better understanding of the scholarly work process, the problems scholars have and possible solutions, and the features of a computer tool that might augment thinking. The study was guided by two research questions:

1. How do scholars think, in the information-organizing stage of the scholarly work process? Or, more specifically, what are the thinking activities of selected scholars in the information-organizing stage of the scholarly work process?

2. What do scholars need to augment their thinking, in the information-organizing stage of the scholarly work process? Or, more specifically, what computer tool features

augment scholarly work activities, as revealed by scholars' use of a random information processor as a personal documentation system?

Limitations

This study was exploratory research, not an attempt to answer questions or test hypotheses. It focused on one kind of activity within the broader scope of scholarly work, one kind of thinking within the broader scope of human thinking, and one kind of tool that might be helpful. The research did not look at scholarly communication, information seeking and acquisition, or writing and publishing. It could not reveal much about thinking that occurs separately from the use of tools that externalize the results of the process of thinking. It did not propose that a particular kind of tool is better than others or that scholars can or should use computer tools. It made no attempt to discover why scholars adopt or fail to adopt computer tools.

In focusing on how scholars used a particular kind of computer tool to accomplish a limited set of activities, this research did not provide a comprehensive view of scholarly work. The research did, however, lay foundations for a general understanding of what scholars need that a computer tool can provide.

A limit to the generality of this study's findings, even after all the boundaries have been drawn, resulted from the participant recruitment method—both a strength and a weakness of the research design. Participants in this research were self-selected volunteers who perceived some benefit of the computer tool used in this research and were therefore willing to learn to use it, experiment with it, and take time to describe their experiences.

Although the results based on the experiences of these six scholars cannot be generalized to any larger population, this in-depth look at how a few scholars work suggests variables that can be looked at under more controlled conditions, across a larger number of scholars, in future studies.

CHAPTER 2

REVIEW OF THE LITERATURE

Overview of the Literature Sources

The review of literature on scholarly thinking for this research covered a broad range of related literature as well as several relevant research studies. The review was broad in order to consider the range of activities encompassed by scholarly work, the scholar's problems and possible solutions inferred from the literature, and the application of computer tools to the scholarly work process. Because no single line of research has focused on this problem, I drew on research on the use of personal documentation systems by scholars and knowledge workers, literature on thinking and writing as major components of the scholarly work process, and research on cognitive processes that may be augmented by computer tools.

To provide a basis for looking at how scholars think, I started with the traditional literature on thinking (Dewey, 1933; Bruner, Goodnow, & Austin, 1956; Bloom, 1956). A view of thinking as a problem-solving strategy emerged from both the cognitive perspective (Gagne, 1985) and the behavioral approach (Skinner, 1953, 1957). Findings from experimental psychology on cognitive processes, specifically learning and short-term memory problems and solutions (Ausubel, 1960; Miller, 1956, 1968), contributed research findings to the theoretical framework that emerged from this review of diverse literature.

I included literature on writing because writing is a major activity of scholarly work and is often the end-product of the process. The writing literature I reviewed is restricted to a focus on scholarly writing by mature writers. Much of this literature is prescriptive rather than research based, suggesting potentially helpful tools for scholars (Howard & Barton, 1986; Hurwood, 1986; Murray, 1978; Peirce, 1971; Richards & Richards, 1965; Skinner, 1981, 1987; Woodford, 1986). Research studies from the writing literature (Daiute, 1985; Gregg & Steinberg, 1980; Walton & Balestri, 1987) lent support to findings from the other literatures reviewed.

To fill in the gap between scholarly thinking and scholarly writing, I drew heavily on the literature on personal documentation systems (PDSs). As both a tool and a strategy, the PDS is an integral part of what the scholar does. Problems users have with their PDS are problems scholars have in their work, and tool solutions involving a PDS could be the augmentation tools pioneers in information science recommended (Bush, 1945; Engelbart, 1961; Licklider, 1960). Therefore, the review of the literature on tools for thinking included research on tool solutions for knowledge workers: office managers using personal information managers (Barreau, 1995; Cole, 1982; Malone, 1983; Reynolds, 1995; Stibic, 1980, 1982), academic researchers and their personal documentation systems (Burton, 1972, 1981; Heeks, 1986; Jahoda, 1970; Jahoda, Hutchins, & Galford, 1966; Sauvain, 1970, 1979), and scholars adopting the computer as a tool for categorizing information (Case, 1984, 1991; Kwasnik, 1989; Trigg & Irish, 1987).

The review chapter is organized in two main sections, corresponding to the two research questions. A review of literature related to scholarly work activities, problems, and solutions is presented first, to lay a foundation for a consideration of tools to augment thinking. The literature related to computer tools is organized according to the proposed areas of scholarly work problems. Based on the literature review, a set of computer tool features to augment scholarly work is proposed. The chapter concludes with a description of a particular tool with some of these features, relating the tool to the research questions and overall research goal.

Scholarly Work Process

Thinking

Research on "What can be done to help scholars think?" requires a definition of thinking and clarification of how it fits in with the rest of what scholars do. Two themes recur in the major published works on thinking: Thinking is problem solving, and thinking involves ordering, categorizing, and organizing. An overview of these themes from a traditional perspective is followed by a description of these themes from a behavioral perspective, emphasizing thinking as doing and focusing on the activities of scholarly work.

Thinking as Problem Solving and Organizing

In How We Think, Dewey (1933) defines thinking as “ordering of subject matter with reference to discovering what it signifies or indicates” (p. 247). Focusing on reflective thinking instead of random stream of consciousness associations, ideas, and

fantasies, Dewey emphasizes ordering and problem solving. Reflective thinking is deliberate and controlled, an "orderly sequence leading up to a conclusion" (p. 47). It is logical and scientific, involving detecting relations, testing inferences, investigating and questioning (p. 49). As a problem-solving activity, thinking involves searching and inquiring to find information that will resolve a doubt. Classifying and subdividing information makes it more readily available when needed. When such ordered thought is combined with action, it is more potent than thinking for its own sake. Reflective thinking, then, is ordering and problem solving that leads to action.

In A Study of Thinking, Bruner et al. (1956) focus on categorization, or concept attainment, as thinking. Categorizing or grouping objects, events, and information into classes and then responding to them in terms of their class membership are the activities of concept formation, "one of the most elementary and general forms of cognition by which man adjusts to his environment" (p. 2). Concepts are not discovered— they are invented (p. 7). The process of attaining concepts is not just "an aspect of what is conventionally called thinking" but the foundation of all cognitive activity. Thinking is “the kind of behavior called problem-solving” (p. 246). It is both an everyday behavior and the behavior of the scientist. By assimilating and categorizing information, the scientist achieves “the predictive benefits that result from the use of invented categories” (p. 7).

Bloom's taxonomy of intellectual abilities and skills is the product of a committee set up to develop a taxonomy of educational objectives based on teachers' goals for their students (Bloom, 1956). It is a taxonomy of cognitive activities, thinking, and problem

solving, including the behaviors of remembering, reasoning, concept formation, and creative thinking. The intellectual abilities and skills categorized in Bloom's taxonomy are the products of critical thinking, equivalent to Dewey's reflective thinking. These intellectual abilities are used in applying information to new situations and problems. The taxonomy divides them into six major categories: knowledge, understanding, application, analysis, synthesis, and evaluation. The last five of these classes emphasize organizing and reorganizing material.

To summarize this literature on thinking (see Figure 1): For Dewey, thinking is ordering and problem solving. For Bruner, Goodnow, and Austin, it is categorizing and problem solving. In Bloom's taxonomy, thinking consists of problem-solving cognitive activities that may be summarized as organizing and reorganizing information.

Building on the work discussed above, Gagne (1985) describes cognitive strategies, or strategies of thinking, as "routines that may influence any of the phases of learning, remembering, and thinking" (p. 150). Cognitive strategies are how we learn—the methods we use to store, remember, and use information in productive thinking, the strategies we use in solving problems. Cognitive strategies range from the very simple to the complex. A simple strategy for remembering, for example, is to repeat the information several times. Grouping or clustering items to be remembered and using visual images are other strategies for remembering. Problem-solving strategies include

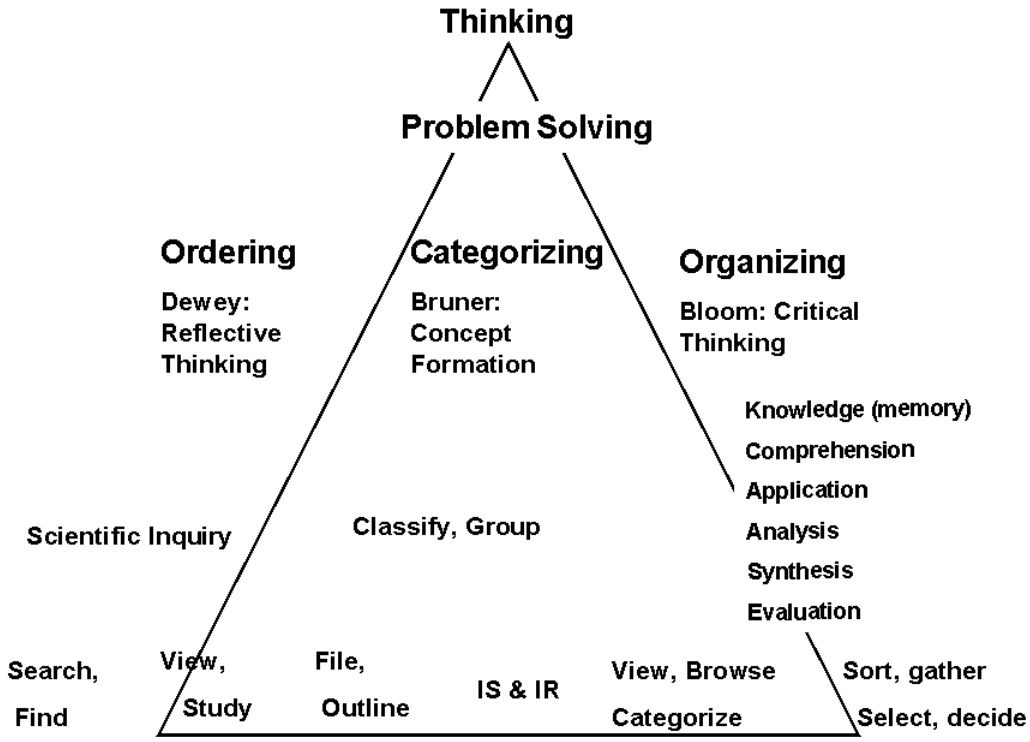

Figure 1. Overview of traditional views of thinking and specific thinking activities focused on in this research study.

breaking the problem down into component parts (analysis) and gathering and combining information from various sources (synthesis).

In contrast to Gagne's view of these activities as cognitive strategies to influence thinking, a behavioral approach categorizes the same activities as, simply, thinking. Saying words repeatedly to memorize them, grouping similar items, and creating or visualizing an image are all activities we engage in, behaviors that frequently include physical components that can be observed by others or at least by ourselves. Thinking, from this

perspective, whether overt or covert (capable of being observed by others, or not), is "behaving which automatically affects the behaver" (Skinner, 1957, p. 438). Categorizing, for example, is not only thinking but also a physical-world action that results in changes in the actor's subsequent behavior. Thinking is behavior—not a precursor of action, but the action itself (p. 449).

Thinking as Doing

Thinking is undoubtedly a major component of scholarly work. From a cognitive perspective, researchers might ask, what do scholars do to improve thinking? From a behavioral perspective, the question becomes, simply, what do scholars do? This section considers some of the observable activities of scholars mentioned in the literature, before returning to an example of the behavioral perspective to relate these activities to the earlier discussion of thinking.

Sauvain (1970) provided a comprehensive list of what scholars do, in describing the scope of his research study of a scholar's use of Autonote, an early computer application for personal information storage and retrieval:

> Taking of notes, jotting down of references, filing, categorizing piles of information, browsing through various kinds of textual material, writing reminders, searching for an item vaguely remembered, gathering information relevant to a particular problem at hand, organizing and reorganizing, writing and revising papers, and so on" (p. 7).

Filing and indexing. Scholars collect information and organize it. They survey the literature to keep current in their field and file information for later retrieval (Burton, 1972). They maintain personal collections, sometimes indexed (Heeks, 1986; Jahoda et al.,

1966). These personal collections consist of both source materials (books, journals, articles, reports, correspondence, data) and notes, ideas, and plans (Sauvain, 1970; Stibic, 1980). Filing systems that permit the retrieval of stored information may become more elaborate over time, as the amount of information increases and the limits of human memory are recognized (Burton, 1972; Sauvain, 1970).

In addition to collecting source materials, scholars are concerned with the "processing as well as the storage of information . . . extracting and evaluating facts and opinions from documents, and synthesizing them into a picture of the subject" (Moon, 1988, p. 271). They need to be able to deal with "smaller packets of information than is represented by the average paper or document . . . unit facts, concepts, considerations, etc." (Engelbart, 1961, p. 122). Creating as well as discovering this information, they "structure or tag 'objective' information to fit subjective needs and uses" (Burton, 1972, p. 53).

Surveys of scientists and researchers provide some indication of the use of personal filing systems and indexes among academic scholars. In early research, Jahoda et al. (1966) found that most of 75 university scientists and engineers had a personal collection; 61% kept a personal index. The index, mainly of journal articles, was usually arranged by subject and kept on notecards or in file folders. Most indexes had one access point; few used keywords.

Heeks (1986), in a replication of Jahoda's research 20 years later for the British Library Board, found that most researchers kept a bibliographic index; only about 10%

had a computerized version. Personal indexes were not restricted to bibliographic: researchers also had filing systems for laboratory results, mailing addresses, correspondence, slide collections, notes, abstracts, and quotations. None used keyword descriptors (p. 19). Junior researchers used their filing system to conduct simple searches on known index fields, to find out if they had an article or if they had read it, or to verify bibliographic data or location. Senior researchers relied on memory to answer these questions (p. 27).

Note taking. Scholarly thinking in the process of producing knowledge, which includes creative scholarly writing, starts with taking notes, recording ideas, and making lists (Howard & Barton, 1986; Richards & Richard, 1965; Skinner, 1987; Trigg & Irish, 1987; Woodford, 1986). In a study of 20 researchers at Xerox PARC using NoteCards, a computer program designed to help people manipulate and structure information to augment scholarly writing and thinking, Trigg and Irish (1987) found that "common elements of doing research" included "taking notes from reference books and articles, gathering data from various sources, and generating notes 'from one's head.'" Note taking was particularly important for scholars engaged in long-term projects when the form or the focus of the final paper was not initially known (p. 96).

In research designed to investigate the information processes and needs of scholars in the organize-collection stage of research, Case (1984) found that "taking notes on literature is a process central to scholarship." In taking notes, the scholar screens material and selects relevant information. The scholar transforms the material, condensing it,

making inferences and drawing conclusions” (p. 100). In addition to creating notes from source material, scholars record their own ideas and observations in the form of notes. Most scholars in Case's research study (15 of 18) used notecards and computer lists to capture ideas and references; one maintained "hundreds of thousands of 5 x 7-inch cards” (Case, 1991, p. 662).

This note-taking phase of the scholarly work process is known as prewriting in the writing literature. It is a phase where writers rehearse what they have to say. Talking to themselves, thinking about it, hearing it in their heads is a form of brainstorming that evolves into note taking: "the jotting down of random bits of information which may connect themselves into a pattern later on" (Murray, 1978, p. 377). The writer "catches an idea on the wing or teases out half-formed verbal behavior" (Skinner, 1957, p. 405) and records it on scraps of paper, notecards, in journals and diaries, or even in a computer database.

Organizing and planning. Describing the scholarly work of historians, Case (1991) points out that as a vague initial question becomes more focused, scholars "must develop categories reflecting the subtopics of concern to them, and assign appropriate labels to them (p. 663).” Scholars display and review their notes, to discover order, patterns, and relationships (Murray, 1978). At this point scholars either write to discover what they have to say, or plan what to say in a process known as “prewriting” and then write (Daiute, 1985). Or they do both (Howard & Barton, 1986; Spradley, 1979).

Planning often begins as a rough outline that helps the writer structure and evaluate the information collected (Daiute, 1985, p. 81). Prewriting for discovery shifts to more formal planning, as writers design or plan a paper by labeling and classifying notes, arranging them in order, and organizing them to create a sequence that becomes an argument or topical draft (Howard & Barton, 1986). Writers outline for easier writing and clarity (Peirce, 1971; Trigg & Irish, 1987; Woodford, 1986).

In the NoteCards study, Trigg & Irish (1987) found variability in the amount of planning and outlining that writers do: "Usually paper structuring or layout is done in an outline, which is massaged and fine-tuned for some time before any text is written" (p. 103). "Some writers, however, create no explicit paper layout structure using cards and links. . . . Still other writers do no explicit rendering of paper layout whatsoever until the time of final document composition" (p. 104).

Of the 60 academic scholars participating in Case's (1984) research study, 73% created outlines before writing; others found it less important to plan or outline when they adopted the computer (p. 86). Scholars (20 historians) participating in a later research study (Case, 1991) indicated that much of the organization and retrieval of texts occurs during the act of writing and not before (p. 662).

To summarize, scholars take notes and make lists; review information, discover patterns, and categorize their information; create rough and sometimes detailed outlines; write drafts to discover what they have to say; reorganize plans and sequences; and, sooner or later, compose, edit, and revise. This review of traditional definitions of thinking

and of research on what scholars do suggests that thinking may be defined in terms of specific actions that accomplish the ordering, categorizing, and organizing of information—which in turn accomplishes the higher-order goal of problem solving.

Thinking and writing as problem solving

The focus of this research is on thinking as doing—on the specific actions in the physical world (without denying the existence of cognitive processes in the mental world). From an augmentation framework, "thinking is not a process that takes place inside the brain. Thinking is an activity in which the brain participates along with the eyes and the hands and a multitude of external devices" (Skagestad, 1993, p. 162). From a writing perspective, the viewpoint is expressed by Bushell (personal communication), in his manual for graduate student writers: "Designing the best way to display your argument is not an abstract mental process. It is the physical process of arranging organizing ideas to see how they work together—to see gaps or redundancies."

This behavioral perspective is best exemplified by Skinner's (1953) description of problem solving, a synonym for thinking throughout the literature. Skinner uses the problem of recalling a name as a simple example of more complex problem solving. A problem is defined as a situation in which a response (#1) exists in some strength that cannot be emitted (e.g., you forgot the name). A solution is a response (#2) that alters the situation so that the strong response (#1) can be emitted—and the problem disappears. "Finding a solution" is any behavior (#3) that, through the manipulation of variables, makes the appearance of a solution more probable. Behavior #3 is precursor or

preliminary behavior: manipulating some variables or stimuli that will set up other stimuli that will control the #1 response (Skinner, 1953, pp. 246-247). In trying to recall a name, you might go through the alphabet, pronouncing the letters. Hearing yourself pronounce the initial letter of the person's name might provide just enough of a prompt for you to say the name and recognize it as the name you were trying to recall.

Writing and other scholarly endeavors may also, sometimes, be a complex problem-solving situation. In this case the problem is that a response (what you are trying to say) exists in some strength but cannot be emitted. Once you write it, you will recognize it as what you wanted to say, but at this point you cannot write it. A solution may be to make notes or an outline—a response that alters the situation. If you are then able to write, the problem disappears, and no problem-solving response (thinking or reasoning) is needed. Finding a solution—thinking or reasoning to solve the problem—involves manipulating stimuli that will set up other stimuli (such as notes or an outline) that will control the writing response. Problem-solving (thinking) strategies in this case include manipulating and reorganizing your notecards on your desk, editing and revising your outline, highlighting or color-coding parts of your notes until you recognize a pattern, and prompting and probing your own verbal behavior by asking yourself questions and attempting to answer them.

In this example of problem solving to achieve a written product, the problem-solving or thinking behavior involved specific actions in the physical world—manipulating notecards, categorizing or organizing information, asking and answering questions. These

same activities might be described in more abstract or general terms as analysis, synthesis, or evaluation—or critical or creative thinking. By describing them in terms of specific, physically observable behaviors, however, researchers may be more likely to identify problems that scholars have and information technology tools that may help solve the problems.

Scholarly Work Process Problems

Scholars forget. They collect information, get ideas, make plans, and then forget them. Describing personal indexes as a solution, Jahoda (1970) points out: "If he has a photographic memory, chances are he will not need an index. Unfortunately, most of us are not so blessed and we need memory aids" (p. 113).

Scholars lose information: "The user can find a pertinent document in a public data base of one million documents in a few minutes, but he is not able to find a paper in his own file without long, arduous searching" (Stibic, 1980, p. 8). Scholars file documents in file folders and then forget which file folder they used: "I don't always remember what the decision was," a research participant lamented (Case, 1991, p. 664).

Scholars waste time searching for their information. "I can spend hours locating something I've got somewhere," one participant reported. Another said, "You lose track of stuff. . . . You can't find it when you need it and you waste lots of time looking for it." A third participant "loses notes all the time" (Case, 1991, pp. 664-665).

Scholars use the wrong tools and methods to keep track of information they collect (Stibic, 1980, p. 8). They take notes on sheets of paper, in bound notebooks, and

on notecards, and "filing these bits of information constitutes a problem for everyone" (Case, 1984, p. 102).

Files and Piles: Find and Remind

Scholars face a dilemma: Ideas not stored in a personal filing system get lost (Stibic, 1980, p. 2), but ideas filed away in the filing system are forgotten: "out of sight, out of mind." Scholars, like office workers, need reminders. Malone (1983) studied the personal information management strategies of office workers and found that information often ends up in piles instead of files[1] because (1) classifying information is difficult and (2) people need spatially arranged, visual reminders of documents.

The problems with filing systems are revealed in comments by Malone's research participants: "The further away from me it gets, however, the less often I am likely to look at it" and "You don't want to put it away because that way you'll never come across it again" (p. 107). Participants in Case's (1986) research made similar comments about filing bits of information: "They tend to get lost in filing cabinets" and "are never seen again" (p. 101). Malone concluded that office workers need files to solve the find problems, and piles to solve remind problems. This review of scholars' problems suggests that find and remind issues (and files and piles) apply to scholarly work as well.

[1] Files: Elements are explicitly titled and arranged in systematic order. Piles: Elements are not necessarily titled, no systematic order, spatial location of pile is important for finding (stacks of papers and books are obvious piles; books on a shelf in no systematic order are also piles, using this definition).

Short-term Memory: Review and Display

Scholars contend with another category of problems when they think about the information they have collected—when they do their "tough knowledge work" (Engelbart, 1970, 3a). In this case they are up against the limitations of short-term memory (Miller, 1956, p. 95). Complex problem solving requires advance planning and understanding the relationships among many concepts simultaneously, which is difficult if not impossible to do without external aids (Bruner et al., 1956). Writers, too, must find ways to handle the "information processing load" of so much to deal with at once (Gregg & Steinberg, 1980, pp. 73-93). The scholar and writer must be able to view many reminders at once, either physically or cognitively:

> No human being can hold very many concepts in his head at one time. If he is dealing with more than a few, he must have some way to store and order these in some external medium, preferably a medium that can provide him with spatial patterns to associate with the ordering—e.g., an ordered list of possible courses of action. (Engelbart, 1961, p. 122)

Scholarly Work Process Solutions

Organizing Information

Filing system: PDS. Scholars need appropriate methods and tools to deal with their problems of finding, losing, and forgetting information. A traditional solution for handling source materials is a filing system:

> Every professional person owns his personal collection of documents (books, reports, journals, cuttings, photocopies, slides etc.), and he also produces and stores many notes, his own drafts, quotations, calculations, drawings, minutes etc. that must be well organized and accessible at any time. He needs his own personal documentation system. (Stibic, 1980, p. 1)

A personal documentation system (PDS) consists of the "information-handling activities performed by an individual in developing and maintaining his personal reference collection" (Burton, 1972, p. 2). Handling information in the personal collection involves organizing the information: classifying, storing, retrieving, and manipulating source material, bibliographic references, and notes. As both a tool and a strategy (Barreau, 1995), the PDS is an integral part of what the scholar does. Also known in the literature as a "personal index," a personal documentation system is an organized collection of documents, whether formally indexed or not (Jahoda et al., 1966).[2]

“Personal documentation includes inputting, organizing, and structuring the collection and then retrieving information as desired" (Burton, 1972, p. 2). The PDS often includes nonbibliographic material such as lab notes and correspondence (pp. 127-128). It is the scholar's filing system, whether manual or electronic. Burton (1972), after a 3-year study of the personal documentation methods of 13 scientists using a computerized bibliographic system called Famulus, found that the benefits offset the response cost.

By preserving information in a safe archive and making it available for later retrieval, "personal documentation ensures re-usage of information that would be otherwise lost" (Stibic, 1980, pp. 2-3). Providing an organizational system for keeping

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[2] Personal collections may be distinguished from personal indexes: some of the former may not be indexed; some of the latter may not be in one's collection. Together, they are often referred to as "personal documentation” (Moon, 1988; Smith, 1981, 1991). Other terminology used includes "microdocumentation system" (Englebart, 1961); personal indexes (Heeks, 1986; Jahoda et al., 1966); "information storage and retrieval system" (Sauvain, 1970); "personal information system" (Moon, 1988); and "personal information management systems" (PIM) (Barreau, 1995; Malone, 1983). Following Burton (1972) and Stibic (1980), I use "personal documentation system" throughout.

track of references, ideas, and data, as well as notes and extracts gleaned from extensive reading, "a personal documentation system may serve as auxiliary memory" (Weinberg, 1987, p. 243).

More than just an archive or depository, the personal documentation system serves as "the means of bringing into use all of the written or graphic sources of our knowledge" (Otlet, 1907, p. 105). The PDS is a system not only for organizing source documents for information retrieval, but also for extracting and organizing the information they contain. Scholars record their own ideas and observations in the form of notes. Taking notes and storing them for retrieval is one way to deal with the problem of forgetting.

Organizing notes: Outlining. The development of personal documentation systems indicates that scholars, like office workers, need a filing system, not necessarily an elaborate one, for their source material and for notes. What they do with notes besides filing them may be more important, however. They need to categorize information as part of the thinking process.

Outlining helps writers achieve clarity by determining logical relations and discovering gaps in arguments. Outlining lets writers try out different arrangements of linear text to see which sequence best conveys the nonlinear relationships of complex concepts and contributes to understanding—both the reader's and the writer's (Richards & Richards, 1965; Skinner, 1981).

Outlining may be an important solution to short-term memory problems by providing an external aid to display the complex relations among concepts. Thinkers need

to view many “reminders” at once, to overcome the limits of short-term memory: “Outlining allows the trial association of higher-level ideas in the same way that word processing allows the trial association of words. Unless we have the mind of a Mozart, we need to bring the relationship into view before we know if we like it.” (Hurwood, 1986, p. 50)

Grouping and organizing information hierarchically accomplishes a "reduction in load," allowing us to deal with complex information in short-term memory because "the grouping is less complex than the sum of all the features of all of the elements in the collection" (Najarian, 1981, p. 273). The "span of immediate memory" is limited only by the number of items, not the amount of information (bits) (Miller, 1956). Organizing information into chunks (a concept or class) makes it possible to remember and deal with a greater amount of information at once (Ausubel, 1960). Recoding, another name for chunking, "is an extremely powerful weapon for increasing the amount of information that we can deal with" (Miller, 1956, p. 95).

Creating and reviewing a well-structured outline is a way to deal with more information and "think it all at once.” Skinner (1987) describes the concept:

> I used to say that I wrote and rewrote a paragraph until I could “think it all at once.” At times I have felt that I could think a whole paper or chapter of a book all at once. . . . I had organized the material so tightly that I moved effortlessly from one part to another as I thought it. (p. 379)

After reviewing, studying, and organizing complex material many times, we see how its parts are related to each other, we discover patterns and consistency, and we begin to understand complex relationships. A collection of parts becomes an organized

whole. One part leads to another and eventually we are able to think of it as a unified whole. Nothing is forgotten: It's all there at once.

Displaying Information

Visual aids as reminders. Spatial cues play a role in solving memory problems. Malone (1983) found that office workers kept information in stacks or piles of loosely defined, mixed content because of a tendency to locate information based on spatial cues and a need for visual prompts or reminders of things to do, to read, and so on. Other researchers also report the importance of visual aids and spatial-location reminders (Case, 1986; Cole, 1982; Lansdale, 1988; Miller, 1968). Case (1991), in research exploring how scholars handle "the physical artifacts of information," found that physical characteristics "are given first priority in office filing" (p. 667) and recommended that future systems allow the user to assign richer contextual cues to files.

External visual aids relieve the strain on memory and allow scholars to solve more complex problems. A post-it is a visual aid and can be a reminder. So are calendars, schedule lists, clocks, notes, and memos. An outline can be an external visual aid, when the information gets more complex, as can a graph, model, schematic, or diagram. The use of external visual aids “facilitates the reflective process by acting as external memory storage, allowing deeper chains of reasoning over longer periods of time” (Norman, 1993, p. 25).

Outline as thinking aid. Skinner (1987) described a three-dimensional outline he created as a "prosthetic device" to provide an external visual aid when he was working

with complex information and needed help to "think it all at once." He wrote his outline on numbered 5 x 8-in. cards and taped the cards to a stiff plastic panel in a staggered stack so that the main headings at the bottom of each card remained exposed (see Figure 2). The tape provided a hinge allowing any card to be raised, exposing the detailed outline on that card. New information could be entered on any card; a card could be replaced with a fresh one when it became overcrowded or cluttered with revisions. The cards could easily be rearranged as a better order became apparent. This physical outline served as a "thinking aid" to give the author a "running start" when he began a writing session. He could read the exposed entries (the outline headings) quickly; if that was not enough to recapture a "feel" for the paper, he could read the details on one or more of the cards. The outline revealed gaps in the rationale, sections that were too long or too brief, and parts that were in the wrong place or the wrong paper. With this physical device, Skinner reported, "I keep the paper, not 'in mind,' but in front of me as a complex object on which I am at work" (p. 380). The outline not only served as a reminder for the complex whole, the details, and the relationships, but also prompted the writer's verbal behavior, enabling him to continue writing and discover what he had to say.

More Problems

Filing Problems

Finding information with a personal documentation information retrieval system, organizing information with notes and outlines, and displaying the organized information in outlines and visual reminders are solutions to scholarly work process problems, but not

F. (1987). A thinking aid. Journal of Applied Behavior Analysis, 20, 379-380.

without a price. Organizing is hard work, both physically and cognitively, and a never-ending job—information always needs to be reorganized. These two themes recur for each of the solutions considered: There is a tradeoff between the effort and the benefits of information organization, and information never stays organized, because we learn, we discover new information, and we reorganize.

In a survey of 30 office workers, Cole (1982) found that people construct elaborate filing systems but do not use them. Malone (1983) concluded that information is stored in piles because categorizing is difficult cognitively. People cannot decide what the

categories should be and which items go in which categories. Piles are easier: "Leaving them out means that I don't have to characterize them" (p. 107). Historians in Case's (1991) research mentioned the problem of trying to set up categories at the beginning of a project before you know what the categories are (p. 666). Filing is also hard work physically—labeling file folders, getting the information from the desktop to the filing cabinet, rearranging files in drawers, and keeping up with the filing on a daily basis. Filing is a problem as well as a solution.

Indexing has always been difficult, even for the professional indexer. The scholar may not be able to predict how a document will be used in the future, and aspects missed now may be important later. Problems of vocabulary control arise even within the personal collection, and "the indexer . . . is certain to be inconsistent" (Jahoda, 1970, p. 129). Efforts to index collections are sporadic (Burton, 1972; Case, 1991, Cole, 1982). Case (1991) found that "indexes to books and journal articles were usually simple, if they existed at all" (p. 662).

Scholars have trouble with Boolean searches. Few have received any training in search techniques. In retrieving information from large databases, the scholar is often an "information amateur" (Heeks, 1986, p. 5), a "perpetual novice" (Borgman, 1996).

Outlining Problems

Outlining is "perhaps the single most inhibiting demand ever made upon inexperienced writers. . . . It's like being asked to announce one's discoveries before making them" (Howard & Barton, 1986, p. 51). Questioning mature and practicing

writers, Emig (1971) found few who planned before writing, few who developed text from an outline.

For many scholars, outlining occurs only during the writing process, not before (Case, 1991, pp. 76-77). Change and reorganization are problems: "The outline is continually changing, sort of like a back-and-forth act," one of Case's historians reported (p. 76). Notecards may be easy to manipulate when creating outlines, but they are cumbersome when reorganization is necessary. Backing up to a previous version is difficult.

Computer Tool for Thinking

A computer tool to help the scholar think should improve the scholar's ability to accomplish one or more of the activities of scholarly work without introducing new problems. A computer tool may augment scholarly work by supplementing memory, helping the scholar find lost or forgotten information and gather similar information for synthesis. Computer tools can save time formerly spent filing, searching for, and reorganizing information.

Computer Tool Features

PDS/Filing System

The problems of scholarly work and the solutions suggested by this literature review imply a need for tools that support information storage and retrieval in personal documentation systems, both for reference citations and for notes, with a powerful but easy-to-use search engine. Information so stored should be very accessible and safe from

the possibility of loss. Customizable indexing and Boolean search capability should be available but not required.

The search capability of a computer tool may be the most valuable feature a computer can provide to improve upon current practices. With a powerful search engine (assuming the information is in the computer system), there is no longer a need for alphabetical order, hierarchical organization, spatial cues, or even Boolean logic. The scholar is free to organize in any way, or not at all: "The power of the computer is to find information rapidly, regardless of how it is organized" (Norman, 1993, p. 173).

Computer tools have provided indexing capabilities for years [e.g., Autonote (Sauvain, 1970) and Famulus (Burton, 1972)]; recent tools have improved upon indexing capabilities [e.g., Notebook II+ (Rudestam & Newton, 1992)]. Whether scholars take advantage of these indexing features, however, is not known. Systematic indexing may be less important for smaller personal collections than it is for large collections in libraries and on the Internet.

Indexing may remain a problem for computer users in another guise, as the file-naming problem. Computer tools create a recall problem because of users' difficulties categorizing and naming files and remembering the names (Lansdale, 1988, p. 64). Researchers have looked at how people categorize information in their physical environments to determine how to design computer systems to help people categorize their computer documents (Barreau, 1995; Case, 1991; Kwasnik, 1989; Malone, 1983; Reynolds, 1995). It is not yet clear whether recent improvements in computer tools

(longer file names, more thorough searches across subdirectories or folders, even automatic indexing) have solved the lost-file problem. A computer tool should not introduce a new problem by requiring scholars to name information in order to retrieve it.

A computer tool for thinking should support organizing, categorizing, or classifying information. With the computer, we may not need to classify to find, but we still need to classify to learn and understand (Norman, 1993, p. 173). Entering information into a computer documentation system "encourages systematic accumulation of carefully prepared notes" (Sauvain, 1970, p. 74). The extra processing the scholar does during data entry to categorize and impose order on the information in the system increases learning and clarifies the scholar's thoughts about the subject matter (Moon, 1988, p. 266; Sauvain, 1970, p. 75). In this process, the computer serves as a tool for thinking.

Recommended tool features. As a result of studying how managers organize the information in their offices, Malone (1983) concluded that electronic systems can help with information find and remind problems by simplifying the mechanical process of filing and providing help for categorizing, retrieving, and reminding (pp. 108-110). For the information we put into the computer, we should have systems that provide reminders, as do piles in our physical office environment, and make categorizing, naming, or classifying files and information easier.

Malone recommended specific features to solve classification problems. Computer systems should not require the user to name or title files and information. They should allow deferred classification, perhaps in the form of "piles" on the computer "desktop."

Classification could be made easier on the computer by allowing multiple categories and multiple copies of the information. The system should allow the user to retrieve information by attributes other than topic, by multiple attributes, and by partial information. Classification could also be automatic, with intelligent agents doing the job based on user-assigned rules.

Case (1988) suggests that the piles Malone recommended inspired the development of Apple's HyperCard. Based on a 3 x 5-in. card model, HyperCard displays one card at a time, with cards in "stacks" (each stack is a file). The user can link cards within or across stacks (Larson, 1988). One advantage provided by HyperCard is the deferred classification Malone recommended. The user can record information on a card and put it in a stack without having to categorize it further with a name or topic. HyperCard stacks are the computer version of piles of paper on desktops.

Outline Processing

A computer tool to augment thinking should provide outlining capabilities at least as good as the best manual methods. The computer tool should permit easy, fast reorganization of outline structure, as the manipulation of notecards does. It should allow the user to visualize the information at various levels of abstraction, as do Skinner's (1987) Thinking Aid, Engelbart's (1970) NLS (oN Line System), and most outline processing programs.

The computer tool for outlining should make categorizing and outline processing physically easier and faster. Just as a word processor frees the writer from retyping, the

outline processor should free the thinker from inflexible structures (Hurwood, 1986). Reorganizing should be as easy as moving notecards in physical space, allowing the scholar to experiment with different arrangements.

The computer tool for outlining should support structuring and restructuring by allowing multiple organizations of the same information to coexist. Research indicates that "changeovers are gradual and sometimes reversed" in the transition from one outline to a different one (Trigg & Irish, 1987, p. 101). The tool should allow the user to back up to a previous version of the outline when the new structure does not work.

In an early article entitled "Writing with a Computer," Goldstein (1961) proposed a prototype system called P.I.E. that would represent plans at various levels of abstraction, allowing the user to organize topics independently of the details and not be locked into a particular sequence early. Engelbart's (1970) NLS (later called Augment) emphasized this feature. NLS controls views of the information using structure cutoff, level clipping, statement truncation, and content filters (7a-9f) "to get away from the geometric bondage inflicted by pages, margins, and lines—things which have very little if any bearing upon the content and organization of one's text" (9f).

Another example is Think Tank, a computer outlining tool for writers. The program allows the writer to begin with a simple list, group related ideas, insert paragraphs under headings, and hide paragraphs to consider only the outline (Daiute, 1985, p. 81). MaxThink, an outline processor, provides additional aids to thinking, including prioritizing, randomizing, bin-sorting, and indexing (Larson, 1991).

Affordances of a computer thinking aid. A computer tool for thinking should "afford" outlining, sorting, and prioritizing. To afford in this sense means to make an activity not only possible but also highly probable:

> The affordances of an object refers to its possible functions: A chair affords support, whether for standing, sitting, or the placement of objects. A pencil affords lifting, grasping, turning, poking, supporting, tapping, and of course, writing. In design, the critical issue is perceived affordances: what people perceive the object can do. We tend to use objects in ways suggested by the most salient perceived affordances, not in ways that are difficult to discover. . . . Different technologies afford different operations. That is, they make some things easy to do, others difficult or impossible. (Norman, 1993, pp. 105-106)

A VCR affords playing videotapes. It also is functionally capable of recording up to 2 weeks of television programs according to a schedule the user programs in advance, but programming a VCR is not user-friendly or obviously available. Few people use this feature of their VCR. The VCR does not afford programming multiple recording sessions in advance.

Similarly, a word processor affords text processing and text formatting. It is possible to create tables, equations, complex diagrams, and multilevel outlines with a word processor, but the word processor does not afford these additional activities. Most users are not aware of these advanced functions.

If organizing, categorizing, and classifying information are as important for scholarly thinking as this literature review suggests, a computer tool to augment thinking should afford these organizing activities. It should make it very easy to categorize and

outline information, to organize and reorganize. Whatever else it is, a tool for thinking affords organizing.

Displaying Information

Synthesizing information to produce new knowledge is a complex problem-solving activity that requires several methods of displaying information and conceptual relationships. Scholars need to be able to view the details in order to discover patterns and regularities, and they need to be able to "zoom out" to see the complex relationships among concepts. They need to be able to rapidly scan large amounts of information and to combine and synthesize that information in a single view. A computer tool to augment thinking should support all of these needs.

Viewing the information. A computer tool that lets the scholar see more information at once implies bigger and better display devices (Sauvain, 1970; Case,1991) and more powerful graphical interfaces (Engelbart, 1983; Trigg & Irish, 1987). It requires innovative software applications that support "sensemaking, that is, the restructuring, recoding, and analysis of information for purposes of insight" (Card, Robertson, & York, 1996, p. 112).

A computer tool that supports easy, fast scanning of information should work as well as a book or a microfilm display device. With a book, scholars can rapidly turn the pages to skim the text; skimming text on microfilm is even easier, with the rapid rotation of the handle controlling the film spool. The computer tool should permit scanning just as rapidly without the barrier of artificial file boundaries.

On a computer, "it is enormously clumsy to search directories and open files one at a time to inspect their contents" (Lansdale, 1988, p. 64). In research designed to determine features users need in a personal document manager, Reynolds (1995) found that users want to be able to peek at or view the first page of documents without starting an application. This ability would allow rapid scanning and minimize the tradeoff between the problems of recall and recognition.

Viewing relationships. To discover patterns and regularities, scholars need to gather similar information items to view them concurrently. Any good information retrieval tool will do this. A database search engine will gather information based on a term supplied by the user. A computer tool for thinking should allow the scholar to gather all relevant notes, copy them for re-sorting, and view and re-sort them to discover new relationships (Heeks, 1986; Malone, 1983; Sauvain, 1970).

To zoom out to see the complex relationships among concepts, scholars need to view the relational network graphically: "When dealing with complex structure, it is essential for the user to be able to see the overall organization" (Trigg & Irish, 1987, p. 101). NoteCards, a hypertext browser, displays the network nodes and links users create to link their notes conceptually. Graphic displays are especially helpful when the user is not sure something is relevant or where it fits (p. 96). As early as 1970, Sauvain pointed out the need for communicating the structural relationships of text (pp. 43-45).

The computer tool should also provide an outline view to display information at various levels of abstraction, to allow the simultaneous view of higher-level concepts.

Outline processors like Think Tank and MaxThink provide a way to display conceptual relationships in order to "think it all at once." In usability studies of NoteCards, researchers found that users liked the graphical browser but also needed to display an outline structure for a linear view of their information (Trigg & Irish, 1987, p. 106).

Basic viewing features. Other tool features that support thinking by helping the scholar overcome the limitations of short-term memory include rapid response time, multitasking, and easily accessible storage. Problems of slow computer system response time and the adverse effect on productive thinking (Sauvain, 1970, p. 19) have generally been solved. Multitasking and very large, easily accessible storage are also common features of today's computer tools.

Multiple windows for multitasking allow rapid shifts from one activity to another while "sustaining the problem-solving context" (Sauvain, 1970, p. 47). Multiple windows are useful for computer note taking (Daiute, 1985, p. 95) and promote "fluid research writing" (Daiute, 1985, p. 95). Rapid access to databases of notes searchable on a keyword (Daiute, 1985, p. 223) or "infobases" of vocabulary words, thoughts, and metaphors (Hurwood, 1986, p. 74) help the writer synthesize ideas and facts without stopping to refer to books every step of the way.

The computer tool should provide containers (databases, files, or stacks) that are always available and rapidly accessible to capture ideas immediately, without disrupting the fluency or losing the context. They should help the user answer "Where was I?" as well as keep track of tasks, subtasks, and reminders (Sauvain, 1970, p. 47) and capture

"sudden, ephemeral, sometimes insightful flashes of thought" that occur during problem solving (p. 74).

Info Select as a Thinking Aid

Recommended Features

Based on literature suggesting the major categories of scholarly thinking, the problems scholars have in organizing their information, and potential solutions to those problems, the preceding section proposed specific computer tool features as the features of a "thinking aid" for scholars. Activities that might be augmented with tools include taking notes, filing information, planning and outlining, viewing, reviewing, or studying the information, and writing. Computer tools should help with these activities by improving performance, saving time, and/or supporting creative thinking. A thinking aid should help in the general areas of finding, organizing, and displaying information without introducing new problems.

A computer tool for thinking should provide a powerful but easy-to-use search engine, with an indexing capability. The computer tool should not complicate recall and recognition of information by introducing file-naming problems. It should support categorizing and organizing, including outline processing, making it easy to reorganize, defer classification, keep multiple versions, and view structure and details at various levels of abstraction. Display capabilities should support rapid scanning, gathering information for synthesis, and viewing conceptual relations.

Info Select Features

A personal information management computer application called Info Select has most of these features. Info Select is characterized by its manufacturer as a "random information processor" because it is designed as a storage place for random information, which the human user then processes through categorization and hierarchical classification. Info Select is both a text processor and an outline processor, with a sophisticated search engine and several additional features suggested by the literature review as important characteristics of a tool for thinking.

As a random information processor, Info Select is similar to HyperCard and NoteCards, described earlier. All three of these programs are based on the 3 x 5-in. notecard metaphor. The user creates notecards and saves them in stacks; classifying information is optional. As a text processor, Info Select provides typical word processing capabilities for formatting, editing, and revising text. As an outline processor, the program allows the user to easily set up a hierarchical structure with any number of levels and organize notes within this structure. Combining these features in a Windows interface, Info Select provides a view of both the outline and the notes on one screen, allowing the user to move quickly back and forth between the two methods of processing information (see Figure 3).

Select version 4, used by participants in this research.)

Info Select "affords" organizing and reorganizing. The outline processor makes it very easy to create new topics, revise the level of topics and move them, and view the structure at any level of abstraction. Both notes and topics (outline headings) can be moved with a simple drag-and-drop procedure. Generic topics can be set up for miscellaneous notes as a "pile" for notes to be classified later. Both notes and topics can be copied, singly or as a group. Both notes and structure can be printed at any level of detail, or exported to a word processor.

The program has a powerful but easy-to-use search engine. The user can query on a word or phrase, specifying a search of topic headings, note text, or both. Boolean search

operators and "fuzzy" or "neural" searches are available. Notes can be searched on other attributes, including date created and size, and searches can be restricted to a particular outline level. The user can create an index by setting up keywords and unique data markers. Search results are shown in a "search filter" viewed as topics and notes in the outline structure; results can then be gathered into one topic or printed out or simply browsed.

Info Select solves the file-naming problem by making it possible to keep all information in one computer file that is loaded into random access memory (RAM) when the program is started. This makes it possible to create hundreds or even thousands of notes without naming or classifying them. The program's search engine can be used to find a note based on a keyword or a word or phrase in the text.

Besides solving the recall problem, this feature of the program helps the user with the recognition problem. Because all information is available in RAM, the user can rapidly scan or browse through all notes or any category of notes, or the results in a search filter, without having to open and close files or wait for other programs to load. All information is immediately available and accessible. Through this combination of powerful searching, all information available in computer memory, and view of both notes and outline structure, Info Select provides most of the display capabilities[3] recommended for a

[3] Missing is a graphical view of network relations, as available in Xerox PARC's NoteCards and in some hypertext browsers such as Microsoft's FrontPage.

computer thinking aid: rapid scanning, gathering information for synthesis, and viewing conceptual relations.

The Research Study

This research studied scholars using Info Select as a personal documentation system to process information (notes and outlines) during work on a scholarly project leading to the writing of a paper for publication or dissertation. Observing how six scholars used this tool over a 3- to 6-month time period contributed to the foundations for a better understanding of the scholarly work process, the problems scholars have, and the features of a computer tool that might augment thinking. Specifically, the research addressed these two research questions:

1. What are the thinking activities of these scholars in the information-organizing stage of the scholarly work process?

2. What computer tool features augment scholarly work, as revealed by scholars' use of this random information processor as a personal documentation system?

CHAPTER 3

METHODOLOGY: DATA COLLECTION

The methodology for this research is described in two separate chapters because of the complexity of the data analysis method. This chapter begins with a rationale for the research design. It describes the research participants and setting, the data sources, and the procedures for data collection, ending with a consideration of reliability and validity issues. Chapter 4 describes the content analysis methodology, including the coding system and the methods for displaying the data.

Research Design Rationale

There has been very little research on the scholarly work process. As researchers, we assume we know what scholars do based on our experience, scattered hints in the research literature, and prescriptions handed down from our teachers. With very little directly related research, however, there is no basis for accurately describing what scholars actually do, how they organize information, and how they think; what tools they use, and which tools might augment thinking. Scholarly work is obviously not a single behavior but a complex repertoire of many behaviors. With so many variables involved and no indication of how they relate to each other, exploratory research is needed.

Exploratory research could take at least three different directions. We might ask scholars to describe their work process, their problems and needs, and the kinds of tools they imagine would help them think. We might ask them to describe their scholarly work

process in general, or what they did the last time they worked on a project, or what they are doing now, as they do their work. The main problems with these approaches are that scholars may not be entirely aware of the activities and cognitive processes involved in their work, and, in describing a past project, they may forget to mention important activities.

Another approach would be to observe scholars doing their work. Naturalistic field research, using direct observation or participant observation, could make scholars more aware of their work and capture data that would otherwise be missed, but participation in such research would be time-consuming and disruptive. It is difficult to imagine why scholars would be motivated to participate. Another problem with direct observation is the fact that thinking is typically private behavior and therefore not available for observation by others.

Even if scholars could accurately and fully describe or demonstrate how they work, they would not necessarily know what they need to augment thinking and what tool features would be helpful. To answer those questions would require finding scholars who (a) are using computer tools to augment thinking and (b) are aware of and can describe their use of tools to augment thinking. Participants would also have to be (c) aware of which features of the computer tools are helpful and (d) willing to participate in research that is time-consuming and disruptive to their work.

This study followed the lead of Case (1984), who found that the introduction of a new tool serves as a discontinuity that makes scholars more aware of their work process

and more receptive to questions about their work habits. In Case's research, the new tool was the computer; in this research, the program Info Select was introduced as a new tool.

Instead of trying to find scholars who were already using a particular computer tool for thinking, this study provided the tool and trained scholars to use it. Participants were scholars who perceived the potential benefits of such a computer tool for thinking and were willing to learn to use the tool and report on its effects on their scholarly work. It was assumed that providing a potentially useful tool and training in how to use it would solve the motivation problem, as scholars participated in the research for their own reasons. Instead of being disruptive, the research was designed to directly benefit the scholars who participated. The scholars became collaborators, both allowing the researcher to observe the scholarly work process and participating as researchers in a self-experiment, observing and describing their own behavior.

Observing how the scholars used the computer tool and which features were preferred revealed details about the scholarly work process that would otherwise have remained hidden. What the scholar said about the use of the tool and how the scholar compared this tool to other tools and methods were analyzed to explore which features of computer-based thinking aids are most useful to scholars.

A case study is a history of an individual (or event, organization, program, etc.) using direct observation, interviewing, and other methods, relying on multiple sources of evidence, both qualitative and quantitative, usually guided by theoretical propositions. The case study was chosen as the most appropriate research method because it is a particularly

useful method "when a 'how' or 'why' question is being asked about a contemporary set of events over which the investigator has little or no control" (Yin, 1994, p. 9). The case study is also appropriate for "what" questions that are exploratory rather than enumerative in nature. Multiple cases were studied to capture the range of variability of scholarly work and provide convergent evidence for describing patterns and regularities.

This research methodology is similar to that used by Case (1984, 1991), who conducted case studies including interviews and observations, and to that used by Heeks (1986), who conducted case studies with interviews, diary analysis, and direct observation. For this research, four open-ended interviews were conducted with six scholars who agreed to learn and use the program Info Select as a personal documentation and information-organizing system for notes and outlines related to a current writing project. Intensive training and support were provided to introduce to these individuals tool features a review of the literature indicated are important. Multiple case studies involving interviews, written evaluations, direct observation, and analysis of computer logs and files provided an in-depth look at how these scholars used the specified application to do their scholarly work.

Participants and Setting

The six cases for this multiple case study research were faculty and graduate student scholars in academic settings. The participants fit the definition of scholar as one "whose core activity is the advancement of knowledge" (Case, 1984, p. 8) and who were currently working on a project that involved studying, organizing, and interpreting

information to produce a publishable written product. Three participants were tenured professors, two at the University of North Texas and one at the University of Memphis, in the fields of information science, behavior analysis, and anthropology. The three doctoral students, two at the University of North Texas and one at the University of Florida, were working on degrees in information science and behavior analysis.[4]

Participants were recruited in a purposive rather than random or volunteer manner, based on the replication logic of multiple case studies. Scholars were recruited from several disciplines and from doctoral students as well as faculty, chosen on conceptual rather than representative grounds, to provide data to describe the full range of variability of scholarly work activities (Miles & Huberman, 1994). One requirement of the study was that participants be scholars who already had a moderate to high level of computer expertise and access to computer technology in their work environment.

Recognizing that participation would require extensive time, commitment, and cooperation on the part of the scholars, I began recruitment with faculty members I had reason to believe would benefit from the use of this tool, who met the above requirements. I requested a 1-hr interview with these scholars, asking them to tell me about their scholarly work process (the initial interview). After the interview, if the

[4] Scholars were recruited from social science disciplines instead of natural sciences because the computer tool features focused on in this research are particularly appropriate for handling textual information rather than quantitative data.

scholar seemed eligible and interested, I described my research topic briefly and demonstrated the Info Select program. If the scholar still seemed interested, as most did, I described the research participant's role in more detail, emphasizing the commitment needed. All scholars who saw the demonstration and were invited to participate agreed to do so. (Two agreed to participate but were not available to do so for several months.)

Recruitment of doctoral students was handled in a similar manner for one participant. The other two saw a presentation of the research topic and demonstration of the Info Select program first, and were interviewed after they expressed interest in participating based on the presentation.

Immediately after recruitment and before software training began, the scholars read, signed, and kept a copy of the consent form (Appendix A), which described the research and assured participants they would not be identified in any reports or publications. Participants received a complementary copy of the software donated by the manufacturer and help installing it if desired.

Most of the scholars participated in the study over a period of 6 months (3 months longer than required by the research design). One scholar finished in 4 months. One completed the final interview after 3 months but quit using the program after 2 months.

The research setting was to be the scholar's study (generally, a home or university office), wherever the scholar works when organizing information for current writing projects. Interviews, software training, and direct observation of scholarly work were to be conducted in the scholar's natural work setting, because the goal, as in most case

studies, was to study "a contemporary phenomenon within its real-life context" (Yin, 1994, p. 13).

All scholar interviews were conducted in person, at the scholar's usual workplace, with the following exceptions: Interviews with one scholar took place at the researcher's campus office, using the researcher's computer to view the participant's Info Select file, as the location was more convenient for the participant and researcher. The second and third technical support interviews with the scholar in Florida took place by phone rather than at the scholar's office, because of the distance. In this case, both the researcher and participant were looking at and referring to the current copy of the scholar's Info Select file during the tape-recorded phone interviews. The length and content of these interviews were comparable to the second and third interviews for other participants.

The only other procedural difference was the fact that one scholar was using an older notebook computer running the Windows 3.1 operating system and therefore an earlier version of Info Select. The differences are minor—placement of some items on menus and no sorting bin feature—and unlikely to have affected how the participant used the program for scholarly work.

Measures and Data

A unique strength of the case study is that it can deal with a variety of evidence (Yin, 1994, p. 8), resulting in the convergence of data. To balance the advantages and disadvantages of the different methods of exploratory research, this research combined open-ended, in-depth interviews designed to reveal details of the scholarly work process,

direct observation to provide data on what scholars do as well as what they say, and the introduction of a new computer tool to make the covert (unobservable) thinking behavior more overt and scholars more aware of their thinking processes. These multiple data-collection strategies resulted in both qualitative and quantitative data that were linked through the process of pattern matching to theoretical propositions that emerged from the review of the literature.

Case studies are based on a theoretical framework that provides direction for what data to collect and what to measure. The theoretical framework that emerged from the literature review for this research suggested that the scholar's use of the Info Select program would reveal aspects of the scholarly work process and specifically would provide data about features of a tool to aid thinking. This framework can be summarized in a set of brief propositions:

1. Thinking is doing: It is behavior, an activity scholars engage in, often covert but capable of being made overt.

2. Thinking is a problem-solving activity that involves organizing and ordering information.

3. Thinking activities include finding/filing information, organizing, ordering, outlining information, reminding, and displaying organized information.

4. These activities imply the tool features scholars need to augment thinking: A tool that supports finding, organizing, reminding, and displaying information.

5. Info Select is a computer tool that supports these activities with specific tool features.

6. To the extent that Info Select does have the features of a thinking aid to augment the scholar's thinking, the scholar's use of this tool in this research study would reveal previously unavailable aspects of the scholarly work process and the specific features of a tool to aid thinking.

The research questions and the sources of data for exploring answers to these questions were:

1. "What are the thinking activities of scholarly work?" The data were the scholars' descriptions of the scholarly work process of thinking and organizing information for writing and other scholarly work. The data were verbal behavior, oral and written. The collection method was mainly in-depth, focused interviews. Indirectly, data concerning the use of the computer tool also provided information about scholars' thinking activities.

2. "What computer tool features augment scholarly thinking?" The data were: (a) The scholars' use of specific features of the computer tool (which features, what the features were used for, how often and how long used), and the scholars' descriptions of features used and results obtained. Data collection methods included a data log kept by scholars, computer files created by the program, interviews, journals kept by scholars, and direct observation. (b) The scholars' evaluations of program features used, and problems, needs, and likes related to tool use. The scholars' evaluations of the tool in the final

interview were the main source of these data. Also important were questions and comments during interviews throughout the study, and evidence from direct observation of features scholars used or had problems using. Data collection methods included interviews, journals, and direct observation (see Table 1).

Table 1
Data Sources and Types of Data

4 in-depth, open-ended, focused interviews, tape-recorded: Interview 1: Current scholarly work process. Interviews 2 and 3: Technical support for using Info Select. Interview 4: Changes in scholarly work process.
IS Training Checklist: Filled in by researcher during training session and technical support interviews, and by scholar in final interview. Info Select features trained, demonstrated, used, liked, problems.
Tool Evaluation Forms 1 and 2: Administered in first and final interviews. Rating importance of scholarly work activities and how well Info Select enabled those activities, using 5-point Likert scale.
Computer Tool Survey: Brief survey of computer applications the scholar uses and self-evaluation of tool expertise.
Journal/log kept by scholar: "Snapshot" of problems and benefits, how scholar uses the program, self-recorded "aha" experiences. Also email correspondence related to use of program.
Data Sheet (usage log): Kept by scholar for each work session. Date, duration of usage, type of usage (e.g., add notes, organize notes), questions, comments.
IS log file (assert.txt): Data automatically recorded by Info Select. Date, time opened, and time closed for each working session.
IS content files (overview.wd2): Number of notes, topics, references; amount of structure indicated by topic levels; use of labels for notes; use of keywords.

IS = Info Select.

Procedures

Interviews

Four in-depth interviews were conducted during the research study, separated by approximately equal time intervals (1 to 2 months). The initial and final interviews included both open-ended questions and use of a Tool Evaluation Form. The second and third interviews consisted of open-ended "show me" prompts, training as needed, and use of the Info Select Training Checklist. Interviews lasted about an hour. All interviews were tape-recorded for later transcription. Table 2 highlights the events of the research schedule, which are discussed in more detail in this section.

The interview method used for this research might best be described as the focused interview. Neither ethnographic nor formally structured, but somewhere in between, the focused interview is open-ended and conversational, but guided by the research interests (Holstein & Gubrium, 1995; Yin, 1994). It involves asking a focusing question to establish the direction of the interview. The focus question is supplemented by prompt questions, based on a list of topics to be covered (not an interview guide with specific questions). The researcher also asks follow-up questions and makes requests for clarification based on what participants say. The interviewer's job is to "Listen more, talk less, and ask real questions" (Seidman, 1998). The method is also called active interviewing (Holstein & Gubrium, 1995), because the interviewer activates narrative, provokes and incites responses, sets parameters, and serves as a catalyst.

Table 2
Research Schedule

Research event	Occurs when
Initial interview: current scholarly work Open-ended questions Prompting questions Tool Evaluation Form 1 Computer Use Survey	Beginning of study
Info Select program training Direct observation as teacher/tutor IS Training Checklist	Same session as initial interview, or another session within a week; also during technical support interviews
Ongoing technical support	Whenever requested
Technical support interview (I#2)* Open-ended questions Direct observation IS Training Checklist	1 – 2 months after initial interview
Technical support interview (I#3)* Open-ended questions Direct observation IS Training Checklist	1 – 2 months after I#2
Final interview: current scholarly work and using Info Select* Open-ended questions Prompting questions Tool Evaluation Form 2 IS Checklist: used/liked/problems	End of study: 1 – 2 months after I#3

Note. Additional data collected after interviews 2, 3, and 4 included the Info Select content file, usage log, journal, and data sheets. IS = Info Select.

The initial interview focused on the scholarly work process. The session began with an open-ended question designed to elicit a detailed description of the scholar's work process: "Tell me about your scholarly work process." See Appendix A for examples of the focusing questions actually used, and a list of prompt questions used during interviews to stimulate discussion on particular topics.

The second and third interviews are referred to as technical support interviews because their main purpose was to provide additional training as needed and solve any problems the scholars had encountered in using the software. Scholars were prompted to demonstrate their use of the tool features, to be sure they knew how to use them. They were encouraged to talk about the ways they were using the program to accomplish their scholarly work, which elicited new information about their scholarly work activities. A typical focusing question was "Show me what you've been doing with Info Select since we last met." Any changes in the scholarly work process or work environment were discussed.

The final interview focused on the scholar's experience during the study and any changes in the scholarly work process as a result of using Info Select. The scholar was prompted to describe perceived benefits and problems of using the tool for scholarly work. In some cases, a personalized question was asked based on something the scholar had said in an earlier interview—for example, "In the first interview, you said printouts were very important. Is that still true?"

Training and Direct Observation

Training on how to use Info Select was conducted after the initial interview, with training sessions arranged at the scholar's convenience during the first 2 weeks of the research study. Training consisted of one-on-one, hands-on instruction for all relevant features of the program. Training was standardized to cover the same features in the same order, using the same instructional content, developed by the researcher for this study (a sample page from the training documentation is included in Appendix A). The amount of training was based on the scholar's level of computer expertise—that is, training continued until the scholar demonstrated competence with the features and felt comfortable with them. The training required two or three sessions of 1 to 2 hr each.

Training was not limited to initial training sessions; scholars could request and receive additional training any time during the study. Questions were answered in person, in a telephone conversation, or in an email message. Training was documented on the Info Select Training Checklist, a list of program features that users should know to use the program effectively (see Appendix A). The checklist was used during training and during the two technical support interviews to ensure that all features were taught. In general, training sessions were not tape-recorded. If questions or comments occurring during a training session seemed relevant to the research questions, however, they were documented on tape or in writing immediately following the training session.

Direct observation of the scholar's use of Info Select during training and technical support sessions supplemented the verbal behavior elicited by interviews and checklists.

Scholars were encouraged to demonstrate their use of the program's features, which in some cases revealed problems not apparent in verbal descriptions. A scholar who insisted he knew how to use the Summary feature, for example, hesitated when asked to demonstrate the feature and then asked for further training.

Other Data Collection Methods

At the end of the initial interview, the scholar responded to the brief Computer Tool Survey (provided in Appendix A), which assessed the types of computer applications used and the scholar's perceived expertise. At this time the scholar also responded to the longer Tool Evaluation Form (see Appendix A), which was a list of scholarly work activities that could be augmented by tools (based on the Info Select Training Checklist expanded with other tool features the literature review had suggested would be important to scholars). Using a 5-point Likert scale, scholars rated the activities according to the question, "How important is it for you to be able to __?"

At the end of the final interview, the scholar again responded to the Tool Evaluation Form, using the same form but with the focusing question changed to, "How helpful is Info Select in enabling you to ___?" The Info Select Checklist was also used in the final interview, with response columns labeled "used," "liked," and "problems" (instead of "trained" and "demonstrated"). Scholars were instructed to check off the features they had used, liked, or had problems with. Scholars were encouraged to ask questions or make comments while responding to both forms. Questions and comments were tape-recorded, providing useful clarifying data.

The scholars were asked to fill out a Data Sheet (usage log) after each working session. The Data Sheet (see Appendix A), supplied to participants in paper form, included blanks for date, start and end times, and questions and comments, with a checklist of Info Select activities scholars could use to indicate their activities during the current session. The researcher collected Data Sheets at each interview, or reminded the scholar to record data using the Data Sheet.

The single Info Select content file containing all notes and outlines the scholar created was collected (on floppy disk or as an email attachment) just before each of the last three interviews for document analysis. Measurements using this file included number of notes, references, and topics, structural complexity based on number of topic levels, and use of keywords.

The scholar was asked to keep a journal, on paper or as notes in an Info Select topic, of experiences and feelings related to use of the computer tool, especially whenever encountering problems or noticing particular benefits of using the program. Three scholars kept a journal, providing a snapshot of how these scholars used the program, problems with tool features, and self-recorded "aha" experiences. Journal entries were collected three times, with the Info Select content file. Scholars were reminded to make journal entries if they were not already doing so.

Case Study Protocol and Reliability

The research procedures and instrumentation described above were documented in detail in a case study protocol. Such protocols increase reliability by permitting replication

and reducing researcher bias and error, and allow comparisons of research findings across cases. The protocol included the data collection instruments (focusing questions, forms and checklists, and usage logs) and described general rules for using them. It included procedures for training scholars to use the Info Select program, with a schedule, a set of lessons, and all relevant documentation. Also included in the protocol were documentation of the data analysis database and a description of how it was used, and rules for transcribing the interviews. Most of the case study protocol is provided in Appendix A.

In case study research, reliability that permits replication refers to the probability of being able to replicate the results if the same case were studied again—by the same researcher or another researcher (Yin, 1994, p. 36). The case study protocol increased the probability of replication by providing standardized questions and forms, as well as procedures for using them. Researcher error and bias were reduced, and objectivity increased, by ensuring that the same procedures were used in multiple sessions with the same participant and in similar sessions with different participants. The detailed protocol increased the availability of comparable data. The research database provided an audit trail, a record of the chain of evidence used to reach conclusions and make recommendations.

Another way to increase reliability in case study research is to conduct a member check, asking the study participants to review the researcher's interpretations for accuracy (Rudestam & Newton, 1992, p. 76). This research included two forms of member check. One was in the form of clarifications from the scholars throughout the study when

questions arose about the meaning of the data collected. The second member check occurred after data were analyzed and written in the form of descriptions of scholars and their work process. Each scholar was given the opportunity to review the description of his work process and comment on it as well as remove any statement he thought might compromise his anonymity. Only one change, related to a demographic fact, was requested as a result of this member check.

Research Validity and Justification for Research Design

This research was designed to combine the advantages of case studies with the strengths of qualitative research to increase the internal validity. Case studies, unlike ethnographic and grounded theory qualitative approaches, do not avoid prior commitment to a theoretical framework. They frequently rely on the prior development of a conceptual framework that focuses and bounds the collection of data (Yin, 1994). Working within a theoretical framework is one way to increase the credibility and therefore the internal validity of the research (Miles & Huberman, 1994). This research was guided by a conceptual framework based literature review related to scholarly work and thinking.

An emphasis on qualitative data, which is most appropriate for exploratory research, increases internal validity by increasing confidence in the meaningfulness of the data. The focus on naturally occurring, ordinary events in the natural setting and the richness of data provided by including contextual detail increase credibility (Miles & Huberman, 1994, p. 10). This research collected qualitative data in the natural setting and analyzed the data without removing the observations from their meaningful context.

Research procedures that increase internal validity include prolonged engagement, persistent observation, and data triangulation (Rudestam & Newton, 1992, p. 39). This research explored the scholar's experience in detail over an extended period of time (3-6 months). Multiple interviews and multiple sources of data increased internal validity by revealing discrepancies and establishing factual accuracy.

External validity is often considered to be a problem for case study research, because small samples or few participants cannot ensure generalizable results. The replication logic of case studies, however, is based on analytic generalization, not statistical generalization. For analytic generalization, observations from a case are matched to predictions of the existing (or emerging) theory, instead of comparing data from a sample to statistically probable characteristics of a population. The case study is analogous to an experiment; conducting multiple case studies is analogous to conducting multiple experiments: "If two or more cases are shown to support the same theory, replication may be claimed" (Yin, 1994, p. 31).

According to this replication logic, external validity in case study research does not depend on large samples and generalizing to a population, but depends more on the fit of the methods and procedures, on the fit of results with the theoretical framework, and on the careful selection of multiple cases to replicate the results: "Multiple-case sampling gives us confidence that our emerging theory is generic, because we have seen it work out—and not work out—in predictable ways" (Miles & Huberman, 1994, p. 29). This

research relied on the use of a detailed conceptual framework and the careful selection of multiple cases to increase external validity.

Pilot Study

A pilot study was conducted using most of these procedures. Data from the pilot study were analyzed to determine appropriate ways to categorize and display the data. The training procedures were developed and refined during the pilot study. The major changes made in the data collection procedures based on the pilot study were the inclusion the Training Checklist and the Tool Evaluation Form, and modification of the interview technique to include prompt questions, to ensure that important data were not missed entirely and to enable comparisons across cases.

Case study protocol changes based on the pilot study included teaching and encouraging the scholar to keep a journal and usage log (the pilot scholar did not). Extensive changes to the coding system and methods for doing the content analysis and displaying the data were made based on the pilot scholar's data and early data from participating scholars.

CHAPTER 4

METHODOLOGY: CONTENT ANALYSIS

Content analysis is both a method of observation and measurement and a method for analyzing data. As a method of observing and measuring, it is a secondary observational tool, using a product of verbal behavior (in this case, interview transcripts) as a data source for identifying variables and assigning them to coding categories. The coding process itself is a method for analyzing data: "how you differentiate and combine the data you have retrieved and the reflections you make about this information" (Miles & Huberman, 1994, p. 56). The codes are tags or labels that are applied to the variables identified, in order to categorize the verbal data, to reduce large amounts of data to smaller, more manageable chunks, and to discover and then display relationships among variables.

The coding system for a content analysis may be derived inductively from the raw data, emerging during the data collection and analysis phase of research, or it may be based on a theoretical framework established by prior research or a review of the literature. This study combined both methods by starting with a tentative conceptual framework based on the review of the literature and modifying the coding system as needed based on the data analysis.

The codes in a coding system may be descriptive, interpretive, or pattern codes (inferential and explanatory) (Miles & Huberman, 1994, p. 57). A lower level of analysis

employing descriptive codes seemed most appropriate for exploratory research attempting to identify the activities of scholarly work. Although the ultimate goal is to explore a process (the scholarly work process and the role of tools to augment that work), the immediate focus was on identifiable scholarly activities, and, at an even lower level, specific actions of scholars that are observable instances of the ongoing activities.

Developing the Coding System

To develop the coding system, I started with the scholarly work activities and problems mentioned in the literature and added recommended and implied tools and tool features that might serve as solutions to the problems described. The result was a conceptual framework consisting of four main categories of scholarly activities, abbreviated as FORD: finding, organizing, reminding, and displaying information. A separate list of basic tool features (BTF) supplemented the main categories.[5] Included on the tool list as potential solutions were Malone's (1983) recommendations (deferred classification, multiple categories and copies, windows and multitasking), the features of good outline-processing tools, and several suggestions from the literature related to display features. Using the Info Select Training Checklist, I added the few Info Select features that were not already on the comprehensive list. I used this master list to code the pilot study data and participating scholars' initial interviews.

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[5] Basic tool features were not the focus of this study. It was assumed that current software would have incorporated these and they would not be a problem. They were included for comprehensiveness in the content analysis, and turned out to be important.

The Unit of Analysis

Before any data could be coded, it was necessary to determine and identify the units of analysis—the chunks of transcript text that would receive the codes. The original plan was to base the unit of analysis on a behavioral unit consisting of described behavior (something the scholar did) and its consequence (the result of whatever the scholar did). The unit might also include antecedent stimuli or prompts. Antecedents and consequences would provide the context for the behavioral action or activity. Included in the unit might be a tool or tool feature the scholar used or had trouble using, and/or stated or implied needs and problems. The decision to use the behavioral unit was made when the pilot participant's data were analyzed, when it became evident that words and phrases describing the scholar's activities and mentioning tool features, taken out of context, were meaningless. As Miles and Huberman (1994) put it, qualitative data "are about actions (which carry with them intentions and meanings and lead to consequences). . . . Those actions always occur in specific situations within a social and historical context" (p. 10).

An example of a behavioral unit might be a scholar's statement: "When it's time to write the paper, I spend too much time searching through my notes to find a reference." The behavior or action is "searching through my notes." The antecedent context is "when it's time to write the paper," and there are two consequences for the searching behavior: finding a reference and spending too much time.

When applied to the actual scholars' transcripts, however, the behavioral unit was not sufficient. Participant scholars did not refer as often to consequences as the pilot

scholar had, and antecedents for behavior were seldom mentioned explicitly. What became very obvious, however, was that scholars often referred to the object of a behavioral action, and frequently mentioned a tool or media used to accomplish the action. The example mentioned above would be more likely to occur without the "when" clause. Coded as behavior (FS), object of behavior (preceded by a colon) (:R), media used (preceded by a hyphen) (-N), the activity "searching through my notes to find a reference" would be labeled FS:R-N (find-scan references using notes). The object and using/media categories, therefore, evolved directly from what scholars said in the first interviews. (The procedures for unitizing the data are described in more detail below.)

Using behavior-object-media as the unit, instead of antecedent-behavior-consequence, captures some new information (object and media) and loses some information (antecedent and consequence). Instead of dropping this information, I included the contextual information (usually a consequence) in the behavioral unit whenever it seemed important or relevant. This information appears in the unit lists in the appendix, if not in the code itself. Therefore, the contextual information was always available for descriptions of scholarly work within and across participants. Consequences of scholars' activities, as it turned out, were best handled by the categorization of scholarly problems, needs, and likes that evolved during the data analysis phase. For example, the "spend too much time" in the searching activity mentioned above implies a problem related to searching. The code FS:R-N still applies to the unit, but now it is not only classified as a scholarly work process activity, but also as a problem (the problems, needs, and likes

categorization schemes are discussed in greater detail below, in Additional Coding Schemes).

Development of AfFORD-W Categories

The original four major categories, FORD, were divided into several subcategories—e.g., find by querying, scanning, or gathering; organize by categorizing, sorting, outlining, moving. Each activity item on the code list was given a two-letter code, starting with the FORD category letter and adding a second letter to represent the subcategory. Thus, the items mentioned above would be coded FQ, FS, FG, and OC, OS, OH (H for hierarchical), OM.

Based on the scholars' descriptions in initial interviews, I added three major categories: W (writing), B (bibliographic reference activity), and N (note taking). In applying the codes, however, I realized that B and N are the objects of action, not the action itself—an indication that something was wrong with the relational structure of the coding system. I removed these two categories and created the A (add) category for the items previously classified as N. After removing the W category and trying to code the data without it, using W as an object, I later reinstated it, because the scholars referred to writing as both a product or object of their activities and as a major action category of scholarly work. I subdivided the F category to represent find and file, uncertain whether to consider this one category or two. The catch-all "other" category was added for activities that did not fit anywhere else (labeled X, because O already stood for organizing). The final Code List, shown in Appendix A, reflects these changes (the last two columns in the

Code List, object and media, are discussed below, in the section on Coding the Transcripts).

I made revisions to the coding scheme throughout the data collection phase and into the data analysis phase. When all final interviews were completed, I coded all transcripts, and recoded several times. I simplified the coding scheme by eliminating subcategories suggested by Info Select tool features but not referred to by scholars. For example, the four varieties of find-query were unnecessary, because no scholar used any search feature other than a simple word search. I kept the BTF category separate, because it refers not to actions but to characteristics of actions and attributes of tools, the adverbs and adjectives of descriptions.

Coding System Issues

Some adjustments to the coding scheme were necessary because the codes used for content analysis should be both mutually exclusive and exhaustive (Weber, 1985). Mutually exclusive means that a unit cannot be given more than one code. Two coding categories should not overlap to the extent that a coder would be uncertain which code to apply to a unit. Several subcategories of the original coding scheme were not mutually exclusive. For example, moving and copying notes (NM and NC), when N (notes) was a major category, overlapped with the organizing categories for copy and move (OC and OM). Dropping the N category, and using the A (add) category instead, solved part of that problem. Refining the definitions and examples in the Code Book (provided in Appendix A), to specify precisely when to use each code, solved the rest of the problem—

at least, to the extent that two coders could achieve intercoder reliability of 80% or above.[6] (The distinct boundaries of the coding system may be artificial differentiation of activities that naturally overlap to some extent, a point that is considered in the Data Map section, below.)

The requirement that categories be exhaustive led to the creation of several new subcategories as well as one major category. Coding categories that emerged from the scholars' actual descriptions, instead of from the review of the literature, included category W and subcategories AT, A2, AV, OL, and OZ (type, copy, convert, list, and integrate). The X (other) category[7] eventually contained TA, CC, ST (think about, communicate with colleagues, conduct research); Win and UF (Windows-compatible and user-friendly) were added to the BTF category. A code symbol }i was established to capture the concept "quickly" or "immediately."

Unitizing the Data

Unitizing in content analysis involves differentiating the units of analysis from the surrounding text of the sampling unit (in this research, the set of four transcribed interviews, journal entries, training notes, and email messages). Also known as the recording unit or coding unit, it is the text that is recorded in the database and on lists,

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[6] Other coding categories that presented a problem for mutual exclusivity (solved by Code Book definitions), were AV, A:, and OM for convert, import, export, transport information, OC vs. OS; OL vs. OH; DM vs. DW; and RA vs. A:N.

[7] The X category indicates that the coding system was not entirely exhaustive. However, there were not enough instances of activities in any X subcategory to warrant the creation of a new major category, so I left these as exceptions to the exhaustive rule. Further research may determine the need for more categories.

and it is the text that gets a code. The decision in this study to focus on a recording unit based on behavior-object-media was, as Krippendorf (1980) recommends, an attempt "to aim for the empirically most meaningful and productive units that are efficiently and reliably identifiable" (p. 64).

Identifying the units of analysis consisted of identifying and numbering consecutively the behaviors mentioned in the already numbered paragraphs of the transcripts. Behavior was defined as something the scholar does or did or will do; it is generally described with action verbs and their objects. Not included in the definition of behavior (and therefore not counted as units of analysis) were state verbs ("is," "have," "felt"), nonbehaviors (negative statements), repetitions in the same paragraph, contradicted or modified statements, and conditional statements. A set of rules and examples was developed to ensure unitizing reliability and stability (see Appendix A). The rules were modified during the development phase to achieve stability.

Problems were encountered in developing the procedures for unitizing, for several reasons. The coding unit is more difficult to define when the data collection technique involves open-ended interviews rather than a set of structured questions. In the latter case, there is often a fairly discrete, circumscribed chunk of text—the participant's response—that contains one coding unit (sometimes more than one). The open-ended interview provides no natural structural unit that might correspond with the coding unit. The participant's "response" may be as short as a word or as long as several paragraphs or pages. Repetition as well as verbosity must be handled with a set of consistent rules.

In this research, neither sentence nor paragraph corresponded with the coding unit. A sentence might contain one behavior, several, or none. Locating the coding unit was difficult because it often consisted of words or phrases scattered across two or more sentences instead of consecutive words or phrases. There were no keywords to make identification easier, although looking for action verbs was helpful. Early, unsuccessful attempts to unitize the data were confounded by attempts to differentiate behavioral chains (a series of actions in one sentence connected by "and," "or," and "and then"), behavioral clusters, and complex or composite behavior. This led to complex code "sentences" that could not easily be categorized or manipulated.

Another solution to these problems, besides refining the set of rules for unitizing, was to establish a procedure that separated the unitizing and coding steps but allowed some back and forth looping. Instructions for this procedure were as follows:

1. Unitize by underlining and number each behavior in the transcript (along with its antecedent and consequence, if relevant). Write the unit out on a list, with its identifying paragraph number and behavior number. Paraphrase it or quote it directly. Break behavioral chains and composite units into separate low-level behaviors (actions), giving each a separate number. Looking for action verbs is helpful, as is familiarity with the coding system and looking for behaviors that can be coded according to the system. Sorting out meanings from semantic ambiguity is essential.

2. Code the units after all the units have been identified and listed. (The procedure for coding is explained in detail in the next section.) If it is possible to assign two or more

codes to a unit, break the unit into its component parts and renumber as two or more units before applying a code to each. If the same code is applied to two or more units from the same paragraph, apply the repetition rule and eliminate all but the first unit for that code.

The procedure, therefore, was not simply a two-step linear procedure. Unitizing required prior knowledge of the coding system, and problems encountered in the coding step required returning to the unitizing step before proceeding with coding.

Coding the Transcripts

How the Units Were Coded

Using the Code List and written instructions (see Coding Steps in Appendix A), representative samples of the data were coded by the researcher and by three other coders (graduate students and faculty) for reliability testing. The coding steps consisted of applying a specific coding category (column 2 of the Code List in Appendix A) to each unit of analysis, adding a colon and the code for an object (column 3) if an object of the behavior was mentioned, and adding a hyphen and the code for the media used to accomplish the behavior (column 4) if appropriate. For example, "photocopy an article" would be coded A2:S-cm (A2 for copy, S for source article, and cm for using a copy machine). Activities too general to be classified with the specific categories were assigned one of the major categories, if possible; otherwise they were classified as X (other). Most categories could be classified with the specific codes.

Coding was based on keywords and manifest content wherever possible, with explicit examples of keywords and phrases provided for the coder in the Code Book

(Appendix A). Rules and definitions in the Code Book helped the coder distinguish among categories. Some of the rules may appear somewhat arbitrary, in cases where dictionary definitions of category terms are so similar the terms may be used synonymously in everyday language—for example, categorize, sort, and index. Rules were developed to distinguish such terms, making them mutually exclusive for the purposes of this study, recognizing that arguments could be made for a different grouping. The results (both coding reliability and data results) seem to support the present coding system.

The object and media lists evolved as the data were classified. Only a few new object and media codes were added to the lists after the initial interviews were coded. To help the coders identify the object and media from the surrounding text, instructions suggested asking the question "What?" or "To what?" to determine the object of an action, and "Using what?" to identify media or tools. (Clarifications for applying these codes are included in Coding Steps, in Appendix A.) Object and media are optional categories, not required and often not needed. They are not considered in reliability tests and have no affect on the data display, nor do they figure in the limited frequency counts mentioned in the results (chapter 5). They do, however, increase the descriptive power of the coding scheme, particularly in the discussion of tools and tool features scholars use.

The many examples of coded units in the Code Book show the range of units to be labeled with the code. The examples are actual coded units. The Code Book evolved during the first round of coding the transcripts. It was refined after all units had been initially coded, using a list of all coded units sorted by subcategory so it was easy to see

the similarities and range of variability for a particular code. Revisions to the coding scheme, described earlier, as well as to the Code List and Code Book were made during this ongoing process.

Assessing Intercoder Reliability

Coding reliability is accessed to determine whether the data are sufficiently reliable to warrant analysis—that is, whether the data represent variations in real phenomena or measurement inconsistencies and biases (Krippendorf, 1980, p. 129). Of the three types of reliability described by Weber (1985), stability and reproducibility are relevant to this research. (Accuracy, the strongest form of reliability, requires comparing the coding results to a standard, which for this newly created coding scheme did not exist.) Stability, the weakest form of reliability, refers to one person coding the data the same way more than once. Stability was achieved at or above the 80% level of reliability in coding most of the data for this study several times—for example, 87% agreement on coding one interview transcript on two occasions separated by 3 months.

A stronger form of reliability is reproducibility, which assesses intercoder agreement, a consistency implying shared understanding of meanings. Coding reliability was assessed by having two individuals code the data using the same procedures, instructions, and sample of the data. The data sample was a nonrandom sample of units of analysis chosen to be representative of all the major categories to be coded. Reliability was calculated as the percentage of agreement between two coders (number of agreements divided by number of coded instances). A reliability percentage was computed for each of

the major coding categories, because the categories represent logically distinct variables. Combining them into one reliability figure could mask a weakness in the coding system. A minimum level of agreement of 80% was set as the goal based on standards acceptable for exploratory research (Krippendorf, 1980, p. 147).

Intercoder reliability was achieved after three rounds of testing, interspersed with revising the Code Book definitions and instructions. The first round of testing resulted in overall reliability percentages ranging from 60% to 87% for six samples of data. Category percentages were not even calculated, because it was obvious that many revisions were necessary. This preliminary testing revealed the need for detailed written instructions, finer distinctions in the Code Book, and, especially, clear rules for distinguishing the RA category from the A:N category, both having to do with note taking. The RA/A:N categories were the source of most coding disagreements.

The second round of testing provided the new coder with a more complete Code Book but only limited instructions. The ambiguity of coding the note-taking activity remained, but shifted to disagreements in coding the W and A categories. The overall intercoder agreement was 77%. The category agreements were A-61%, O-87%, W-80%, and 100% for the remaining four categories. Without the W/A ambiguity, the A category agreement would have been 92% and reliability would have been acceptable for all categories.

In the third and last round of testing with a new coder, a revised Code Book and almost an hour of one-on-one instruction and training on how to interpret and apply the

codes resulted in an overall agreement of 93%. Category agreements were 80% for O, 88% for F, and 100% for all remaining categories, well above the targeted level for data reliability. Even at the subcategory level, overall agreement was 83%. This level of reliability provided a reasonably trustworthy basis for making inferences and recommendations at both the major category level and the more specific subcategory level.

Additional Coding Schemes

Kwasnik (1992), explaining how facet analysis is a useful tool for building classifications that lead to theory, says that "to analyze something . . . is to view it from all angles—the same entity, but with emphasis on a different dimension or facet" (p. 73). The content analysis for this research viewed the same data from four different perspectives in an attempt to answer the two broadly stated research questions. The coding scheme (1) described above was used to explore the first research question: What are the activities of scholarly work? Additional analyses were undertaken to explore the second research question related to what tools or tool features would augment that work. This involved coding the same data to identify (2) problems, needs, and likes concerning (2a) scholarly work, tools in general, or Info Select in particular; (2a-1) change in scholarly work process related to the use of Info Select; and (3) tools scholars used, as well as (3a) problems, needs, and likes related to use of those tools or tool features. The classification in 2a together with that in 2 made it possible to consider 9 possible combinations, the most useful being tool-related problems (PT), scholarly work-related needs (NS), and likes related to the use of the Info Select tool (LI). Codes for 3b, basic tool features, were

applied to units as needed. This section describes the procedures used for these additional data analyses.

Table 3 lists all of these data analysis dimensions and may serve as a useful focal point for this description of what was done. The structure of the numbered list in the preceding paragraph and in the table is deliberate, intended to express the relationships among these classification schemes—also expressed in words in column 3 (e.g., scheme 2a coded the same units as scheme 2, whereas scheme 2a-1 coded a subset of the units coded by 2a).

Evaluative Statements

The second classification scheme, evaluative statements, categorized evidence of problems, needs, and likes in the scholars' transcripts. The units of analysis were often, but not always, the same as the units already coded as scholarly work behavior (behavior-object-media units)—in which case they were already coded according to the AfFORD-W categories. In some cases, they were new units—for example, an evaluative statement about a tool, with no behavior mentioned (e.g., "that software is useless"). In other words, the units classified by scheme 2, as problems, needs, and likes, were either a subset of already coded behavioral units or were new, nonbehavioral units. Unitization was straightforward in either case.

Table 3
Additional Coding Schemes Summary

Coding scheme	Categories	Units are subset of:	Basis for identification
1. SWP activities	√	All Behv/Object/Media units	Manifest & latent content
2. Evaluative statements	PNL	#1, plus others[a]	Keywords & manifest content
a. Context for eval. statement	STI	(same units as #2)	Keywords & manifest content
(1) Behavioral change	√	#2a: LI (Likes:IS)	(already classified)
3. Tools/Tool features	TM/TE	All units	Manifest content
a. Tool eval. statements	PNL	#3 AND #2[b]	(already classified)
b. Basic tool features	BTF list[c]	All units	Keywords, manifest content

Note. Schemes 1, 2, and 3 are not mutually exclusive. Coding categories within a scheme, however, are mutually exclusive. √ = Unit was coded as member of this category or not (yes or no). SWP = scholarly work process. PNL = problems, needs, likes. STI = scholarly work, tools, Info Select. IS = Info Select. TM/TE = tools manual/electronic. BTF = basic tool features.

[a] "Others" included conditional statements and statements involving no behavior (e.g., "that software is

[b] Tool PNLs are a subset of SWP PNLs, with much overlap.

[c] BTF list is in Appendix A.

Coding the units presented few problems because categories were based on manifest content, or keywords in the units, which were generally easy to identify. The

three coding categories—problems, needs,[8] and likes—were considered to be mutually exclusive (a potential problem, discussed below). Problem was operationalized as something the scholar called a problem or described as difficult to do or as affecting something else in an adverse way. Most problems involved negative statements (don't know, can't find, not productive) or adjectives most English-language speakers would categorize as clearly implied problems (a pain, tedious, frustrating, useless).

Need was operationalized as something the scholar said he needed or wanted (need, want, need to, want to, would like, wish, have to have, a priority, very important, ideal). Items were also classified as needs if any of these meanings were clearly implied without these keywords. Needs were often clearly implied in conditional statements (if __, then I could __; would be handy; __, so I can __; how do I __? to do __, you do __).

Like was operationalized as something the scholar described using positive words (like, prefer, helps me, good, excited about) or something most speakers would consider desirable (handy, saves time, quicker, easier, a snap, accurate, advantage). Change, a subset of likes, was identified by keywords and phrases (change, different, now, started doing __ after __; beginning to; doing __ instead of __; for the first time; doing more of. In some cases positive statements accompanying a behavioral description clearly implied change (good for, better, easier, lets you __; helping me do __; yippee; fantastic).

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[8] Initially, the data were classified into four categories: problems, needs, wants, and likes. Analysis of the content led to collapsing needs and wants into one category.

Coding the data for scheme 2a, the context of evaluative statements, was even more straightforward, simply a matter of deciding whether the problem, need, or like was related to tool use, Info Select use, or scholarly work in general (the default, if no tool was mentioned). This scheme might be thought of as classifying kinds of problems, needs, and likes. The units coded for this scheme were the same units as those coded for problems, needs, and likes. The behavioral change scheme (2a-1 on the table) used keywords and manifest content implying change to code units already classified as LI (likes Info Select).

Although unitizing and coding evaluative statements and their subsets were straightforward, determining how to apply the scheme and what counted as manifest content ("clearly implied") were challenges. When the scheme was first applied to data, it was assumed that the problems, needs, and likes categories were mutually exclusive. The same was assumed for the tool, Info Select, and scholarly work subcategories. In fact, neither scheme consists of mutually exclusive categories. A single unit might describe both a tool need and a scholarly work need, or both a problem and a need. For example, the unit "searching may not find it because it doesn't include that keyword" could be classified as a word-search problem (FQ and PT) or as a need for a file-scanning tool (NT and FS). Problems often imply needs, and needs imply likes. The boundary between "clearly implied" and not so clearly implied had to be specified.

These issues were resolved with more coding rules. It was decided to treat the categories as mutually exclusive. Units that could conceivably be coded in more than one

way were coded in the most obvious way. Adding keywords to the Code Book lists made this process less subjective. In the rare cases where a unit strongly required two codes, the unit was split up or repeated so that both codes could be applied without arbitrarily choosing one and throwing away data. The problem of implications was handled by being conscientiously cautious in making implications, using the Code Book keywords and their synonyms and not coding a unit that required "bending the rules" or creative imagination.

One final problem, for coding according to these additional schemes, arose when a unit was already coded as a behavioral unit. Sometimes the AfFORD-W code needed to be modified, because the problem, need, or like related to a different category than the behavior, as when a behavior (in one category) caused a problem (in another category) (e.g., filing something away, fA, results in not being able to display it, DS). This was handled by making a duplicate of the unit and revising its AfFORD-W code to match the new focus for scheme 2.

Tools and Tool Features

The final coding scheme, scheme 3 on the table, was tools and tool features. Tool was operationalized as an information technology device or aid for performing scholarly work, limited, for purposes of this research, to physical devices, manual and electronic (and not including information products: notes, outlines, books, and activities serving as methods or strategies of scholarly work, such as note taking, outlining, and writing). Tool feature was operationalized as an operation or function a tool provides as well as an attribute or characteristic of a tool that affects its operations or functions. More

specifically, tool features include, for computer tools, all of the features listed as basic tool features, and features such as those listed on the Info Select Checklist and the Tool Evaluation Form (all included in Appendix A and all based on the literature review in chapter 2).

The tool/tool features coding scheme has three levels of categories. On the first level, tools and tool features were identified and classified as either manual, TM, or electronic, TE, using the existing database of units of analysis (all units already identified as scholarly work behavior or problems, needs, and likes). The second level of tool analysis involved pulling out units that were already classified as tools and as problems, needs, and likes, resulting in tool/tool feature evaluative statements. In other words, this classification scheme focused on units coded as problems, needs, and likes that involved tools or tool features. There were no unitizing or coding problems, because no additional classification was needed.

The third coding scheme for tools applied the BTF subcategories (listed in Appendix A) to any units in the entire database that mentioned one of these basic tool features. Classification for this scheme was straightforward, relying mainly on keywords (time, efficient, easy, fast, etc.).

Same-coder reliability tests, or recodings over time, were conducted for these additional schemes to reach a high level of agreement.

Displaying the Data

Clustering and counting are 2 of the 13 tactics Miles and Huberman (1994, p. 250) describe for making sense of qualitative data: for generating meaning and for understanding the data at a higher level of abstraction. This section discusses the role of these two tactics in the display of data resulting from this research.

Data Map

Data display provides "an organized, compressed assembly of information that permits conclusion drawing and action" (Miles & Huberman, 1994, p. 11). It ranges from the extended texts of ethnographic studies to the tables and graphs of experimental research. This research uses conventional tables and graphs to display the quantitative and summary data. A graphic designed to represent the categories of the scholarly work process proposed for this research is used to display the coded data resulting from the content analysis. Referred to as a data map, it displays the scholarly work process as a set of overlapping categories serving as containers for codes representing scholarly work activities (see Figure 4).

Initial attempts to depict the scholarly work process on a flow chart were abandoned when too many arrows going in all directions were needed to represent the work flow scholars seemed to be describing. This research was not designed to sort out the steps or stages of the scholarly work process. Instead of a flow chart, the data map, with ellipses as containers or classification bins for the codes representing scholarly activities, seemed more appropriate. There is no obvious beginning or end to either the

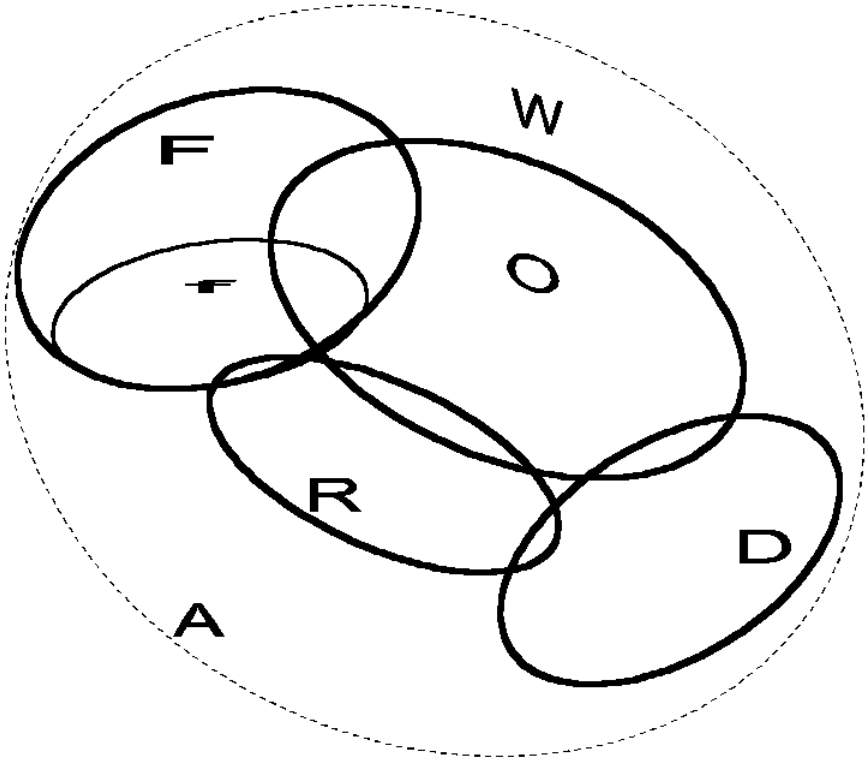

Figure 4. Data map: Major categories of scholarly work process, based on multiple case study results. A=Add, f=file, F=Find, O=Organize, R=Remind, D=Display, W=Write.

circles or the scholarly work process, and categories may overlap with other categories in as-yet-undetermined ways.

Evolution of data map during data analysis. The original data map (Figure 5) consisted of four slightly overlapping ellipses labeled FORD, intended to display, evidence of a scholar's coded activities. The O circle was drawn slightly larger than the others, because initial data indicated that more activities would need to be mapped in this category. The overlapping boundaries of O and F were intended to suggest, tentatively,

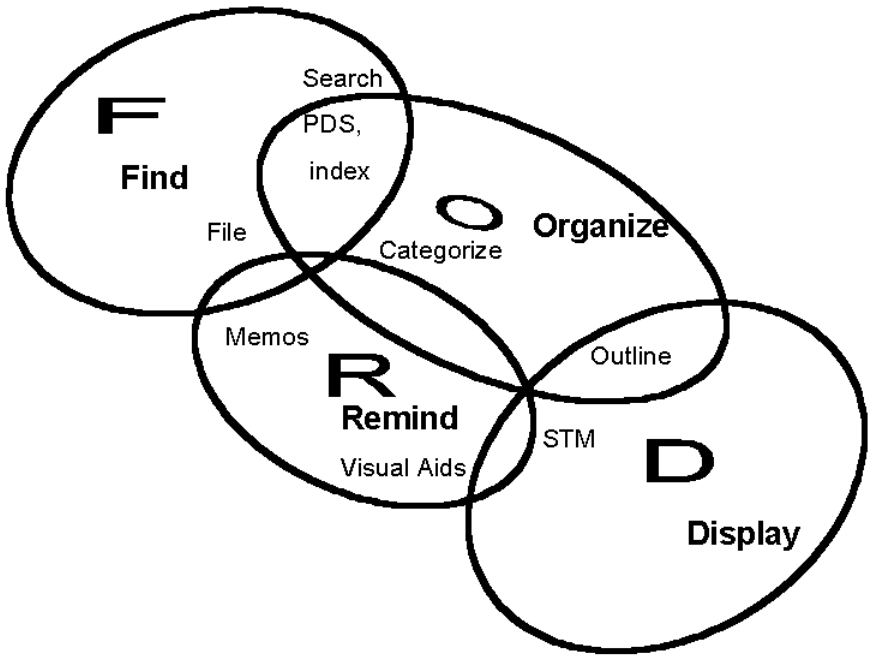

Figure 5. Original FORD map: Theoretical framework of scholarly work process categories, based on review of literature.

that finding information is closely related to organizing and classifying information. The activities of indexing and filing the information were so intimately tied to both F and O, they were located within the overlap area. Similarly, outlining was located in the O-D overlap to suggest its dual role as an organizing activity and as a way of displaying the structural relationships of information. The overlapping boundaries on the map allow for the possibility that categories may not be mutually exclusive. They reflect uncertainty as to where to draw the boundary line and how large to draw the category relative to other categories.

Each subcategory code was located in a particular area within its major category on the map. Although these locations were at first arbitrary, an attempt was made to locate codes close to related codes if a relationship was suspected. For example, A:R was located close to fA and FG (adding references, filing, and gathering information), and OH was near W-O (outlining and writing using an outline). Figure 6 shows the locations of codes on a template data map; Figure 7 shows the same in descriptive words instead of codes. Early use of the data map proved it was feasible to plot the actual codes on the maps at their assigned locations, thereby displaying the greatest amount of data and retaining specific details, without sacrificing readability. Viewed individually and compared across scholars, these maps might reveal the patterns and variability of scholarly work.

As the coding system evolved during data analysis, so did the data map. When the A (adding information) and W (writing) categories were added to the coding scheme (based on the transcripts), A and W circles were added to the original FORD data map. The A and W categories were not the primary focus of the study, but scholars mentioned activities in these categories frequently. Adding information and writing seem to be pervasive and ongoing throughout the scholarly work process. To reflect this reality, the original FORD circles were surrounded with the A and W categories, using a dotted-line to suggest a permeable, expandable outer boundary (scholars might have described many more activities that could be classified as A and W had they not been specifically instructed to focus on the in-between activities). Showing f (file) as a subset of F (find)

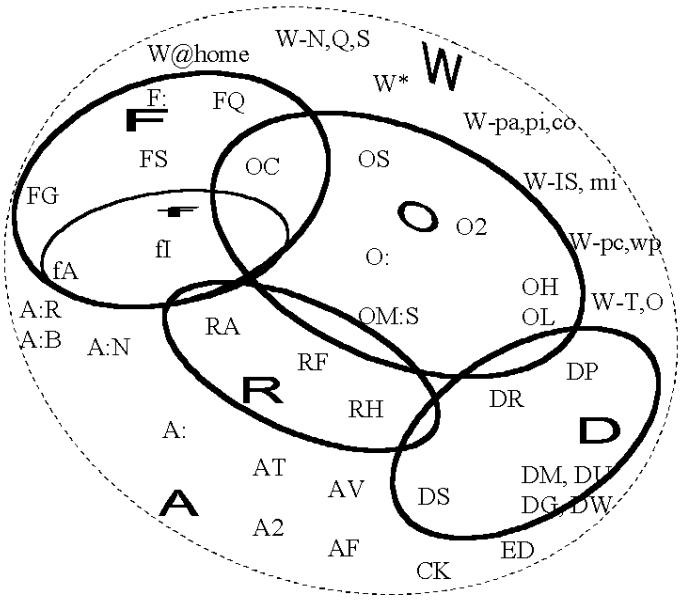

Figure 6. AfFORD-W template map, using codes. A=Add, f=file, F=Find, O=Organize, R=Remind, D=Display, W=Write.

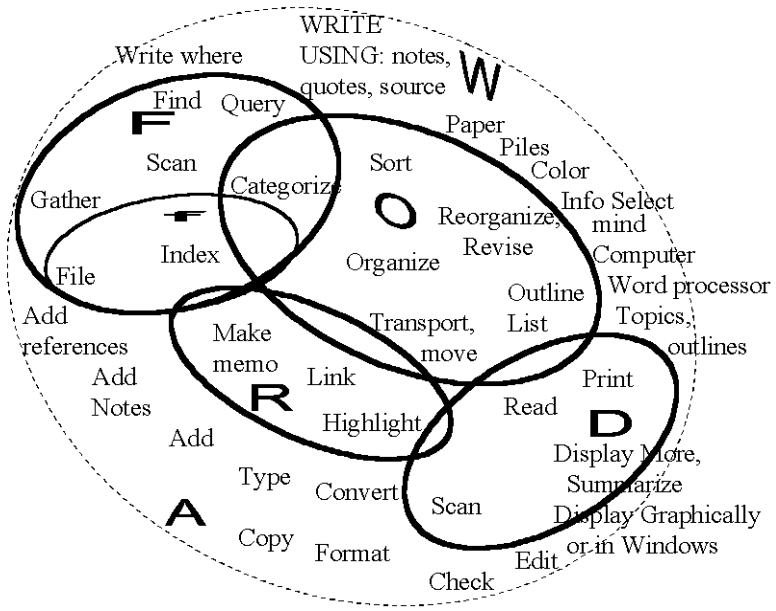

Figure 7. AfFORD-W template map, using words.

seemed to be a way of representing the uncertainty of whether they are one or two categories.

Data map versus table. Tables could be used to display the same data. Like the data maps, they would display who did what—activities in the various coding categories for each of the scholars. They would reveal gaps—no activity in a particular category, for one or more scholars. Like the data maps, tables would support drawing inferences or conclusions based on perceived patterns (e.g., many scholars mentioned x and z, few mentioned y, suggesting a possible correlation between x and z).

The data maps are used instead of tables because they capture the possible relationships among data categories and subcategories. On a table, such categories would be separated with no hint of a relationship. Another major advantage of the data map is that it can display the big picture better than a table. The data maps for scholarly work activities (Figure 11, p. 136) show the codes for 202 activities (after removing repetitions from the total of 550 activities), for all six scholars, on one page. That is a data reduction of roughly 120:1 (approximately 120 pages of transcribed narrative reduced to 1 page of display data). By presenting more information on one page, the data map allows comparisons that might lead to discovery of patterns and regularities not readily noticed otherwise.

Plotting the data. Data maps were used to display the codes for scholarly work activities and codes for problems, needs, and likes (change) related to these activities. Early in the data analysis, the codes for scholarly work activities were plotted on three

maps for each scholar: one map for data from the initial interview, one for technical support interviews 2 and 3 combined, and one for the final interview data. Three additional maps for each scholar displayed codes for problems, needs, and likes. The six maps for each scholar were displayed on one page. This within-scholar view of the data was a necessary but not particularly useful step in the data analysis process.

The same data maps were reorganized to view the data across scholars. The three maps for scholarly work activities were collapsed into one map, distinguishing codes from interviews 2, 3, and 4 with boldface type. Displaying the codes for all scholarly work activities on one map per scholar, and the six scholars' maps on one page, to compare results across scholars, proved to be more useful than the earlier within-scholar display. The same method was used to study the data for problems, needs, and likes. These across-scholar displays are used in chapter 5 to display the research results.

Frequency Counts

The data map shows categories instead of territories, and subcategories instead of cities and towns. As a metaphor, it suggests that each scholar has created a world of his own, his own version of the generic map with its hypothetical cities. Unlike most geographical maps, however, the data map used in this research does not represent the population (the number of instances of an activity occurring in the scholar's behavioral repertoire over any given period of time). The map shows the existence of an activity, but not its frequency or prevalence.

Although counting plays a role in qualitative research and especially in content analyses, it is important to know "when it is a good idea to work self-consciously with frequencies, and when it's not" (Miles & Huberman, 1994, p. 253). Deciding when to use frequency counts was a particular challenge for this research.

After the data were unitized and coded, it seemed logical to count the number of times an activity or problem was mentioned—by a particular scholar and by all scholars. Tallying the codes in a category seemed useful for adjusting the size of the circles on the data map. The tallies indicated that most scholars talked about adding and organizing information more than anything else.

Frequencies were not used to report data units, however, because:

1. The open-ended interview technique provides no control for verbosity and repetition. Some scholars talk more than others; some repeat themselves within or across interviews. There is no reason to believe that verbal repetition means the scholar does the described activity more often than a scholar who mentions it only once.

2. The major coding categories are not divided into an equal number of subcategories. The A and O categories may appear stronger, with a greater number of coded units, simply because these categories are more finely differentiated by the coding system.

Instead of reporting frequencies for mentioning an activity, this research reports only presence or absence. The data maps show whether an activity was mentioned at all, for each subcategory. Repetition was deliberately eliminated from the data maps (although

not from the units lists in Appendix B). When results are discussed at the level of major categories, a slight concession to frequencies is made, by focusing on categories for which at least two subcategories were mentioned by scholars (unless the uniqueness of an activity seems worth discussing). (Not mentioning an activity, however, cannot be assumed to mean the scholar does not do that activity or have opinions about it.)

Counting does play a role in the data analysis, however, in displays and discussions of coded categories and subcategories representing how many scholars mentioned the existence (at least once) of an activity, a problem, need, or like, or a tool or tool feature. The assumption is that if only one or two scholars mentioned an activity, it might be idiosyncratic; if three or more scholars mentioned the activity, it might be worth looking at further as possibly representative of the scholarly work process.

The purpose of this study was to observe and describe activities of the scholarly work process. Classifying activities into the 35 coding categories was a way of identifying at least that many variables. This research was not designed to measure those variables or determine relationships among them. As exploratory research, the goal was simply to begin to identify the variables and to describe those identified. The results are presented in chapter 5 in the form of descriptions of the range of scholarly work activities and themes that emerge from looking at the data generated by multiple case studies from the several perspectives discussed in this chapter.

CHAPTER 5

RESULTS

This chapter presents the study's results in three sections, after a brief review of the available sources of data. The first of these sections consists of six case study reports, each a narrative description of a scholar, his work, and his participation in this study. These reports summarize the descriptive detail provided by each scholar to establish a context for the quantitative and content analytic results that follow. The next section describes the scholars' Info Select usage patterns, drawing on the quantitative data provided by data sheets, duration logs, and the Info Select content files. The results of the content analysis are presented in the final section, organized according to the two research questions.

Review of Data Sources

Transcripts of what the scholars said during the four interviews are the main source of data. All six participants completed all four interviews. The interviews lasted from .5 to 1.5 hr and produced from 7 to 25 pages of transcribed verbal descriptions. These transcripts are supplemented in two cases by email correspondence. The results of a content analysis of these qualitative data are presented in a later section.

The Info Select Checklist (Appendix A) was used during training and the two technical support interview sessions to record training needs and progress, and in the final interview to indicate features participants used, had problems with, and liked. The Tool Evaluation Form (Appendix A) was administered in the first and final interview sessions to

collect information on which activities are important to scholarly work and which Info Select features the participants considered helpful. The data resulting from the use of these two forms are described in the final section of this chapter, on tools and tool features. A very short Computer Tool Survey (Appendix A) was administered in the initial interview to find out what types of computer software the scholars have used and how they rate their level of expertise with each.

Journals and logs kept by three scholars as Info Select notes provided excellent supplemental data. The qualitative data from these journals (as well as email correspondence related to Info Select use) are included in the content analysis of interview transcripts. Journal data on session frequency and duration supplement the automatic log files, which is especially important for S1, whose automatic log file was lost when his computer crashed before the file was collected.

Data sheets (usage logs) (Appendix A) were given to the scholars to record day, time, and activity data after each session of using Info Select. Only two scholars used the data sheets enough to provide useful, comparable data. A tally of their checkmarks indicates their Info Select activities for the sessions, and the time data on these sheets provides usage durations that corroborate the log file data.

The log file contains data automatically recorded by the Info Select program each time the program is used. The date, the times the program was opened and closed, and other information not relevant to this study were recorded in a log file called assert.txt. A copy of the scholar's log file was obtained at each interview. These files provide session

frequency and duration data. They are invaluable, providing data for the scholars who did not use the data sheets and verifying the accuracy of the data for those who did. The session dates and time data were transferred to a database, which then calculated the durations and totals and provided descriptive statistics.

The Info Select content file (overview.wd2) containing the scholar's work was collected at least three times from each participant. These files serve as usage products. A description of their content supplements the scholars' descriptions of their scholarly work. The file size and item totals (how many topics, notes, and references they contain) reveal usage patterns not otherwise obtainable and clarify the duration data.

Table 4 summarizes these sources of data, showing which sources are available for each scholar. The data triangulation included in the research design proved useful, minimizing the loss of data when one participant's log file was lost and providing corroborating evidence that the automatically generated log file could be trusted. (Arrows on the table show which data supplemented the important duration information in the Info Select log files.) It was unlikely that all scholars would take the extra time to record in journals and keep data sheets, but these extra sources of data, when provided, were valuable.

Scholar Descriptions: Case Study Reports

This section describes the cases in some detail, to provide a background for the presentation of results that follows. Each scholar is described in the context of his

Table 4
Available Sources of Data

Scholar	Inter-views	IS Cklists	Tool Evals.	Journals	Data Sheets	IS log files	IS content files
1	√	√	√	√	→		√
2	√	√	√	√	→	√	√
3	√	√	√			√	√
4	√	√	√			√	√
5	√	√	√		√ →	√	√
6	√	√	√	√ →	√ →	√	√

Note. Arrows indicate sources of data supplementing the duration data from Info Select's automatic log files. IS = Info Select.

scholarly work: his current projects and goals, his usual scholarly work activities, and his use of tools, especially computer tools, to accomplish his work.[9] Highlights of the scholar's use of the Info Select program focus on changes in the scholarly work process and ongoing activities that became more observable through the use of the program. Problems and solutions that emerged during the study are described briefly, often in the scholar's own words. These summary descriptions are a distillation of the four interview transcripts (20-25 pages each), supplemented, for some scholars, by journal entries and email correspondence.

[9] Not all of the participating scholars were men. However, in an attempt to preserve their anonymity (as well as simplify the narrative), I refer to each using male-gender pronouns. For the same reason, I do not mention the scholar's location or field in the descriptions that follow. Scholars are referred to throughout by an identifying number preceded by "S" for scholar. Identifying numbers were assigned consecutively when scholars began their participation. Coincidentally, odd numbers refer to faculty and even numbers to doctoral students.

Scholar 1 (S1)

A tenured professor, Ph.D. program director, and scholarly writer, S1 was working on the new edition of his well-known textbook during the time of this research. He described his project as being in the "thinking stage" of analyzing the content of the book and the literature of the discipline to identify and gather information that should be included in the new edition. He was currently reading books and articles, taking notes, and sorting the notes and putting them into chapter folders, systematically building up the chapters over time. He would at some point "sit down and sort all those folders out," keeping the book's objective and intended audience in mind.

The book's current table of contents served as the initial outline for the project. The outline, according to S1, is "where the thinking is . . . the critical thinking." It is the "roadmap" that provides the logical sequence for an organized first draft, resulting in less rewriting and therefore greater efficiency. The outline is both a starting point and the result of analyzing the literature and deciding what to include in the book.

Next comes the "creative writing stage," involving capturing ideas ("scribbling") with no focus on syntax or grammar. Asked to elaborate on this process, S1 described "the mechanics of what I do." He said he does all creative writing with pencil and pad. Working on a computer at this stage is distracting, scrolling through a file is frustrating; flipping the pages on a pad is easier and twice as fast. At some point, he rips the pages off the pad, sorts them into piles, and staples each pile together with a label for the major idea on top.

When he is ready to start working on individual chapters, he types useful notes and "scribblings" into a computer file and throws the rest away. He starts with the difficult chapters, saving "the fun part" for last. These are still notes, not narrative. He uses the computer mainly as a word processor, a typewriter; he composes and revises by hand. After typing the notes into the computer, he triple-spaces them and enlarges the font, then prints them out and organizes by cutting and pasting (with scissors and tape), crossing out, inserting with arrows and symbols in margins. He uses these reorganized printouts to compose "the first real draft" on the computer, then prints again and does extensive revisions by hand. He finds trying to revise on the computer to be "awkward"—with paper, you can spread out the pages and see 10 or more pages at once, and "there's no scrolling." The computer, however, is great for fast typing and doing a spell check to catch the typographical errors.

The notes, now in computer files, in subdirectories by chapter, are kept in case the book editor questions a fact or reference later. An extensive ongoing bibliography is compiled on a paper pad, with references numbered so notes can be keyed to the references. S1 saw no reason to try to keep references in alphabetical order, but admitted that looking up a particular author "becomes pretty difficult" when the list grows to 400 or more citations. At end of the project, he types up a reference list, using only the references cited in the book, and sorts them on the computer. He said he would rather browse the handwritten bibliography than scroll to find a reference.

Asked specifically about computer applications that help him with his work, S1 said that he considers grammar-checking software "next to useless." He does not use outlining programs, or databases, but he does use an automated indexing program. He prefers to take notes manually and do revisions using paper because he can work anywhere, even on the sofa "during TV commercials." Asked about problems in doing his scholarly work, S1 mentioned that his method of "working piecemeal," which he also called "organized chaos" (working on chapters out of order and scattered across a long time period) leads to duplication: He forgets what he has already written.

Using Info Select. A scholar who considers organizing and outlining as the secret to good writing, S1 saw the potential of Info Select for his major categorizing/outlining project. After the initial training sessions, he made an extensive outline using Info Select and the table of contents of the previous edition of his book. His plan was to develop the outline further and type the notes from his chapter folders into the outline topics, where they could be easily reorganized and expanded. After creating the initial outline, he made a duplicate copy of it to use as his working copy. He imported existing text files and an extensive index from his word processor, and started developing a glossary. He typed highlighted notes from sources into Info Select notes, and took random notes while reading. He found it helpful to record ideas in Info Select "before I forget" them and to be able to search on a term to find out where in the outline to put a new note.

He used the program to create a reference list keyed to the numbered sections of his book outline. At first putting the references in a single note, he then discovered the

value of splitting them into separate notes that could later be sorted and reorganized as well as searched. He realized that having his outline and notes in Info Select solved his duplication problem, because instead of relying on memory he could now do a simple word search to see if he had already covered a topic. As he became more adept at reorganizing notes by dragging them, he realized he could work more efficiently on the computer and not keep "clinging to the manual method" of printing out and revising with paper and scissors.

The best feature of Info Select, for S1, was the outline processor. As "an outline person," he appreciated being able to create outlines, easily revise the outline structure, and view the outline simultaneously with the notes. He discovered the value of preserving previous outline versions to compare with the latest version. Summarizing his experience with the program in his journal notes, he called it an aid, saying it makes organizing easy, "allows you to see what's going on, thus allowing you to make decisions and get ideas," reduces the time involved in manually revising text, makes things easier, and promotes ideas.

Scholar 2 (S2)

A doctoral student in the final year of his degree program, S2 was working on two articles for publication during participation in this study. He was also conducting government-funded experimental research, collecting and organizing information for his dissertation review of the literature, and preparing conference presentations.

In doing his scholarly work, S2 reads the literature, makes notes on a copy of the paper or chapter, and then types notes and reactions to the text into the computer immediately. He records all notes for a paper or project together in one file, and saves the file by author and date. When he was studying for his qualifying exams, he kept all such notes in one subdirectory and reviewed them on the screen. Projects and different subject areas are organized by subdirectory. He makes no printouts.

He has tried two different methods for writing a paper, neither of which he considers ideal. One method is to keep all notes in one long file and move (copy and paste) parts to the end of the document when writing the paper. The document tends to become too long, making the process inefficient. Another method is to keep notes in different files and the manuscript in a master file. In this case, switching documents slows him down.

In writing a paper, S2 makes a very rough outline only if "nothing's occurring." To get started again, he jots down ideas or topics. This rough outline or list serves as a prompt to generate some writing, not as a guide for writing. More important, when he has a problem writing, is looking at the graphs and jotting down points that summarize the results.

S2 has a filing system for source articles and books, but not for notes. He seldom tries to go back to the notes he has recorded in the computer, because finding them "gets to be such a pain," but he feels that he needs to be able to retrieve them. He often can remember who said what, but cannot remember the paper or year, so he has to open and

scroll through files to find something. The word processor's search feature is not useful, because he still needs to remember which file to look in, then search it, which "sort of destroys the whole point of keeping your notes in the computer."

Another problem with browsing or searching for something is that "something else catches my eye" when scrolling. He may get off track on something for hours, forgetting his original task. He brought up this issue of the "flow" of his writing and thinking processes several times during the interviews. Also important for S2 was being able to classify and explore the data to discover patterns. He uses spreadsheet and graphing software for this purpose.

Using Info Select. S2 had no problem learning how to use Info Select's features, completing the entire tutorial in 3 hr. He probably used the program more than any other participant, using most of its features for some serious scholarly work. He used the program to store references, with and without abstracts and annotations, organized by topics for his dissertation; to take notes for his dissertation, experiments, and grant proposals; to keep a research log and to record summaries of research meetings with his advisor; and to capture miscellaneous ideas (jokes, reminders, and ideas for future writing). In the last couple of months of the study, he used the program to do the actual writing—the narrative for articles or chapters.

In using the program to organize references, he was pleased to discover he could capture the results of an online library search, including abstracts and descriptors, and import them into Info Select. He annotated the references with his own notes and

reactions and then sorted them into appropriate nested topics, using the terms "fantastic" and "beautiful" to describe his new personal documentation system. He expected the search feature to become important soon, perhaps helping him search for patterns in the data described in the notes. For now, he would occasionally search on a word or phrase "just for fun."

He felt that his use of the program was "perfectly timed," because he "needed to be able to have bits of information I could move around" and look at "in a flash." Being able to organize and reorganize the notes, breaking them up and categorizing them into finer details than ever before, allowed him to see details and patterns he would not have noticed. "I'm doing different kinds of things," he said. "I wouldn't have organized in this way before, because it's just too labor intensive."

In Info Select, he said, he did not "get hung up on the flow of it" as he sometimes did with the word processor. It was easier to separate out a section to work on, focusing on one section at a time—a method S2 called "atomized writing." If he got an idea about something else while writing, however, it was also easy to immediately categorize the new idea without interrupting the flow.

Trying to anticipate future needs, he wondered whether he should use keywords to index his notes. He expected to want to organize some notes in unique ways, e.g., by procedural issues, now that he was using a tool that would allow him to manipulate information in new ways. When he learned how to create a new topic from the results of a word search, he immediately saw how that could be useful. Asked if he could imagine a

tool that would help him with his scholarly work, S2 said his "Christmas list" would include a tool that could do everything Info Select does plus provide him with the full text of source articles, "so that my reading and my writing would be integrated." An agent within the tool would retrieve articles from the digital library within seconds: "I think of a paper, and it's instantly available."

Scholar 3 (S3)

Tenured professor, former department chair, scholarly writer, and researcher, S3's field work and publications have covered a wide diversity of project topics. Nearing typical retirement age with "no intentions of retiring soon," S3 plans to increase his productivity in the area of scholarly writing and continue teaching. His greatest reward, he said, "comes from the classroom and interacting with young people." In recent years, S3 has become a web site distance learning innovator who considers himself to be "on the cutting edge of technology application in the classroom."

His current writing project involved preparing an introduction for a publication of symposium articles presented last year at a national conference. His main use of the introduced software, however, was in preparing instructional material and summarizing classroom lectures for later use in designing exams and future courses.

In describing his scholarly work process, S3 said he begins writing as soon as he begins to collect data in the field. Typing or dictating notes is analysis, is thinking. Creating thorough notes and then writing papers about the data as soon as possible "helps

you pull it together." Delivering papers at meetings involves defending your ideas, which helps you develop your ideas and understand your data.

Earlier in his career, S3 dictated notes into a tape recorder and had them transcribed. Now he types them into the computer, in short word processing files. Sometimes he indexes them, by leaving half the page blank and adding keywords or additional annotations. He then studies his notes, either on the computer or on printouts, looking for themes. By the time he is ready to write for publication, he has analyzed his data thoroughly and written, presented, and defended papers on the topic. Now he will "just sit down and write 200 pages—I have it all in my head."

Asked about whether he uses outlines as a writing strategy, S3 said he sometimes jots down ideas, in pencil, but outlining is "not that productive." He may review his outline-list occasionally, as a getting-started activity ("mainly it's just getting my ideas in my head"), but he rarely revises or continues to work with an outline. He abandoned the use of notecards long ago, because he "couldn't keep them straight." Instead, he kept typewritten copies of his notes in notebooks until he began to use the computer.

The typewriter had a major impact on his writing, S3 said, because his handwriting is "horrible" and he needs to see his notes neatly printed. Now he composes on the computer, but it has not increased his writing productivity as the typewriter did, because of competing activities (email, the Internet): it "tends to distract my writing process, my thought process."

Although the computer is not the perfect writing tool for S3, it solves, or should solve, other scholarly work problems. S3 considers email and the Internet great for sending information back and forth between colleagues. The main advantage of the computer, however, is that "it has a perfect memory." S3 has an entire filing cabinet of notes he plans to throw away because nothing is filed in any indexed way to be retrievable. His filing system "has always been a disaster." He cannot find transparencies for class lectures if he keeps them in piles, and printouts inevitably get lost. S3 said the computer solves his problem of keeping track of information. He said he has no computer filing problems and no need for a computer search program. Questioned further, however, he admitted that his computer filing system "probably could be better" and that he has no problem finding things because "I'm looking at them every day." He mentioned later, twice, that reorganizing files in subdirectories takes time and "then I can't find things." The computer's perfect memory may be a potential not fully realized.

There is a certain ambiguity in S3's use of computer tools that is difficult to describe. He has always explored and used the most current technology. He was using Windows 3.0 on a stand-alone work station when everyone else was using the DOS operating system; he experimented with an early DOS version of the Info Select program. He began developing web pages for his course material before most instructors ever heard of the term "distance education." On the other hand, when he began participating in this study, he had no experience with file management software and was depending on others

to organize his files in subdirectories and transfer files to his web site. Learning new software seems to require effort and time, but he is aware of its value, and persists.

Other than the file-organization problem, the only other scholarly work problem S3 mentioned is finding the time to do more writing. With a full teaching load and his web site development project, little time is left for scholarly writing. He says he has "never been disciplined enough to sit down at 6:30 everyday and write until 8:00 in the morning."

Using Info Select. S3 said he was "excited" about using Info Select and felt "motivated" to get back into scholarly work by the prospect of using it: "Maybe using the IS software will get me started on writing." He talked about how he planned to use the program for course lecture notes, journal writing, and his symposium introduction writing project. He predicted that the program would help him organize his notes and ideas in ways he never could with paper notes and filing cabinets, possibly allowing him to handle more information than he could in the past, when he had to have it all "in his head" for writing.

Learning the program's features was not easy. Certain basic features, especially related to indenting notes under topics, continued to cause him problems throughout the 6 months of the study. He persisted, however, and eventually used most of the program's features—and was proud of his results. He used the program more than any other scholar in the study, and considered it to be a valuable new tool for his scholarly work.

At the beginning of the second interview session, S3 said "I think I've really found a system that I can write well with." He had used the program for his writing project, and

had found it to be a "positive writing experience." After using a scanner to copy quotations and other source materials into Info Select, he was able to pull notes directly into his writing without retyping. He found the program useful for storing random notes, "a note here and a note there," and appreciated being able to can "pop back and forth." He said this was the first time he was able to find quotations when he needed them. After systematically creating notes and summarizing scanned material, he found that "when I finally sat down to write it, it came very easily."

After he started using Info Select for this research study, S3 started typing up notes about his class lectures immediately following the classes. He did this because "it was a more manageable system, one where I could recover the notes and keep records." He used the program to keep track of what he covered in class, in order to develop subsequent lectures and eventually exams, and teach the course in future semesters. He felt that being able to organize and then find the information helped him produce better-organized lectures.

Other uses for the program included developing and printing overheads for class, rereading notes to explore an idea, planning future projects, handling correspondence, and starting a reference system. After experimenting with several reference programs over a period of years, and installing one on his home computer but not using it, he decided, at the end of this study, to use Info Select for references because he would be able to add notes and keywords easily, and his references would be more accessible in the same system as his notes and reminders.

The value of this tool for S3 can be summarized in his statement that "it's given me an organization I never had before." He repeated again and again: now he could find things. This value does not seem to be related to a specific tool feature, such as the search feature, because there is no strong evidence that S3 even used the search feature. It seems more likely that the program provided a set of useful tool features in a single accessible program that made it more likely he would record information systematically.

Scholar 4 (S4**)**

A doctoral student just beginning to define the area of his dissertation research, S4 is still taking courses and working full time. He expressed interest in participating in this study when Info Select was demonstrated at a colloquium, because he saw its potential for helping him organize the information he would be collecting for his own research. At the time he started participating in this research, he was working on a couple of papers with his faculty advisor.

When he begins a scholarly project, S4 gathers source material and makes a personal copy. He marks information he will want to get back to later, using a "three-tier system" of highlighting, circles, and asterisks to indicate the importance of the information. These marks make it easier to find something later, when he thumbs through the book or article to gather information.

S4 does scholarly work on the move, in whatever location he finds himself. He keeps books and articles handy in his car to read in a coffee shop, while waiting for someone, whenever he has the opportunity. He takes notes on scraps of paper, napkins in

the coffee shop, on a legal pad or in a spiral binder. He copies passages from a book, to use later, adding a reference citation to identify the source and page number. The computer is a valuable tool for writing, but not portable enough for note-taking on the go.

When he gets to the writing stage on a project, S4 uses the computer "for putting it together" after gathering information and making handwritten notes. He types the notes into the computer and then cuts and pastes to organize them according to an informal, mental outline of main points or categories. Then he proceeds sequentially, going from point to point, filling in with the word processor, synthesizing his own thoughts with ideas and quotations collected from the literature. Sometimes the mental outline takes on a physical form, resulting in a pile of source articles being divided into several subcategory piles, sorted, labeled, and then used during the writing process. The writing takes place mainly at the computer, although sometimes S4 prints out what he's done, leaving blank spaces to fill in by hand, before typing the additions and correction into the computer.

The bibliography is usually done later, although S4 is trying to get into the habit of doing it up front, to save time later. He has used notecards for keeping track of references, intending to set up a database for bibliographic material at some point. Mainly he keeps references in lists copied from source material, on lists he has developed, and on scraps of paper. He has not yet decided whether to purchase bibliographic software or develop his own system. In the meantime, bibliographic notecards and source articles are filed alphabetically in a filing cabinet, with a separate file for dissertation articles, after they are

kept for awhile in stacks or his briefcase. Notes are not saved, either on the computer or in files or stacks. Instead, he saves the finished product, a printout of the final paper.

Another activity of S4's scholarly work process is "crunching the data," creating charts and tables to analyze and display the results of results. S4 prefers to keep this activity separate from the writing process: "When I'm writing, I like to write." He uses a spreadsheet program to manipulate the data, and refers to the data with an "insert table" reference in his word processing document.

S4's greatest problem, or "difficulty," in doing scholarly work is memory, "unless I make a conscious effort to create some organization." He reads something, says "I gotta remember this," and then forgets where it is. His three-tiered highlighting method helps but is not foolproof, because he has to remember to go back to that source to review the marked material. If information captured on scraps of paper "gets lost in the shuffle," he may decide to do without it, saying, "Well, OK, I guess I can write this paper without using that, but I sure wish I remembered where it was."

Finding time to organize the information is a problem, for a scholar who is also working full time in the business world and still taking courses. The need for an organized system has become acute: "I'm starting to get overwhelmed with all the stuff I'm collecting."

Using Info Select. S4 saw Info Select as a potential solution to his memory problem. He felt it would provide a system for organizing and keeping track of information, keeping it at his "fingertips" or allowing him to find it with the search feature.

He began putting information into the program instead of onto scraps of paper, remarking, "Now, it's more meaningful to me, and certainly it's something I can find more quickly."

During the first 3 months of his participation in the study, he created a topic with seven brief reading notes, a topic with two chapter-summary notes, and a topic for miscellaneous thoughts containing four notes. All notes were a screen or less in length. In the next couple of weeks, he planned a vacation trip to France, adding 32 notes identifying cities, lodging, and restaurants, and printing out the results to use when consulting a travel agent. These notes were organized alphabetically and had extensive formatting (boldface, underline, indent, font, and color). He did not add anything to the system during the next 3 months in the study.

Learning how to use the program was not a problem. S4 caught on fast and seemed comfortable with all the basic features and many of the more advanced features. In the second interview, he seemed pleased with his scholarly notes, saying, "These are things I can go back to." He asked about ways to link notes across topics, and was glad to hear there was a feature to add that extra level of complexity to the organizational structure. He also expressed a desire to interface the program with a hand-held device that would let him scan in bits of information instead of marking sources manually and then typing in the information.

By the third interview, S4 was realizing that finding the time to get the information into the system was a real problem. He wondered how much of the source material to include (all of it, an outline, or selective brief notes), for the system to be useful. He

speculated again about a hand-held, portable device to easily take notes in a coffee shop or wherever he happened to be, commenting that most people do not read the literature at their desktop computer. In the final interview, S4 described the problem as not only finding the time, but being "more diligent" about getting the information into the system and organizing it. He still wanted "to be able to sit in the easy chair and get that information direct into some type of digitized storage device."

Overall, it appears that S4 recognized the potential of this computer tool to augment his scholarly work, but did not realize the benefits—for various reasons having to do with time, effort, and "self-discipline." Asked if using the program had changed the way he works in any way, he said, "Yeah, it tells me to be more disciplined in my note taking!" He was not sure whether he would actually change his work habits, but he stated that his participation in the study "provides me with some impetus to discipline myself with my note-taking and diligently find the time to plug that information into Info Select, because it is pretty easy to use."

Scholar 5 (S5**)**

S5 is a tenured professor, department chair, and prolific writer in his field. During the 3 months this scholar participated in the research study, he had six writing projects (papers, chapters, and conference presentations) in process, working "in spurts" on one, switching to another, depending on external deadlines. Because of heavy demands on his time, S5 completed most of the work related to this research during the first month of participation, which was Christmas break.

Describing his usual scholarly work process, S5 said he makes a rough outline or sketch of general topics for the project and then starts writing. He occasionally refers to source materials read previously, but mainly just writes a draft and checks references later. He may write 10 or 15 pages, decide the writing is not moving in the right direction, and throw out the whole first draft and start over. The first part of the piece, which serves as a framework for the rest, is the hardest to write. This scholar may rewrite a paper five times, or more, making major changes at first and minor changes in later drafts. When he is not throwing out a draft to "start over from scratch," he is rewriting sections, moving or deleting parts, adding to the ideas, or, later, revising based on reviewers' comments. He does not revise the outline after starting to write, but he may change the structure of the headings and sections during the writing.

When reading source material, S5 uses a pencil to make marginal notes or underline parts to remember. Important articles are copied and added to the scholar's collection to be referred to again and again. S5 makes notes to commit information to memory, then rarely goes back to the notes. Textual notes are typed into the computer, and schematics are drawn on paper. Writing is done at the computer, using a word processing program.

S5 writes at home and does administrative and teaching-related work at school. He has a well-organized filing system in both locations, including file cabinets updated each year, bookshelves containing project notebooks, piles for current projects, and hierarchical subdirectories on the computer well-organized and maintained chronologically as well as

by project or topic. Even with a well-organized system and division of labor, the scholar finds it necessary to transfer files between the two offices and sometimes finds that a file needing a modification is not available at the current location.

Note-taking can be a problem for the scholar, according to S5. When you are taking notes for one project, you focus on the current topic; your notes are selective. Later, working on another project, you may or may not remember something you read but did not take notes on. Often you remember that you read something, but you do not remember precisely where. Besides the need to supplement partial memory, there is the need to find the information quickly. Pressured for time, S5 cannot spend hours reviewing notes, and wondered if the computer could provide a solution, making it easier to get back to previously taken notes.

A computer user for many years, mainly for word processing, email, and scheduling, S5 recognizes the potential of the computer as a tool for writers and scholars. The computer, S5 said, "has capacity that transcends what you can do with your own thinking and your own processing." The scholar needs to understand this capacity and learn to control it: "I could be a more effective writer if I used the computer more effectively."

Using Info Select. This scholar has used Info Select as personal information manager, minimally, since the DOS version, maintaining a searchable address and phone list. Although he was using the latest version when this research began, he did not know some of the basic operations, such as how to get a note into a topic and how to move and

reorganize notes. By the end of the study, he was using most of the advanced features, as well as the basics, and remarked, "I keep finding new ways to use it . . . because I need something that will do this."

S5 used the program to create reading notes and reminders (a to-do list and a list of pages from a book), to record writing and experiment ideas, to keep data on time spent in work activities, to type in direct quotations, and to develop a 90-item reference list. Many of the reading notes are extensive, lengthy, scrollable notes. This fairly extensive note-taking activity is not reflected in S5's initial interview description of the scholarly work process, and may indicate a change in work habits based on useful features of the program. In S5's words, "I really liked . . . having a place to put your notes and especially knowing that when I put them here I'll be able to get back to them."

Adapting to a new tool may require a paradigm shift, however: "I forget that I don't have to remember where they are." The search feature provided the potential to "pull together a lot of stuff that I probably would never have been able to pull together otherwise."

Info Select was probably of greatest value to S5 as a personal documentation system (PDS) to manage references: "This will keep me from having to go to the Internet . . . to find those references. I can just go in here and find it in my references." After creating an extensive bibliography, S5 coded the references for a specific paper, and later used the search and summary features to pull together the references for that paper and print out the list. S5 also coded some of the same references for a different paper, saying,

"I can see enormous potential there. . . . It's very personalized . . . everybody can build their own database."

Although computers have the capability of finding information quickly and effortlessly, according to S5, "the real challenge is to get the information into it." Sometimes scholars need to have full text available for searches, sometimes they need abstracts to skim through and find the exact information desired, and sometimes they want to be able to capture just a sentence or two while reading the source material. For S5, a wand scanner to accomplish the latter would be most useful.

Scholar 6 (S6)

A doctoral student who has completed the coursework toward his degree, S6 was studying for qualifying exams during his first month of participation in this study. He planned to use Info Select as a study aid and then to begin working on his dissertation proposal, collecting information to expand his 30-page literature review during second 2 months of participation.

S6 does his scholarly work at home, using photocopies and library books to write a first draft. He gets topic ideas in the shower or just before falling asleep. Next day, he jots down the ideas and then writes an introduction. Writing something "makes it real," clarifies the idea. Then he likes to let it simmer ("cook") for a couple of weeks before he continues writing, if there is no immediate deadline.

He uses electronic resources to identify sources and bibliographies, which he copies in the library to take home. He seldom takes handwritten notes, because of his

"miserable handwriting." Instead, he uses his laptop computer in the library for brief notes and citations. Back at home, he color-codes both the photocopies and his computer notes and introduction (thesis statement). Color-coding with highlighters and post-it notes supplements memory and precludes having to reread so much. The introduction serves as an outline of "rough points," which he expands as he reads the literature. The rough outline becomes the headers in his paper.

When he has enough material, he sits down at computer with piles of color-coded articles spread out on the bed. Choosing a color to start with, say, green, he will "sift through everything," pull out an article with green coding, write a paragraph, take another article, write another paragraph above or below, and "build that way." He writes "thinking at the keyboard." He considers this method of filling in the outline structure with facts, quotes, and connections to be the "most efficient way." After writing this rough draft with his word processor, he edits a printout, and then revises the draft on the computer. He likes to have someone else read the draft, and will often post it on the Internet, where he has a "network of colleagues" who review each others' work.

Over the years, S6 has collected "a huge clip file," which he is organizing with a personal database program called EndNote. The program lets him import search results directly from Dialog without typing any bibliographic information. He prefers to build the bibliography from the beginning of a project, having learned that saving that task to the end "put such a damper on the whole project." The clip file itself, the source articles, are

kept in three piles: the comps pile, the dissertation pile, and the "boxed-up, put-in-the-garage, throw-away pile."

Asked about ways computer tools or programs could help him do his scholarly work better, S6 said he wants to be able to scan in the full text of articles, then annotate and color-code them electronically. He would like the computer, as a modern-day version of Bush's Memex, to collate the highlighted information automatically. Referring to currently existing tools, he expressed frustration with Word's outlining feature and confidence that EndNote would solve the tedious clerical work of retyping or cutting and pasting references. Color-coding, he said, solves his memory problem: "Generally I write what I've marked and then I don't worry about it."

Using Info Select. S6 used the program intensively during his first week of participation, creating 16 topics and 79 notes to use as "flashcards" in studying for comprehensive exams. During the week before the exams, he brought the total to 34 topics and 140 notes (10% were imported files; about half were quite brief, many were screen-sized, a few were long and scrollable). The notes were informal, with no attempt to correct typos and spelling. He used these notes to prepare for exams, skimming quickly through the notes, glancing at a note and trying to talk about it, studying it if necessary. He concluded that, "for a mental task like the exams, it helped me to organize my thinking."

Doing library research with the program on his laptop, S6 found the outline structure helpful for discovering gaps, reminding him of research remaining to be done. He

experimented with taking notes during a group discussion and found that using the outline structure to jump to other notes or record new information "without having to scroll through my document or take my eyes off the group" was easy, and "much faster to work with than Word." Based on his overall experience during the study, he concluded that tool would be of most value in developing lecture notes for teaching (searchable in subsequent semesters) and any other "long-term knowledge management project": "Because the outlining in this is easier, it's easier to group things, it helps you organize your thinking . . . to think in those clusters."

S6 used Info Select very little (adding a single long note) after the two weeks of studying for his exams, probably for several reasons: (a) The program's incompatibilities with Windows standards bothered him. (b) Because of his expertise with so many other applications, he had little need for this program for writing or organizing bibliographic materials. (c) The need to write an application for his dissertation research postponed his proposal-writing activities beyond the deadline for this study.

Recruited to provide some variability in the computer expertise of participant scholars, S6 breezed through the 3-hr training session in less than an hour and began discovering new program features not included in the training. It seemed likely he would use the program in ways that would never occur to other scholars. His computer expertise, however, may have led him to focus more on evaluating the software for usability than on scholarly work issues. He found it frustrating that some program features were not compatible with Windows standards: there was no print-preview, no way to

select multiple items, no help index, no automatic warning of misspelled words. The program locked up a few times, perhaps because he was using more advanced features and "pushing the limits." His high expectations for software tools and his awareness of the program's imperfections may have limited his exploration of its potential as a scholarly work tool.

Info Select Usage Patterns

This section presents the quantitative data collected using duration logs, the Info Select content files, and the data sheets, to describe scholars' use of the Info Select program. These results support and extend the qualitative data by showing the correspondence between what participants say and what they do. The first part of the section describes Info Select usage patterns based on the content files and logs, showing how much time scholars spent using the program and what they did (how many notes, topics, and references they created). The data sheet results, presented last, are not as useful as predicted, because only two scholars recorded data using this instrument.

Durations and File Content

The duration data described in this section, compiled from log files, data sheets, and journal logs, are presented numerically in Table 5 and graphically in Figure 8. The file content data (file size and item totals), derived from the Info Select content files, are presented numerically in Table 6 and graphically in Figures 9 and 10. Total durations and sessions per day are included in Table 6 for easier comparisons.

Table 5

Info Select Usage: Session Duration

S#	Sessions[a]	Duration total, hr	Min/max hr	Average hr/session	Project time, months
1	~15[b]	~50		~2	6
2	124	163	0.16/7.2	1.3	6
3	136	370 (185[c])	0.18/12.7	2.9 (1.4[c])	6
4	17	13	0.17/3.6	1.1	6
5	58	82	0.16/9.98	1.5	4
6	33	53	0.19/8.8	1.7	3

Note. Does not include sessions of less than .2 hr (10 min).
[a] Session = opening and closing the software program.
[b] Symbol ~ indicates data is an estimate based on journal notes.
[c] Adjusted for "inflation" to half size, because S3 was not using the program all of this time.

S1 did almost all work in Interval 2 (between the second and third interviews), and none in Interval 3 (between third and final interviews). His duration data (50 hr) are estimated, based on his journal entries, which included dates but not times. (His duration log file was lost when his computer crashed.) He set up a "basic outline" (97 topics, 3

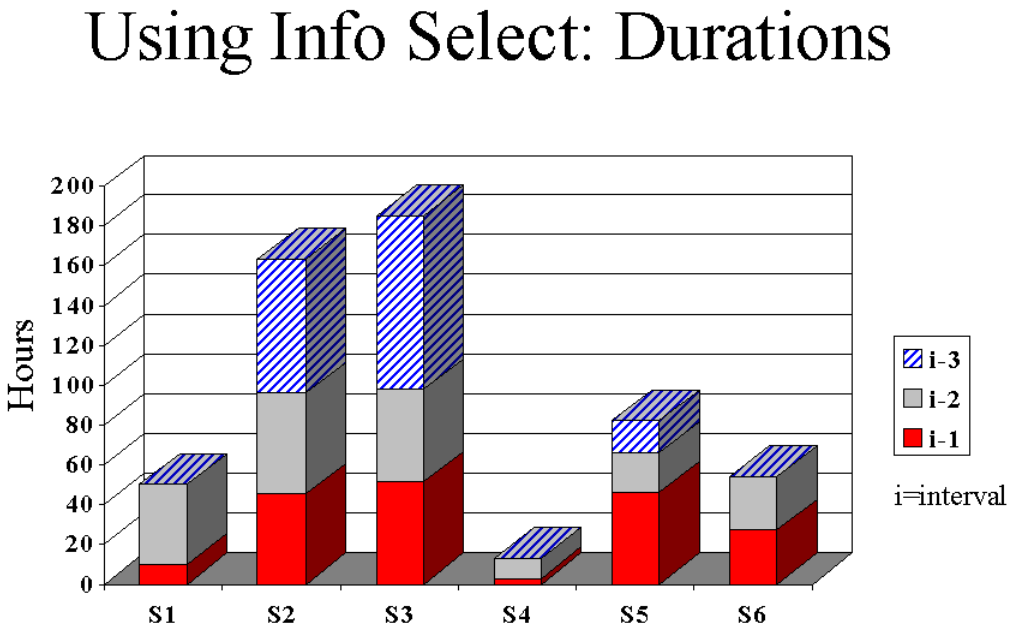

Figure 8. Info Select usage data for all scholars: duration totals, in hours, for each of the three study intervals (e.g., interval 1 = the time period between interviews 1 and 2).

levels) in Interval 1, then added 25 notes and 11 subtopics to a "working outline" (duplicate copy) in Interval 2. The item totals are disproportionately high, compared to duration and file size, because he imported 131 references and other notes from word processing files.

S2's work is evenly distributed across the three intervals and resulted in almost twice as many notes and twice as many references as any other scholar (and, with 163 hr, twice the duration of any scholar except possibly S3). (Not included in this total are the many short sessions (less than 10 min) during which S2 used the program to record

Table 6
Info Select Usage: File Content and Session Data

S#	i#	I date	Topics	Notes	Refs	Duration hr	Sessions[a]	Days	File kb
1		8/28							
	1	9/25	97	0	0	~10[b]	~5	~5	9
	2	12/17	108	38	131	~40	~20	~20	158
	3	3/24	--	--	--	0	--	--	--
						T=50	T=25	T=25	
2		8/19							
	1	11/2	17	120	50	45	67	34	137
	2	2/3	36	163		51	64	33	233
	3	3/30	43	257	165	67	55	34	464
						T=163	T=186	T=101	
3		9/3							
	1	10/26	12	60		102	58	42	49
	2	1/25	14	88		94	52	39	121
	3	3/29	20	121	2	174	73	50	254
						T=185[c]	T=183	T=131	
4		9/16							
	1	12/1	3	12		3	9	9	8
	2	1/21	4	44	9	10	9	9	25
	3	3/22	--	--		--	3	3	--
						T=13	T=21	T=21	
5		12/28							
	1	2/4	22	84	28	46	32	32	76
	2	3/8	22	90	30	20	14	14	91
	3	4/21	23	151	90	16	24	24	115
						T=82	T=70	T=70	
6		1/4							
	1	1/14	16	79		27	16	16	44
	2	3/1	34	140	1	27	21	21	96
	3	4/12	--	--		--	--	--	--
						T=54	T=37	T=37	

Note. Duration data does not include sessions of less than .2 hr (10 min). i#=interval, I date=interview date.
[a] Session = opening and closing the software program.
[b] Symbol ~ indicates data is an estimate based on journal notes.
[c] Adjusted for "inflation" to half size, because S3 was not using the program all of the time he had it open.

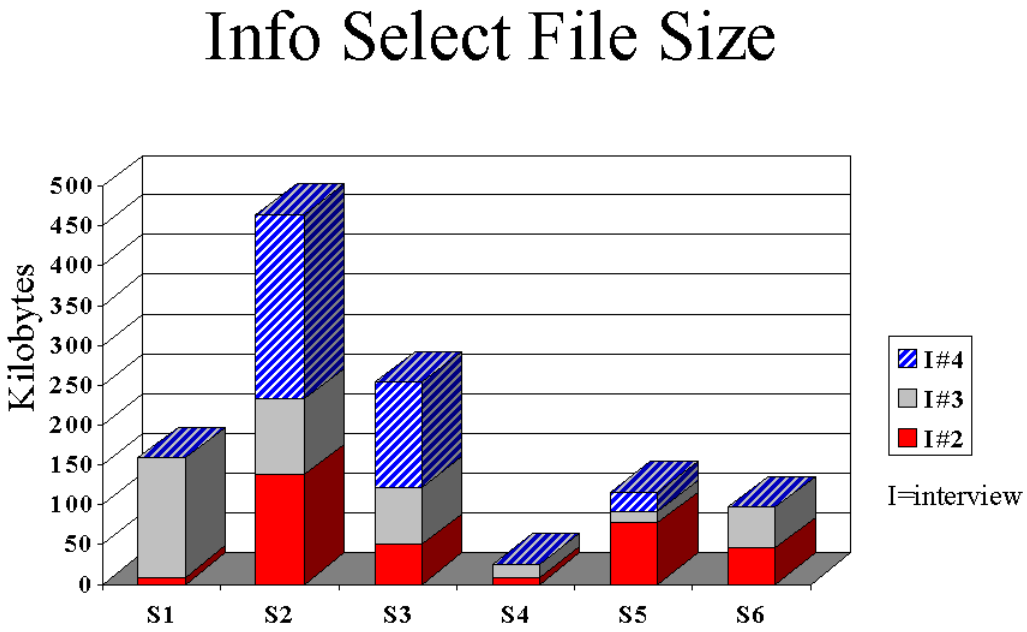

Figure 9. Info Select usage data for all scholars: file sizes, in kilobytes, at the time of interviews 1, 2, and 3.

experimental research data.) There are no gaps: S2 used the program very steadily over the entire period. During Interval 1, he added 120 notes in 8 topics, including 50 references, many with abstracts. In Interval 2 he added 2 topics, 18 subtopics, and 43 notes. In Interval 3, he added 7 topics, 94 notes, and 115 references. He kept a log-journal of his program usage, which corresponds very closely with the duration file.

S3's work is also evenly distributed across the three intervals, with both topics and notes added throughout. His final file consisted of 20 topics, 121 notes, and 2 references. His durations are similar for all intervals, and file sizes increase regularly across time. His

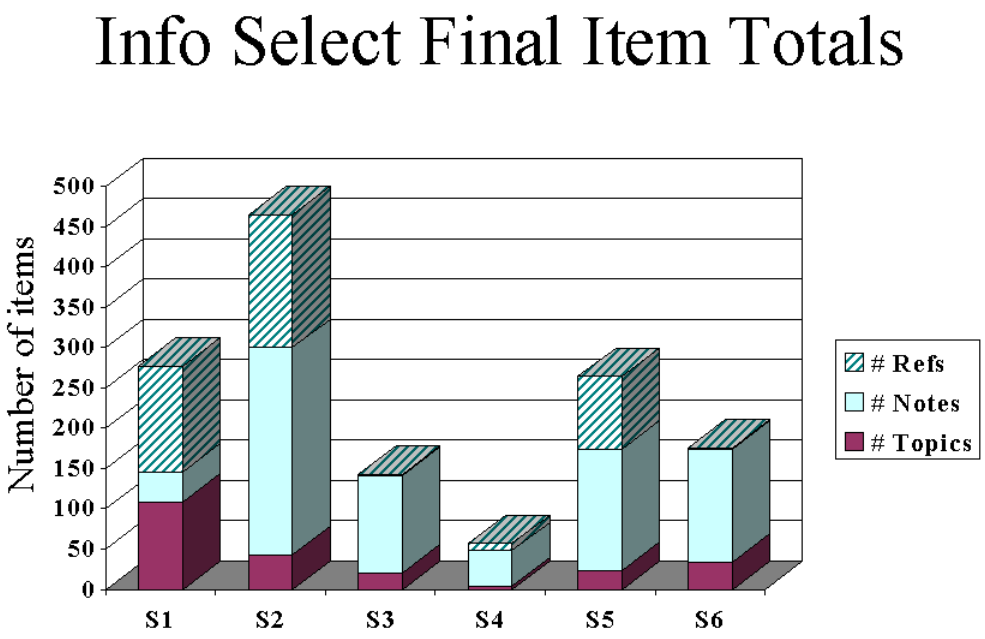

Figure 10. Info Select usage data for all scholars: final item totals for topics, notes, and references.

370-hr total duration does not represent continuous usage. He opened the program when he arrived at his office, left it open while he was teaching classes, and returned to record what was covered in class before closing the program. The duration shown for him in Figure 8 has been adjusted for this "inflation" by reducing it to half its size.

S4 spent the least amount of time of all scholars, resulting in the smallest file, and did most of this work in Interval 2 (10 of 13 hr), none in Interval 3. He was not working on any specific scholarly work project. He added travel plans consisting of 32 notes in one topic, with extensive formatting (bold, underline, indent, font, and color).

S5 did half of all work in the first month (46 hr during Christmas break), adding 84 notes in 11 topics, including 28 references. He added only 4 notes and 2 references in Interval 2. Duration data for Interval 2 (20 hr) and many long, scrollable notes in the final file suggest S5 was adding to existing notes during this time. In Interval 3, he added 60 references and 2 notes, in sessions totaling 16 hr.

S6 worked with Info Select the same amount of time in Intervals 1 and 2 (27 hr), and not at all in Interval 3. He created 16 topics and 79 notes in the first week of participation. In Interval 2, he added 18 topics and 64 notes. His item total (mostly notes) is, like S1's, relatively high compared to duration and file size, indicating he may have imported some notes. The file size is small for the large number of notes because many of his notes were brief study flashcards. He recorded durations on the data sheets for most sessions; these data correspond well with the duration file.

Comparing Duration, File Size, Item Totals. Three scholars (S1, S4, and S6) did not use Info Select at all in Interval 3; S1 and S4 also did very little in Interval 1. S2 and S3 worked consistently throughout, with similar durations in each interval, and used the program more than anyone else. S2 produced more (file size and item totals) than any other scholar, and probably used the program more.

Item totals show that most of the scholars created a few topics and many notes. S1 did the opposite: many outline topics and few notes. Half of the scholars used the program for references (S1, S2, S5). S2 created more of everything.

Generally, for all scholars, there is an expected correlation of all three variables: file size, usage durations, and item totals. There are also exceptions. The longer durations for S5 in Intervals 2 and 3 compared to the small increment in file size are probably because this scholar was adding many references (brief notes) to the system during this time. S3's low item totals compared to moderate file size may be because he created few references (which would increase the item total without significantly increasing the file size). His file size and item totals are both low compared to his overall duration, which may still be inflated.

There is no indication of differences among the scholars related to academic level—that is, faculty (identified by odd numbers) versus doctoral students (even numbers).

Data Sheet Results

S5 recorded data for 11 sessions over the first 2 months of participation, for 27 hr of work. S6 recorded data for 13 sessions over a similar time period but for 45 hr of work. S6's activity totals are generally higher than S5's, but this difference is probably because his data represent work during almost twice as many hours.

Table 7 displays these data as frequency counts and totals for the different kinds of activities the scholars recalled doing when using Info Select. Adding and editing are the most common activities these scholars were aware of doing. Organizing, viewing, and adding keywords or captions are less frequent activities; reorganizing and searching are infrequent, and Boolean searching does not occur at all.

Table 7
Frequencies of Activities of Scholars Using Info Select, Based on Data Sheet Kept by Scholars

Activity	Object	S5	S6	Totals
Add	Topic	1	12	13
	Note	7	13	20
	Reference	4	0	4
		T=12	T=25	T=37
Edit	Topic	6	5	11
	Note	2	12	14
	Reference	0	0	0
		T=8	T=17	T=25
Organize	Topic	1	3	4
	Note	2	4	6
	Reference			
		T=3	T=7	T=10
View	Topic	3	1	1
	Note		4	7
	Reference			
		T=3	T=5	T=8
Caption/	Topic	4		4
Keyword	Note	4		4
	Reference			
		T=8		T=8
Split/Join	Topic	4	1	1
	Note			4
	Reference			
		T=4	T=1	T=5
Search	Word	2	1	3
	Boolean	1		1
	Scan			
		T=3	T=1	T=4

These data cannot be compared directly with the data resulting from coding the transcripts, because the categories with the same names may not be as similar as they appear. Activities classified as "edit" on this data sheet might be classified as "add" (formatting or revising grammar and punctuation) or "organize" (revise, reorganize) using the coding system. The categories were not defined for scholars and no attempt was made to ensure reliability in classifying activities. Furthermore, there is no basis for assuming that data for other scholars would be similar.

With all these caveats, little can be concluded from these data, except that, for these two scholars, adding and editing information was a prevalent activity and there was little need for searching. This is not surprising, considering that both were just beginning to use this tool to set up an information system.

Summary of Usage Data

Most of the scholars created more notes than topics. Half of the scholars used Info Select for references. Results from the data sheets indicate that add and edit were the two most frequent activities; search was the least frequent.

The time spent using Info Select varies from quite high (S2 and S3) to very low (S4). The usage products (file size and item totals) range from very high (S2) to very low (S4), with most scholars in the middle range. It should be reiterated that the length of participation in the study was less for two scholars (4 months for S5 and 3 months for S6). S6 did nothing in Interval 3, so it might be predicted that he would do nothing given longer participation time. S5 used the program progressively less over the three intervals.

It seems unlikely that longer participation by these two scholars would change the overall picture of variability across six scholars shown by the duration, file size, and item totals graphs.

Table 8 provides an overview of the data on the scholarly work process and the use of Info Select reported so far. The descriptive data are summarized in a single statement in columns 2 and 3, based on interview transcripts and journal entries. The next three columns summarize the quantitative data gathered from Info Select log files and content files (usage duration, file content, and use of Info Select in final interval of study). The last column sums up the value of the Info Select program for the scholar, based on interview and journal data.

Research Question 1: Scholarly Work Process

This section and the next present the results of the content analysis of qualitative data using the coding system and additional coding schemes described in chapter 4. The data map developed to represent scholarly work process activities is used to display the coded data throughout both sections, for each scholar and most of the coding schemes. Tables are used to summarize the results across multiple cases. This section addresses the first research question, using the data map and an extended narrative description to summarize the activities of scholarly work (thinking) based on the results all six case studies.

Table 8

Scholarly Work Process and Use of Info Select: A Summary

S#	Important for SWP	Main use of IS	Hr	IS File content	Change in i-3	Value of IS
1	Organizing and outlining as secret to good writing with less revision.	Filling in outline for textbook revised edition.	~50	3-level outline of 97 topics, 25 book notes, 131 references	No activity in Interval 3	Massive information in detailed hierarchical outline (potential).
2	Classifying and exploring data to discover patterns; "flow," PDS, and "atomized writing."	Annotating references and recording ideas for dissertation and article writing.	163	257 notes in 43 topics, 165 references, ideas abstracts, research log, reminders	Using IS for actual writing	Annotated PDS; indexed data for pattern recognition; handy research log.
3	Writing as analysis; organizing notes as basis for organized lectures and finding information.	Preparing instructional material; making notes after class as reminders.	(185)	121 notes in 20 topics: class notes and overheads, writing, sources, letters, reminders	Searching and finding notes and quotes	Class notes for short- and long-term retrieval; organizing and memory.
4	Highlighting sources: easy and portable; discipline and time to record/input notes.	Class notes and vacation travel itinerary.	13	44 notes in 4 topics: 12 class reading notes, 32 travel plan notes	No activity in Interval 3	Difficult to evaluate: no SWP.
5	Creating PDS for references; scanning references and sources for later searches.	Note taking for articles and conferences; PIM reminders.	82	61 reading notes in 23 topics, 90 references, ideas, quotes, time data	Extensive bibliographic activity	Efficient, easy, flexible PDS; PIM for phone numbers and addresses.
6	Color-coding for memory and writing; formatting writing; PDS; networking.	Making flashcards to study for exams; notes for how-to manual.	53	140 notes in 34 topics: 139 brief study cards, 1 long manual note	No activity in Interval 3	Organized study cards; fast notes during group discussion.

Note. Data sources: Interviews, journals, Info Select log files, and Info Select content files. SWP=scholarly work process. IS=Info Select. Hr=duration of usage, in hr. i-3=Interval 3.

Mapped Codes: Scholarly Work Activities

Figure 11 shows six data maps containing all the codes for scholarly work activities, with one map for each scholar. The data are from all interviews, training, journal entries, and email messages. Repetitions have been removed. Codes for units classified as "other," because they did not fit in any defined category, are placed outside the map boundaries, in the bottom right corner, along with BTF codes.

Codes for the activities mentioned after the first interview are distinguished by boldface type. This differentiation reveals that interviews 2, 3, and 4 added substantially to the scholarly work activities mentioned in the first interview (except for S4, who did not do much scholarly work during the study).

Even without the data for interviews 2, 3, and 4, the activities are fairly evenly distributed across all categories for all scholars, with few exceptions (fewer A's for S2 and S3; not much O for S2). The combined-interview view shows that S2 and S4 had little to say about writing (few W's). These two scholars were doctoral students in the pre-writing stage of their research—but so was S6, who referred to writing more than anyone. Not mentioning an activity, of course, does not mean it is not part of the scholar's work process.

Excluding the idiosyncratic W and "other" categories that emerged from the data, every subcategory in the coding system is mentioned by at least half of the scholars, often by five or all six scholars. The exceptions (6 of 28 subcategories) are ED and DU (mentioned by two scholars), and DG, DM, and RF (mentioned by one scholar). The

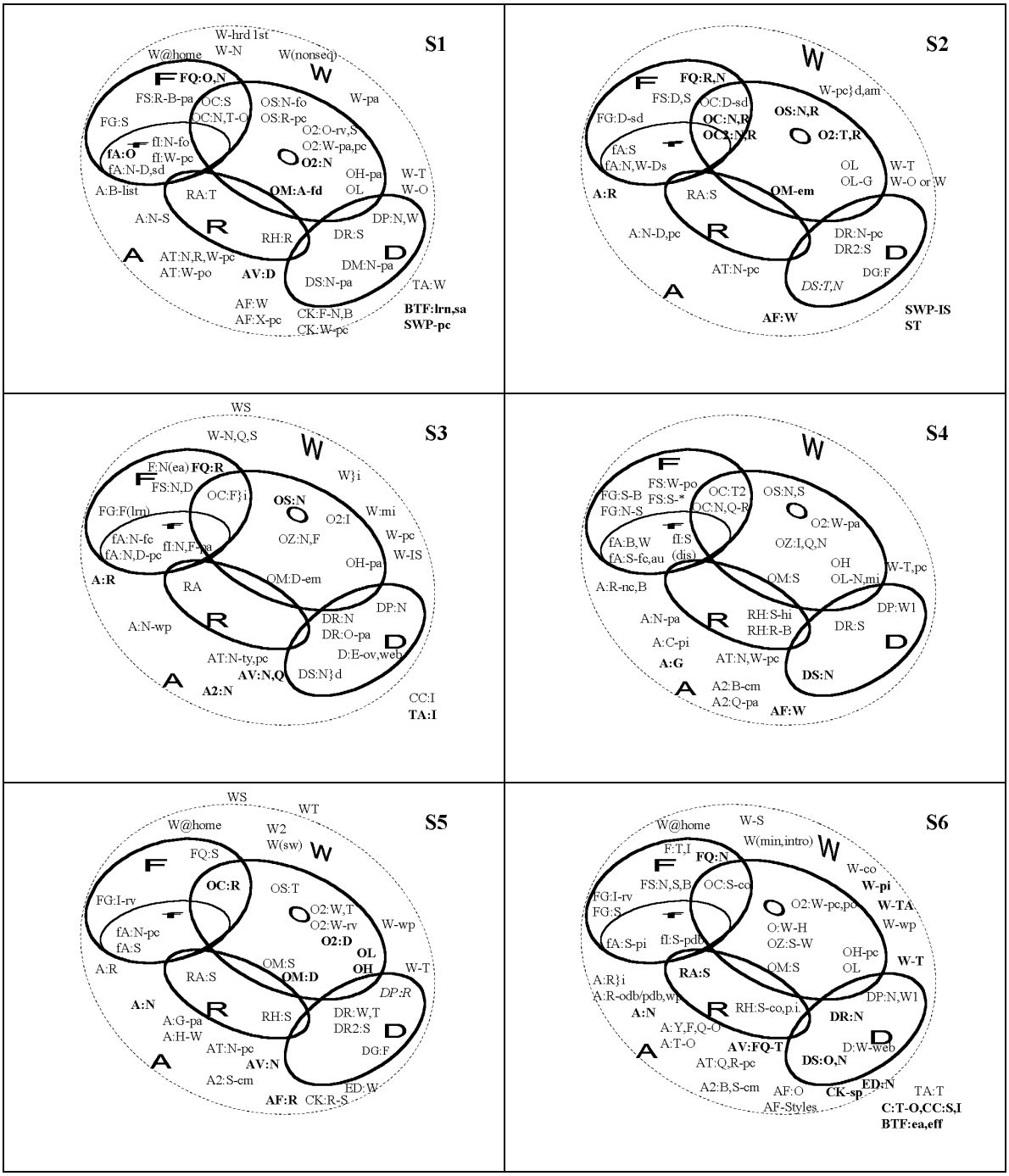

Figure 11. Scholarly work process activities, all scholars. A=Add, f=file, F=Find, O=Organize, R=Remind, D=Display, W=Write. Boldface = data from interviews 2, 3, or 4. Source: All interviews, journals, training, and email.

codes DU and RF should be eliminated because they refer to specific Info Select features, not scholarly work activities. ED (editing grammar and punctuation) is undoubtedly a common writing activity, but not likely to be discussed within the context of these interviews. The same may be true for DG (display graphically). DM (for display more) is probably not a useful category.

Tentative conclusions based on Figure 11 maps are:

1. The fact that some activity in most of the subcategories was mentioned by at least half of the scholars suggests that these are the scholarly work process activities.

2. These categories appear to account for most of what scholars do, in doing their scholarly work.

3. There is not much variability across scholars evident in this display of data—in contrast to the variability suggested by the quantitative data on Info Select usage described in the previous section, and the variability in scholarly work projects and demographics evident in Table 8.

4. A methodology that includes a longitudinal perspective (several interviews over 6 months) and use of a tool (prompting descriptions of the scholarly work process) seems justified by the additional data made available, as shown by boldface codes added to the maps in Figure 11.

Scholarly Work Process Description

This overview of the scholarly work process activities uses the same coded units (shown on the activities map, Figure 11) but refers to a list of the units of analysis (see

Scholarly Work Process Activities in Appendix B). The goal is to supplement the coded map with meaning, using the actual descriptions of participating scholars. This discussion is summarized numerically in Table 9, which lists the codes and how many scholars mentioned something in each code category. Because this research was not designed to investigate stages or the order of activities, the discussion follows the alphabetical order of the listed codes, with one exception: The F/f category is discussed after the O category because it seems to make more sense to talk about filing and finding information after it has been organized.

Participating scholars create bibliographies (A:B) and add reference citations (A:R). They may use notecards, numbered lists on paper, a word processor, or a database application. Some download references to their personal files directly from online databases. They add references immediately or save the task for later. Half of the scholars in this study used Info Select for references; two planned to do so in the future.

Taking notes (A:N) is a major activity of scholarly work for these scholars. The kinds of notes mentioned by participating scholars include reading notes, summaries, plans, ideas, and extracts from resources. The scholars take notes immediately or later; randomly or methodically while reading; daily after class or during discussions. They use pencil and paper or even a napkin; most use a word processor on the computer. They take thorough notes or type up previously highlighted material.

All of the scholars talked about typing up (AT) their handwritten notes, transcribing tape-recorded notes, or getting their marginal notes from the source to the

Table 9
Scholarly Work Process Activities Mentioned by Scholars

Code	Meaning	SWP
A:R,B	Add references, bibliog.	6
A:N	Add notes	6
AT	Type up notes	6
AV	Import/convert	5
A2	Copy	4
CK/ED	Check/Edit	3
AF	Format	6
DP	Print	5
DR	Read, study, review	6
DS	Scan, browse, view	5
D-viz	Display more, graph, …	
fA	Filing system	6
fA-sc	Scan into system	
fI	Index system	3
FG	Find: Gather	5
FQ	Find: Query	5
FS	Find: Scan	6
O2	Revise, reorganize	6
OC	Categorize, key	6
OH/OL	Outline, list	6
OS	Sort, order	6
OM	Move, transport	6
OZ	Integrate, synthesize	4
RA	Reminder note	5
RH	Reminder highlight	4
W	Write	6
W-O,T	Write using outline	5

Note: The number of scholars is provided only for items mentioned by at least half of the scholars. SWP=scholarly work process.

computer. Most of them mentioned importing or converting (AV) notes from other computer applications to use them in Info Select. Many also exported notes from Info Select to word processing files.

These scholars make photocopies (A2) of source articles to add to their own collections. They copy bibliographies to use in finding other sources. They copy passages from a source, by hand or by computer, to keep in their notes. On the computer, they copy material from one file to another and files from one subdirectory to another. Other clerical kinds of activities mentioned by the scholars are doing a spell-check or checking facts (CK), editing (ED) a draft, and formatting (AF) text. The latter activity, including changing fonts and typefaces or applying "styles" to improve the appearance of documents, was mentioned by all scholars.

Each of the three major display subcategories was mentioned by at least five of the six participants. The scholars print out (DP) notes, references, drafts, and overheads. They read, study, and review (DR) source material, notes, outlines, and highlighted information. They read on the computer screen, from printouts, and using published material. They reread. They also scan or browse (DS)through the same kinds of material quickly, viewing without intentionally searching.

All of the participating scholars referred to organizing their information in each of the five main organizing subcategories: revising or reorganizing, categorizing, outlining, sorting or ordering, and moving or transporting. Organizing by synthesizing or integrating (OZ) was mentioned by four of the six scholars.

The scholars revise and reorganize (O2) documents, notes, references, outlines, and writing drafts. They make minor changes, cut and paste, drag, split and join, insert and delete. They revise using printouts or revise on the computer, or both.

Categorizing (OC) information includes organizing notes by subject matter, identifying and then keying one type of information to another (adding keywords), labeling, coding, and clustering or grouping like information. Participating scholars categorize notes, references, and source material. They categorize into subdirectories, topics, folders, and piles. They key references to outlines, notes to references, and quotations to source page numbers. New categories emerge when they study their information and discover previously unrecognized patterns.

Making outlines, ranging from simple lists (OL) to detailed hierarchical structures (OH), is a prevalent scholarly activity for the participants. They jot down points, make rough sketches, come up with topics, and create extensive formal outlines. They outline mentally or use paper or computer software. Only one of the scholars revises and works with a formal outline throughout a project; the others mentioned using a rough outline just to plan the project and get started writing.

The scholars referred to sorting (OS) information alphabetically and chronologically, into folders and topics. They sort notes, references, source material, and topics. They may sort physically, using a pair of scissors or labeled piles, or they use a word processor's cut and paste operation. Shown the Info Select sorting bin feature, several scholars began sorting their notes or references enthusiastically, but most never used the feature again.

Transporting (OM) information from one location to another may not sound like a very scholarly activity, but it is a necessary activity and mentioned by all scholars. They

carry information back and forth on floppy disks or laptop computers. They send files to colleagues using email or the Internet. They carry source materials around in the car, transporting them between home and work offices.

The participating scholars keep their information in a filing system (fA). They store source material, bibliographies and references, and copies of their own writing products in filing cabinets, piles, and computers. One has a notecard filing system for references. All have filing cabinet systems for source articles, usually arranged alphabetically by author. Most have notes in computer files on hard disks and floppies, but only one mentioned going back to such notes after a project was completed. One scholar "saves everything." Only one scholar keeps older versions of outlines. All mentioned wanting to archive certain kinds of information separately.

Setting up a file indexing system (fI) is probably an activity everyone does but few talk about. As one scholar put it, "When you set up file cabinets, you index files." Only half of the scholars mentioned indexing specifically: indexing notes with predetermined keywords, indexing references with an electronic database, and indexing text with an automated indexing program.

At least five of the six scholars mentioned something in each of the three subcategories of finding information. They were interested in finding their notes, quotes, "things," a particular article, or a topic to write about. Finding information by gathering (FG) includes collecting facts and sources in the library or online, gathering information from sources, and even collecting comments and suggestions from reviewers.

Finding information using a query (FQ) in all cases involved a simple word search. The scholars search for references in libraries. They searched their Info Select notes for notes matching a search word. One searched his notes to avoid duplicating something he had already written. One searched "just for fun."

The third subcategory of finding involves scanning, browsing, skimming (FS) through the information to find a particular item. All of the scholars use this method. They scan their references, notes, or sources, often by scrolling through computer documents, to find "something remembered," themes, "suspicious" duplications, quotes, other sources, and "something, don't know what."

Participating scholars create reminders to help them remember something important. They create notes or memos (RA) or mark information with highlights and color-coding (RH). Most of the scholars write reminder notes, record ideas immediately, annotate margins, keep a log, or use a calendar—all to keep from forgetting. Two use color-coding extensively. Three use highlighting, circles, or underlines to remind themselves of important information.

Writing undoubtedly is a major scholarly activity. The description of writing by scholars in this study is incomplete, because participants were instructed not to describe their writing—to focus, instead, on the scholarly work that takes place in between collecting material and writing about it. Four of the scholars in this study discussed their writing extensively (at least as much as they talked about any other code category except

adding and organizing activities). Therefore, what they said about their writing is summarized here, even though the data are incomplete.

All of the scholars do their creative writing at home (only three mentioned this, but other data indicate it is true of all). The kinds of writing mentioned include introductions, literature reviews, articles or papers, a reference manual, and exams. One scholar said he writes as soon as he collects data, because writing is analyzing. Two others write regularly, very early every morning. One scholar writes the hardest part first; another says the first part is the hardest. One writes a little bit, and then waits a couple of weeks, letting it "cook." One writes a first draft and then may throw it out and start over. Two mentioned writing nonsequentially or "piecemeal," jumping around out of order. One called it "atomized" writing and considered it a major improvement. The other referred to it as "organized chaos." At least one scholar works on several projects concurrently, switching back and forth.

The scholars mentioned writing in pencil and writing with the computer's word processor. Most of the scholars write from at least a rough outline or list of points. Three follow the outline closely, filling in details and transitions; others use the outline as a starting point only. For two scholars, notes become text. One refers to source articles spread out on the bed and writes "thinking at the keyboard." One scholar says he sits down and writes 200 pages, because "I have it all in my head."

Sauvain's (1970) list of what scholars do, quoted earlier, bears repeating. Listing all of the major coding categories used in this study, it could be a meta-summary of this overview based on six case studies of scholars describing their work:

> Taking of notes, jotting down of references, filing, categorizing piles of information, browsing through various kinds of textual material, writing reminders, searching for an item vaguely remembered, gathering information relevant to a particular problem at hand, organizing and reorganizing, writing and revising papers, and so on" (p. 7).

Research Question 2: Tools to Augment Scholarly Work

The second research question asked what tools or tool features might augment scholarly work (thinking). This section lists the tools participating scholars use and categorizes the data units as problems, needs, and likes, related to scholarly work, tools in general, or the Info Select tool in particular. Results of using the Info Select program are described, with a focus on changes in scholarly work activities. The scholars' responses to the Info Select Checklist and the Tool Evaluation Form provide additional data on tools and tool features scholars use and prefer. The section concludes with findings related to specific themes referred to in the literature review.

Tools and Tool Features Scholars Use

A very short survey done during the initial scholarly work process interview accessed the scholar's use of computer tools and self-evaluation of expertise with the tools. Table 10 shows the results. S6 is the computer tool expert. The others use only one or two of the surveyed tools, all with at least moderate expertise. Four of the scholars use

online databases; three use a personal information manager (PIM) (two used earlier versions of Info Select).

Table 10
Computer Tool Survey

Tool	Expertise, on scale of 1 to 5 (5=highest)					
	S1	S2	S3	S4	S5	S6
Grammar/Style Checker	xx		3		√	5
Online Database	5	4		4		5
Outline Processor						5
Personal Information Mgr			3		2	5[a]
Personal Database/PDS			xx[b]	√[c]		3[d]
Indexing software	5[e]					
Other:						
Spell Checker	√		√			
Spreadsheet		√	3			
Graphing		√				
Grading			√			
Web site production			√[f]			

√ = use . xx = does not like.
[a] Timex DataLink [b] Citation 7 [c] Access, dBase 2 [d] EndNote [e] ProCite [f] FrontPage

Two scholars use many manual tools; others mentioned mostly electronic tools. Everyone mentioned tools for filing (cabinets), adding references, writing with a personal computer, using email, and transporting information. No one mentioned tools for finding (except online database searches, mentioned by three scholars).

Tools participating scholars use (with the number of scholars mentioning the tool, in parentheses, where relevant) include:

- MANUAL: paper, pencil, file cabinet (5), notecards, manila folders, stapler, scissors, notes, outlines, lists, calendars, highlighters, color highlighters and post-its.

- ELECTRONIC:
    - HARDWARE: typewriter, audio recorder, transcriber, copy machine, scanner, pc, laptops (3), floppy disks, Timex DataLink.
    - SERVICES: email (6), Internet (3), online databases (3).
    - SOFTWARE: word processor: WordPerfect (5), Word (3); graphs and tables: WordPerfect, Excel, SigmaPlot; databases: dBase, Access, EndNote, Citation, ProCite; other: Info Select, PowerPoint, WebCt, Pascal, Perl, FrontPage, file manager.
    - TOOL FEATURES: spell-checker (4), grammar checking (3), thesaurus, equation editor, outliner, styles.

Problems, Needs, Likes as Indicators

The reason for identifying scholarly work problems, needs, and likes was to see if this would suggest useful or beneficial tools and specific tool features to augment scholarly work. This section describes the problems, needs, and likes scholars mentioned that are related to tools in general and to scholarly work.[10] Problems and likes (change) specifically related to using the Info Select program are discussed in the next section. Problems, needs, and likes that are mentioned by less than half of the scholars are shown on maps but are not discussed in the text, because they are less likely to be representative

[10] If some items discussed as problems, needs, or likes seem repetitious of items mentioned earlier as scholarly work activities, it is because the groups are not mutually exclusive: An item may be both a scholarly work activity and a problem.

of the scholarly work process. (They may be mentioned as minor tool problems, however.) Findings related to problems, needs, and likes coded as BTF (basic tool features) are interspersed throughout the text.

Problems. Codes representing scholars' problems are shown on the maps in Figure 12, one map for each participant. For four scholars, problems seem to cluster in the find and file categories (S2, S3, S4, S5); for two, there are more than a few problems in the add category (S4, S6). Hardly anyone talked about writing problems, and there is not much in the organize and display categories. The map view is not particularly helpful until it is supplemented by a closer analysis of the scholars' descriptions represented by the codes.

Analysis of the scholars' words (listed in Appendix B) reveals that all six scholars were concerned with memory problems. The codes for these problems occur mainly in the F category but also turn up in RA, A, and W. Four scholars described problems related to locating information when memory is partial: We remember something exists but forget where it is (S2, S3, S4, S5). Three scholars described memory-for-content problems: We forget information when it does not fit into our "framework categories" (S5), we create reference manuals as aids for remembering facts (S6), and imperfect memory leads to duplication in writing because we forget what we have already covered (S1).

Most of the scholars also mentioned other F problems not specifically related to memory. These include finding documents stored in subdirectories or filing cabinets,

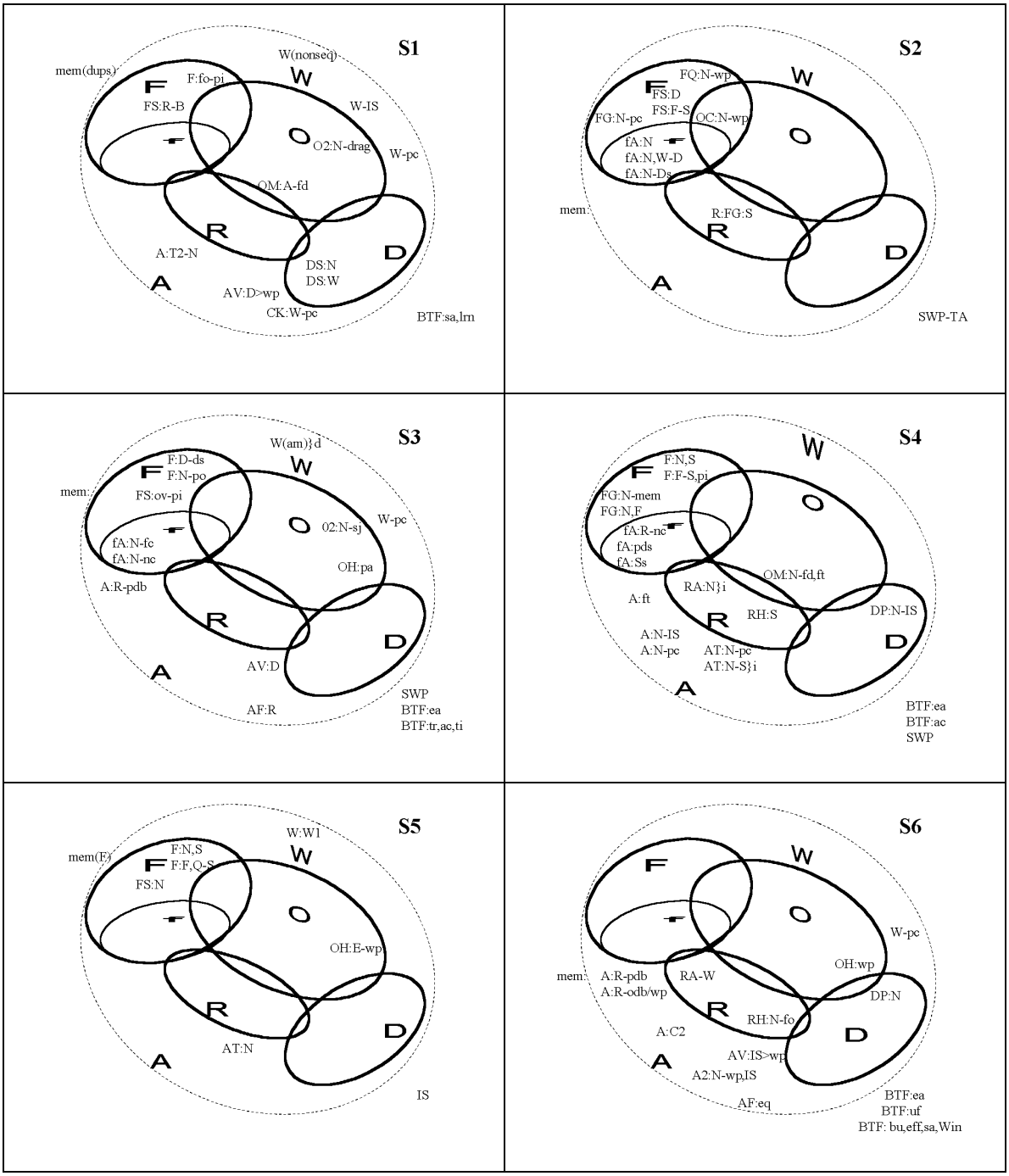

Figure 12. Scholarly work process problems, all scholars. A=Add, f=file, F=Find, O=Organize, R=Remind, D=Display, W=Write. Source: All interviews, journals, training, and email.

finding overheads and folders stored in piles (or finding the pile), and losing notes that were printed out (S1, S3). Finding quotes or facts in notes or source material is also a problem (S2, S4, S5), and trying to find something by reviewing notes takes too much time (S5). A related but different problem is that trying to find or record information or ideas disrupts the flow of writing or thinking: "I'll get lost in the notes" (S2, S5).

Half of the scholars reported problems with their filing systems (fA). S2 has no physical filing system for notes. He keeps notes in one very long computer document or many documents: Neither system works well. S3 said his filing system has always been a disaster. He is going to throw away the contents of his filing cabinets because the notes are not indexed to be retrievable. He tried using notecards, but it "never worked, because I couldn't keep the stuff straight." S4's reference card file system is not working, and he is getting "overwhelmed with all the stuff."

To summarize, most of the problems the scholars mentioned in their descriptions of scholarly work are related to human memory, finding information, and setting up or maintaining filing systems to keep the information. Most of the memory problems were coded as belonging to one of the F subcategories, so it can be stated that all of the problems common to three or more of the scholars are F/f, find and file, problems.

Tools involved in the problems discussed above include filing cabinets and computer filing systems, computer notes and printouts, and piles as a system for organizing information. The scholars use online databases to find information resources, but only one scholar mentioned using any tool to find information in his own system.

Using his word processor's find feature was not helpful, S2 reported, because "I still have to know where to go to look for it, which sort of destroys the whole point of keeping your notes [in the computer]."

Minor tool problems, mentioned by only two scholars, fall into the filing (fA), adding references (A:R), and outlining (OH) categories: keeping information in one long document or many short documents "slows me down" (S2); cutting and pasting references into document is "tedious" (S6), the Access program is "a bear" (S6), and the Citation program is "too damn clumsy" (S3); and the word processor's automatic numbering is "frustrating" (S5, S6).

Needs. Codes representing scholars' needs are shown on the maps in Figure 13. Codes are distributed across the categories for most scholars, although four did not mention writing needs and only three had much to say about adding-information needs. Again, a closer analysis of the scholars' descriptions represented by the codes (listed in Appendix B) is required to reveal the patterns.

A common need for five of the six scholars was to input information more efficiently. Participants wanted to scan or electronically import source material into the computer to have it available when doing scholarly work. Most (S2, S3, S5, S6) specifically mentioned wanting to scan in the full text. Full text and abstracts in the system would allow scholars to search for the information whenever they needed it. With entire articles in the system, S2 proposed, "my reading and my writing would be integrated." Several scholars (S4, S5, S6) wanted an "magic wand" hand-held device to

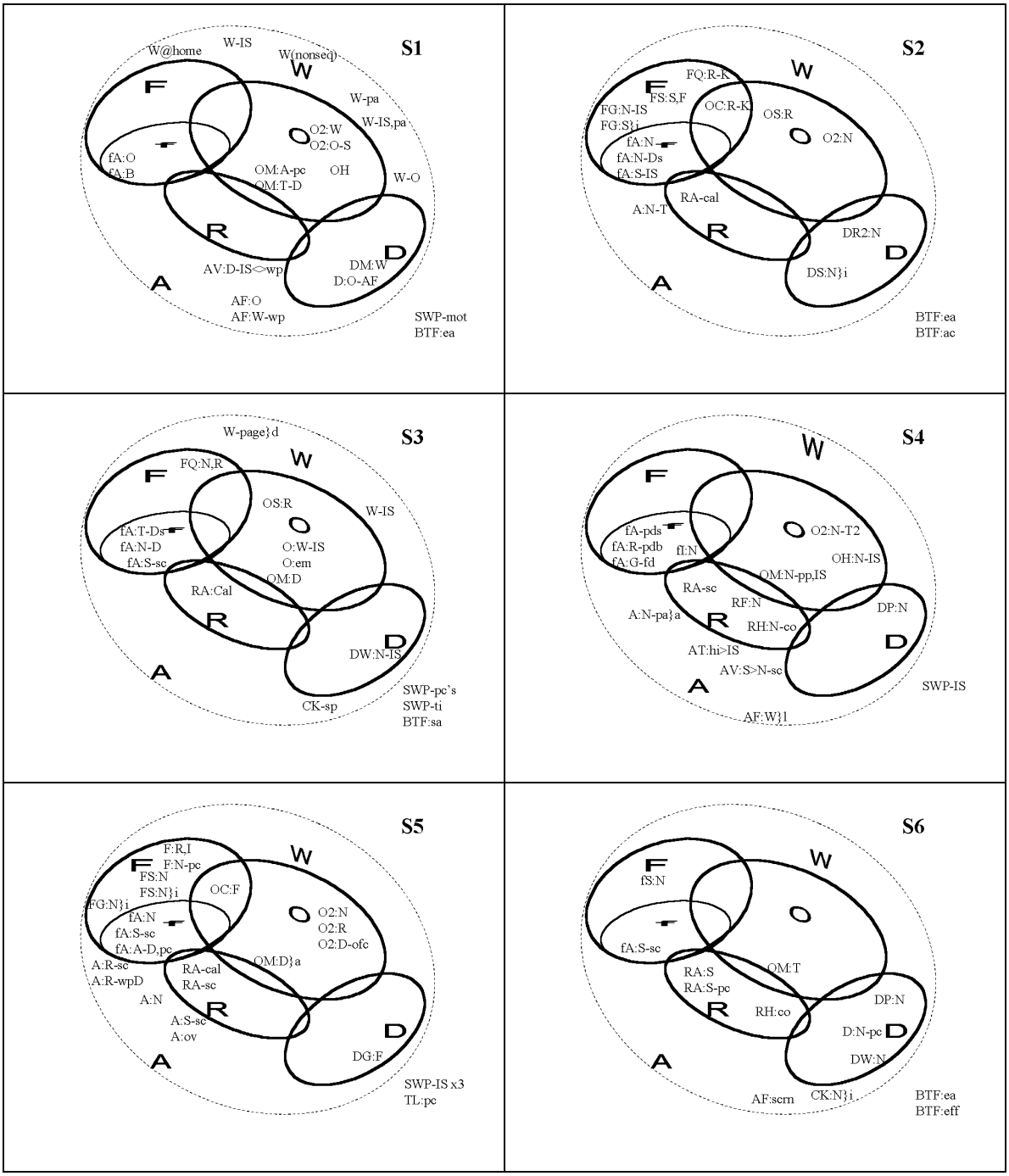

Figure 13. Scholarly work process needs, all scholars. A=Add, f=file, F=Find, O=Organize, R=Remind, D=Display, W=Write. Source: All interviews, journals, training, and email.

capture smaller segments of source material. According to S6, this electronic highlighter would be the "Memex" Bush predicted in 1945.

Scholars were concerned with the need for a system (fA) to "get back to my notes" (S2, S4, S5), back to written drafts (S5), or back to earlier versions of an outline (S1). Four scholars talked about the need to search their notes when writing or trying to make sense of data. Two of these (S2, S3) emphasized the need to do this quickly ("in a flash," "within seconds," without getting "lost in the notes"). S5, however, admitted to not being sure how to scan and find information quickly enough to be worthwhile. S6 said he'd be "nervous" about relying on a word search to pull out all the information he needed: The word might not be present in an important note, and "You don't know what you don't know. You don't know what's missing."

Scholars talked specifically about the need for revising and reorganizing information. S2 needed information-bits that could easily be rearranged. S5 needed "a better way to reorganize notes" and also needed to be able to make revisions at another work location. S4 wanted to revise an outline to create more levels. S1 described in some detail the need to reorganize outlines and revise writing to get a work published.

Four scholars expressed the need to display or visualize the information in specific ways: faster (S2), more at once (S1, S3, S6), or in a specific format. S1 formatted his outline with white space to make the hierarchy more visible; S5 needed graphs and tables to display data.

Most scholars referred to the need to transport their information back and forth between locations on a frequent basis. One (S3) found Info Select to be "a terrific advantage" because "instead of carrying my briefcase I can just carry my IS [Info Select file disk] in my pocket." Three scholars specifically requested a calendar feature, to plan class assignments (S5), check office appointments from home (S3), and keep track of scheduling of experimental subjects (S2).

In summary, needs expressed by a majority of the scholars include scanning full text and highlighted notes into the information system (fA), being able to get back to stored notes and references (also fA), and searching notes to find specific information (FQ, FS, FG). Scholars were also concerned with revising and reorganizing (O2), displaying information (DS), transporting files (OM), and having a calendar to record reminders (RA). Table 11 shows the number of scholars mentioning different categories of problems and needs (an expansion of Table 9), allowing a comparison with the data for scholarly work process activities scholars mentioned. Issues in the finding and filing system categories appear to be of some concern across activities, problems, and needs.

Tools related to the needs described above include scanners, preferably small and portable, to input information, and a computer filing system or personal documentation system (PDS) that would organize references, outlines, notes, and drafts, and retrieve material quickly and efficiently. The scholars need a tool to revise and reorganize information, including outlines. Tools for displaying information should be fast and

Table 11

Scholarly Work Process Activities, Problems, and Needs Mentioned by Scholars

Code	Meaning	SWP	Problem	Need
A:R,B	Add references, bibliog.	6		
A:N	Add notes	6		
AT	Type up notes	6		
AV	Import/convert	5		
A2	Copy	4		
CK/ED	Check/Edit	3		
AF	Format	6		
DP	Print	5		
DR	Read, study, review	6		
DS	Scan, browse, view	5		
D-viz	Display more, graph, …			4
fA	Filing system	6	3	4
fA-sc	Scan into system			5
fI	Index system	3		
FG	Find: Gather	5		
FQ	Find: Query	5	5	4
FS	Find: Scan	6		
Mem[a]	Memory		6	
O2	Revise, reorganize	6		4
OC	Categorize, key	6		
OH/OL	Outline, list	6		
OS	Sort, order	6		
OM	Move, transport	6		5
OZ	Integrate, synthesize	4		
RA	Reminder note	5		3
RH	Reminder highlight	4		
W	Write	6		
W-O,T	Write using outline	5		

Note. The number of scholars is provided only for items mentioned by at least half of the scholars. SWP=scholarly work process.

[a] Mem is not a code in the coding system, but is added here to group a number of items, most of which are code F but some of which have other codes (R, W, …).

capable of displaying large amounts of information, and should allow customized formatting and layout.

Tool features worthy of minor mention include calendars (S3, S5), color-highlighting (S4, S6), and transportability (S5).

Likes. Likes related to the use of tools other than Info Select are not shown on a map because there is not much to show. Only two scholars mentioned more than four items; these were distributed across all categories. Two scholars like working with paper and pen because the tools are portable (S1, S4). Two scholars prefer composing at the keyboard (S2, S6). S6 referred to many activities involving electronic tools, particularly for formatting writing. Two scholars like using online databases for gathering references (S2, S6). No coding subcategory occurs more than twice.

Using Info Select

The Info Select tool has certain tool features that allow users to do certain activities. This section briefly reviews which tool features the scholars liked, based on what they actually did with the tool features and then described in interviews and journals. It also considers the problems scholars reported having, using Info Select, and the implications of those problems for tool features. The section ends with brief reference to the basic tool feature results, most of which were already presented as Info Select tool feature problems or likes.

Likes and change. The list of items coded as likes related to using the Info Select program was extensive. To reduce the data to a more manageable and comprehensible

size, I recoded the data in terms of change, asking: To what extent did using this tool result in any change in the scholar's behavior, and in which coding categories did such changes occur? The classification of data according to indications of change resulted in the data maps shown in Figure 14 and the description list in Appendix B. Likes that do not correspond with behavioral change have been removed.[11] The data representing change is a subset of likes, making it easier to see similarities across scholars.

Four of the scholars started a reference database (fA:R) in Info Select and considered it an important use of the program and of significant value. None of these scholars had used a reference database prior to this; all had used word processor files for references. S1 added 131 references to the system and said, "Maybe this software will allow me to easily do stuff along this line that I couldn't do with the word processor." S3, after debating whether to use this program or a database application for references, decided Info Select would be better, more flexible, for handling "connotations." Two scholars pointed out the potential for having their own version of the literature, a personalized database (S2, S5). They both entered many references and began to realize that potential.

[11] Most of the items removed were evaluative statements ("nice," "handy," "easy," "useful") about Info Select features that were never used again. This may be the effect of researcher bias: Scholars said what they thought the researcher would like to hear. S6, in particular, seems to have placed heavy emphasis on evaluating the software.

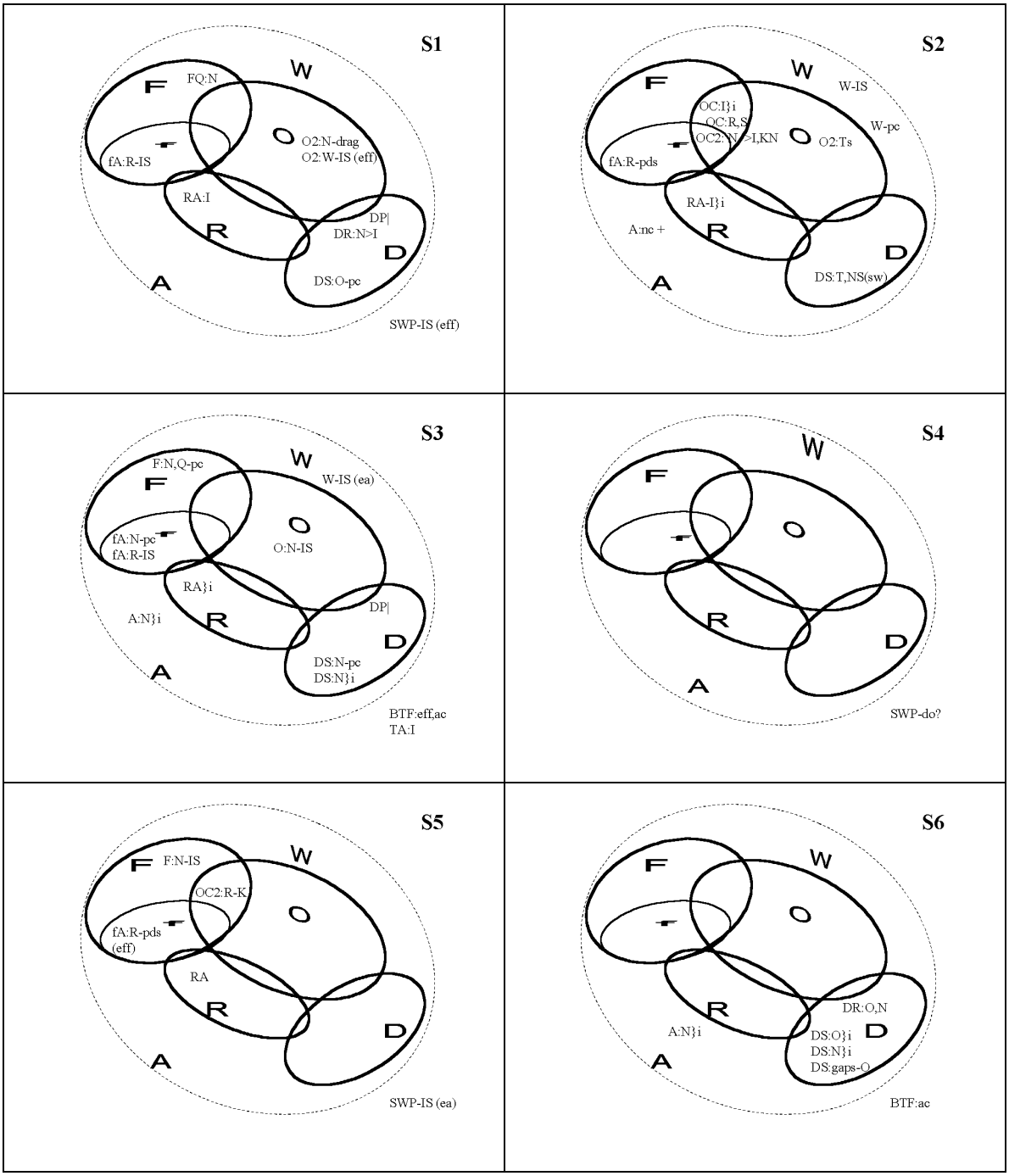

Figure 14. Scholarly work process change after using Info Select, all scholars. A=Add, f=file, F=Find, O=Organize, R=Remind, D=Display, W=Write. Source: All interviews, journals, training, and email.

Also in the fA category are codes representing the use of Info Select as a personal documentation system (PDS) for notes as well as references: S5 stored reading notes in the system and appreciated being able to get back to them. S3 used the system to keep track of quotes, and was able to recall material that he never could have recalled before. He also started typing up notes after class, because it was a "more manageable system." He even started writing drafts in Info Select, because he could "keep everything together in one system." S2, after using the program for both references and notes of his reactions to the readings, described his results as "a fantastic series of cards."

Being able to find (F) information was a welcome change for three scholars. S3 said this was the first time in his life he could find references, notes, and quotes when he needed them. S5 coded references with keywords and then gathered all coded references to print a bibliography. S3 believed his lectures were better organized, now that he was able to find his notes. S1 used the search feature to "see how many times I've already said that" and avoid duplication.

Four scholars referred to change related to displaying their information (D). Two said they now look at notes, outline, or written drafts on the computer screen instead of on paper (S1, S3). Three described reviewing the outline topics as a way to find information quickly and efficiently (S1, S2, S6). Two said that viewing the outline structure helped them discover gaps and make decisions (S1, S6). S1 described getting new ideas by studying his notes and outlines; S2 liked the way he could "just arrow down

to a different topic" when he felt "stuck." Two scholars were impressed with the ability to navigate through the information quickly, without scrolling (S3, S6).

Scholars were able to record reminders (RA) and ideas immediately, without interrupting a train of thought, because the program was so accessible and it was easy to do so. They discovered new ways to revise and reorganize (O2) writing, notes, and topics (S1, S2, S3). Because it was easy to categorize (OC) information, they were better able to organize their notes, making finer distinctions. As S2 put it, "I'm doing different kinds of things. I wouldn't have organized in this way before, because it's just too labor intensive." New ways of organizing led to discovery of patterns in data (S2).

In summary, change in the scholarly work of participants (and expressed likes) occurred in five major categories. In the fA category, four scholars reported changes in the way they stored references and notes, indicating the use of the program as a personal documentation system. Features allowing the scholars to search and find (F) information proved valuable for several scholars. Capturing ideas and creating reminders (RA) was an important activity, as was being able to categorize (OC) and reorganize (O2) information in new ways. The scholars took advantage of the capability to quickly display (DS) information in order to study, get ideas, explore relationships, and discover patterns—in other words, to think.

Overall, features the scholars liked about Info Select were that it provided a personal documentation system for notes and references; fast navigating; easy reorganizing

and categorizing; accessibility and capability to add or categorize immediately and to convert from other programs.

Info Select problems. Three scholars had some difficulty learning to use basic Info Select features, even after several months in the study. Aside from these learning problems, 12 tool-feature problems were mentioned, 7 of the 12 by S6 (listed in Appendix B). Half of these problems concerned the print function: no print preview, cannot select multiple noncontiguous items to print, and a program crash while printing. Three scholars had a problem converting text (importing and exporting) (S1, S3, S6). Two were unable to format text sufficiently (no equation editor; loss of formatting when exporting text) (S3, S6). Two experienced some version-control problem because they were saving their Info Select file to a floppy disk (S1, S4). The last problem is a general computer-tool problem; the others are specific to Info Select and suggest areas for design improvement.

BTF Problems and Likes. Most of the units coded BTF (basic tool feature) were also classified according to the main coding system and have been discussed already in various contexts. They are briefly summarized here (and listed in Appendix B) because of their implications for tool feature recommendations. Of the 12 items on the BTF list (see Appendix A), only 4 were mentioned by at least half of the scholars. Of these 4, easy and accessible stand out as important attributes of tools. Half of the scholars considered Info Select easy to learn and use; the other half had problems related to ease of learning or use. Accessibility was important to four scholars; three scholars reported liking Info Select because it made their information more accessible. Several scholars mentioned or implied

that efficiency was a need and a benefit of using this program. Many coding decisions in this category were based on latent content, so they cannot be regarded as strong evidence for scholars' interest in efficiency. Most of the scholars mentioned something about saving time with tools or a specific tool.

Problems, Needs, and Likes Summary

Table 12 is the result of adding the data on change and likes related to the use of Info Select to the table showing the previously summarized data on scholarly activities, problems, and needs. This makes it possible to compare, across the various coding categories, the number of scholars mentioning scholarly work changes and likes with the numbers mentioning scholarly work activities, problems, and needs.

The fA (filing system) and F (finding) categories continue to be the most frequently mentioned across all the additional coding schemes. Activities in these categories are mentioned by at least half of the scholars as problems, needs, likes, and change. The O2 (reorganize) and RA (reminders) categories, mentioned as needs by at least half of the scholars, are also mentioned as likes and show evidence of change. New categories (mentioned as change and likes but not mentioned as problems or needs) are DS (display by scanning) and OC (categorize). Conspicuously missing in the problems, needs, likes, and change columns are the A subcategories (with one exception); mention of DP and DR (print and read), fI (index), OH/OL (outline, list), OS (sort), OZ (integrate), and RH (highlight).

Table 12

Scholarly Work Process Activities, Problems, Needs, Change, and Likes Mentioned by Scholars

Code	Meaning	SWP	Problem	Need	Change	Like:IS
A:R,B	Add references, bibliog.	6				
A:N	Add notes	6				
AT	Type up notes	6				
AV	Import/convert	5				4
A2	Copy	4				
CK/ED	Check/Edit	3				
AF	Format	6				
DP	Print	5				
DR	Read, study, review	6				
DS	Scan, browse, view	5			4	5
D-viz	Display more, graph, …			4		
fA	Filing system	6	3	4	4	5
fA-sc	Scan into system			5		
fI	Index system	3				
FG	Find: Gather	5				
FQ	Find: Query	5	5	4	4	5
FS	Find: Scan	6				
Mem[a]	Memory		6			
O2	Revise, reorganize	6		4	2	3
OC	Categorize, key	6			2	5
OH/OL	Outline, list	6				
OS	Sort, order	6				
OM	Move, transport	6		5		
OZ	Integrate, synthesize	4				
RA	Reminder note	5		3	3	4
RH	Reminder highlight	4				
W	Write	6				
W-O,T	Write using outline	5				

Note. The number of scholars is provided only for items mentioned by at least half of the scholars. SWP=scholarly work process. IS=Info Select.

[a] Mem is not a code in the coding system, but is added here to group a number of items, most of which are code F but some of which have other codes (R, W, …).

Info Select Checklist

Another source of data on Info Select tool features scholars used, liked, and had problems with is the Info Select Checklist (Appendix A). The data collected in three different interview sessions are combined in Table 13. The Info Select tool features are listed in the order they were taught, from the most basic operations to the more complex.

Empty spaces in the Trained column of the table indicate that a few features were not even trained, for certain scholars. Placeholders seemed trivial and unnecessary, and multitasking turned out to be irrelevant. Folders and converting topic to note were too advanced for certain participants, based on where they were, how much time was left, and their lack of need for those features. The view multiwindows feature was shown only to three scholars who specifically requested it, because it was confusing and not useful. Lack of training could account for lack of demonstration and usage for features 28-34, but not for the other features: 9, 11, 12, 14-17, 20-22, and 25.

Demonstrated is checked if the scholar demonstrated the ability to use the feature at least once, which could have been right after training. It does not imply the scholar ever used the feature after that. A comparison of demonstrated and used, however, shows close correspondence. Not using a feature may be the result of not learning it well enough, or it may be because the scholar did not need it. Not needing a tool feature could be related to stage of scholarly work project or type of project. For example, most of the participants did not yet have enough data in the system for the search feature to be important.

Table 13

Info Select Checklist Data: Features Trained, Demonstrated, Used, Liked, Problems

#	Info Select tool feature	Trained						Demonstrated						#	Used						Liked						Problems					
	S#	1	2	3	4	5	6	1	2	3	4	5	6		1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
1	Add/delete topic/note	√	√	√	√	√	√	√	√	√	√	√	√	1	√	√	√	√	√	√		√		√	√	√	√					
2	Create/edit caption	√	√	√	√	√	√	√	√	√	√	√	√	2	√	√	√	√	√	√		√		√	√							
3	Edit	√	√	√	√	√	√	√	√	√	√	√	√	3	√	√	√	√	√	√	√	√		√	√							
4	Save file	√	√	√	√	√	√	√	√	√	√	√	√	4	√	√	√	√	√	√	√				√					√		
5	Move/copy topic/note	√	√	√	√	√	√	√	√	√	√	√	√	5	√	√	√	√	√	√	√	√		√	√							
6	Indent, promote	√	√	√	√	√	√	√	√	√	√	√	√	6	√	√	√	√	√	√		√		√	√		√		√			
7	Split/join notes	√	√	√	√	√	√	√		√	√	√	√	7		√	√	√	√	√		√			√					√		
8	Format notes	√	√	√	√	√	√	√	√	√	√	√	√	8			√	√						√								
9	Sort (alphabetical)	√	√	√	√	√	√	√			√	√		9	√		√	√	√		√	√	√	√	√							
10	Search (word/phrase)	√	√	√	√	√	√	√	√	√	√	√		10	√	√	√	√	√	√	√	√		√	√					√		
11	See different views	√	√	√	√	√	√							11				√	√	√				√	√							
12	Shortcut keys	√	√	√	√	√	√	√			√	√		12		√			√	√					√							
13	Save, backup IS file	√	√	√	√	√	√	√	√	√	√	√	√	13	√	√	√	√	√	√	√	√	√	√	√							
14	Search (date, size)		√	√	√	√	√	√					√	14	√						√											
15	Boolean search	√	√	√	√	√	√	√			√		√	15	√						√											
16	Search (data marker)	√	√	√	√	√	√		√		√			16																		
17	Sort (date, marker)	√	√		√	√	√	√	√		√	√		17	√						√											
18	Caption: implicit/explicit	√	√	√	√	√	√	√	√	√	√	√	√	18	√	√		√	√	√					√		√			√		√
19	Print	√	√	√	√	√	√	√	√	√	√		√	19		√	√	√		√		√	√							√		√
20	Summary (body, caption)	√	√	√	√	√	√					√	√	20			√			√												
21	Summary (range)	√	√	√	√	√	√				√	√		21			√		√	√					√							
22	Summary (level)	√	√	√	√	√	√							22			√			√												
23	References: format	√	√	√	√	√		√						23	√		√	√	√		√				√					√		
24	References: keywords	√	√	√	√	√		√	√			√		24	√	√	√		√		√		√		√							
25	References: summary	√	√	√	√	√						√		25			√		√	√					√							
26	Import, export	√	√	√	√	√	√	√	√	√	√	√	√	26	√	√	√		√	√	√						√					
27	File-Topic	√	√	√	√	√	√	√	√	√	√	√	√	27			√	√	√	√				√	√	√						
28	Reminders: folders		√		√	√	√						√	28			√			√												
29	Placeholders/bookmarks	√	√				√	√	√				√	29			√							√								
30	Create topic from search		√		√	√	√					√	√	30																		
31	Convert topic to note		√	√										31																		
32	Sorting bin			√	√	√	√							32	√		√		√	√	√			√	√							
33	View multi-windows		√	√			√		√					33		√																
34	Info Select multitask				√								√	34																		

All of the scholars used the most basic features (1-6, 10, 13, 18); five scholars used features 7 and 26 (split/join and import/export). Sort and print were used by four scholars at least once, as were format references, keywords for references, file-topic, and sorting bin. Half of the scholars used different views, shortcut keys, and reference summary. There were 12 features only two or fewer scholars used: complex searches, complex sorting, and the summary feature; converting, "folders," multitasking and multiwindows, and formatting notes (participants were warned against formatting, because transferring the information to a word processor would result in loss of formatting).

Most of the problems were learning problems (based on checklist data supplemented by training transcripts). S1 indicated problems with four features due to "remembering how," and S4 "needed help" with six features. Neither used the program as much as the other participants. S3 had a problem indenting notes and topics because he kept forgetting to open the topic first. This problem was not related to a lack of usage. S6 had problems with two features that are not compatible with Windows standards.

For S5 and to a slightly lesser extent S1, there is a very close correspondence between used and liked on the checklist. For S3 and S6, there are very few likes checked. S3 appears to have skipped all the basics as being not worth commenting on (or marking as likes). He also skipped the tool features he did not use or had trouble using (all summary and convert features). He checked as liked and commented verbally on four specific features he used extensively or was especially impressed with and felt confident

using. S6 marked only two features as likes, although during the interviews he referred to many features he liked.

Most of the first 13 features—the basic tool features—were checked as likes by three or four of the participants (the remaining two scholars, S3 and S6, marked very few likes). As with the checklist usage data, only more so, the advanced features were not checked. Scholars in general did not like the advanced searches (date, Boolean, and data marker) and advanced sorting. They did not like folders, an advanced feature for further classification. Only S5 liked and used the summary feature for gathering references into a reference list. Three scholars did like the file-topic feature, and three liked the sorting bin and used it enthusiastically at least once.

To summarize the checklist results, all scholars used the most basic features. There were 12 features only two or fewer scholars used: complex searches and sorting, the summary feature; converting, folders, multitasking and multiwindows, and formatting notes. Most of the problems are learning problems. Scholars in general did not like the advanced searches (date, Boolean, and data marker) and advanced sorting.

Tool Evaluation Forms

The Tool Evaluation Form (Appendix A) presented the same list of activities, in the first and final interviews, with the focusing question slightly different. The question for Form 1 was "How important is it to you to ...?" and the question for Form 2 was "How useful is Info Select in enabling you to ...?" Participants completed the survey in writing by circling a number from 1 to 5, with 5 as the highest rating. The research goal was to infer

tool features from the rated activities, based on common codes (e.g., if F activities are rated important, tool features that support finding are inferred to be important).

Table 14 shows the ratings each scholar gave, for each item, with a slash separating the Form 1 rating from the Form 2 rating. (Blanks indicate the scholar did not do that activity or did not remember doing it.) On both forms, S2 and S5 gave 5's to most items, and S3 and S6 distributed many low ratings across all major categories. On Form 1, S4 gave many low ratings, in all categories, on Form 2; however, S4 gave all high ratings. S1 also gave many low ratings on Form 1, in all categories except for the reference category; on Form 2, S1's ratings were generally high, with a few low scores in the D and BTF categories.

Table 15 shows, for both forms, only the items receiving the highest and lowest ratings by scholars. In column 4, showing high ratings on Form 1, activities involving references are prominent. Specific activities that were rated as most important for scholarly work by all scholars include taking notes, reorganizing them, classifying them into categories, avoiding retyping them, and saving them safely; creating references, sorting and categorizing references, and browsing, gathering, and printing references; saving time and effort, being efficient and fast. High ratings are distributed across most of the major coding categories, but low ratings occur for other subcategories in the same major categories. Mixed highs and lows in major categories indicate that scholars' needs are variable in these areas. The items in these categories do not cluster together as a group.

Table 14

Tool Evaluation Forms Data: Interviews 1 and 4

Code	Tool Feature	S1 I/IS	S2 I/IS	S3 I/IS	S4 I/IS	S5 I/IS	S6 I/IS
A							
	Take notes	2/4	5/5	5/5	4/5	5/4	5/4
	Revise notes	4/3	5/5	3/5	5/5	5/4	5/4
	Format notes	4/	5/4	3/5	2/5	5/	3/2
	Move/copy notes	4/4	5/5	5/5	5/5	5/5	5/4
	Split/join notes	4/	5/5	5/3	5/5	5/5	5/2
	Avoid retyping	4/4	5/5	5/5	3/5	5/5	5/4
f							
	Multiple notes	2/	5/	2/1	1/5	2/	4/1
	Multiple outlines	2/5	5/	2/1	1/5	5/5	1/2
F							
	Find notes	4/4	/5	5/5	4/5	5/5	4/5
	Search specific	3/4	5/5	5/5	4/5	5/	4/5
	Search gather	3/4	5/5	3/5	3/5	5/	5/4
	Boolean search	2/4	4/	2/5	3/	5/	5/
	Search: date, neural	2/	4/	5/3	2/	5/	3/
	Index notes	2/3	5/	5/5	1/5	4/5	2/
	Save notes	4/4	5/5	5/5	5/5	5/5	5/3
O							
	Organize notes	4/4	/5	5/5	4/5	5/	5/5
	Sort notes	3/4	5/5	5/5	4/5	5/	5/4
	Sorting bin	2/4	5/	3/3	4/5	/5	5/2
	Physically reorg	4/	2/	3/1	4/	3/	3/1
	Classify notes	4/	5/5	5/5	5/5	3/	5/3
	Defer classify	3/4	5/	3/1	2/5	4/5	2/1
	Create outlines	5/5	5/5	5/5	1/5	5/	5/5
	Revise outline structure	4/5	5/5	3/5	1/5	5/	5/4
	Revise outline content	3/4	5/5	4/5	2/5	5/	5/4
	Archive outlines	2/4	/	3/1	1/	3/5	1/2
	Topic from srch	3/	/	5/5	3/	/	2/3
D							
	View outline only	4/5	4/5	4/5	3/5	5/	5/5
	View level	4/4	5/5	3/5	3/5	5/	4/3
	View notes only	4/2	5/	5/1	4/5	5/	1/2
	View notes and outline	/2	5/5	/5	/5	/	/5
	View in windows	3/	5/5	5/1	1/5	5/	4/3
	Scan quickly	3/4	5/5	5/5	5/5	5/3	3/5
	View graphically	2/1	5/	3/5	1/3	5/	3/5
	View on printouts	4/4	5/5	3/1	2/5	4/	5/3
	Summarize by amt	2/2	5/	5/5	5/4	/	4/3
	View more than screen	4/2	5/5	3/1	4/2	5/	5/2

(table continues)

Code	Tool Feature	S1 I/IS	S2 I/IS	S3 I/IS	S4 I/IS	S5 I/IS	S6 I/IS
B							
	Create references	4/4	5/	5/5	5/5	5/5	4/
	Format references	4/4	5/	5/1	3/5	5/5	2/
	Annotate references	4/4	5/	5/5	3/4	5/	3/
	Index references	4/4	5/5	5/5	3/3	5/	4/
	Sort references	4/4	5/5	5/5	5/5	5/5	5/
	Categorize references	4/4	5/5	5/3	5/5	5/5	4/
	Query references	2/4	5/5	3/5	5/5	5/	4/
	Gather references	4/4	5/	5/5	5/5	5/5	3/
	Browse references	4/4	5/5	5/5	5/5	5/4	3/
	Print references	5/2	5/	5/1	3/5	5/5	5/
	Verify references	3/3	5/	5/5	4/5	5/	3/
T							
	Save time	4/4	5/5	5/5	5/5	5/5	5/3
	Save effort	4/4	5/5	5/5	5/5	5/3	5/4
	Be efficient	4/4	5/5	5/5	5/5	5/3	5/3
	Clean copy	4/2	5/5	3/1	5/5	5/3	2/4
	Easy (learn/use)	3/2	5/5	5/5	5/4	5/3	2/2
	Accessible, available	4/4	5/5	5/5	5/4	5/5	4/4
	Fast	4/4	5/5	5/5	5/5	5/5	5/3
	Switch tasks	2/	5/5	5/5	4/5	5/4	3/3
	Safe storage	4/4	5/5	5/5	4/5	5/5	3/1
	Transfer to apps	2/2	5/5	5/5	4/4	5/5	5/2
	Backups	2/3	5/	5/5	3/4	5/5	2/2
	Rearrange files	4/4	5/5	5/5	3/5	5/5	4/4

Table 15
Tool Evaluation Forms 1 and 2: Highs and Lows

	Code	Activity	High 1	High 2	Low 1	Low 2
A	A:R	Add references	√	√		
	A:N	Add notes		√		
	AT	Avoid retyping notes		√		
f	fA:N	Save notes safely	√			
	fA:O	Archive outlines			3	2 sd
	fA:O2,N2	File multiple copies: N & O			4 sd	3 sd
	fI:N	Index notes			3 sd	
F	F:N	Find notes	√	√		
	FG:R	Find: Gather references	√	√		
	FG:N	Gather notes		√		
	FQ:N,R	Word search notes, refs		√		
	FQB	Find: Query Boolean		√	3 sd	md
	FQN	Fuzzy/neural search			3	md
O	O:N,O	Organize notes, outlines		√		
	O2:N	Reorganize notes		√		
	OC:R	Categorize references	√			
	OCD	Defer classification			2 sd	2 sd
	OH	Create outlines		√		
	O2:O	Revise outline structure		√		
	OS:N	Sort notes		√		
	OS:R	Sort references	√	√		
R	RA:R	Annotate references		√		
D	DP:R	Print references				1 sd
	DS:R	Browse references	√	√		
	D:N	View notes only				3 sd
	D:O	View outline only		√		
	DW	Display in windows				1 sd
	DU	IS summary				1 sd
BTF	bu	Make backups			2 sd	
	cl	Clean copy				2 sd
	ea	Easy to learn/use				2 sd
	Ac, sp	Accessible, Fast	√	√		
	ti,ef,eff	Save time,effort, be efficient	√√√	√		
	mm	Move, rearrange files		√		

Note. Checkmarks for High indicate all ratings were 4 or 5. Numbers for Low indicate the number of scholars rating the item low. Lows are shown only for items that were rated less than 3 by at least 2 scholars. sd=split data. md=missing data (only 1 or 2 data points).

Almost every item that was rated high on Form 1 was also rated high on Form 2. Many new items were also rated high, mainly related to finding and reorganizing information. High ratings for three word-search items and three outline-related activities suggest that these activities became more important during the study, as scholars used this program, or that scholars became more aware of doing these activities while using this program. This initial focus on references seems to have shifted to a focus on notes and outlines. Basic tool features related to speed, efficiency, and accessibility seem to have become more important or more noticeable.

It is also revealing to look at items that two or more scholars rated as "not important" (rated as 1 or 2). Numbers in the last two columns of Table 15 indicate how many scholars rated an item low on the evaluation forms.[12] Several items were consistently rated low: file multiple copies of notes or outlines (fA:O2); archive outlines (fA:O); advanced searching—Boolean or neural (FQB, FQN); and defer classification (OCD). Worth noting is that three of these four are in the F/f category.

It should also be noted that almost every item rated low on either form is actually a split rating (“sd” on the table), with two or three scholars rating it low and at least two rating it high. The table entry "md" indicates missing data: only one or two scholars rated the item. Only one item (Find: Query Boolean) went from a low rating on Form 1 to a

[12] Three activities on Form 1 are not relevant for Form 2 because they cannot be accomplished in Info Select; they are excluded from this discussion: physically rearrange notes/outlines, display graphically, and display more. Most scholars rated the first two as unimportant on Form 1.

high rating on Form 2, but the missing data suggests that many scholars did not know how to rate this or did not use the feature.

Two items were rated low on Form 1 but neither high nor low on Form 2: index notes and make backups. Six items were rated low on Form 2 ("Info Select enables ...") but not on Form 1 ("important"): print references, view notes only, display in windows, summary feature, clean copy, and easy to learn/use. It seems likely that several of these low ratings were because certain tool features were difficult to learn or use for at least half of the scholars.

The items rated low (multiple copies, archive outlines, index notes, find Boolean and neural, defer classification, display in windows, summary) are the same activities scholars had trouble learning and did not use (cf. checklist data described in previous section). These same activities never showed up on the scholarly work process activities maps or even as problems, needs, and likes.

Specific Themes

The review of the literature was concluded with the suggestion that Info Select is a tool for thinking because it affords organizing and outlining. It therefore seemed appropriate to conclude the content analysis of tools to augment thinking with a review of data that might support or refute that suggestion. I did this by searching the database of 818 units of analysis for all units containing the term "thinking," all units mentioning "outlining," and units I had tagged "afford" when entering the data. The results of these

searches are described briefly here (see Appendix B for the complete lists) and discussed in chapter 6.

Thinking and writing. Three scholars focused on categorizing and outlining information as critical thinking activities. S1 referred to categorizing and sorting notes into folders as the "in-depth thinking" and the "thinking stage." He described the outline as "the critical thinking" and "where the thinking is." S2 said hierarchical categorizing "helped my thinking about this complicated data base." He used Info Select to organize his thinking because it was "easier to group things"; having done so, the writing was easy, because "you don't even have to think." S6 said he organized his thinking with Info Select because it "helps you to quickly develop outlines."

Two scholars referred to reorganizing notes and displaying outlines as creative thinking. S2 said reorganizing led to the discovery of new relations in the data; S1 said viewing the outline let him "see what's going on and make decisions and get ideas."

Two scholars seemed to equate writing with thinking or analysis. S3 considered the process of taking notes, writing a paper, and defending ideas as analysis. For S5, writing is the process of discovering what to think about a topic, a process that often involves several drafts. I studied a list of units coded W, to see if other scholars meant thinking when they discussed writing. Scholars described what they wrote, where, when, and how, including what tools they use (see W category in Appendix B, Scholarly Work Process Activities). They did not talk about covert (unobservable) thinking activities.

They talked about writing from a list or outline, using notes, thinking at the keyboard, and writing with "it all in my head."

Affordances and outlining. I predicted, based on the literature related to scholarly work problems and solutions and especially the concept of affordances,[13] that a computer tool for thinking should afford outlining, organizing, reorganizing, and sorting. Descriptions of their use of Info Select by several scholars seem to back up this prediction. S2 said he was moving and reorganizing notes and topics more, "just because it's so easy to move." He found himself doing more categorizing, at finer levels of distinction, because the program "allows me to categorize the literature . . . much more efficiently . . . than I ever could before." S5, referring to the program, said "I think it made it easier, and therefore made it more likely that I would do more than I might do." S6 said, "because the outlining in this is easier, it's easier to group things; it helps you organize your thinking."

Scholars did not mention outlining as a problem, need, like, or change. Most did not mention outlining at all as an activity, unless prompted with a question. Only one scholar, S1, did extensive outlining in Info Select, using the Selector to create topics for a hierarchical outline, with notes under the topics. When S2 was filling out the Tool Evaluation Form and I pointed out that the program's Selector is an outline, he said he needed to go back and answer the outline-related questions differently. Reading the same questions, S4 asked, "Did we do outlines?" S5 took some time to consider the possibility

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[13] "We tend to use objects in ways suggested by the most salient perceived affordances, . . . they make some things easy to do, others difficult." (Norman, 1993, pp. 105-106)

of doing outlines using the Selector and concluded it would be useful but would require a "shift in the way you think."

If Info Select affords outlining, were most scholars using the Selector as an outline without even realizing it? A review of the content files does not support this supposition. Four scholars had notes within topics, like lists, with no hierarchy of nested topics at all. One scholar used the Selector as a simple outline of three levels, having imported his book's table of contents into the Selector. Another scholar had created a four-level hierarchy in the Selector, but he also had a detailed, multilevel outline within a single note. To process the outline would require the same kind of cut and paste, the same difficulties of changing the level of a section, encountered in a word processor—the problems that an outline processor should solve. There is no evidence that any scholar was taking advantage of the outline-processing capabilities of the program.

CHAPTER 6

DISCUSSION AND CONCLUSIONS

This chapter considers, first, whether the research findings support the theoretical propositions and framework of the study. Results supporting the study's definition of thinking and the proposed categories of scholarly work activities are discussed. Evidence is presented to justify the methodology of using a tool to reveal details of the scholarly work process.

The second section considers whether the findings support the predictions based on the literature review, and the implications of these findings for tool features. The discussion focuses on the three major categories of scholarly work emphasized by the scholars and activities in those three areas related to specific predictions.

The chapter concludes with a discussion of contributions of this research to knowledge of scholarly work process and tools to augment scholarly thinking. Gaps in current knowledge are presented as indications of the need for further research in specific areas. The advantages and limitations of the research methodology are reviewed, leading to recommendations for future research.

Support for Theoretical Propositions

Thinking and Scholarly Work

1. Thinking is doing: Activities scholars engage in, often covert but capable of being made overt. Scholars almost always talked about specific observable activities (all of

the categories and subcategories of the coding scheme) instead of using the term "thinking" (less than 2% of the coded units contain the term). Undoubtedly some portion of scholarly thinking remains unobservable, but a database of 550 scholarly work activity units mentioned by scholars indicates that many of these activities are observable, at least by the scholar reporting them.

2. Thinking is a problem-solving activity that involves organizing and ordering information. Half of the scholars specifically mentioned organizing (categorizing and outlining information) as the critical thinking activities (see Specific Themes, p. 150). The rest of the scholars did these activities and described them, without using the term "thinking."

3. Thinking activities include finding/filing information, organizing, ordering, outlining, reminding, and displaying organized information. The content analysis indicates that these are the majority of thinking or scholarly work process activities that scholars are aware of. Together with adding, reminding, and writing, they constitute almost all of what scholars talked about when they described their work. This is true without noticeable variability across six scholars.

A Tool to Augment Thinking

4. These activities imply the tool features scholars need to augment thinking: A tool that supports finding, organizing, reminding, and displaying information. (This is a logical argument.)

5. Info Select is a computer tool that supports these activities with specific tool features. Evidence of change in scholarly work process and statements of what scholars liked about the program support this proposition. Scholars used and liked features in all of the major proposed categories, especially in the subcategories related to filing, reorganizing, categorizing, reminding, and displaying (scanning).

Use of Tool as Methodology

6. The scholar's use of Info Select would reveal previously unavailable aspects of the scholarly work process and specific features of a tool to augment thinking. “Previously unavailable" could refer to information not mentioned in the initial interview but available in later interviews because of use of the program or because of additional interviews. There is strong evidence for such previously unavailable information. Interviews 2, 3, and 4 supplied 48 new data units (not repetitions) for scholarly work activities. More important, most of the problems, needs, and likes units (75-80%) for five of six participants are from later interviews. The data are much richer than a single interview with no program use would have provided.

"Previously unavailable" could also refer to information that contradicts the predictions of the literature review or was not predicted. Such information, and especially the findings of the study that support the literature review predictions and their implications for features of a tool to augment thinking, are the topics of discussion in the next section.

Support for Literature Review Predictions, and Implications for Tools

fA/PDS: Filing System

The review of literature related to scholarly work problems and potential solutions indicated a need for tools that support information storage and retrieval in personal documentation systems (PDSs) for both reference citations and notes. This study found that, prior to the use of Info Select, only one scholar used a specialized application for references. All used their word processor or paper and pen to record notes. They stored source material in filing cabinets and computer subdirectories, and usually kept notes only until the completion of a scholarly work project. Scholars reported problems with setting up and maintaining filing systems and especially with finding information after filing it. Remembering the exact location for a particular fact was a problem for everyone. Findings categorized as needs indicate the same: Most of the scholars mentioned the need to be able to get back to stored notes and references and to search notes to find specific information.

All of the scholars used Info Select as a filing system for notes. Three scholars used the program to store references. Four of the scholars reported changes in the way they stored references and notes, indicating the use of the program as a personal documentation system. Although no scholar explicitly mentioned the difficulties of using database bibliographic applications, the fact that these scholars kept their references in a word processor file until they began to use Info Select suggests that easy, user-friendly, and familiar format may be important features for a PDS tool.

Predicting “paperless information systems,” Lancaster (1979) suggested the personal documentation system should allow the researcher to download information fast and organize it in a personal file to get back to easier or use it. Five scholars in this study expressed interest in using a scanner to add source material (full text or smaller amounts) to the personal system. They believed the scanner would provide an efficient method for collecting information that could then be found using the tool’s search engine.

F: Finding

Finding the information was a major concern for most of the scholars. All expressed initial interest in the multifaceted search engine available in Info Select. Most believed it would solve their memory problems. Findings show, however, that only one scholar used the search feature for scholarly work. Several tried the search feature and mentioned the potential benefits of using it. One used it to gather a reference list after marking references with a keyword. Most continued to browse through their notes and references when looking for a fact or reference.

One result of the literature review was the recommendation that a computer tool for thinking should have a powerful but easy-to-use search engine with indexing capability. Research results, however, show little interest in indexing and no use of advanced search features. In fact, the scholars seldom even used the simple word search feature. Like the researchers Heeks (1986) surveyed, the scholars in this study appear to be "information amateurs," conducting simple searches or relying on memory.

Why did the scholars show little interest in the program's search capabilities after describing problems finding information and the need to supplement memory? There are several possible reasons but no evidence to support them from this study. It may be that scholars did not have enough information in the system yet to warrant searches, so they continued to rely on memory. The fact that they wanted to scan in more information seems to support this suggestion. Advanced searches may have been too difficult to learn or too complex to use, for most scholars. The data indicate that ease of learning and ease of use are important characteristics of computer tools for these scholars. Not searching may have been because of a lack of experience with searches, because many scholars rely on library professionals to search the literature. If this is the case, the situation should change in the next few years, as Internet searching becomes commonplace. Finally, it may be that searching is not especially important except as part of an integrated system combining organizing, browsing, and even simple keyword indexing features with a powerful but simple search engine.

O: Organizing

Based on his study of office managers organizing information, Malone (1983) recommended specific computer tool features to solve classification problems. These features included support for categorizing and organizing, making it easy to reorganize, defer classification, keep multiple versions, and create multiple categories. Automatic classification according to preset rules should be possible, and file-naming problems should not complicate the recall and recognition of information.

Findings of this research support the first two recommendations but not the others. Categorizing and reorganizing information were major activities for all participating scholars, and more than half indicated specific needs related to reorganizing and revising. At least half described features of Info Select they liked in these two areas, and a couple of scholars changed their work process because of these features.

The program provided capabilities for the more advanced features Malone recommended (except for automatic classification), but scholars expressed no interest in these features. They rated the features as unimportant and did not use the features. These activities were not described as problems or needs. Only one scholar kept a previous version of an outline. Malone proposed these features because, he said, categorizing is difficult and naming files is a problem. Scholars in this research mentioned no problems with classifying information. Given the opportunity to defer classification (just throw a note in a "miscellaneous" stack), no one was interested. Shown the sorting bin feature, whereby the user sets up several categories and then sorts notes into them, participants immediately and quickly categorized large amounts of information, showing no hesitation at all. These findings tend to support the literature on thinking (Bruner, Goodnow, & Austin, 1956; Miller, 1956; Ausubel, 1960) that suggests that organizing and categorizing are the essence of thinking and what scholars do.

Scholars reported a need for tools to reorganize information (O2), as predicted by the literature review. They reported a need for tools to help them move or transport their information (OM), which was not predicted. Moving the information from one application

to another or from one location to another is not as straightforward as it should be. Scholars need to easily carry the information or be able to access it from another location.

Based on literature in the areas of writing (Daiute, 1985), memory (Miller, 1956), and scholars' needs (Case, 1984; Skinner, 1987), it was predicted that outline processing would be an important tool for scholars. Info Select, it was proposed, is a tool that "affords" organizing and outlining, making these activities easy and therefore more likely to occur. The findings support this prediction for organizing (OC) but not for outlining (OH).

Contrary to the literature review prediction, Info Select did not afford outlining (by definition), and outlining was not a solution to scholars' memory and organizing problems. Only one scholar used the program's Selector as an outline; three expressed surprise that an outlining feature existed. Info Select's Selector looks like a file manager, with files (notes) nested within folders or subdirectories (topics). It may be that familiarity with file managers prevented the scholars from seeing the Selector as an outline processor. This perceptual bias—combined with the fact that most of the scholars were not accustomed to making outlines more complex than simple planning lists—may have prevented the scholars from taking advantage of the outlining feature.

Other explanations for the lack of interest in outlining may be proposed. The literature is contradictory: Outlining is highly recommended (Peirce, 1971), but it is difficult (Howard & Barton, 1986); either few writers make outlines (Emig, 1971), most make outlines (Case, 1984), or variability exists (Trigg & Irish, 1987). Most of the

scholars in this study indicated that they make simple list-like outlines, suggesting that they have little need for advanced outline processing features.

D: Displaying

Recommended tool features based on the literature review included display capabilities that support rapid scanning, gathering information for synthesis, and viewing conceptual relations. Tool features specifically related to outlines included the capability of viewing structure and details at various levels of abstraction.

The study's findings support only the first of these recommendations. With the scholars showing no interest in outline processing, it is not surprising that they would also show little interest in complex ways of displaying outline structure. Only a couple of scholars mentioned something about displaying information graphically. The scholars did not specifically mention a need to display more information on the computer screen, although at least one referred to this need indirectly, saying that he needed to read his drafts on paper so he could see more at a time.

A need for multiwindows and multitasking was predicted, but these activities were not mentioned by scholars. It may be that the nature of scholarly work does not require trying to do several activities at once as might occur in an office environment.

The one display feature that stands out as important for these scholars was rapid scanning (DS). Scholars liked being able to scan through their notes quickly in Info Select, with all information immediately accessible and easy to get to without scrolling text line by line. The fact that they described change and likes related to rapid scanning of information,

although they did not mention any problems or needs in this area, suggests that scholars may have become more aware of the importance of rapid scanning because of their experience with this program. The difficulties of scanning information on a computer screen may be taken for granted until a better tool is available.

Although most of the scholars liked the rapid scanning feature in Info Select, none compared it to the problems of trying to scan word processing files to find information. Studies have shown that users find it very difficult to search for information across files without being able to easily "peek" inside (Lansdale, 1988; Reynolds, 1995). The scholars in this study did not mention that problem in their first interview or in subsequent interviews after using Info Select. It may be that they were keeping different kinds of information in this program than they usually keep in word processing files. It may also be that scholars rely on memory of what information is in which word processing files, instead of trying to search across files.

BTF: Learning Problems

Based on the literature review, 12 basic tool features were included as a separate coding system for the content analysis. The scholars rated the importance of these, along with the set of activities. Rated or predicted as important by scholars were efficiency, time-saving, and accessibility. Efficiency and accessibility were mentioned in interviews to some extent, when scholars referred to tool characteristics. Far more emphasis, however, was placed on easy: easy to learn, easy to use.

It was predicted that Info Select would be easy to use. Extensive training was

provided, but four scholars still had problems learning the features of the program. Most did not seem to want, need, or use the more advanced features, and they gave these low ratings. Were the low ratings because they had no need for these features, or because they found them difficult to learn or difficult to use? Even the scholar who had no problems learning to use these advanced features did not use them.

Contributions to Knowledge

Scholarly Work Process

This study's main contribution to knowledge is a theoretical framework, based on a review of literature related to thinking and personal documentation systems, for understanding the thinking activities of scholarly work. Multiple case studies of six scholars using a computer tool for organizing information supported the proposed theoretical framework. The findings provide a foundation for a better understanding of scholarly work activities, problems, and potential solutions to those problems.

As exploratory research, the study resulted in a preliminary taxonomy of scholarly work activities and thinking problems. The 7 major categories and 28 specific subcategories provide a framework for classifying the activities and problems of scholarly work. The framework is a useful starting place for future research on scholarly thinking. It might also serve as a useful system for classifying tools scholars use, to look for weak areas where development efforts could be focused effectively. If the framework holds up after more research, it could be used as the basis for educating young scholars, to provide instruction and practice in all the important areas of the scholar work process.

Gaps. Many questions remain, for research on scholarly work. The proposed categories overlap in ways that are not yet clear. Details, such as whether filing and finding are one category or two and whether adding notes and making memos are the same activity, need to be clarified through further research. How much of the thinking process remains unobservable is not known. Many of the variables that affect the scholarly work process are not understood. Variables might include the type and scope of scholarly project and the stage of the work; the scholar's tool expertise, goals, and motivation; external demands on the scholar's time and other constraints. The field is wide open for further research.

Tools to Augment Thinking

Through a content analysis of descriptions of how the participating scholars used Info Select as a personal documentation system for their scholarly work, this research revealed some of the kinds of scholarly work problems that can be solved with this particular computer tool and some of the problems that remain. As a practical contribution of this research, specific recommendations can be made about computer tools and tool features that could augment scholarly thinking. The results indicate scholarly work process activities could benefit from:

- A personal documentation system for notes as well as references, highly accessible and easy to learn and use.
- Tool features supporting fast input of both full text and selected information using scanners.

- A simple search engine integrated with features supporting rapid scanning of search results.
- Tools for categorizing and organizing, reorganizing and revising, and easily transporting information.

Gaps. Info Select is one tool that provides many of these features. What other tools provide similar features? Are there additional features of other tools that this research did not reveal because of its focus on and use of a particular tool?

Is the scanner an efficient method for getting the information into the system? If scholars could easily scan in everything they wanted, would organizing, indexing, and finding become more severe problems and demand better solutions? Finding information on personal computers might become as difficult as finding something on the Internet. How will scholars handle full-text source material in their own digital system?

Why did the scholars show so little interest in advanced search features? Several possible reasons were suggested, but this study provided no answers.

Why was there so little interest in and use of outlining? Is outlining itself so difficult, or are the tools the problem? With better tools, would scholars do more outlining? If they did, would this activity solve thinking and memory problems, as suggested by the literature?

What could scholars do, with better display devices? Why was there such a lack of interest, on the part of scholars in this study, in displaying conceptual relations structurally

and graphically? Innovations in windows multitasking and graphical displays occurred years ago. Why are scholars apparently not using these features?

Participating scholars seemed to appreciate having immediate access to all information in their Info Select filing system, and yet they expressed no problems with standard word processing filing systems that do not provide instant access and rapid scanning. Scholars in this study said nothing about the file-naming problem discussed in the literature. Is there a problem? Are there tool features scholars need but are not aware of needing?

Is "Keep it simple" a good rule for tool features? Scholars' learning problems and failure to use the more advanced tool features seem to indicate this may be true. Do scholars sufficiently understand how these more advanced tool features could help them or improve their work? How much training is needed, for them to be able to use these features successfully and efficiently, in order to accurately assess their value? Or is it a design problem instead of a training problem? If the advanced tool features, including the outline processing features, were designed to provide perceived affordances for their respective activities, as Norman (1993) recommends, would scholars use them?

Methodology

The methodology for this research was complex and somewhat nontraditional, based on some assumptions that needed testing. A review of what worked well and areas where improvements could be made might be helpful to other researchers. The overall design of conducting multiple case studies using focused interviews and a content analysis

of transcripts was successful, providing rich data. The only problem with this method is that it is extremely time consuming.

The triangulation of methods and data was invaluable. The mix of methods helped overcome biases and disadvantages of any one method. Viewing the data from many different perspectives answered questions and clarified uncertainties. Supplementing the usage logs with the program's automatic log was essential. The longitudinal perspective involving several interviews over a time period of 3-6 months and use of a tool to prompt descriptions of the work process were justified by the additional data made available.

Some risk was involved in certain initial assumptions underlying this methodology. The study proved these assumptions to be accurate:

- The introduction of a new tool would make participants more aware of their work activities and result in more data.
- A new tool and training in how to use it would motivate scholars to participate for at least 3 months.
- Scholars would try to adapt the program to their usual scholarly work process, rather than adapt their work to the program.
- Scholars would not be biased by the training: They would not use features they did not consider useful for their own work.

The main data collection method, focused interviews, worked very well. The journals were an excellent source of data, but motivating participants to keep a journal

was a problem. Of the three journals kept for this study, one added valuable new data. The other two were interesting but not essential.

The file content analysis was useful but limited. It provided information about the products of scholarly work, not the activities. Together with the automatic usage log, however, content files provided duration and usage information that clarified the scholars' overall work patterns.

The Data Sheet was disappointing. Only two participants recorded data, and the data were not comparable with the content analysis data. If designed and used properly, data sheets could have made participants more aware of their activities and provided valuable data.

Limited direct observation during training sessions and interviews revealed some problems scholars were having with the program, even contradicting some verbal descriptions. The indirect observation and unplanned talk-aloud protocol that occurred during the pilot study, however, were more useful than the direct observation that occurred in the actual research.

Recommendations for Further Research

The many questions raised by this research and the gaps in current knowledge described above indicate the need for further research on scholarly thinking. The topic is so complex and the variables so many and still not well understood, that further exploratory research is needed. Additional case studies to see if the framework categories apply as well to other scholars is recommended, along with some methodological changes.

In future research, an attempt to control for the type, scope, and stage of the scholar's writing project would provide more comparable data. Controlling for external variables that interfere with the scholarly work, especially demands on the scholar's time, would provide more data, more evenly distributed across scholars. The study should be conducted for a longer time period, even over several years. Similar research might be conducted with a different computer tool, or several tools.

Helping the scholars scan in a critical mass of source material to see the effect on organizing, filing, and finding activities would allow the researcher to investigate one of the issues raised by this study. Teaching Info Select as an outline processor, with practice in outlining with it, and then observing whether scholars use it for outlining, might shed light on another issue. More training and more time might make a difference in whether scholars use the advanced features.

Future research should encourage journal-keeping, improve the data sheets and motivate participants to use them, employ indirect observation and a talk-aloud protocol, and encourage more discussion of the scholarly work process and problems. Discussion might be encouraged by doing a member check early in the study, which might prompt scholars to clarify descriptions or add more detail. Another method would be to set up an interactive group of scholars, similar to a focus group, and facilitate open discussion of scholarly work.

One way to combine all of these methodological details would be to recruit a group of scholars to participate in 2-week "total-immersion" workshops once a year for

several years. The workshops could be conducted at a retreat setting away from routine work demands, with the latest computer technology and excellent technical support. The daily schedule would include technology training and practice, scholarly work time using the technology, and interactive discussions among the scholars and researchers. A research study of this scope and intensity might answer some of the questions raised in this study and contribute to both theory and practical applications for scholarly work.

APPENDIXES

A. CASE STUDY PROTOCOL

B. CODED LISTS

APPENDIX A

CASE STUDY PROTOCOL

INFORMED CONSENT FORM

INTERVIEW PROCEDURES

COMPUTER TOOL SURVEY

TOOL EVALUATION FORM

INFO SELECT TRAINING CHECKLIST

DATA SHEET

CODE LIST

BASIC TOOL FEATURES

CODE BOOK

CODING STEPS

UNITIZING PROCESS

My name is Leslie Burkett. I am a candidate for the Ph.D. Degree in Information Science, at the University of North Texas. This research study is being conducted for my doctoral dissertation.

Informed Consent form

I, _____, agree to participate in a study of activities involved in the scholarly work process and the use of a computer tool to augment scholarly work. The purpose of this study is (1) to identify and provide better understanding of the thinking/information-organizing activities of the scholarly work process leading to the writing of a publishable paper and (2) to identify the useful features of a computer-based thinking aid for scholarly work as revealed by scholars' use of a random information processor as a personal documentation system. The information obtained from this study will inform recommendations for computer-tool features that may help scholars accomplish their work more efficiently and effectively.

As a participant, I understand that my involvement in this study will consist of learning and using the computer program "Info Select." I will use this computer program over a period of 3 months to input and organize information for a scholarly work project that will eventually (but not necessarily by the end of the 3-month study) be used in the writing of a publishable paper. I agree to learn the relevant features of Info Select, as listed on the Check List of Info Select Features, in personalized, one-on-one training sessions with the researcher during the first two weeks of my participation in the study. I agree to participate in four 1-hour interviews with the researcher, at the beginning of the study and at the end of each month of the study, answering questions about my scholarly work activities and my use of this computer program. I understand that during some of these interviews I will be expected to complete a tool evaluation form, a checklist of tool features used, and/or a questionnaire asking for demographic and computer-experience information. In addition, I agree to keep an Info Select Journal of my experiences using the computer program during this study; to fill out a usage log after each session I use the program; and to provide a copy of my Info Select computer file to the researcher at the end of each week starting with week 3 of the study.

I understand that any information obtained in this study will be treated as confidential, recorded in a database with a code number rather than my name to preserve confidentiality. Audiotapes of recorded interviews and all printouts of information collected will be kept in a locked filing cabinet. I understand that I will be given the opportunity to review descriptions of the results of my participation in this research and to remove any statement I consider inaccurate or feel would compromise my anonymity; after doing so, I agree to allow Leslie Burkett to use the results of my participation in any way thought best for publication.

I have been informed that there is no personal risk or discomfort directly involved with this research. Benefits of participation include learning to use new computer software that may enhance my work and receiving a complimentary copy of the Info Select software. I understand that my participation in this study is voluntary and that I may withdraw at any time without penalty. If I have any questions or problems that arise in connection with my participation with this research, I may contact Leslie Burkett (researcher) at 214-581-3602 (beeper) or 972-353-4280 (home) or Dr. Philip Turner (dissertation advisor) at 940-565-2731 (work) or 940-484-8214 (home).

_____ _____

(Date) (Signature of participant)

_____ _____

(Date) (Signature of investigator)

This project has been reviewed by the University of North Texas Committee for the Protection of Human Subjects.

INTERVIEW PROCEDURES

Interview 1:

1. Introduction (focus question) example:
"My research is about the scholar, and the thinking process, and using the computer as a tool to help the scholarly work process. Basically what I'm interested in: When you do some kind of scholarly work, you would probably collect information from whatever sources and eventually end up with a paper, a publication, a dissertation, whatever. And what I'm mainly interested in is anything that goes on in between, in the process. I'm not that interested in how you go about collecting the information but what you do once you're reading something and doing whatever you do with it. So, this is what I want to talk about for awhile, just what it is that you do."

2. Prompting questions:
What is your current scholarly work project?
How (where) would you do that?
Any problems with that?
Tell me about it.
What do you do?
Do you do ____? (Notes? Outlines? Printouts?)
Clarifying questions about what scholar just said.
Questions depend on whether scholar keeps talking or not.

Interviews 2 and 3: Technical Support

Setting: Scholar's work computer (or reasonable substitute), with scholar's Info Select program open on the screen.

1. Focusing question (request):
Show me how you've been using the program.

2. Prompting questions/requests, when appropriate:
What have you found to be benefits of using the program? Problems?
What do you want to do with it, you haven't done yet?
Are you doing your scholarly work any differently, using this program?

3. Researcher and scholar go over checklist of Info Select features together, to see which features scholar is using, has problems with. Make sure scholar knows how to use (can demonstrate use of) each of the features.

4. Customized questions based on scholar's questions, problems with program, and my analysis of wd2 files and usage logs and journals from previous weeks (clarify any uncertain points and provide technical support as needed).

Sample focusing requests:

I#2: "The purpose of this interview is to talk about what you've been doing with Info Select, problems, whether we need to review anything useful to you at this point, features you are using and what you may need in the near future."

I#3: "Show me what you've been doing, using the program, and let's see if there's anything I need to show you that would help you do your work."

"This meeting is to get an idea of what you've been doing with the program. Any surprises as to how you've been using the program?"

Interview 4 (Final Interview):

1. Focusing question:
Tell me about your experience using Info Select.

Example:
"Tell me a little bit about your experience in using this program, how you've been using it, and anything you want to show me on the screen that you've discovered since we last talked."

2. Structured questions: 30 min.

Info Select Checklist (scholar fills out)
Tool Evaluation Form 2

Customized questions based on scholar's initial interview, comparing what scholar said in first interview with what scholar says about experience with Info Select and how scholar does scholarly work now: e.g., In our first interview session, you said ...; do you do this differently now?

Other Interview 1 Introductions (examples):

"This is my dissertation in a nutshell, the 10 sec. version. What I'm interested in is scholars and the thinking process and the use of computer tools to help this thinking process. That's basically what it's all about. In a more specific way, I'm interested in what the scholar does in the process of creating knowledge and publishing a paper or a book or whatever that this results in, and this is a schematic [showing graphic]: the scholar collects information, from whatever sources, books, journals, other people talking, and at some point does something with that information that results in a publication. I'm not focusing on the collection stage, which is what we ordinarily do in information science, or the writing stage. I'm trying to get at what happens in between."

"Ok. I'm looking at how scholars manage their information, how they use it, how they - the thinking process they go through. Scholars collect information from either reading articles and books or running experiments or whatever, they collect all kinds of information, and at some point they write up a paper. Mostly I'm interested in what happens in between. Not how you find information and collect, we'll probably touch on writing a little bit, because it's hard to separate that, but mainly I'm interested in recording information, what form you put it in, what you do with it, up to this point where you start writing it up. So what I want YOU to talk about is what you do, your process, what you go through."

"Getting an idea about how scholars work and whether the computer could be a tool to help them work, and if so, what features of a computer program would be useful for scholars. My first step in here is to ask people to tell me about how they do their scholarly work, talking about what it is you do when you have a project to write a paper or an article or do a dissertation proposal, where you gather information, organize it and do something with it. So I just want you to talk for awhile about what you do in this process. It's very interesting, I'm seeing a lot of variability . . ."

COMPUTER TOOL SURVEY

Which of these computer tools do you use?

Please check all items that you use and rate your level of expertise for each item checked:
1= novice, 5=expert.

Also, for each item checked, include the brand name of the computer program(s) you use.

Use? (√)	Computer tool	Expertise	Program (brand) name
	grammar/style checker	1 2 3 4 5	
	online bibliographic databases	1 2 3 4 5	
	outlining program	1 2 3 4 5	
	personal information manager	1 2 3 4 5	
	personal bibliographic database	1 2 3 4 5	
	personal indexing program	1 2 3 4 5	
	others (please specify):	1 2 3 4 5	

TOOL FEATURES EVALUATION FORM: 2

How helpful is Info Select in enabling you to:	**Circle one:** **Least → Most**
Take notes on computer?	1 2 3 4 5
Revise/edit/format notes?	1 2 3 4 5
Format notes?	1 2 3 4 5
Reorganize (move, copy) notes?	1 2 3 4 5
Reorganize (split, join) notes?	1 2 3 4 5
Avoid retyping notes?	1 2 3 4 5
Find notes?	1 2 3 4 5
Search for specific note/fact?	1 2 3 4 5
Search to gather similar notes?	1 2 3 4 5
Use Boolean operators to search?	1 2 3 4 5
Do neural or fuzzy or date searches?	1 2 3 4 5
Set up an index to your notes?	1 2 3 4 5
Save notes safely, to get back to later?	1 2 3 4 5
Organize notes/create outlines?	1 2 3 4 5
Sort notes?	1 2 3 4 5
Use sorting bin to sort many notes at once?	1 2 3 4 5
Physically (using paper) rearrange notes or outlines?	1 2 3 4 5
Classify notes into categories?	1 2 3 4 5
Save notes without classifying or naming them?	1 2 3 4 5
Create hierarchical outlines for writing?	1 2 3 4 5
Revise, reorganize outline structure?	1 2 3 4 5
Revise, reorganize outline contents (move notes)?	1 2 3 4 5
Preserve older versions of outline	1 2 3 4 5
Create new outline category from search results?	1 2 3 4 5
File multiple copies of a note?	1 2 3 4 5
Keep multiple copies of an outline?	1 2 3 4 5
View outline without notes?	1 2 3 4 5
View outline at various levels of abstraction?	1 2 3 4 5
View notes without outline?	1 2 3 4 5
View outline and notes simultaneously?	1 2 3 4 5
View notes in multiple windows simultaneously?	1 2 3 4 5

Scan quickly through notes, across files and folders?	1 2 3 4 5
Display outline relations graphically?	1 2 3 4 5
Display notes or outlines on printouts?	1 2 3 4 5
Summarize and display various amounts of information?	1 2 3 4 5
Display more information than fits on computer screen?	1 2 3 4 5
Create references?	1 2 3 4 5
Format references?	1 2 3 4 5
Annotate references?	1 2 3 4 5
Index references?	1 2 3 4 5
Sort references?	1 2 3 4 5
Categorize references?	1 2 3 4 5
Query references?	1 2 3 4 5
Gather references?	1 2 3 4 5
Browse references?	1 2 3 4 5
Print references?	1 2 3 4 5
Verify, Check references?	1 2 3 4 5
Save time when managing your information?	1 2 3 4 5
Save effort when managing your information?	1 2 3 4 5
Be efficient when managing your information?	1 2 3 4 5
Have clean, attractive-looking notes and outlines?	1 2 3 4 5
Easy to learn, easy to use method of managing information?	1 2 3 4 5
Readily accessible, available notes and outlines?	1 2 3 4 5
Work fast, without delays?	1 2 3 4 5
Switch among several tasks at once?	1 2 3 4 5
Safe long-term storage place for notes and outlines?	1 2 3 4 5
Transfer notes and outlines between computer programs?	1 2 3 4 5
Make backups of notes and outlines?	1 2 3 4 5
Move or rearrange files containing notes and outlines?	1 2 3 4 5

CHECK LIST: INFO SELECT FEATURES USED, LIKED, PROBLEMS

Scholar: _____

√ **used**	**Info Select Feature**	**Liked**	**Problems with**
	Add/delete topic/note		
	Create/edit captions		
	Edit notes		
	Save File		
	Move/copy topic/note		
	Indent/promote topic/note		
	Split/join notes		
	Format text		
	Sort alphabetically		
	Search (Get)		
	See different views		
	Shortcut keys		
	Backups		
	Search: neural/date/size		
	Boolean operators (and/or)		
	Other search options		
	Sort on date, data marker		
	Captions: implicit/explicit		
	Print: Layout/Captions		
	Summary: body/captions		
	Summary: lines range		
	Summary: indent level		
	References: formatting		
	References: keywords		
	References: summary		
	Import/Export notes		
	File-Topics		
	Reminders: Folders		
	Placeholders		
	Create topic from search		
	Sorting Bin		

DATA SHEET - USAGE LOG

For each session with Info Select, record the Date, Start Time and End Time. At the end of the session, think back about the activities you did during that session and check them off the list below if you did them at all.

Then record any questions you have for me about how to do something, and any comments you may have about anything.

DATE:	START TIME:	END TIME:

Check off (√) each activity you did this session:

√	DID:	TO: (√ one or more)
	Add	topics — notes — references
	Edit	topics — notes — references
	Split, combine	topics — notes — references
	Organize, rearrange	topics — notes — references
	View, study	topics — notes — references
	Search	topics — notes — references
	Kind of Search:	1. Word/phrase search 2. Boolean ("and/or") search 3. Browsed/scanned
	Add captions or keywords	topics — notes — references

Questions or Comments:

CODE LIST

1: Major	2: Specific categories	3: Object/what	4-Using/media
A	A ADD	N note	pc computer,
ADD/EDIT	AT Type	S source: article,	electronic
	A2 Copy, add again	paper, book	pa paper, pencil,
	AV Add-convert, import/export	O outline	by hand
	AF Format	T topic	mi mind, mental
	ED Edit	C caption/label	nc notecards
	CK Check, proofread	Ci implicit caption	fc file cabinet
F FILE	fA File: Archive	H header	pi piles
	fI File: Index		po printout
F FIND	FQ Query-find	D document (file)	sty styles
	FS Scan-find	W writing/draft	co color
	FG Gather-find	F fact/data	ps post-it
O	OC Classify, categorize	I idea, comments	hi highlight
ORGANIZE	OS Sort		cp cut and paste
	OH Hierarchicalize (outline)	B bibliography	rv reviewer
	OL List	R ref-cite	cm copy machine
	OM Organize-move	K keyword	sc scanner
	O2 Reorganize, Revise (O2:W)	X index	ty typewriter
	OZ Integrate, synthesiZe		tr tape recorder
R REMIND	RA Annotate, memo to remind	G graphic	pp Palm Pilot
	RH Highlight, color-code	U summary	fo folder
	RF IS Folders feature		sd subdirectory
D DISPLAY	DS Display by scanning/browsing	Y transition	li list
	DR Read, review, study	L level	lr lit. review
	DP Print out	A all	sb sorting bin
	DG Display graphically	Q quotes	sj split/join
	DU Display summarize	J project	em email
	DM Display more information	E education,	ov overhead
	DW Display in windows	lecture	fd floppy disk
W WRITE	W Create original text		odb online database
	(WS, WT, W2-see Code Book)		pdb pers'l database

Note. X (Other) = TA, ST, C, CC (see Code Book).

BASIC TOOL FEATURES

Basic tool feature	BTF code	Info Select feature	Tool Evaluation Form question
Accessible	ac		Available?
Back up	bu		Make backups?
Clean copy	cl		Attractive, clean?
Easy	ea		Easy to learn, use?
Efficiency	eff	shortcut keys	Be efficient?
Effort	ef		Save effort?
Fast	sp		Fast?
Manage files	mm	move, copy files	Move, rearrange files?
Safe storage	sa	backup wd2 file	Safe long-term storage?
Time	ti		Save time?
Transfer information	tr	import, export	Transfer between applications?
Windows multitasking	sw		Switch among tasks?
Added later: User-friendly	uf		
Windows standard	win		

CODE BOOK

ADD/EDIT

A Add
To add to your information, as in A:N (add notes). Usually a low-level, clerical activity.
A:N make notes, take notes, create notes (when meaning is "make", not really "creative"); meaning add notes to my collection; develop notes for class.

A:B-nc created bibliography using "old notecard method"
A:C-pi add a category label to top of piles (not OC, but clerical)
A:H-W put a heading in the text
A:Y-W add connecting phrases to draft
A:T add topics, expand topic list, add more topics

AV Add-convert
Add something by converting something else; convert between programs; import/export where emphasis is on converting.
AV:T-FG create (convert actually) topics from file-gather search
AV:W-N convert notes to text ("add writing using notes" -- not creative writing)
Use A:.. for import, dump, download, if the emphasis is on bringing the information into the system instead of converting the information.

AT Add-Type
Type, transcribe, computerize already created material.

AT:N-ty transcribe the notes
AT:R-pctype up the references for book
AT:W-pc use the computer just to type it in

A2 Copy, add again
To make copies by hand or machine. Clerical activities:
A2:N(pc) copy your notes using computer (transcribe notes)
A2:S(cm) copy source material using copy machine
A2:O(pa) copy your outline using paper

AF Format
To improve appearance of written material using bold, underline, spacing, fonts, etc. Clerical activity.
AF:W format the writing
AF:H-sty use Word's Styles feature for headers

ED Edit
Fix grammar, punctuation, spelling.
Use O2:W for revision of writing (more than just AF Format and ED edit).

CK Check, proofread
Verify accuracy, compare and discriminate; pre-editing, to determine what needs fixed.
CK:W-pc spell check on computer
CK:R verify accuracy of reference cites

FILE

fA File: Archive
To store, keep, save, put away.
To store information (archive it) in a filing system for safekeeping and possible later retrieval. Focus on **archive**--filing information away somewhere because you are not going to use it on a daily basis or any time soon.

Usually storage in file cabinet or in computer subdirectories (folders), sometimes in boxes or on floppy disks. The stored items are explicitly labeled at some level (e.g., the file folder) and are arranged in some systematic order. Often, hierarchical order: File cabinet, drawer, drawer-subdivisions, folders, notes.

Filing involves classifying, storing, retrieving: this category focuses on the storing and archiving (for later) activity. (see Organizing or Finding, for the other two).

fA:D-sd put things that have to do with one subject in a subdirectory
fA:N-fc file notes (physically)
fA:N-pc keep notes on computer

fI File: Index
To create a system to store information; system for IR.

A system (file, table, list) that "reveals or indicates," guides or facilitates reference (finding stored information), e.g., an alphabetical listing of names or subjects. A list or guide to the collection archived; e.g., a list of references. May or may not involve deliberately created keywords.

**To avoid confusion with other categories, I'm limiting the use of this category to the act of creating or developing an index (system or guide as defined above).

Use other categories for classifying information according to an index system (OC), sorting information into categories or folders (OS), moving the information among categories (OM), finding the information using an index keyword (FQ), and setting up tabbed folders to aid memory in finding several pieces of related information in the system (RH).
fI:N-pa index my notes, on paper
fI:W-Procite use Procite for automated indexing

FIND

Find, look for, search
Information Retrieval activities and methods.

F:N find things (notes)

FQ Query-find
To find information in a computerized or indexed system by deliberately searching for it using a search query.

Use FS Scanning if S is searching a manual (paper) system without an index, even though S has a specific word or date in mind, because scanning is the only way to find it.

FQ:S look for reference (an article) in library

FS Scan-find
To search by scanning or browsing the information source.
Look for by scanning or scrolling; "sift through"

Doesn't matter how specific the "query" is: a word, fact, idea, or something that hasn't been defined but you know you're searching for it.

Use DS Display by Scanning if S is scanning or browsing but not specifically looking/searching for something.

Use FG Gather if S mentions that the search is intended to find more than one information piece.

FS:D	search by scrolling document
FS:N,S	sift though notes and source articles
FS:S	find something by rereading articles

FG Gather-find
Collect, gather, pull together
Searching intended to find and collect/gather more than one information piece: e.g., all my "cognition" references, or all my notes on memory.

An FG search may be an automated/index (FQ) search or scanning (FS) search--use the FG category if gather is implied.

FG:co	pull out greens
FG:F(lr)	pick up [collect] the data in library or office [do literature research]
FG:S-B	find (collect) more source articles using bibliographies
FG:I-rv	get (collect) ideas/comments using reviewers

ORGANIZE

OC Classify, categorize
Organize, categorize, classify, key, identify, analyze, break down, group

To arrange or organize according to a class, category, or concept; to put in a set or group with members that have some attribute in common. Labeling or naming something to identify it as a member of a class or category is also classifying (OC).

To develop a classification scheme -- the subtopics of a major topic -- and assign labels or names to the topics, as part of the scholarly process of reviewing information and discovering order, patterns, and relations.

This is very similar to fI File-Index: Use fI Index to refer to the system for storing the information; use OC to refer to deciding what the categories are and deciding which category a piece of information belongs in and/or putting it there.

OC:R-N	cite (identify, key, ie classify) references in notes
OC2:T	divide file category into subcategories
OC:N,T-O	key the notes and folders to outline
OC:S	analyzed my book
OC2	reclassify, discover patterns

OS Sort
Sort, put in order, put into categories, Prioritize: organize to create a sequence, to establish the order of precedence. Bin-sort: put items in bins (containers, categories), classify many items almost simultaneously.

Similar to OC Classify, but not quite the same. Use OS when word "sort" is used or for either of these two specific meanings: prioritize or bin-sort.

OS:N sort all those folders out (sort what's in them)
OS:N-po cut up printout with scissors, arrange it in order by chapter and subtopics
OS:N-T sort the notes according to chapter subheadings (outline topics)
OS:S sort articles into labeled piles
OS:N-sb sort using IS sorting bin feature
Use OS for sort or order when it's not clear which specific sort is meant.

OH Hierarchicalize (Outline)
To outline in hierarchical structure organized or classified according to rank, arranged in a graded series (higher and lower levels). Involves a structure. Think of the traditional outline: nested levels, balanced points.

Use OL if S refers to making a nonhierarchical list.

OH-pa make detailed outline on paper
OH:W start outlining the body

OL Outline-List
Outline as a list of main points or topics. Not hierarchical.

OL:T [come up with] the topics
OL jot down points
OL-mi make mental outline (vs paper)

OM Organize-move
To organize by moving something; cut and paste as clerical activity. Take, carry, send information.
A low-level activity: use if moving information is mentioned but nothing S says indicates a more specific category, such as OC for classifying, OS for sorting.

OM:D move document/file from one computer to another
OM:S carry (move) source article from home to office

O2 Reorganize, Revise
To organize again, to revise. Cut and paste for revision and organizing.

O2:O revise the outline
O2:W revise writing by moving sentences and paragraphs around to organize them.
O2:O-S change the outline, based on reading new material
**use O2:W for revision of writing (more than just AF Format and ED edit)
O2:W "clean it up, marking things to move around, go back and clean it up"
O2:W-pa revise by hand, anywhere
O2:W3 revise draft 3 (less revision)

OZ Integrate, Synthesize
To organize by combining and synthesizing or integrating:

OZ:A "starting to put it all together"
OZ:I,N combine (my own thoughts) with thoughts I've synthesized from writings (articles)
OZ:Q-N interject quotations from the notes I have
OZ:S-W integrate next article with what I've got

REMIND

Use one of these categories if S specifically refers to memory, remember, learn. Otherwise, first see if a different category is appropriate.

RA Annotate, memo to remind
Writing a memo to remind yourself, a note on your calendar, a post-it in a book, a note in the margin.

Use A:N for taking notes, unless memory or remind is specifically mentioned or strongly implied.

RA use [write] notes [as a way of remembering things to include in papers]
RA:T made myself a note beside some of the outline topics

RH Highlight to remind
Highlighting, using underline or bold or asterisks, to remind or help you learn or remember. Similar to RA but not using words. Includes color-coding.

RH-co developed color-coding
RH:R circle numbers of references for the book (to remind about which to use in the bibliography)

RF Folders to remind
IS Folders feature: Attaches a "tab" to similar information objects to facilitate identification, to remind and to get back to a group of similar items.

RF gathered information in library using Folders reminders
RF:T used folders feature to mark outline points needing information

DISPLAY

DR Read
To read, review. Study.

DR:S rereading article to see how it relates to my research
DR2 reread

DS Display by scanning/browsing
To view by scanning or browsing. Skimming, looking at, viewing -- but not "reading" (DR). Not search by scanning (FS).

DS:N browse through my notes
DS:N-pascan paper notes
Use DR Read for study.

DP Print out
To display by printing out a copy. To display in print form.

DP:N print notes out

DP:W1 print out rough draft

DG Display graphically

To display in schematic, graph, flow chart, network, picture, matrix, or tabular form. Something visual, besides words, to indicate relationships among concepts, ideas, or parts. Show structure.

DU Display summarize
Display LESS information: IS feature.
To selectively display less information: e.g., all the main points (without the details); or only the details (without the headings); or only the first line of each paragraph, or first and last sentence of each paragraph--which might generate a kind of abstract or summary).

DM Display more information
To see MORE information at the same time, e.g. on a computer, see more on the same screen -- via bigger and better monitors, smaller and clearer fonts, organized "desktops" and other interfaces, dual monitors, wall-size screens.

DW Display in windows
To use multiple windows for multitasking, allowing rapid shifts from one activity to another, switching back and forth, using the "clipboard" to move information among files or applications, displaying information in two or more files at the same time on the screen.

WRITE

To write a paper or article (more formal than notes). Create original text.
W write, write a draft, start writing
W:intro write the introduction
write using:
W-co write about color-coded part (only)
W-N write: the notes become text
W-O write following the outline
W-pa write by hand, anywhere
W-pc continue writing on computer
W-T use outline points to prompt writing (write using outline points)
W-Worduse Word, to write
W2 second draft or write again, start over
But:
O2:W for revision of writing (more than just AF Format and ED edit)
WS submit it (the paper), deliver it
WT toss it out
W(min) write a minimum amount
W(nonseq) write out of order, nonsequentially
W(sw) write for several projects, switching back and forth
W@home write at home

OTHER

TA:T busy thinking about it (general topic)
C, CC talk about it; communicate with colleagues about it
ST do a study or research, run an experiment, collect research data

CODING STEPS

1. Classify the activity/behavior using the categories in code list col. 2 (Specific categories).

a) If the activity is too general for the specific activities in col. 2, classify it according to a major category in col. 1.

b) If there is no category for it in either col. 1 or 2, categorize it as "other" or invent a new category (major or specific) for it.

2. If an object of the activity is mentioned, find it in code list col. 3. Put a colon after the category code you selected in step 1, and add the object code after the colon.

a) If object is not listed, add it to list and give it a code letter; add it to the category code with a colon.

b) If no object mentioned, go to step 3.

3. If text indicates what the person used to do the action (tool, media), find it in code list col. 4 and add it to the code preceded by a hyphen.

a) Media mentioned but not listed: add it to list and then do step 3.

b) No media mentioned: skip step 3.

For example:
"Copy my notes into the computer"
1. col. 2: A2 for copy A2
2. col. 3 object: N for notes A2:N
3. col. 4 using: pc for computer A2:N-pc

"type up my class notes on my laptop" (has handwritten notes, so it is transcribing)
1. col. 2: AT for type AT
2. col. 3 object: N for notes AT:N
3. col. 4 using: pc for computer AT:N-pc

SYNTAX:

re Col. 3: Objects
Ask What? To What? what was the object of the activity.

re Col. 4: Media/Using
Ask Using what?

May be a Using without an Object:
W-pa (write using paper)

All of the objects in Col. 3 may be used for Media (col. 4), and vice versa (rare):
A:R-B (add references using bibliography)
W-O (write using outline)
A:hi (add highlights) (rare: col. 4 item used as object)

These Activities don't usually require an object but often include media:
W, OH, OL

EXAMPLES: PUTTING CODES TOGETHER:

A2:S-pc copy (transcribe from) source material
A2:S-cm copy source material using copy machine
A2:O-pa copy your outline using paper
A2:S-sc copy source material by scanning (digitizing)

CONSEQUENCES OR RESULTS OF ACTIVITY:
Are sometimes useful for determining the true meaning of the activity.
e.g.:
"look at bibliographies
--> to pinpoint other valuable articles"
(may also be on coding sample as "look at bibliographies to pinpoint other valuable articles")
sorting it out:
"look at bibliog": DR:B or DS:B
purpose: "to pinpoint" = to find or locate, so F for Find as the important activity
"other articles" -- not just one, but many, so FG for Find-Gather
"articles" = S for Source
so, FG:S-B (find-gather source articles using bibliographies) seems to be the real meaning ("look at" is just a low-level activity for accomplishing it)

Col. 3 CLARIFICATIONS:
S Source: article, book, journal, paper, anything published
T Topic: of outline or list or entire project. Also used for category, as in "divided my notes into the topics"
O the outline (unless Topic is specified or implied)
D document meaning computer file (as in Word .doc) -- use S source for published documents.
B bibliography: a list of references
R reference, reference-cite in the manuscript (BUT B for the reference list when bibliography is meant, even though S may call it "reference list")

Col. 4:
pc computer, or electronic word processor or similar
pa handwritten, on paper, using pencil, any of these
mi mind, mental, cognitive, "in my head"
odb Doalog, PsycLit, Library card catalog
pdb EndNote, ProCite, Citation, Reference Manager

MULTIPLE OBJECTS OR MEDIA:
String them together with a comma:
DR:W,O ("read the writing and the outline")
fA:S-fc,au ("file the articles alphabetically by author in filing cabinet")

WHEN: symbol } for “when?”
A:N}i (add note immediately)
}l later, }d daily, }y yearly or next year, }a all the time or anywhere
AT:N}i ("type up my notes as soon as possible")
A:R-B}i ("add the reference to the bibliography immediately")

MISC:
If something in the sentence seems relevant to the scholar's work and doesn't fit into any of the syntax above, add it in parentheses:
W(nonseq) (“write in any order”)

UNITIZING PROCESS

Identifying the Units of Analysis

Number each paragraph in the transcript, for identification purposes. Identify and number consecutively the **behaviors** described in each numbered paragraph. **Underline in pencil the behavior and its object** (if any) as you number it.

A sentence may contain one behavioral unit, several, or no units. A unit may consist of words or phrases scattered across two or more sentences in a paragraph, instead of consecutive words or phrases. If there are several behavioral units in a sentence, identify each as a separate unit.

Behavior: What the Subject **does** or **did** or **will do** (usually active verbs and their objects). Ignore "state" verbs, nonbehaviors (negative statements), repetitions in the same paragraph, contradicted/modified statements, and conditional statements. (Rules with examples follow.)

If the consequence of the behavior is mentioned, underline it also, to be included as context (don't number it). Sometimes, recognizing a consequence helps you identify the **behavior**. Same for antecedents specifying context.

Rules with Examples

BEHAVIOR: action/activity/do verbs
"I write the first draft by hand"
"I do all my writing on the computer"
"I try to write a first draft as soon as I can." (ignore "try" and focus on the behavior: "write")

COUNT AS ONE BEHAVIOR:
Repetitions: same behavior, often in different words, in **same** paragraph--count it just once. In a new paragraph: count it again.

"I'll write down something. I like to write a little bit, ..." (3-2)
"My preferred method is to write just a little bit .... I wrote one page ....I sit down and write something.... Then once I write something, I have the idea." (5 sentences, nothing new -- all this is same behavior)

Repetitions in overview statements or summary statements: A detailed description in action verbs follows a general overview statement or is followed by a summary statement. Count it once (the detailed part).
"Usually I color-code ... I'll go through and mark something in green and something else in yellow ..."

Contradicted/**modified** statements: count the second one.
"I don't go back to my outlines ..., but sometimes when I'm writing, I add or delete points from my outline." (number the second one as the behavior)

NO: DON'T COUNT AS BEHAVIOR:

"state" verbs: "is", "have", "felt"
"I felt much better about it."
"I like to be efficient."
"I am/was frustrated with ... "; "I am tired."
BUT: "I am writing an outline." (behavior)
"I think it helps to ..." ("think" used as opinion or belief)
"I have an outline."
BUT: "I have to revise it." (verb form, not possession)

negative statements/nonbehaviors:
"I don't take notes." "I rarely make outlines."
On this continuum, don't count never and rarely, but do count the rest:
{ never/rarely/occasionally/sometimes/often/always }
"I do color-coding. **Otherwise,** I end up reading the article again and again." (color-code is the behavior; rereading is the consequence that is avoided, so it's nonbehavior)
used to do (but don't anymore)

conditional statements: "would", "could"
"I would if I could..." "I wish I could...want to..." "If I had the right tool, I could do x..."
BUT: contingency statement: "If I find the right book, I'll read it." (count as behavior: this is not conditional, it is what S does, when the occasion arises)

"use": as in, to use a tool, to use an object
"I use WordPerfect." "I use a pencil."
BUT: "I use the computer search program to find the quotations I need." (ignore "use" but count "to find ..." as behavior)

ADDITIONAL RULES, AND RULES FOR COMBINING RULES:

COUNT "think" as an activity of scholarly work (that can be specified as overt behaviors but often is not)
BUT NOT "think" as opinion.

"do, did, will do": COUNT past tense BUT NOT "used to but don't anymore."
Count future tense.

Topography--grammar, syntax: watch for "I do this" behaviors hidden in passive voice and similar grammar: transform the passive to active and count it.
"I spend a lot of time making an outline. It'll be reorganized several times as I do the writing." (Behv#1: make an outline; Behv#2: revise the outline while writing.)

"have" (possess) vs "have" (verb form): "I have an outline." (don't count) vs "I have to make an outline before I write." (do count)

Scholar is responding to a Question that I asked: Combine my question and S's answer, then see if it is behavior: Me: Do you make outlines? S: "Yes." implied behavior: "I make outlines."

Unitizing Steps:

1. Unitize by underlining and numbering each behavior in the transcript (along with its antecedent and consequence, if relevant). Write the unit out on a list, with its identifying paragraph number and behavior number. Paraphrase it or quote it directly. Break behavioral chains and composite units into separate low-level behaviors (actions), giving each a separate number. Look for action verbs. Look for behaviors that can be coded according to the coding system. Sort out meanings from semantic ambiguity.

2. Code the units after all the units have been identified and listed. If it is possible to assign two or more codes to a unit, break the unit into its component parts and renumber as two or more units before applying a code to each. If the same code is applied to two or more units from the same paragraph, apply the repetition rule and eliminate all but the first unit for that code.

Unitizing requires prior knowledge of the coding system. Coding problems may require revisions to the units of analysis.

APPENDIX B

CODED LISTS

SCHOLARLY WORK PROCESS ACTIVITIES

SCHOLARLY WORK PROCESS PROBLEMS

SCHOLARLY WORK PROCESS NEEDS

SCHOLARLY WORK PROCESS CHANGE

INFO SELECT PROBLEMS

BASIC TOOL FEATURES (BTF): ACCESSIBLE

BASIC TOOL FEATURES (BTF): EASY

BASIC TOOL FEATURES (BTF): EFFICIENT

SPECIFIC THEMES: THINKING

SPECIFIC THEMES: AFFORDANCES

SPECIFIC THEMES: OUTLINING

SCHOLARLY WORK PROCESS ACTIVITIES

Code	Unit of Analysis	S# Src-ID
A:B-B	create book bibliography from long bibliography	S1 I1:33-3
A:B-nc	created bibliography using "old notecard method"	S4 I1: 6-1
A:B-pa	make extensive bibliography on one continuous numerical list -->"think I still spend less time" than other methods	S1 I1:33-1
A:B-pdb	building a bibliog. database in EndNote	S6 I1:17-2
A:B}i	do bibliography up front (early) -->"saves me time later. So I'm trying to get into the habit of doing that."	S4 I1: 2-5
A:B}l	do bibliography (later)	S4 I1: 2-4
A:C-pi	add a category label to top of piles	S4 I1: 8-2
A:Ci-N	added descriptive implicit captions	S4 I3: 4-1
A:D-wp	imported text files from word processor RTF files	S1 I3: 1-1
A:ft	created file-topic by accident	S4 T2: 2-2
A:G-F	crunching the data (creating charts and tables)	S4 I4: 4-1
A:G-pa	sketch schematics on paper	S5 I1: 9-1
A:H-W	put a heading in the text	S5 I1: 7-2
A:N	put the highlighted notes into IS	S4 I2: 1-2
A:N	take thorough notes -->analysis	S3 I1: 5-1
A:N(cls)}i	typing in comments after class	S3 I3: 3-1
A:N(glos)	started glossary in a note	S1 I3: 4-1
A:N(long)	added long notes in IS [keep whole sections in a "clump"]	S5 I2: 1-1
A:N(OD)	add random notes, ideas to misc topic	S2 I3:23-1
A:N(plan)	added notes (travel plans)	S4 I3: 1-1
A:N(plan)	added notes: planning course assignments	S5 I3: 3-1
A:N(web)	typing in notes for web page	S3 I3: 4-1
A:N,i-IS	is now putting notes and ideas into IS instead of on scraps of paper "Now, it's more meaningful to me, and certainly it's something I can find more quickly."	S4 T2: 2-1
A:N,K}l	add notes and keywords later	S2 I3: 6-4
A:N-D	put (add) summary and reaction below reference notes in same document	S2 I1: 6-2
A:N-hi	put highlighted notes into IS	S1 I3: 4-5
A:N-IS	used IS for notes	S5 I4: 4-2
A:N-IS}i	"Started typing up notes after my class lecture when I finished lecture, only after I installed IS. "was a more manageable system, one where I could recover the notes and keep records" ... "I knew where I had been and will be able to use the notes to lecture from again and ... I may be able to publish a text from them"	S3 E2: 1-2
A:N-NP	imported info from NotePad to IS	S6 I3: 9-1
A:N-pa	write notes on anything (scraps of paper, napkins)	S4 I2: 4-2

A:N-pa	"make notes on a spiral pad or on a napkin while reading that book"	S4 I1:14-1
A:N-pa	did some notes using pencil and paper	S1 I3: 4-6
A:N-pa	write down notes [on paper]	S4 I1: 1-4
A:N-pa}a	make notes anywhere, on paper	S4 I1: 5-1
A:N-pc	make notes [reactions to reading] on computer	S2 I1: 1-4
A:N-R	make reading notes below the abstract	S2 I2: 2-5
A:N-S	put in stuff from the resource	S6 I4: 5-4
A:N-S	take notes, when reading a book	S1 I1: 9-2
A:N-S	took random notes while reading	S1 I3: 4-2
A:N-S(sc)	summarize scanned information	S3 I4: 2-2
A:N-T	imported information into a topic	S1 I3:11-1
A:N-T	adding notes to course topics -->"When I teach that course again, all I have to do is plug into my [IS] notes.	S3 I4:12-1
A:N-T	adding notes with IS, focusing on one section at a time	S2 I2: 1-3
A:N-tr	dictate notes into tape recorder	S3 I1: 4-1
A:N-web	capturing stuff from web and putting into one long IS note	S6 I3: 1-2
A:N-web}i	adding notes from web, quickly	S6 I3:12-1
A:N-wp	use word processor for notes	S3 I1:13-1
A:nc+	"Now I do that notecard bit a little more than I used to" [make notecards] -->"definitely different" (SWP)	S2 I4: 3-1
A:N}i	adding notes to IS during discussion	S6 I2: 5-2
A:N}i	typing up my lectures day to day, and doing summaries of class discussions	S3 I2: 9-3
A:N}i	"throw it [info] in there"	S6 I2: 4-4
A:N}i	get in and out of notes quickly	S3 I2:10-1
A:N}i	added notes to IS immediately	S4 I3: 5-2
A:N}i	reading or just think of something: open IS and start taking notes [immediately, no paper]	S2 I4:12-1
A:N}i	reading, "have something to say," "just stick it in there"	S2 I4: 1-4
A:N}i-IS	develop notes for class daily "Have a record of what I've talked about on a day to day basis." [2-7]	S3 I2: 2-1
A:ov	doing lecture transparencies in IS	S3 I3:11-1
A:Q	add quotes to IS	S3 I3:19-1
A:R	adding references	S1 I3:15-1
A:R	"sketch in" related references	S5 I1: 1-3
A:R	added refs	S5 I3: 1-1
A:R	made a reference in a note	S3 I2:14-1
A:R	starting to put refs into IS	S3 I4:16-1
A:R	adding references	S2 J1: 3-1
A:R	make a little note for it (ref)	S2 I3: 6-3
A:R	put a bunch of references in	S2 I2: 2-1
A:R,K	download references with descriptors	S2 I2:22-1
A:R-B	write new references on same page (bibliography copy)	S4 I1:17-7
A:R-B}i	for each source, add the reference to bibliography [immediately] -->"build a bibliography as I go"	S6 I1:10-1

A:R-IS	add refs in IS	S5 I4: 1-1
	-->"incredibly easy"	
A:R-IS	bring search results directly into IS	S2 I4: 2-4
A:R-IS	add refs in IS	S5 I2: 3-2
A:R-odb	"dump" [import ascii] entire search results into IS	S2 I2: 2-3
A:R-odb/pdb	import refcites into EndNote from Dialog	S6 I1:16-2
	-->accurate, avoid retyping	
A:R-odb/wp	use cut and paste to move important references to Word from Dialog	S6 I1:25-1
	-->built bibliography, "tedious"	
A:R-pdb	have put about half my articles (references) in EndNote, stopped	S6 I1:28-1
A:S-sc	copy, scan things to it	S3 I4: 1-2
A:S-sc	scanning material into IS (quotes and manuscripts)	S3 I2: 1-4
	-->"getting tremendous amount of mileage out of this."	
A:S-sc	scan important source material	S3 I4: 5-1
	-->"it's a snap"	
A:S-sc>IS	copy things from scanner into IS	S3 I3: 2-1
A:Sty-wp	set up styles in Word	S6 I4: 6-1
A:T	create a subtopic for xyz	S2 I4: 5-3
A:T	added miscellaneous topic	S2 J1: 4-1
A:T-O	added subareas to working outline	S1 I3: 4-3
A:T-O	put down a lot more points (in outline)	S6 I1:18-2
A:T2	create sub-subtopics	S2 I4: 5-6
A:T2-N	using notes for subheads in outline	S1 I2: 2-1
	-->can't indent topics properly	
A:X-wp	imported index from word processor file	S1 I3: 3-1
A:Y	fill in connecting phrases	S6 I4: 5-5
A:Y-O	go back and "fill that all out with connections"	S6 I1: 9-3
A:Y-W	add connecting phrases to draft	S6 I1:12-2
A2:B-cm	make a copy of the article's bibliography	S4 I1:17-6
A2:B-cm	copy the bibliography	S6 I1: 4-5
A2:D-sd	copy file into this year's subdirectory, to reuse it	S5 I2:13-3
A2:N-wp,IS	pasting from wp	S6 I2:32-1
	-->"frustrating" because can't see pasted note until out of edit mode	
A2:Q-pa	copy some passages out of the book	S4 I1: 2-2
A2:S-cm	photocopy articles	S6 I1: 2-3
A2:S-cm	make copies of articles	S5 I1:11-1
A2:S-cm	photocopy articles	S6 I1:15-1
	-->huge clip file	
AF:H-Sty	use Word's Styles feature for headers	S6 I1:20-3
	-->consistency, handy, easy, can reformat	
AF:O	made outline hierarchy visual with blank topics and indents in captions	S1 I2: 1-3
AF:O	use tabs and bolds to outline	S6 I1:20-2
AF:R	can't format references in IS if you want to transfer them to word processor	S3 I4:17-1
	-->"shortcoming"	
AF:R-wp	reformat refs style in Word, for paper to submit	S5 I3: 3-3

AF:scrn	changed display fonts for laptop and 21-inch monitor	S6 J1: 6-1
AF:W	triple space the text and enlarge the font [for draft chapter]	S1 I1:20-1
AF:W-wp}l	format ("garbage") text in word processor later	S2 I4:13-3
AF:W}i	put everything in proper style while composing	S6 I4: 6-2
AF:W}l	do writing and tables separately -->not interrupt writing with having to create a table	S4 I4: 7-1
AF:X-pc	format index automatically using Procite -->don't have to format manually, saves time	S1 I1:48-1
AF2:W}l	reformat document later if I need to [using Styles]	S6 I4: 6-3
AT:hi>IS	"plugging it [what I want to have access to in the future] into a program like IS"	S4 I3:16-4
AT:N	type up the notes -->analysis of data	S3 I1: 5-2
AT:N-IS	load them [notes on paper] into IS	S4 I2: 4-3
AT:N-pc	put handwritten notes into the computer	S4 I1:12-1
AT:N-pc	put textual notes in computer	S5 I1: 9-2
AT:N-pc	type margin notes on computer	S2 I1: 1-3
AT:N-pc	"have to take that information and at some point get it on the computer." -->computer not portable enough, "cumbersome"	S4 I1:14-2
AT:N-pc	transfer notes to computer (computerizing my notes)	S1 I1:19-2
AT:N-ty	get someone to transcribe tape recorded notes -->very expensive	S3 I1: 4-2
AT:Q,R-pc	type quotes and citations into laptop	S6 I1: 4-4
AT:Q-pc	do [type in] notes on computer [quotes]	S6 I1:14-1
AT:R-pc	type up the references for book	S1 I1:35-2
AT:W-pc	write [actually type] on computer -->faster	S1 I1:24-6
AT:W-pc	"go back to the computer and fill in those spaces"	S4 I1:13-3
AT:W-po	write [transcribe] "the real chapter" [on computer] using revised printout	S1 I1:20-4
AT:W@ofc	input [type in] at office or anywhere	S1 I1:40-1
AV:D-IS,wp	converting documents between IS and wp because IS "screws it up" sometimes (direct scanning into IS)	S3 I4: 5-2
AV:D-wp>IS	import RTF works fine "import RTF works really well! Good."	S1 j1: 3-3
AV:FQ>T	made a topic out of search results -->"neat", "could be useful"	S6 I3:10-2
AV:IS>wp	export to Word -->"Did weird things on the spacing."	S6 I4:24-1
AV:IS>wp	backing up by copying IS note to Word	S3 I4: 9-2
AV:N-W	copy IS notes to writing draft -->"that was really beautiful."	S3 I3:19-2
AV:N>W	pull notes into writing without typing	S3 I2: 1-5
AV:N>web-wp	converting to html in Word	S3 I3: 4-2
AV:N>wp	"dump" [export] IS notes or topics to word processor file	S2 I2: 9-1

	-->"fantastic", "very useful"	
AV:N>wp	export a note to Word	S5 I2: 9-1
AV:Q>W	pull quotes directly into my manuscripts	S3 I4: 1-3
AV:U>txt	save abstract as ascii file (convert)	S2 I3:30-1
CK:F-N,B	go back to notes and keyed reference [when editor challenges a fact]	S1 I1:33-4
	-->can prove it or change it	
CK:N-sp	did spell check	S6 I2:16-1
CK:R-S	get refs and check to see if they are related	S5 I1: 1-4
	-->find other related refs	
CK:W-pc	use computer to do a spell check	S1 I1:21-2
CK:W-pc	spell check on computer	S1 I1:24-7
	-->catches typos (accuracy)	
ED:N-th	used thesaurus	S6 I2:16-2
ED:W	edit draft (minor changes)	S5 I1: 2-7
BTF:ea	used online Help to learn about Print feature, to print some (not all) notes in topic	S6 I2:22-2
	-->"took me awhile to figure it out	
BTF:eff	used shortcut keys	S6 I4:19-1
	-->speed	
BTF:lrn	spent time relearning how to use IS	S1 I2: 1-1
	-->"not entirely wasted"	
BTF:sa	did something and lost all his IS topics and notes	S1 T1: 2-1
	don't know what!	
D:E-ov,web	puts lectures on transparencies and on web page	S3 I1:24-1
D:W-web	turn it into a web document	S6 I1:13-1
	-->get "excellent comments" and advice on where to submit	
DG:F	look at graphs (data)	S2 I1:11-1
DM:N-pa	spread out notes [paper]	S1 I1:24-3
	-->visualize/see 10+ pages at once	
DP:E-ov	use transparencies for lectures	S3 I2: 2-3
DP:L	printed selected notes and outline levels	S1 j1: 2-2
	likes printing flexibility (cf S6!)	
DP:N	print that out (computer notes)	S1 I1:19-3
DP:N	printed out all notes	S4 I3: 1-4
DP:N	crashed when printing notes	S6 I3: 6-1
DP:N	print IS notes	S2 I4:13-2
DP:N-IS	print straight from IS	S2 I2: 9-2
DP:N-ov	print class notes to transparencies	S3 I2: 2-2
DP:N-pa	Q: is printing out on paper still important? A: No. "This has gotten me over that. I don't have to put anything on paper."	S3 I4:15-1
DP:N-pc	print out computer notes	S6 I1: 8-1
DP:N-ty	get something (notes) typed	S3 I1:17-1
	-->can start working on it	
DP:ov	printing transparencies from IS	S3 I3:11-2
	-->"don't even go to Word anymore."	
DP:R	make printed refs lists	S4 I2:16-1
DP:W	print out the draft chapter	S1 I1:20-2
DP:W1	print out rough draft	S6 I1:12-1
DP:W1	print a draft, with spaces	S4 I1:13-1
DR:F,st}i	look at research status data quickly	S2 I3:11-2

DR:N	look at all these notes (review)	S3 I2: 2-5
DR:N	go back and look at my notes	S3 I1: 5-6
DR:N(plan)	see the plan	S5 I3: 3-2
DR:N-IS	organizing information to study for exams -->tool useful	S6 I4: 1-1
DR:N-pc	read [my notes] on the computer	S2 I1: 2-1
DR:N-po	review [study from] printout	S6 I4: 4-1
DR:O's	go back and compare outline versions very useful	S1 I4:14-2
DR:O-pa	reviews the outline [on paper]	S3 I1:26-2
DR:O>I	got another idea for process, studying IS outline (next day)	S1 j1:11-1
DR:O>I	got idea for book process, by studying IS outline	S1 j1:10-1
DR:O}i	review using outline as flash cards -->see it quick	S6 I2:21-2
DR:S	read a paper (article)	S2 I1: 1-1
DR:S	reading a lot	S3 I4:12-2
DR:S	read the source article	S4 I1: 1-2
DR:S	read an article	S4 I3:16-1
DR:S	review the literature -->learn what to write	S1 I1: 5-1
DR:S	read chapter in book	S4 I4: 9-2
DR:S(sc)	review scanned information	S3 I4: 2-1
DR:S,N	read a paper (article) and my notes on it	S2 I1: 6-1
DR:S,U	read a paper or abstract	S2 I4: 5-1
DR:S}a	reading the literature all the time	S2 I3: 6-1
DR:T	look at outline	S5 I1: 6-2
DR:W,T	see the writing and see the outline shows new topic	S5 I1: 7-1
DR2:hi	read through the highlights	S4 I3:16-3
DR2:N	rereading IS notes -->"and the idea was there, immediately"	S3 I2:11-2
DR2:S	rereading article to see how it relates to my research	S2 I1: 8-4
DR2:S	rereading articles	S6 I2: 4-2
DR2:S	go back to [look at] important articles	S5 I1:11-2
DS:B	look at bibliographies	S6 I1: 4-2
DS:F,A	pull up all my data in IS	S3 I4: 2-3
DS:gaps-O	see a topic with only one note in it -->tool lets you organize information, see the organization struction, and discover the gaps	S6 I3:17-1
DS:N	flip pages on notepad to see notes	S1 I1: 7-4
DS:N}d	look at them (notes) every day	S3 I1:21-2
DS:N}i	see/scan quick, easy -->"easy to see, real quick," "very useful"	S4 I3: 4-2
DS:N}i	quickly see items	S4 I3: 1-3
DS:N}i	"pop back and forth" between notes	S3 I2:11-4
DS:O	scanning the outline	S1 I4: 8-1
DS:O	collapse everything down to just your outline, to see [vs scroll] -->liked speed of navigating via outline instead of scrolling through text	S6 I4:14-1
DS:O	"like being able to see my growing outline"	S6 J1: 5-2
DS:O+N	see the outline and the notes	S6 I4:18-1

DS:S	go through each resource	S6 I4: 5-3
DS:T,N	"stuck on something" [blocked], "can just arrow down to a different topic" -->"better", BTF:sw	S2 I4: 4-1
DU:O	view outline only	S6 I2: 7-1
DU:R	printed out refs using Summary feature	S5 I3: 1-4
F:N	prepared class handouts in AmiPro, WordPerfect, then Word "Never could locate files"	S3 E2: 1-1
F:N	find things (notes) -->easy, no trouble	S3 I1:21-1
F:N,Q	finding things -->better organized lectures	S3 I3: 1-2
f:N-IS	put notes in IS, "having a place to put your notes" -->can get back to them	S5 I4:11-1
F:N-IS	keeping track of quotes, finding and recalling material -->"able to recall material that I couldn't have before."	S3 I2: 9-2
F:N}i	jump to a note [vs scroll] quickly -->"it's very fast"; "you're not scrolling", "much faster to work with than Word"	S6 I2: 7-2
F:N}y	finding notes, next semester	S3 I4:18-2
F:Q	finding quotes	S3 I3: 2-2
F:S	find a paper (source article)	S2 I3: 6-2
F:T,I	trying to come up with my general topic	S6 I1: 2-6
fA:A-D,pc	saves everything old files	S5 I3:24-1
fA:A-IS	keeping everything in IS -->"I can go back and find it."	S3 I4:18-1
fA:B	"keep bibliographies in a place that I know where they're at"	S4 I1:17-4
fA:B-IS	creating references "Maybe this software will allow me to easily do stuff along this line that I couldn't do with the word processor."	S1 j1: 4-1
fA:D	organize course files in subdirectories by year	S5 I3:23-1
fA:D	save all versions (drafts)	S1 I1:21-1
fA:D,A	keep both versions (keep everything)	S5 I2:13-4
fA:G-fd	save files on various disks	S4 I4: 5-2
fA:N	made a file-topic of comps notes	S6 I3: 1-1
fA:N,D-pc	file notes and files on computer -->good disks	S3 I1:21-4
fA:N,W-D	keep notes and text in one [too] long document	S2 I1: 6-3
fA:N-D	keep notes in short files (documents on computer)	S3 I1:12-1
fA:N-D,sd	keep notes until book published, in a document or subdirectory	S1 I1:32-1
fA:N-Ds	keep information in several documents -->"slows me down"	S2 I1: 6-4
fA:N-fc	file notes (physically) -->a disaster; don't know what I have	S3 I1:18-3
fA:N-IS	doing all notes in IS, none on paper	S2 I3:18-1
fA:N-pc	keep notes on computer	S5 I1:15-1

fA:N-pc	store notes in computer -->perfect memory; always know where they are	S3 I1:18-2
fA:N-sd	save notes by author, year, in one subdirectory	S2 I1: 1-5
fA:O	kept older versions of outline	S1 I4:14-1
fA:R-nc	have refs card file system -->not up-to-date	S4 I2:16-2
fA:S	file papers (articles)	S2 I1: 5-1
fA:S-fc,au	file articles alphabetically by author in file cabinet	S4 I1: 6-2
fA:S-home	keep source material at home	S5 I1:13-2
fA:S-pi	keep articles in 3 piles: comps, dissertation, and throw-away	S6 I1:28-2
fA:T-Ds	create separate file (filing system) for dissertation articles	S4 I1: 7-1
fA:W	"save the finished product" (the writing)	S4 I1:16-1
FG:co	pull out greens	S6 I1: 8-4
FG:D-sd	for quals, stuck everything in one subdirectory	S2 I1: 1-6
FG:F(lr)	pick up [collect] the data in library or office [do literature research]	S3 I1: 2-1
FG:I-rv	get comments from readers	S6 I1:13-2
FG:N-S	gather the information (from articles)	S4 I1:17-5
FG:N-T	pull up a cluster of information	S6 I4:13-3
FG:R	do online library search	S2 I2: 2-2
FG:R-odb	find refcites with Dialog	S6 I1:16-1
FG:rv	get peer reviewers to read it	S6 I1:12-5
FG:S	collect appropriate source articles	S6 I1: 8-3
FG:S	gather a resource	S4 I1: 1-1
FG:S	gather articles	S6 I1: 2-2
FG:S	"digging up material about" X	S1 I1: 5-2
FG:S-B	look at bibliographies to pinpoint other valuable articles	S4 I1:17-2
FG:S-odb	collect source articles, using electronic sources	S6 I1: 4-1
fI:N,F-pa	index notes and data	S3 I1:29-2
fI:N-fo	make labeled manila folder for each chapter -->But couldn't find the pile, in interview	S1 I1: 9-1
fI:S-pdb	get [huge clip file: articles] under control with EndNote	S6 I1:15-2
fI:W-pc	use Procite for automated indexing -->does "the dirty work"	S1 I1:47-1
FQ:N	using search feature	S6 I3: 5-1
FQ:N	use searching to avoid duplication: "see how many times I've already said that"	S1 I4: 7-1
FQ:N	searched for all notes on a word	S6 I3:10-1
FQ:O	word search the outline for possible duplications find duplications, save time	S1 I4: 9-2
FQ:R	searching on word for refs	S3 I4: 3-4
FQ:R,N	searching on word/phrase--"just for fun"	S2 I2: 5-1
FQ:R-K	searching on keyword -->"real easy", "it pulls these things right out"	S1 I3:16-2
FQ:R-K	used Search to pull out by keyword	S5 I3: 1-3
FQ:R-pc	do library search [electronic]	S2 I4: 2-1
FQ:S	look for reference in library	S5 I1:17-7
FS:A	start looking at all the other things -->find useful info, not wasted time, get	S5 I1:17-8

	off-task	
FS:B-pa	flip through bibliography on paper [to find something, don't know exactly what I'm looking for] -->"easier than scrolling"	S1 I1:36-1
FS:co-S	look for green highlights in article -->the written paper	S6 I1: 6-1
FS:D	search by scrolling document -->get distracted by something else for hours	S2 I1: 6-5
FS:F	find "sound-byte" (information bit)	S6 I2: 4-3
FS:F-S	found important information reading magazine	S4 I3: 5-1
FS:F-S	scroll through authors' papers to find it [something remembered]	S2 I1: 3-1
FS:N	scrolling to find something	S3 I3: 7-1
FS:N,D	look at notes and files for themes	S3 I1:14-2
FS:N,S	sift through notes and source articles -->"build that way", integration of new material with old	S6 I1: 8-2
FS:N-pa	scan paper notes -->faster than scrolling	S1 I1:24-4
FS:O	search (scan) the outline for "suspicious" possible duplications	S1 I4: 9-1
FS:ov-pi	looking through piles for transparencies -->"I can't find a damn thing in it."	S3 I4:18-3
FS:Q	finding quotes	S3 I4: 3-3
FS:R-B	look up a reference by author [by scanning 400+ cites not in alphabetical order] --> "pretty difficult", "system breaks down" when refs accumulate, but ...	S1 I1:34-1
FS:S	find something that relates to my dis. topic	S4 I2: 5-1
FS:S	find something by rereading articles	S2 I1: 8-3
FS:S*	later, "just thumb the book" to find the asterisks -->quicker, can find, "way to get back to it"	S4 I1:10-2
FS:S-B	find other articles using the bibliographies	S6 I1: 4-3
FS:W-po	(Q: do you go back to notes?) A: Go to a printout of final paper	S4 I1:16-2
O:N(cls)	organizing material covered, for later exams	S3 I2: 9-4
O:N,D-pc	organize notes and files with computer -->keep track of things	S3 I1:21-3
O:N-IS	organized everything in IS -->"It's given me an organization I never had before."	S3 I4:18-4
O:N-IS	organizing information in IS -->"They're right there. And I can find the information."	S3 I2:10-3
O:N-IS	organizing my courses	S3 I2: 7-1
O:N-T	organized well, by topic -->no reason to use Search	S6 I2:18-1
O:TA-IS	organizing my thinking with IS	S6 I4: 2-1
O:TA-IS	use IS to "organize my thinking in a bunch of different areas"	S2 I4: 1-1
O:W-H	use outline points as headers -->"helps me to better visualize where I'm	S6 I1:18-3

	going", "helps the reader"	
O2:D-ofc	make minor change in file at other location	S5 I3:20-1
O2:D-sd	reorganizing word processing files into subdirectories -->takes time, "then I can't find things" [10-2, 10-3]	S3 I2: 1-2
O2:D-sd	reorganizing word processing files into subdirectories -->takes time, "then I can't find things" [10-2, 10-3]	S3 I2: 1-2
O2:F-G	manipulating data in Excel	S4 I4: 5-1
O2:F-prg	wrote a merge program to combine lots of ascii files	S2 I3:28-1
O2:I	change my ideas -->analysis	S3 I1: 5-5
O2:N	cut and paste it	S1 I4: 7-3
O2:N,T	use IS to move and reorganize notes and topics	S2 I2:15-1
O2:N-drag	dragging for cutting and pasting and moving things around do better with drag	S1 I4: 5-2
O2:N-js	joined two notes	S6 I3: 9-2
O2:N-sj	split up long notes	S5 I2: 1-2
O2:N-T	reorganizing IS notes into topics	S3 I4: 7-1
O2:N}i	edit note quickly -->"nice feature, I like that"	S6 I2: 7-3
O2:O	revise the outline structure	S1 I4:13-2
O2:O-O	revise previous table of contents to create a new outline	S1 I1:14-1
O2:O-rv	revise outline based on editor's feedback	S1 I1:11-2
O2:O-S	change the outline, based on reading new material	S1 I1:16-1
O2:R	"clean it up" [imported refs]	S2 I2: 2-4
O2:R-drag	separated 125 references into individual notes "I came to appreciate the dragging thing! It was made to rescue idiots."	S1 j1: 8-1
O2:R-sj	go through and split refs list up	S2 I4: 2-5
O2:R-sj	split references into separate notes -->can now search, sort on anything I want	S1 I3:15-2
O2:T	"able to break each topic up into more specific things"	S2 I4: 1-3
O2:T	may change rough outline while writing a draft	S5 I1: 6-1
O2:W	cross out passages [on draft], mark passage to insert or combine	S1 I1: 8-1
O2:W	rewrite -->get published	S1 I1:17-3
O2:W	revise draft (add/delete sections, paragraphs, ideas)	S5 I1: 2-6
O2:W	cut and paste when writing, all the time	S4 I4:20-1
O2:W-hrd	reread/revise the hard chapters (my writing)	S1 I1:22-2
O2:W-IS	reorganize by cut and paste and move easier	S1 I4:10-2
O2:W-pa	"handwrite some things in"	S4 I1:13-2
O2:W-pa	do revisions by hand: delete and move around and change tenses	S1 I1:20-3
O2:W-pa	revise by hand, anywhere	S1 I1:26-2

	-->portable	
O2:W-pc	"go back and clean it up" on computer	S6 I1:12-4
O2:W-pc	"make a logical text out of it," on computer	S1 I1:19-6
O2:W-po	"clean it up, marking things to move around" on printout	S6 I1:12-3
O2:W-po	revise with printout and pencil	S1 I1:23-1
O2:W-rv	"go back and redo it, drawing on [reviewers'] points"	S5 I1: 3-2
	-->significantly revised paper	
OC:D-T	put things that have to do with one subject in a subdirectory	S2 I1: 1-7
OC:D-Ts	split long note into short notes in several subtopics	S2 E1: 1-2
	"it has helped my thinking about this complicated data base"	
OC:F}i	start analyzing [fieldwork] data the first day it is collected	S3 I1: 2-2
OC:hi	note in the margin [of source] where to use [which category] the highlighted information in writing	S4 I1: 3-2
OC:I}i	"idea about something else" while writing: "close this note and go to another one" [immediately categorize idea, not move it later]	S2 I4: 4-2
OC:N	decide where something goes	S1 I4: 7-2
OC:N	using IS to organize notes for papers	S2 I2: 1-1
OC:N	adding notes from source to topics	S6 J1: 5-3
	"better than Word for doing this work"	
OC:N,T-O	key the notes and folders to outline	S1 I1:11-3
OC:N-FQ	searched on a term to find out where to put the new note	S1 I3:10-1
OC:N-pi	rip notes off pad, staple into piles, write on top of each pile "what the major idea is"	S1 I1: 7-5
	-->twice as fast as scrolling	
OC:N-R	"just tagging where I saw that"	S4 I3:16-5
OC:N-R	put refs, page number on IS notes	S4 I2: 1-3
OC:N-R	identify [source] by title and author in my notes	S4 I1: 2-1
OC:N-R	key the notes to the bibliography using numbers	S1 I1:33-2
OC:N-T	put [notes] in different places [topics] [categorized by subject area]	S2 I4: 1-2
OC:N-T	organize the notes by subject matter	S4 I2: 1-4
OC:N}i	tend to put everything in in a clump	S6 I4: 7-2
OC:N}i	reading paper, "just go and stick things in that paper's topic" [categorize immediately]	S2 I4: 8-1
	-->no need for Search function, yet	
OC:Q-R	identify quotes etc by source page number	S4 I1: 2-3
OC:R	using IS to organize a lot of references	S2 I2: 1-4
OC:R	organized references into topics	S2 J1:16-1
OC:R-K	coded the refs (added keyword)	S5 I3: 1-2
OC:R-K	coded refs for papers	S5 I4: 2-2
OC:R-O	keyed references to outline	S1 I3:16-1
OC:S	categorize them: "carving the literature up"	S2 I4: 7-1
OC:S	analyzed my book	S1 I1: 4-1
	-->identify info to update/revise	
OC:S	"say this has to do with xyz"	S2 I4: 5-2

OC:S-co	say "green is about X, yellow is about Y"	S6 I1: 5-1
OC:sd-yr	organize subdirectories for each course, by year	S5 I2:13-2
OC:T2	divide file category into subcategories	S4 I1: 8-1
OC2:N>I,KN	"something hit me" [notice similarities]: "I could see ... it's right there" -->"got to it in a more direct way"	S2 I4: 7-2
OC2:R,N>I	discover different kinds of xyz [result of 5-4]	S2 I4: 5-5
OC2:R-K	recode refs for a different paper "extremely useful"	S5 I4: 2-3
OH	created an outline structure	S6 I1: 9-1
OH	made extensive outline	S1 I2: 1-2
OH	organize well -->avoid rewriting	S1 I1:17-4
OH	create outline based on what's needed	S1 I1:11-1
OH	created subtopics, nested sub-subtopics	S2 I2: 3-1
OH	create detailed outline	S1 I4:13-1
OH-pa	make detailed outline on paper	S1 I1:19-1
OH-pa	makes outline in pencil [on paper] -->get my ideas together; not that productive	S3 I1:26-1
OH-pc	used to use outline mentally, to organize writing; now outlines physically	S6 I1:18-4
OH-wp	organizing with Word's outlining tools -->"I already have a lot of tricks that it gives you for organization"	S6 I4: 1-3
OH:E-wp	outline lecture in Word automatic numbering: a pain	S5 I2: 7-1
OH:S	planned 2 book projects	S3 I4:13-2
OH:W	start outlining the body	S4 I1: 4-1
OL	do rough outline (points)	S6 I1:18-1
OL	make outlines (list key points) -->for future papers	S5 I1: 5-1
OL	create the outline	S4 I1:12-3
OL	come up with the topics	S1 I1: 6-3
OL	Make draft outline or "rough sketch" of general topics	S5 I1: 1-1
OL	make very rough outline (list)	S2 I1:10-1
OL-G	jot down points while looking at graphs	S2 I1:11-2
OL-mi	make mental outline (vs paper)	S4 I1:18-1
OL-N,mi	[use notes to] create an informal outline in my head of categories	S4 I1: 3-1
OL-T	creating topic for each study question	S6 I2: 4-1
OL:I	"rough out ideas" in IS -->"and it's there"	S3 I4:13-1
OL:R	mark certain records [refs and abstracts]	S2 I4: 2-2
OM:A-fd	transporting information home on floppy	S3 I4: 9-1
OM:A-fd	make file-topic backups on floppy -->potential version control problems	S1 I2: 3-1
OM:A-fd	transferring information back and forth	S3 I2: 8-2
OM:A-fd	taking all information home on floppy	S3 I3: 1-3
OM:A-pc	carries laptop to office in another city	S1 I4:15-1
OM:D-em	send files back and forth (working with colleagues) using computer -->the advantage of computer; without even leaving office	S3 I1:17-2

OM:D-ft	carrying IS file back and forth from home to office: no problems amazing!	S3 E1: 7-1
OM:D}a	transport files between home and office "all the time" -->need file-topics feature	S5 I3:18-1
OM:IS-fd	load IS file on disk and take it portable, useful	S1 I4:15-2
OM:N-fd,ft	saved to disk (file-topic) -->version control problem with file-topics	S4 I3: 2-1
OM:R-em	email search results to self	S2 I4: 2-3
OM:S	carry books and periodicals around in car [to use anywhere]	S4 I1: 5-2
OM:S	take source material to work when needed	S5 I1:13-1
OM:S	take books and photocopies home	S6 I1: 2-4
OM:T	had to drag each topic into file-topic -->wanted multiple-select feature	S6 I3: 7-1
OM:U-em	send it off in email	S2 I3:30-2
OS:N	sort all those folders out [sort what's in them]	S1 I1:10-1
OS:N	put split notes in separate places	S5 I2: 1-3
OS:N	sorted new subtopics alphabetically	S4 I3:21-2
OS:N	cut and paste information I've gathered (notes)	S4 I1:12-2
OS:N	put notes in alphabetical order by city	S4 I3: 1-2
OS:N-cp	cut and paste to organize the imported information into its proper order	S1 I3:11-2
OS:N-fo	sort notes into folders -->"build up these folders"	S1 I1: 9-3
OS:N-po	cut up printout with scissors, arrange it in order by chapter and subtopics	S1 I1:19-4
OS:N-sb}i	reorganized notes immediately, given Sorting Bin	S3 I3:12-1
OS:N-sb}i	sorted notes very fast when I showed him the sorting bin	S4 I3:21-1
OS:N-T	sort the notes according to chapter subheadings (outline topics)	S1 I1:12-1
OS:R	sorted references: "Neat."	S1 j1: 9-1
OS:R	"manually" rearranged the reference cards chronologically	S2 I2: 7-1
OS:R	sort refs into subtopics	S2 I3: 7-1
OS:R,N-T	then put all xyz refs/notes in that subtopic	S2 I4: 5-4
OS:R-pc	sort the references using computer	S1 I1:35-3
OS:S	sort articles into labeled piles	S4 I1: 8-3
OS:S	sorting it out [the source material] -->learn, explain to readers	S1 I1: 6-1
OS:T	move outline parts around	S5 I1: 6-3
OS2:R,N-T2	sort xyz refs/notes into sub-subtopics	S2 I4: 5-7
OZ:A	"starting to put it all together"	S4 I1: 3-3
OZ:I,N	combine (my own thoughts) with thoughts I've synthesized from writings (articles)	S4 I1:12-5
OZ:N,F	"go back and pull stuff together" (notes, field data)	S3 I1:29-2
OZ:N-IS	integrated, sorted imported notes "I like that"	S1 j1: 5-1
OZ:Q-N	interject quotations from the notes I have	S4 I1:12-6
OZ:S-W	integrate next article with what I've got	S6 I1: 8-6

RA	try to index them	S3 I1: 5-7
RA	adding notes, "to help me remember"	S6 I2:17-1
RA	use [write] notes [as a way of remembering things to include in papers]	S5 I1: 8-1
RA-cal	wants to use calendar in IS	S3 I2: 8-1
RA-cal	keep track of subjects' running using calendar software	S2 I3: 3-1
RA-pc	index my notes on computer	S3 I1: 9-1
RA:F,st	keep log of research subjects' status	S2 I3:11-1
RA:I	recorded ideas in IS "before I forget" them	S1 I3: 4-7
RA:I}i	get research ideas, doing something else: "just throw them in there"	S2 I4:11-1
RA:N-pu	used the pin-up feature for things-to-do and it worked	S3 E1: 5-2
RA:S	make notes on the paper itself	S2 I1: 1-2
RA:S	"make little notes in the margins of books, to remind me"	S5 I1:10-1
RA:S	capture info I'll need later: I need to remember -->"will save me a lot of time"	S6 I3:18-1
RA:ST-IS	keeping log of experiments	S2 I3:15-2
RA:T	made myself a note beside some of the outline topics, to expand on the topic	S1 I1:14-2
RA}i	"can take a note here and a note there" [in IS]	S3 I2: 1-3
RF	played around with the Folders feature -->didn't like it	S6 I3:20-1
RF	gathered information in library using Folders reminders -->"sped up that process"; "that was handy"	S6 I2: 6-2
RF:T	used folders feature to mark outline points needing information	S6 I2: 6-1
RH-co	use color-coding for memory -->"helps me deal with memory"	S6 I1:29-1
RH:K-co	color-coded terms in notes -->easy to see, find	S4 I3: 6-1
RH:N-co	using color for highlighting in notes	S4 I2:10-1
RH:R	circle numbers of references for the book	S1 I1:35-1
RH:R-B	highlight references (in bibliographies) I'll need	S4 I1:17-3
RH:S	add highlighting and asterisks to article to remember -->"Unless I go back to the book, I'm going to lose it."	S4 I2: 1-1
RH:S	highlight and asterisk important information	S4 I4: 9-3
RH:S	highlight what I want	S4 I3:16-2
RH:S	highlight the information	S4 I1: 1-3
RH:S	highlighting while reading	S1 I3: 4-4
RH:S	underline parts to remember	S5 I1:10-2
RH:S-co	color-code [useful] parts of the articles -->works well, reminder	S6 I1: 5-2
RH:S-hi	highlight information in articles (or circle or asterisk)	S4 I1:10-1
RH:S-ps	color-code books with post-its	S6 I1: 6-3
W	start writing	S5 I1: 1-2
W(min)	"write a little bit"	S6 I1: 3-1

	-->"makes it real", "felt better", "have the idea"	
W(nonseq)	write piecemeal (jump around, chapters out of order)	S1 I1:25-1
W(nonseq)	get idea, write sentence out of order need to do a lot of reorganizing	S1 I4:10-1
W(sw)	usually work on several papers concurrently	S5 I4: 2-4
W(sw)	work on several papers, switch back and forth	S5 I1: 4-1
W-co	write about it [green highlights] -->the written paper	S6 I1: 6-2
W-co	write about color-coded part (only)	S6 I1:29-2
W-co	write on that [color-coded part]	S6 I1: 8-5
W-hrd 1st	write hardest part first -->"over the hurdle", "moving", "getting more fun", "easier now"	S1 I1:22-1
W-IS	"This way of writing is working out much better than the standard word processor way."	S2 J1: 9-1
W-IS	writing with IS -->"I think I've really found a system that I can write well with."	S3 I2: 1-1
W-IS	writing using IS -->IS helps	S3 I2: 9-1
W-IS(ea)	wrote using IS notes -->"When I finally sat down to write it, it came very easily."	S3 I4:14-1
W-mi	sit down and write 200 pages: "I have it all in my head"	S3 I1: 5-8
W-mi	typing from head, not paper	S3 I2:11-1
W-N	write: the notes become text	S1 I1:19-5
W-O	write following the outline -->"reduce the amount of time"	S1 I1:17-2
W-O	fill in outline with facts and quotes -->"most efficient way", avoids excessive rereading	S6 I1: 9-2
W-O or W	write using outline, or just write	S2 I1:10-2
W-pa	"creating original text" with pencil	S1 I1: 7-1
W-pa	write by hand, anywhere -->portable	S1 I1:26-1
W-pc	write on a computer -->distracting (email etc)	S3 I1:22-1
W-pc}d,am	write using computer early every morning -->[productive]	S2 I1: 7-1
W-pc}l	continue writing on computer a couple of weeks later	S6 I1: 3-4
W-pi	write with piles of papers spread out on bed	S6 I4: 5-2
W-Q	overused quotes in writing	S3 I4: 3-2
W-S	type [write draft] directly from articles	S6 I1: 2-5
W-T	use outline points to prompt writing (write using outline points)	S2 I1:11-3
W-T	pull out outline point and use it in the writing	S5 I1: 6-4
W-T	write 10-15 pp using outline -->"throw it all out and start over"	S5 I1: 2-2
W-T	break down topics into paragraphs	S1 I1:17-1
W-T	write [about cluster]: "you don't have to even	S6 I4:13-4

	think"	
W-T,pc	go from point to point (in outline) filling information (my own thoughts) in with word processor	S4 I1:12-4
W-TA@pc	write thinking at the keyboard	S6 I4: 5-1
W-wp	use Word, to write	S6 I1:11-1
W-wp	work on paper [writing] in Word	S5 I2: 3-1
W-wp	writing with word processor [vs paper or notecards] "is how I work"	S6 I4: 1-2
W:exam-N	make up exam from notes -->"It's there. It's been a real efficient system."	S3 I2: 9-5
W:exam-N	develop exams from notes	S3 I2: 2-6
W:intro	do one-page plan (introduction)	S6 I1:21-2
W:intro	write the introduction	S6 I1: 3-2
W:lr	do literature review (20+pp)	S6 I1:21-1
W:S	wrote, finished a paper	S5 I4: 4-1
W:S	wrote article	S3 I4: 3-1
W:S-F	creating a reference manual of facts, to aid memory	S6 I3:19-1
W@home	do it (SWP) at home	S6 I1: 2-1
W@home	do SWP at home	S5 I1:12-1
W@home	"creative work" [writing] at home -->no interruptions	S1 I1:40-2
W}i	start writing papers as soon as possible -->productive	S3 I1: 2-3
W2	start over: write draft 2	S5 I1: 2-4
WS	submit it (the paper)	S5 I1: 3-1
WS	deliver a paper -->analysis	S3 I1: 5-3
WS2	submit again -->accepted for publication	S5 I1: 3-3
WT	"I throw out a lot of the prose."	S5 I1: 2-1
WT:W1	throw out the first draft -->"rest of it comes fairly easily"	S5 I1: 2-3
C:T-O	talk about [the study question]	S6 I2:21-3
CC:I	defend my ideas -->analysis	S3 I1: 5-4
CC:S,I	talking in study group	S6 I2: 5-1
ST	running subjects	S2 I3: 1-1
SWP-pc	Q: using computer more, with laptop? A: yes.	S1 I4:16-1
SWP-pc	do SWP more with software and less manually	S1 I4: 5-1
SWP:A-IS	do everything in IS -->"I don't even use WordPerfect anymore."	S2 I4:13-1
TA-T	thinking in clusters, for exams	S6 I4:13-2
TA-T	think in topics	S6 I4:21-1
TA-T	tend to think in clumps	S6 I4: 7-1
TA:I	explore an idea	S3 I2:11-3
TA:T	busy thinking about it (general topic) -->can't sleep	S6 I1: 2-7
TA:W	figure out what to write	S1 I1: 6-2

SCHOLARLY WORK PROCESS PROBLEMS

Code	Unit of Analysis	S# Src-ID
A:N-IS	"the problem is, as extensive as I read, you've got to then find the time to do this process, sit down and pull out what you want to remember"	S4 I3:16-7
A:N-pc	"How do you get that information you want to save onto the computer?"	S4 I4:13-1
A:N-pc	"If I were more diligent" to input the notes: It requires "disciplining yourself to do that."	S4 I4: 9-1
A:R-odb/wp	use cut and paste to move important references to Word from Dialog -->built bibliography, "tedious"	S6 I1:25-1
A:R-pdb	used Access database to add 100 refs -->"this is a bear" ... "There's got to be a better way."	S6 I1:17-1
A:R-pdb	tried using Citation for references -->"too damn clumsy"	S3 I3: 8-2
A:R-pdb	don't add references using EndNote at home (thought he would, but didn't)	S3 I4:20-1
AT:N	Word's automatic date fill-in: "it's not really helpful, it just sort of gets in the way."	S5 I4: 7-1
AT:N-pc	"have to take that information and at some point get it on the computer." -->computer not portable enough, "cumbersome"	S4 I1:14-2
AT:N-S}i	"typing at the same time you are reading:... most people don't do that."	S4 I3:18-5
CK:W-pc	grammar-checking software: "next to useless"	S1 I1:30-1
BTF:ac	problem with email program's attached files going into IS directory	S3 I3:15-1
BTF:ac	Q: Using Lotus Notes? A: No, because "a nuisance", "you find you're depending on it for everything"	S4 I2:28-1
BTF:ea	considers laptop "clumsy", touchpad problem -->touchpad accidents: "calling up files I don't want"	S1 I4:16-2
BTF:sa	computer crashed	S1 I4: 1-1
DS:N	"what I dislike most about the computer is you have to scroll"	S1 I1: 7-3
DS:W	scroll past it, back up, scroll past it again -->get frustrated, irritating	S1 I1:24-5
F:F,Q	you remember something from ref1 that is now relevant, you don't have notes on it, you don't remember exactly where it is, so you have to reread ref1	S5 T2: 1-2
F:F-N	reviewing notes, trying to find something -->takes too much time	S5 I1:17-4
F:F-S	"one of the things that makes writing hard": you remember something, you remember the author, but you can't pinpoint the exact location and find it.	S5 I4: 3-1

F:F-S,pi	"When I go back to that pile in 6 months, I'm not going to remember the content of that book or that article and that specific phrase or chapter I'm looking for."	S4 I3:18-3
F:N	"I don't get back to my notes"	S5 I1:17-1
F:N	prepared class handouts in AmiPro, WordPerfect, then Word -->"Never could locate files"	S3 E2: 1-1
F:N,S	Q: Is finding things a problem? A: "It is unless I make a conscious effort to create some organization	S4 I1:17-1
F:N-po	print notes out -->readable, but lose them	S3 I1:18-1
mem(F)	Our framework categories ("touchstone" articles and references) help us remember information that fits but not info that doesn't fit.	S5 T2: 3-1
fA:N	no filing system for notes	S2 I1: 5-2
fA:N,W-D	keep notes and text in one [too] long document	S2 I1: 6-3
fA:N-Ds	keep information in several documents -->"slows me down"	S2 I1: 6-4
fA:N-fc	file notes (physically) -->a disaster; don't know what I have	S3 I1:18-3
fA:N-nc	Q: use notecards? A: "never worked, because I couldn't keep the stuff straight."	S3 I1:29-1
fA:pds	"it does get very difficult, and tedious" [getting back to your information, without an organized pds, a system]	S4 I3:15-3
fA:R-nc	have refs card file system -->not up-to-date	S4 I2:16-2
fA:Ss	"I'm starting to get overwhelmed with all the stuff I'm collecting."	S4 I4:24-1
FG:N,F	"I know I have it. No question. I remember that I have it. But I don't know where I have it."	S4 I4:12-1
FG:N-mem	remember something but forget location,, not filed -->can't retrieve, "lost in the shuffle"	S4 I1: 9-1
FG:N-pc	finding notes in computer: "such a pain"	S2 I1: 8-2
F:fo-pi	make labeled manila folder for each chapter -->But couldn't find the pile, in interview	S1 I1: 9-1
FQ:N-wp	problem with WordPerfect's Find feature is "I still have to know where to go to look for it, which sort of destroys the whole point of keeping your notes [in the computer]"	S2 I1: 4-1
FS:D	search by scrolling document -->get distracted by something else for hours	S2 I1: 6-5
FS:F-S	scroll through authors' papers to find it [something remembered]	S2 I1: 3-1
FS:N	reviewing and finding notes on computer -->"I'd get lost in the notes just like I get lost in the library" [off-task, finding other, maybe useful, info]	S5 I1:17-6
FS:ov-pi	looking through piles for transparencies -->"I can't find a damn thing in it."	S3 I4:18-3
FS:R-B	look up a reference by author [by scanning 400+ cites not in alphabetical order]	S1 I1:34-1

	--> "pretty difficult", "system breaks down" when refs accumulate, but ...	
F:D-pc	organizing wp files in subdirectories -->takes time; can't find things	S3 I2:10-2
O2:D-sd	reorganizing word processing files into subdirectories -->takes time, "then I can't find things" [10-2, 10-3]	S3 I2: 1-2
O2:W-pc	revising on screen is "a pain"	S1 I1:23-2
OC:I-prg	Q: tried special programs for pattern recognition? A: Ethnograph, Nudist: "too complicated, too unruly"	S3 I1:14-1
OC:N-wp	organizing notes in word processor, "found myself getting all hung up in, sort of the flow of it" -->"getting hung up in ... the flow of it"	S2 I2: 1-2
OH-pa	makes outline in pencil [on paper] -->get my ideas together; not that productive	S3 I1:26-1
OH-wp	"get so frustrated with Word's outline feature ... it's putting in points." -->"So I generally turn that off."	S6 I1:20-1
OH-wp	"tired of fighting with Word's Outline [feature]", "frustrating"	S6 I1:26-1
OH:E-wp	outline lecture in Word -->automatic numbering: a pain	S5 I2: 7-1
OM:N-drag	dragging text: "When I drag, I tend to get it in the wrong place."	S1 I3:12-2
R:FG:S	think of something [in an article], continue working ... -->"I'll never remember to go and get that paper."	S2 I4:10-3
RA:N}i	"If I don't mark it down or key it into IS now, I'm never going to remember this 6 months from now.	S4 I2: 5-2
RH:S	add highlighting and asterisks to article to remember -->"Unless I go back to the book, I'm going to lose it."	S4 I2: 1-1
RH:S	highlights in book: later, "I don't have access to that anymore."	S4 I3:18-1
mem	creating a reference manual of facts, to aid memory	S6 I3:19-1
mem(dup)	writing out of order -->duplication, don't remember I already wrote that	S1 I1:25-2
W-am}d	problem with time: "never been disciplined enough to sit down at 6:30 every day and write unti 8:00 in the morning"	S3 I1:16-1
W-pc	"I find the keyboard distracting, from my thought processes."	S1 I1: 7-2
W-pc	write on a computer -->distracting (email etc)	S3 I1:22-1
W:W1	the hardest part to write is the first part	S5 I1: 2-5
mem	you read and take selective notes from a reference and remember part of what you read	S5 T2: 1-1

SCHOLARLY WORK PROCESS NEEDS

Code	Unit of Analysis	S# Src-ID
A:N	"the real challenge is to get the information	S5 I3: 9-1
A:N-pc,vr	wants to be able to "read that particular sentence into whatever my device is, so it's stored."	S4 I4:17-1
A:N-pp	wants a Palm Pilot type of tool to carry around and record notes to later upload to computer	S4 I1:14-3
A:N-T	adding notes with IS, focusing on one section at a time	S2 I2: 1-3
A:ov	need to create transparencies for lectures	S5 I3: 7-2
A:R-sc	scan in refs	S5 I4: 1-3
AF:O	made outline hierarchy visual with blank topics and indents in captions	S1 I2: 1-3
AF:W-wp	want to format text in wp for publisher	S1 I3: 7-1
AF:W}l	do writing and tables separately -->not interrupt writing with having to create a table	S4 I4: 7-1
AT:hi>IS	"plugging it [what I want to have access to in the future] into a program like IS"	S4 I3:16-4
AV:D-IS<>wp	needs to convert to word processor, back and forth -->"The way I work it is very important that I can move back and forth"	S1 j1: 3-1
AV:S>D-sc	"So if I had something while I'm reading and highlighting, that would extract that information, like a scanner, that I could plug into my computer..." -->"I'd have it, because I was able to just grab it right on the spot."	S4 I3:18-4
AV:S>N-sc	"to be able to sit in the easy chair and get that information direct into some type of digitized storage device."	S4 I4:13-2
CK:em-sp	needs to spell check his email	S3 E1: 6-2
BTF:ea	don't want to upgrade: "I've gotten so comfortable with this, I didn't want to try to learn a different one."	S2 I3:26-1
BTF:eff	needed multiple-select feature	S6 I4:23-1
BTF:sa	needs way to make backups: doesn't use MS Explorer	S3 T1: 1-3
D:N-pc	would have displayed pinup note for question while creating outline -->not need to refer to paper	S6 I2: 3-1
DG:F	grid (table and calculate) feature would be "handy"	S5 I3:31-1
DM:W	solution to see enough on screen problem: "a 30-foot high screen where I could have 10 or 15 pages in front of me at all times."	S1 I1:24-2
DS:N}i	"need to be able ... to look at it [information] in a flash."	S2 I2:19-2

fA:N	Q: do you go back to your notes? A: No, I need to.	S2 I1: 8-1
F:N-pc	computer could help me get back to specific notes	S5 I1:17-5
F:R,I	need abstracts on hand, to skim through and find the exact information	S5 I4: 3-2
fA:A-D,pc	saves everything -->old files	S5 I3:24-1
fA:B-IS	creating references -->"Maybe this software will allow me to easily do stuff along this line that I couldn't do with the word processor."	S1 j1: 4-1
fA:N,W	if I could get back to notes -->"my notes might help me"	S5 I1:17-2
fA:N-pds	"the main thing is knowing where it's at, and being able to get to it when you want it."	S4 I4:20-2
fA:N-pds	[for access, need to] "extract that information and put it into a program like IS or a word processor so I can get back to it."	S4 I3:18-2
fA:O	kept older versions of outline	S1 I4:14-1
fA:R-pdb	need to find time to set up a personal db for self	S4 I1:19-1
fA:S,N-pds	collecting source articles, notes: "How do I keep track of them, to get back to them?"	S4 I3:15-1
fA:S-sc	would like a device to scan in full text of articles	S6 I1:23-1
fA:S-sc	Computer would be useful tool if we scanned in full text so we could use computer search to find these things fast.	S5 T2: 1-3
fA:S-sc>IS	need to be able to scan it right into IS; very important. "This is an important aspect of writing."	S3 I4: 5-3
FG:N-IS	search feature is "going to start becoming important pretty soon, as soon as I start to put this stuff together."	S2 I2: 4-1
FG:N}i	yes [searching for notes on computer would be useful if you could do it fast without getting off-track]	S5 I1:18-1
fI:N	needs indexing system: "may not necessarily use that same term...later on"	S4 I2:20-1
FQ:N,R	will need Search feature "if I write a book", to find my notes and references	S3 I3: 8-1
FQ:R-K	"there may come a point where I'd really want to have those" [keywords]	S2 I2:21-1
FS:I-N	need to search for patterns in the data described in sources	S2 I3:24-1
FS:N	"I want to get back to a text that I've written and I can't remember where it is"	S5 I1:19-2
FS:N	doesn't want to rely on search to pull out notes by keyword: "I'd be nervous about that." (may not have the right word in it)	S6 I3:14-2
FS:N}i	not sure how to scan notes or find things quickly -->might be worth my while; might prompt a lot of verbal behavior	S5 I1:17-3
O:W-IS	Someone organized his web page files: "Hopefully,	S3 E1: 3-1

	IS will do the same for me in writing (particularly writing up lectures)."	
O2:D-ofc	make minor change in file at other location	S5 I3:20-1
O2:N	"needed to be able to have bits of information I could move around..."	S2 I2:19-1
O2:N-sj	need a better way to reorganize notes	S5 I2: 2-1
O2:O-S	change the outline, based on reading new material	S1 I1:16-1
O2:W	rewrite -->get published	S1 I1:17-3
OC:F	database feature: "wouldn't mind seeing that"	S5 I3:32-1
OC:R-K	wanting to organize the literature according to procedural issues	S2 I2:24-1
OH	organize well -->avoid rewriting	S1 I1:17-4
OH	"the secret is that outline", "the way I work"	S1 I1:15-1
OH	create detailed outline	S1 I4:13-1
OH-IS	emphasized importance of outlining: wants to do book outline in IS first, then fill it in. -->Said students who say they don't outline, really do: "in their heads."	S1 T1: 1-1
OM:A-pc	carries laptop to office in another city	S1 I4:15-1
OM:D}a	wish we had some way to connect computers (home and office computers)	S5 I3:18-2
OM:D}a	transport files between home and office "all the time" -->need file-topics feature	S5 I3:18-1
OS:R	"manually" rearranged the reference cards chronologically	S2 I2: 7-1
RA-cal	calendar could be useful	S3 E1: 2-1
RA-cal	need a calendar function, to plan class assignments	S5 I3: 7-1
RA-sc	"segments of books could be scanned in" without typing -->so you could get back to them, find them	S5 I1:19-1
RA-sc	wants electronic highlighter pen, to annotate full-text articles in computer: "Memex"	S6 I1:23-2
RA-sc	want a wand scanner	S5 I2:22-1
RA:S	capture info I'll need later: I need to remember -->"will save me a lot of time"	S6 I3:18-1
RH-co	"have to have some sort of color-coding" -->or "end up reading the article again and again and missing things"	S6 I1: 7-1
RH:N-co	using color for highlighting in notes	S4 I2:10-1
RH:S-sc	wants hand-scanner highlighter tool: "That would be a good tool!"	S4 I2:29-1
W(nonseq)	get idea, write sentence out of order -->need to do a lot of reorganizing	S1 I4:10-1
W-IS	"Maybe using the IS software will get me started on writing."	S3 E1: 1-3
W-IS,pa	said he needs to work with paper after getting notes into IS	S1 T1: 3-1
W-O	write following the outline -->"reduce the amount of time"	S1 I1:17-2
W-page}d	the key: "write a page before I start the day"	S3 I1:16-2

W@home	"creative work" [writing] at home -->no interruptions	S1 I1:40-2
W@home	need to use both computers (home and office)	S3 I4: 9-3
SWP-IS	excited about using IS and feels "motivated" to get back into SW by participating in this study -->helping determine his future direction: get back into writing and SW instead of retiring to play the guitar and play chess	S3 T2: 2-3
SWP-IS	Q: Has using this program changed the way you work in any way? A: "Yeah, it tells me to be more disciplined in my note taking! -->"But whether I'm going to change or not ..."	S4 I4:23-1
SWP-mot	motivation to complete book project	S1 I3:23-1
SWP-ti	need to be "very protective of my time", to write: "it's a matter of setting aside a few hours a day."	S3 I4:13-3

Code	Unit of Analysis	S# Src-ID
A:N-IS}i	"Started typing up notes after my class lecture when I finished lecture, only after I installed IS. "was a more manageable system, one where I could recover the notes and keep records" ... "I knew where I had been and will be able to use the notes to lecture from again and ... I may be able to publish a text from them"	S3 E2: 1-2
A:nc+	"Now I do that notecard bit a little more than I used to" [make notecards] -->"definitely different" (SWP)	S2 I4: 3-1
A:N}i	"throw it [info] in there"	S6 I2: 4-4
A:N}i	adding notes to IS during discussion	S6 I2: 5-2
A:N}i-IS	develop notes for class daily "Have a record of what I've talked about on a day to day basis." [2-7]	S3 I2: 2-1
BTF:ac	changed file-topic back to IS topic: wanted to have everything open and accessible	S2 I3:23-2
DP:N-pa	Q: is printing out on paper still important? A: No. "This has gotten me over that. I don't have to put anything on paper."	S3 I4:15-1
DR:N-IS	going to study using IS notes, not printouts -->easier	S6 I2:21-1
DR:N>I	IS is an aid: studying IS notes promotes ideas.	S1 j1:13-4
DR:O's	go back and compare outline versions very useful	S1 I4:14-2
DR:O>I	got another idea for process, studying IS outline (next day)	S1 j1:11-1
DR:O}i	review using outline as flash cards -->see it quick	S6 I2:21-2
DS:gaps-O	see a topic with only one note in it -->tool lets you organize information, see the organization structure, and discover the gaps	S6 I3:17-1
DS:N}i	"pop back and forth" between notes	S3 I2:11-4
DS:O	collapse everything down to just your outline, to see [vs scroll] -->liked speed of navigating via outline instead of scrolling through text	S6 I4:14-1
DS:O,N	IS is an aid: "allows you to `see' what's going on" and make decisions and get ideas	S1 j1:13-2
DS:T,N	"stuck on something" [blocked], "can just arrow down to a different topic" -->"better", BTF:sw	S2 I4: 4-1
F:N,Q	finding things -->better organized lectures	S3 I3: 1-2
f:N-IS	put notes in IS, "having a place to put your notes" -->can get back to them	S5 I4:11-1
F:N-IS	keeping track of quotes, finding and recalling	S3 I2: 9-2

	material -->"able to recall material that I couldn't have before."	
fA:B-IS	creating references "Maybe this software will allow me to easily do stuff along this line that I couldn't do with the word processor."	S1 j1: 4-1
fA:R,N-IS	using IS for refs and notes -->"I've got this fantastic series of cards": cite, abstract, and reations	S2 I2: 2-6
fA:R-IS	decided to do references in IS after all: better for handling "connotations"	S3 I4:19-1
fA:R-PDS	PDS: "I can see enormous potential there. ... It's very personalized ... everybody can build their own database."	S5 I4: 1-4
fA:R-pds	doing library search, "I'm beginning to see that one of the things that IS allows you to do is have your own version of the literature."	S2 I4: 8-2
FG:N-K	keyword search: "It'll pull together a lot of stuff that I probably would never have been able to pull together otherwise."	S5 I4:10-3
FG:R,N}W	"This is the first time I have been able to recall references and notes while writing"	S3 E1: 4-1
FQ:N	use searching to avoid duplication: "see how many times I've already said that"	S1 I4: 7-1
FS:Q	finding quotes	S3 I4: 3-3
O:N-ea	IS is an aid: makes organizing easy	S1 j1:13-1
O:N-IS	organizing information in IS -->"They're right there. And I can find the information."	S3 I2:10-3
O2:N-drag	dragging for cutting and pasting and moving things around do better with drag	S1 I4: 5-2
OC:I}i	"idea about something else" while writing: "close this note and go to another one" [immediately categorize idea, not move it later]	S2 I4: 4-2
OC:S-IS	"I'm doing different kinds of things. I wouldn't have organized in this way before, because it's just too labor intensive."	S2 I4: 6-1
OC2:N>I,KN	"something hit me" [notice similarities]: "I could see ... it's right there" -->"got to it in a more direct way"	S2 I4: 7-2
OC2:R-K	recode refs for a different paper "extremely useful"	S5 I4: 2-3
OL:I	"rough out ideas" in IS -->"and it's there"	S3 I4:13-1
OM:A-fd	transporting information home on floppy	S3 I4: 9-1
RA:I	recorded ideas in IS "before I forget" them	S1 I3: 4-7
RA:I}i	get research ideas, doing something else: "just throw them in there"	S2 I4:11-1
RA}i	"can take a note here and a note there" [in IS]	S3 I2: 1-3
W-IS	"the 'atomized' way of writing is really helping me to say just what I have to say about one topic before moving on."	S2 J1:10-1

W-IS(ea)	wrote using IS notes -->"When I finally sat down to write it, it came very easily."	S3 I4:14-1
W-Wpc	"I'm so excited about getting this new notebook computer. It's going to be strictly a writing machine."	S2 I1: 7-2
W:exam-N	make up exam from notes -->"It's there. It's been a real efficient system."	S3 I2: 9-5
SWP-IS	"I think it made it easier, and therefore made it more likely that I would do more than I might do." easy to do	S5 I4:10-1
SWP-IS	"I keep finding new ways to use it [IS] ... because I need something that will do this."	S5 I3:11-1
SWP-IS	Q: did using IS affect the way you work? A: "Yes, it definitely affected my attitude about how I should work. ... it made me realize that there has to be more efficient ways to approach the process."	S1 I4:12-1
SWP-pc	do SWP more with software and less manually	S1 I4: 5-1
TA:I	explore an idea	S3 I2:11-3

INFO SELECT PROBLEMS

Code	Unit of Analysis	S# Src-ID
BTF:ea	having trouble remembering the commands (for IS)	S1 j1: 1-1
BTF:ea	online help "annoying" because no index to help topics	S6 I2:23-1
BTF:ea	having problems indenting, deleting notes and creating topics (IS basics)	S3 I2: 6-1
BTF:ea	forgot how to indent notes and topics	S4 I3:12-1
BTF:ea	IS not easy	S6 I4:30-1
BTF:lrn	spent time relearning how to use IS -->"not entirely wasted"	S1 I2: 1-1
BTF:Win	frustrated when program didn't do everything the standard Windows way	S6 I4:16-1
DP:N-prev	no print preview: didn't like	S6 I4:22-1
DP:Ns	can't select some, not all, notes to print -->"frustrating"	S6 I2:22-1

BASIC TOOL FEATURES (BTF): ACCESSIBLE

Code	Unit of Analysis	S# Src-ID
A:N}i	adding notes to IS during discussion	S6 I2: 5-2
A:N}i	"throw it [info] in there"	S6 I2: 4-4
A:R-pdb	don't add references using EndNote at home (thought he would, but didn't)	S3 I4:20-1
BTF:ac	Q: Using Lotus Notes? A: No, because "a nuisance", "you find you're depending on it for everything"	S4 I2:28-1
BTF:ac	changed file-topic back to IS topic: wanted to have everything open and accessible	S2 I3:23-2
DS:O	scanning the outline	S1 I4: 8-1
fA:A-D,pc	saves everything old files	S5 I3:24-1
O2:D-ofc	make minor change in file at other location	S5 I3:20-1
O2:W-pa	revise by hand, anywhere -->portable	S1 I1:26-2
RA}i	"can take a note here and a note there" [in IS]	S3 I2: 1-3
W-pa	write by hand, anywhere -->portable	S1 I1:26-1
SWP-IS	using IS -->more convenient	S3 I3: 1-1

BASIC TOOL FEATURES (BTF): EASY

Code	Unit of Analysis	S# Src-ID
A:nc+	"Now I do that notecard bit a little more than I used to" [make notecards] -->"definitely different" (SWP)	S2 I4: 3-1
A:S-sc	scan important source material -->"it's a snap"	S3 I4: 5-1
BTF:ea	using IS menus -->menus easy to work with	S6 I2:15-1
BTF:ea	easy to use IS (with cue card)	S4 I2: 2-1
BTF:ea	had to "play with it" awhile, to recall how to do things after not using it for awhile	S4 I2: 6-1
BTF:ea	online help "annoying" because no index to help topics	S6 I2:23-1
BTF:ea	forgot how to indent notes and topics	S4 I3:12-1
BTF:ea	better to have good, useful software than easy software: "you can learn to use any software"	S6 I1:24-1
BTF:ea	considers laptop "clumsy", touchpad problem touchpad accidents: "calling up files I don't want"	S1 I4:16-2
BTF:ea	shortcut key doesn't work like the instructions says it does	S1 j1: 1-2
BTF:ea	used online Help to learn about Print feature, to print some (not all) notes in topic	S6 I2:22-2

	-->"took me awhile to figure it out	
BTF:ea	having problems indenting, deleting notes and creating topics (IS basics)	S3 I2: 6-1
BTF:ea	having problems with indent and other IS basic features	S3 I3: 5-1
BTF:ea	don't want to upgrade: "I've gotten so comfortable with this, I didn't want to try to learn a different one."	S2 I3:26-1
BTF:ea	still having trouble indenting in IS	S3 I4: 7-2
BTF:ea	"I think I am finding myself making decisions on creating the book based on what I might be able to do easily, especially with the mechanical stuff." ? afford?	S1 j1: 4-2
BTF:ea	having trouble remembering the commands (for IS)	S1 j1: 1-1
BTF:ea	problem indenting notes (doesn't remember to open the topic, after several reminders)	S3 T2: 2-2
BTF:ea	IS not easy	S6 I4:30-1
BTF:ea	still trouble remembering commands (a week later)	S1 j1: 2-1
DP:N-IS	didn't know how to print on separate page for each note	S4 I3: 3-1
fA:N-IS	doing all notes in IS, none on paper	S2 I3:18-1
FQ:R-K	searching on keyword -->"real easy", "it pulls these things right out"	S1 I3:16-2
FS:B-pa	flip through bibliography on paper [to find something, don't know exactly what I'm looking for] -->"easier than scrolling"	S1 I1:36-1
O2:N,T	use IS to move and reorganize notes and topics	S2 I2:15-1
O2:W-IS	reorganize by cut and paste and move easier	S1 I4:10-2
OC:R,N	"getting information in there ... that's been fun, just because it's so easy to organize it."	S2 I2:27-1
OC:S-IS	"I'm doing different kinds of things. I wouldn't have organized in this way before, because it's just too labor intensive."	S2 I4: 6-1
OM:N-cp	cut and paste: "a lot easier than dragging"	S1 I3:12-1
OZ:N-IS	integrated, sorted imported notes "I like that"	S1 j1: 5-1
SWP-IS	"I think it made it easier, and therefore made it more likely that I would do more than I might do." easy to do	S5 I4:10-1
SWP-IS	"With IS, I think it gives me some of that impetus [to get the notes into the system], because of the features that are there." -->easier than wp to create notes, topics, do searches; more versatile than db	S4 I4:23-2

BASIC TOOL FEATURES (BTF): EFFICIENT

Code	Unit of Analysis	S# Src-ID
A:N	"the real challenge is to get the information	S5 I3: 9-1
BTF:eff	needed multiple-select feature	S6 I4:23-1
BTF:eff	wanted explicit captions to automatically insert heading in note, vs implicit caption inserting caption in outline	S6 I4:21-1
BTF:eff	used shortcut keys -->speed	S6 I4:19-1
DM:N-pu	wanted to display the question while adding topics and notes to IS -->not scroll	S6 I2: 1-1
OC:S	categorize them: "carving the literature up"	S2 I4: 7-1
RH:S-co	color-code [useful] parts of the articles -->works well, reminder	S6 I1: 5-2
W-O	fill in outline with facts and quotes -->"most efficient way", avoids excessive rereading	S6 I1: 9-2
W:exam-N	make up exam from notes -->"It's there. It's been a real efficient system."	S3 I2: 9-5
SWP-IS	Q: did using IS affect the way you work? A: "Yes, it definitely affected my attitude about how I should work. ... it made me realize that there has to be more efficient ways to approach the process."	S1 I4:12-1

SPECIFIC THEMES: THINKING

Code	Unit of Analysis	S# Src-ID
O:TA-IS	use IS to "organize my thinking in a bunch of different areas"	S2 I4: 1-1
O:TA-IS	organizing my thinking with IS	S6 I4: 2-1
O2:O-S	change the outline, based on reading new material -->outline="critical thinking"	S1 I1:16-1
OC:D-Ts	split long note into short notes in several subtopics -->"it has helped my thinking about this complicated data base"	S2 E1: 1-2
W-T	write [about cluster]: "you don't have to even think"	S6 I4:13-4
W-TA@pc	write thinking at the keyboard	S6 I4: 5-1
SWP-pc	computer "has capacity that transcends what you can do with your own thinking and your own processing" -->[better SWP]	S5 I1:16-2
TA-T	tend to think in clumps	S6 I4: 7-1
TA-T	think in topics	S6 I4:21-1
TA:T	busy thinking about it (general topic) -->can't sleep	S6 I1: 2-7

SPECIFIC THEMES: AFFORDANCES

Code	Unit of Analysis	S# Src-ID
A:nc+	"Now I do that notecard bit a little more than I used to" [make notecards] -->"definitely different" (SWP)	S2 I4: 3-1
BTF:ea	IS not easy	S6 I4:30-1
BTF:ea	"I think I am finding myself making decisions on creating the book based on what I might be able to do easily, especially with the mechanical stuff."	S1 j1: 4-2
DR:O>I	got another idea for process, studying IS outline (next day)	S1 j1:11-1
DS:gaps-O	see a topic with only one note in it -->tool lets you organize information, see the organization struction, and discover the gaps	S6 I3:17-1
fA:B-IS	creating references -->"Maybe this software will allow me to easily do stuff along this line that I couldn't do with the word processor."	S1 j1: 4-1
fA:R,N-IS	using IS for refs and notes -->"I've got this fantastic series of cards": cite, abstract, and reations	S2 I2: 2-6
fA:R-pds	doing library search, "I'm beginning to see that one of the things that IS allows you to do is	S2 I4: 8-2

	have your own version of the literature." affords PDS	
O2:N,T	use IS to move and reorganize notes and topics "just because it's so easy"	S2 I2:15-1
OC:S	categorize them: "carving the literature up"	S2 I4: 7-1
RA:ST-IS	keeping log of experiments	S2 I3:15-2
SWP-IS	"I think it made it easier, and therefore made it more likely that I would do more than I might do." -->easy to do	S5 I4:10-1
TA-T	thinking in clusters, for exams -->affords	S6 I4:13-2

SPECIFIC THEMES: OUTLINING

Code	Unit of Analysis	S# Src-ID
DS:O	collapse everything down to just your outline, to see [vs scroll] -->liked speed of navigating via outline instead of scrolling through text	S6 I4:14-1
FS:N-IS,O	"that's why I like the way this software builds the overview page" [can get to the notes when you want them]	S4 I4:20-3
O2:O	revise the outline structure "the best feature"	S1 I4:13-2
OH	"the secret is that outline", "the way I work"	S1 I1:15-1
OH	create outline based on what's needed -->"outline is the key"	S1 I1:11-1
OH-IS	emphasized importance of outlining: wants to do book outline in IS first, then fill it in. -->Said students who say they don't outline, really do: "in their heads."	S1 T1: 1-1
OH:N,W	doing tool eval form 2, S said he needed to go back and answer the q's differently when I pointed out that IS's Selector is an outline -->not using prg to max.	S2 I4:14-1
OH:W-IS	IS as outline: "would be extremely useful ... shift in the way you think ... rethinking it." -->more+ thinking out loud	S5 I4:14-1
W-IS	"I can sort of conceptualize it like this: the whole paper is a topic. The sections in the paper are notes. So there's a notecard called Intro, there's a notecard called method, once called discussion. Put all together, that's your paper."	S2 I4: 4-3
W-O	write following the outline -->"reduce the amount of time"	S1 I1:17-2

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