Collection and organization of written information by social scientists and humanists: a review and exploratory study

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The literature on the information needs and uses of social scientists and humanists tends to ignore the stage of research in which the scholar collects and organizes written information, i.e., the period between locating information and using it. This article reviews literature on information storage in the humanities and social sciences and describes an exploratory study of the content and organization of personal files. In the study, thirty-six professors in a major private university were each interviewed twice during a five month period. During the interview sessions, the scholars were asked to describe the way in which they organize their files. In addition, certain measurements were taken in their offices: the linear feet of books, journals and other printed material on shelves; the number of filing drawers maintained; and the number of stacks of printed material on surfaces within the office. The findings are described and discussed in the light of previous research. Finally, the article identifies ways in which such research could be used to develop superior information products and services and a better understanding of the process of scholarship.

1. Introduction

In the last few decades, a great deal has been learned about the information needs and uses of scientists, engineers and the like. Various studies of scientists [1,9,17,24] and reviews of this literature [8,10,28,39] have documented how and where research workers gather and use information. By studying who scientists talk to, who they cite and where they publish, we can chart the process of research. And from this knowledge we can infer what information tools scientists need and how the results of their research might be better disseminated.

A body of literature similar to that in the sciences examines research in non-science fields. Research into information needs and uses in the social sciences and humanities has been more modest than in that of the physical sciences. The existing literature includes psychologists [35] and other social scientists [13,14,25,42], historians [33,44] and other humanists [2,5,25].

Research on information needs and uses—whether of scientists, humanists or social scientists—tends to focus upon similar things: habits of journal and library usage [3,11,12,34,47], citation patterns [14,36] and interpersonal communication (e.g.[1,9,15,18,29]). Rarely do such studies examine the intervening stage between acquiring relevant information and using it. What happens when scholars and scientists come back from the library, the laboratory or the lounge?

Knowledge is not always immediately obtainable or applicable. It needs to be gathered, digested, organized and stored for future use. Scientists and scholars must have ways of managing the information they acquire, but those methods have received little atttention in the literature. Aside from a few good discussions of how personal files may be organized (e.g.[20,21,41,43,26,33]) little published research exists on what is done with printed information after it is acquired. How is it organized, consumed and transformed into new, original works? Most studies have entirely ignored the stage at which information is assimilated into the mind and files of the researcher. As Orr [34, p.143] notes, "Considerably less of the total research effort has been devoted to information generating, or output, behavior". Similarly, Orbach [33, p.16] suggests that "the internal motivation behind the overt behavior needs to be addressed directly by soliciting researchers' accounts of their behavior".

This article examines the latter stage of research: the time between the receipt of information and its' use (or re-use). It discusses individual information habits in fields that are both less structured and less studied than science or engineering: the social sciences and humanities. The

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topic is approached by establishing a model of the research process and then reviewing literature pertinent to the various stages of the model, illustrated with examples from an exploratory study.

2. The research process

The 'soft sciences' and 'non-sciences', as Price [36] called them, include generic processes that go on in any field of study which make them a phenomenon worthy of examination: how do people cope with a heavy intake of printed information?

Orr [34] envisioned the scientist as a stream of inputs and outputs. The inputs come from his or her observations of the world and from information generated by others. The latter inputs can be in either of two modes: oral (e.g., a conversation with a colleague), or recorded (e.g., a journal article). The outputs can be viewed in parallel: information produced by research goes either to people (colleagues, students or project sponsors) or to records of some sort (books, articles, films, etc.).

Orr's description of the knowledge-generating cycle can be expanded to accomodate non-science fields. Similarly, Stone [46] described research as a five-step process that researchers in any field typically follow:

(1) thinking and talking to people about the topic;
(2) reading the studies that have already been done in the area;
(3) studying original sources and making notes on them;
(4) drafting an original contribution to the literature; and
(5) revising the article for publication.

In Orr's cosmology, steps (1), (4) and (5) would be output phases, while (1), (2) and (3) are part of the input cycle.

An example of this cycle can be found in Hills' [19, pp.139–142] discussion of information processing in the preparation of a research publication. Hills notes that any publication starts with decisions about subject matter, scope, intended audience and level of treatment. Then the author acquires information about the subject—depending upon what he or she already knows, what else is thought necessary, and what means are required to supply the missing information. The search for further information is usually based upon the presence of keywords in the subject matter. Then the new information acquired through literature searches is used to transform (i.e., supplement and extend) existing information. The output phase orders the material into a logical sequence, then gradually composes the ideas into a publishable form. Garvey [14] describes a similar process.

In keeping with the concept of an information processor, this review and the study it describes will focus on processes common to all disciplines: the *collection* and *organization* of printed information. Although interpersonal channels account for a surprising proportion of the information received by scholars (at least in the sciences), written materials are still the primary source of knowledge. The amounts and types of written information that scholars acquire, transform and store reflect both the character of information sources in their respective fields and their individual working habits. Hence, printed or hand-written information is the primary artifact studied here.

2.1. An exploratory study of information storage habits

Our lack of knowledge about how scholars do their work led this author to interview a number of faculty at a leading, privately-funded university in the western United States. The data reported here were gathered in the course of a broader study of the university faculty who had acquired personal computers to aid them in their work. An assumption of the study was that the introduction of a new tool in the writting and information-processing of scholars would prod them to reconsider the methods for their work—and thus make them especially receptive to questions about their working habits and use of information.

A total of 60 university professors from 32 different departments were interviewed twice over a period of five months. The sample closely represented the characteristics of the faculty population in terms of age and rank. Thirty-six respondents (23 from humanities and 13 from social sciences departments) form the focus of this study. The departments classified as 'Humanities' included Asian languages, Classics, English, German, History, Linguistics, Music, Philosophy, Religion and Slavic Languages. 'Social Science' departments in-

cluded Anthropology, Economics, Education, Psychology, Political Science and the professional schools of Business and Law (whose faculty had social science backgrounds and research interests). Results from this study are used to illustrate the discussion, below, of the gathering and organizing of printed information.

3. Collecting information

Scholars collect information through various media, and the use of these channels can vary widely from discipline to discipline. Means of information collection include reading, talking with colleagues, listening to lectures, viewing files and television, experimenting, conducting surveys, analysing archival data, examining artifacts, participant-observation and so on. While methods of gathering data vary considerably between the disciplines, certainly the printed word is the most influential medium of information in all fields. Hence, amounts of printed information are the primary indicators discussed here.

Haag [16] reviews the many barriers to the effective use of published information. Among the problems are the overwhelming volume, varying quality and delays in publication. Dissemination, ownership issues, geo-political boundaries and poor search strategies present other difficulties. The huge volume of published information, by itself, is a major problem for scholars. The sheer amount of scholarly information is bewildering. According to *Ulrich's International Periodical Directory* there are some 100 000 serials issued in the world each year (not including some 32 000 irregular serials), of which 60 000 are periodicals. While a scholar could gather information from any number of these, they typically focus on a very narrow subset of serials known as 'learned journals' [26]. King, McDonald and Roderer counted, 4450 *primary* journals in 1979 [22] and in an earlier [23] publication estimated a U.S. growth rate of 2.6 percent per year.

Many of these journals are indexed in bibliographic databases. Computer-based literature searches are an efficient means for the scholar to locate printed information on a given subject, although they are of little help in coping with the results of the search. Typically conducted through an intermediary, online searching enables a scholar to retrieve citations according to more criteria than simple author or subject headings and to retrieve more recent citations than are available through printed indexes—although the latter is less true in the humanities [46].

Yet even computerized information seeking searching has its disadvantages. Typical online searches retrieve many 'false drops', but attempts to avoid them by narrowing the search may result in the missing of relevant citations. Finally, the process of manual searching may have advantages that are lost in online access [45, p.14]:

> "The traditional manual search yields much valuable knowledge as a byproduct of locating relevant information. One pores over bibliographies and footnotes, reads background material, browses the stacks, and looks through indexes. In the process, one gets a 'feel' for the discipline, comes to recognize the names of many researchers, sees the same classic titles ... and gets a sense of how interpretations have evolved."

It is the often serendipitous process of 'finding' information that makes literature-based research so hard to dissect—compared to the certainties of a laboratory experiment. Yet library research offers comparable problems to that of computerized literature searching. Haag [16] reports that 26% of library searches end in failure and that users do not find the shelved material they seek in 48% of their attempts.

Burchard [5] cited 10 points in describing how the humanist searches for information, noting first of all that it is *the search* itself that is the major part of the humanist's work. Humanists rarely work under the time pressure of scientists, so rapid retrieval of literature is not of great importance. Humanists are dependent upon browsing and serendipity as retrieval methods, since present systems of subject analysis are often inadequate for subject-oriented searches. According to Stenstrom and McBride [42], this makes humanists *better* at information seeking than social scientists.

Some of what the scholar reads and experiences ends up as notes. Taking notes on literature is a process central to scholarship. In taking notes, the scholar screens large amounts of material, selecting only those elements that are relevant to his or her interests. More importantly, the scholar transforms what is read—condensing it, making inferences and drawing conclusions. Another form of notes are those that the scholar takes based upon observation of life, rather than of print.

3.1. Examples of collection habits

All of the faculty interviewed in the present study needed to keep abreast of newly-published material in their respective fields. For most, this amounted to close reading of four or five journals and scanning of several dozen more. The Classics department for example, kept a list of about 275 journals relevant to that field, scattered over four or more locations on campus. One professor carried with him a wallet-sized card on which there were listed about thirty journal titles, their call numbers and locations in the university library system. At least among humanists, this monitoring of the literature was not aided by a current awareness system, but rather by the regular perusal of journal copies. As one scholar said: "I flip through, read the table of contents, and see if anything catches my eye".

Questions about note-taking did not draw comments that are easily summarized. All of the respondents indicated that they took notes from time to time, but they found it difficult to verbalize the process or even to say how often they did it. One respondent, a linguist, offered this description of how he turned his book margin notes into original papers:

> "If it's very important I will make notes from [the book margins] transferred on pieces of paper. It's the fastest way ... very often you're reading something and you want the facts to enter short term memory with a lot of other stuff. You're not so concerned with it being down in hard form. So before I write a paper on a certain topic I might read about twenty or thirty things on it and you're letting it all enter there. Then you begin writing some note on your own paper. And you keep going back to the books themselves. It's not important to me that they're on separate sheets of paper. I still want it to feed into one place."

The traditional medium for taking notes is paper: sheets of notebook paper, bound notebooks, or index cards (often used for bibliographic notes). Filing these bits of information constitutes a problem for everyone. One respondent complained:

> "I'll have a file with loose pieces of paper labeled 'good ideas for this course'. They go in there, and don't often get organized beyond that point for quite a while. Often those little pieces of paper get lost".

These notes—and often the books, journals and article reprints from whence they came—must be stored in a fashion that facilitates retrieval. What the researcher does with such material is the next stage examined here.

4. Organizing information

Few information-seeking studies focus specifically on how scholars organize and store information. Perhaps a more general model will do. For example, Stibic [43, p.20] describes the general types of information found in the working files of *any* professional worker:

> "There are three groups of documents that can be found in any personal file: firstly, there is literature of any type such as books, journals, reports... secondly there are internal documents such as letters... memos, notes, minutes, contracts, project documentation, etc., and, thirdly, there are documents created by the user himself, such as his own notes, drafts, remarks, drawings, calculations, laboratory diaries and logs, excerpts from books, etc."

Scholars need to organize knowledge in a variety of forms. Aside from various kinds of publications (journals, books, individual articles and papers), faculty have other paper-based information to manage: files on classes, student work, administrative assignments, computer analyses, research projects, etc. There may be collections of information in non-paper media, as well: audio and video tapes, magnetic computer tapes and diskettes, photographs, graphics and other forms of visual expression.

At least one study among the growing literature on office information systems is relevant to research work. In his case studies of professional and clerical office workers, Malone [27] made three primary observations about the way these information workers organized their materials. The remarks of his respondents (three of whom were research scientists) are relevant to the information habits of academic workers.

First, Malone found that the difficulty of categorizing information was the critical factor in determining how people arrange their working materials. Like the other respondents, the research scientists organized much of their working materials into small stacks around their offices according to type. For instance, one pile would contain articles (and notes) relevant to a particular project, while another would consist entirely of documentation for the computer system used by the researcher. But the typical researcher's office contained more loosely-defined piles of mixed content, many of them arranged in the order of placement in the piles (i.e. chronologically). This phenomenon—our tendency to locate information

spatially—has been noted by psychologists [30] and in information science reviews of that literature [31]. As George Miller said of his own office:

"Every working day I sit in an office at a desk cluttered with piles of papers in a room whose walls are covered with books and journals. After a few months in that room I had learned where things were. I feel in my muscles that psychological journals are here, and linguistic journals there, and computer publications over there. I know what is in each pile on the desk, and I have a rough idea which file holds which papers. In short, I work in a cubicle that is lined with information which is spatially represented in my memory."

A second finding of Malone's, also suggested by Miller, was the tendency of respondents to arrange materials in such a way as to remind themselves of what to do, as well as to help locate information. Thus, there were piles of correspondence to be answered, journals to be read, and general lists of things to do. Often the proximity of these piles to the respondent's chair was an indicator of the importance or urgency of the tasks it represented: the closer it is, the greater the need of attention.

Finally, Malone identified two common types of document processing problems. One is the problem of what to do with something that defies ready classification or other action. These often end up in 'piles'. Another candidate for placement in stacks are those items that one needs readily at hand, either because they are needed in a current task, or because placing them in full view serves as a reminding function.

Although personal filing systems and workplace arrangements are rarely discussed in the literature on information work, they must play an important role in the actual use of textual information. As Malone implies, such habits have profound implications for the design of computer systems to support information work.

At a gross level, university faculty differ little from business professionals in the way in which they organize their offices. They have piles of papers arranged by subject and author. They have shelves for books, journals and other materials. Where faculty do differ from other office inhabitants is the *amount* of storage they need. Especially where books, journals and journal articles are concerned, faculty require a great deal of personal space. Soper [41] found individual scholars with as many as 9000 books, 2400 issues of journals and 40 000 journals articles! Even the average-sized collections among her sample are quite impressive: 475 books, 158 journal issues and 220 individual articles.

4.1. Examples of organization habits

Following the example of Malone [27], the respondent's offices were examined in the same way one might conduct an archaelogical dig. In his study, Malone drew maps of each respondent's office and asked the respondent to describe the content and arrangement of each file or pile of documents. Likewise, when a professor was interviewed in his or her office, certain observations were made concerning the number of stacks of materials lying around the office; the numbers of books, journals and notebooks on the shelves; and the numbers of filing cabinet drawers and other storage devices. Malone found the number of stacks of paper in a research office to be related to the worker's style and type of work (e.g., whether the paperwork was routine or non-routine). Table 1 summarizes the amounts of printed information found in the faculty offices, by type and academic category.

A 'stack' was defined as any independent collection of at least two separate sheets of paper–in most cases stacks were considerably thicker than this. The number of stacks in the respondents' offices ranged from zero to 49, with a mean of 18.9 and a median of 17. Forty-four percent of the faculty had between six and fifteen stacks in their offices; only 8 percent had more than 30 piles of paper. Like the researchers studied by Malone, the faculty used stacks of materials as an aid to their memory, as well as a physical scheme of organization. Explained one:

"I tend to lay things on bookcases instead of keeping things in filing cabinets—they tend to get lost in filing cabinets. Instead of lists what I tend to have are piles of things, stashed hither or yon, sometimes in outbaskets. Most of the things that are really hot are on my desk at home, which is substantially larger than this one, so they are there as physical entities."

Table 1
Printed information in the office

Category	Mean number of linear feet			Mean number of		
	Books	Journals	Notebooks	Stacks	Files	N
Humanities	39.6	3.4	2.6	17.2	5.1	23
Social Sci.	53.3	25.5	29.3	21.9	11.0	13
(All)	44.6	11.4	12.3	18.9	18.3	36

Another echoed these sentiments and described his way of regulating the amount of material that accumulates in stacks.

"You tend to reach a point of alarm and say 'uh-oh whats in this stack?' And then you go through it and sort it out. The problem with files is that part of the things that go into them are never seen again."

The number of filing drawers was also noted, although such data are highly suspect as their contents could not be examined. The number of filing drawers ranged from zero to 24. The distribution was roughly tri-modal—34 percent had a single four-drawer cabinet, twenty percent had no cabinets, and 38 percent had eight or more. For those faculty with filing cabinets, the average was 7.4 drawers, with a median of six. Most of them probably contained notes and journal articles. Jahoda et al. [20] found that about half of the scientists they interviewed kept their 'personal indexes' in the form of file folders—though many others also maintained card files. These scholars seemed to follow suit. Soper [41] also found many journal articles kept in filing cabinets and encountered difficulties in counting them.

Of the data on reading materials, the amount of books was the most thoroughly collected. Faculty had between zero and 110 linear feet of books in their offices, with a mean of 44.6 and a median of 34. Even at a liberal estimate of eight books per foot, the resulting average (357 books) is considerably lower than the 475 book average reported in Soper's study. Although the difference could be attributed to extreme outliers in her sample, it is more likely that many academics (42% according to Soper) keep part of their materials at home—collections that were usually uncounted in this study.

Respondents kept an average of 11.4 feet of journals in their offices, with a median figure of eleven feet. Again, a rough calculation of journal issues per inch yields average numbers of issues comparable to those found by Soper (158 issues plus 22 bound volumes of journals). 'Notebooks' was a category that included bound reports, manuals and looseleaf material—things which, while quite different in content, were frequently found together on shelves. Forty-six percent of the faculty had no such material in their offices. Of those who did, the average was 18.9 with a median of 16. The figures for journals and notebooks are somewhat skewed, since in both cases three individuals had between 35 and 63 linear feet of those materials.

The social scientists in the sample tended to have more of every type of material in their offices. They had the most stacks of loose paper around their offices (a mean of 21.9 feet) while humanists averaged only 17.2 feet. Contrary to expectations, social scientists kept more books in their offices (an average of 53.3 linear feet) than did humanists (39.6). Coincidently, these figures for books approximate the corresponding proportions of university book publications in the social sciences and humanities in the United States [32].

These social scientists also kept a greater number of journals in their offices—26.5 feet, compared to 3.4 for humanists. They also led the other category of scholars in the number of notebooks and file drawers they maintained. In at least this sample, social scientists store a greater amount of printed information than humanists. This greater need for files may indicate a tendency for social scientists to follow the data-intensive model by which traditional 'science' is conducted. However, these differences could also be explained by the tendency of "humanists... to prefer their homes" as the primary location for their collections [41, p.407]. This implies that a greater percentage of humanists' materials went uncounted in this study.

5. Discussion

Through a literature review and pilot study, this article has attempted to show how an examination of the physical artifacts of scholarship might provide us with some useful information about the processes and needs of researchers in the social sciences and humanities. By examining the ways in which information is stored in the office, we can envision both the kinds of materials and the types of organizational problems that scholars have.

Further studies of the ways in which users file their journals, articles and notes would be particularly revealing. Such information could be useful in several ways. First, it might help librarians, publishers and other parties who deal in printed information to better understand the population that they address, and serve it better in the future. Perhaps certain materials would be better in a form that is more easily stored and retrieved than

their current format. For example, journals might have the names of principal authors printed on the spine, providing at least one at-a-glance index to journals stored on a shelf. Journals could be color-coded by date, perhaps with a patch of blue indicating that it was a Fall quarter issue. Research information could be used to design both superior intellectual products and better ways of disseminating them, similar to Najarian's [31] suggestions regarding the organization of libraries based upon our knowledge of human memory processes.

Second, such research could help the computer industry design better tools for scholarly work. Malone's study, upon which this one was based, was conducted while he was in the employ of the Xerox Palo Alto Research Center. Xerox PARC was where much innovative work was done in the use of icons and pointing devices for improving computer interfaces. Malone's unusual study was undertaken in the context of understanding how people dealt with the physical artifacts of information. The 'memex' (or memory extender) described by Vannever Bush [6] is long overdue; its' development would be spurred by such research.

Finally—and most importantly—it may tell us something about the process of scholarship itself. That research in different fields requires different types of materials may seem obvious. But how many differences found here may be due to individual, rather than group, variations? Are the differences within fields comparable to those between fields? In this small sample, no large intra-field differences were found, but demonstrating otherwise would require much larger samples of fewer disciplines.

The data reported here must be taken with a few grains of salt, since the numbers of respondents are so small. More importantly, their collections of materials are not exhaustively enumerated, since many have a second office at home. The latter caution applies especially to humanists, who often keep larger collections of books at home than in their offices.

Future research could focus on a few central disciplines—say psychology, sociology, history and philosophy—interviewing large numbers of researchers and closely examining the contents of their offices. In this fashion, we could advance our knowledge of the research process and develop tools for its enhancement.

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