NEEDS, DEMANDS AND MOTIVATION IN THE USE
OF SOURCES OF INFORMATION

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ABSTRACT

For designers and managers of information services it is important to have some understanding of the factors that influence the probability that an information need will arise in the mind of some individual, that this individual will be sufficiently motivated to seek the needed information, and that he or she will select a particular information source. While our knowledge of these matters is still very far from complete, the many hundreds of "user studies" that have been performed have at least shed some light on them.

The probability that an information need will arise is most closely related to the type of work in which an individual is engaged--research, teaching or practice--and this will also influence the type of information needed. In the case of a research project, the type of information needed will change as the project moves through its various stages. Some personal characteristics of the individual (including gregariousness and inquisitiveness) may also influence the probability that an information need will arise, as will the "setting" (social, political, physical, economic) in which the individual works.

That a person who needs some item of information will take steps to obtain it will be influenced by the perceived value of the information (money, prestige, urgency), the cost of obtaining it (money, time, ease of use), the probability that the information has been recorded somewhere, the individual's past experience in seeking information, and his or her personal motivations (including peer influence).

Factors affecting the selection of a particular information source (e.g., information center or library) will include some user factors (e.g., previous experience with a source) and many source-related factors, including currency, cost, accessibility, reputation, dissemination and marketing efforts, and the format and content of the information available. Accessibility will be a major factor influencing use of an information source but this goes far beyond physical accessibility; intellectual and psychological accessibility must also be considered.

This paper combines these various factors into a "model" of information-seeking behavior and from this attempts to draw conclusions that may be useful in the design of future information services.
"In adjusting to the new demands of the information age we need to broaden our horizons as to the multiplicity of factors which affect information use." (Summers [1], page 85).

This paper attempts to review what is known concerning the behavior of users of information products and services and to relate these findings to the very important question raised by the organizers of this conference in their call for papers, namely "what services can be expected of a state-of-the-art scientific, technological or industrial information center of the coming decade?"

The discussion is organized around three major events and the probability that these will actually occur. The events are:

1. An information need arises in someone's mind and is recognized by him.
2. The individual seeks to satisfy the need.
3. A particular information source is selected.

The situation is illustrated in Figure 1, which tries to identify the major factors influencing the probability that each event will occur.

Despite the fact that many hundreds, perhaps thousands, of "user studies" have been performed over the last forty years, we still have an imperfect picture of information-seeking behavior. Some elements of this behavior have been studied intensively while other aspects have hardly been examined at all. Good empirical data exist to confirm the importance of some of the "influencing factors" listed in the diagram. However, others are considered significant more on intuitive grounds than on the basis of hard evidence.

**Does an information need arise?**

To begin with, we know little about the factors that determine whether or not an information need arises in the mind of an individual or, more correctly, whether or not he recognizes that a need for information exists. It seems probable that a major determinant is the type of activity in which the individual is engaged. The information needs of those engaged in research and teaching in some field may exceed the needs of the practitioners, although the differences may relate more to the depth and complexity of the information needs than to the frequency with which they occur.
Figure 1. Complexity of the "information need" situation.
Studies of the productivity of scientists, as measured in publications produced, indicate that productivity is strongly influenced by extent of collaboration (Pravdic and Oluic-Vukovic [2]) and by the diversity of the scientist's interests as reflected in the range of topics addressed (Subramanyam [3]). It seems likely that these same influences will affect the information need situation: collaborative research may create a greater demand for information than research that is more individualistic (Orr [4] presents some evidence to support this) and an investigator who addresses a wide range of issues may be the type of individual who is most inquisitive--having more information needs and needs of greater diversity.

Today, of course, research is becoming increasingly interdisciplinary. This in itself will influence the probability that needs for information will arise as investigators in an interdisciplinary environment are exposed to ideas and paradigms from fields beyond their own. In their studies of scientists, Garvey et al. [5] found, not surprisingly, that individuals who changed research areas had more frequent needs for information.

It is important to be aware of the distinction between the probability that an individual will need information at some point in time and the probability that the need will be recognized. Studies of the general public have shown that those whose information needs are most critical are the least privileged members of society--e.g., least educated, least affluent, least able to fend for themselves--but it is precisely these individuals who are least likely to recognize that they need information (Warner et al. [6]). Typically, they know they have problems (rats in the basement, a husband who abuses his children, a son who is becoming a drug addict) but are unable to recognize that such problems reflect information needs (how do I get rid of the rats?, where can I get help or protection for members of the family?).

The same phenomenon may apply to some extent in the world of scientific and technical information. Those with higher levels of education, occupying positions of greater responsibility or engaged in more advanced research, may place greater demands on information services. However, it is not clear whether this means that they have greater needs for information or that they are more likely to recognize the existence of such needs.

The stage an individual has reached in some activity will influence the amount and type of information needed and the type of source consulted. One example can be found in studies of the adoption of innovations (Rogers and Shoemaker [7], Havelock [8]). Awareness of the innovation, and interest in it, may come from print sources but the decision to adopt it is likely to be most heavily influenced by information received from individuals, especially those perceived to be authoritative sources. Printed sources (e.g., instruction manuals) may be needed again at the implementation stage. The evaluation stage of the adoption process may involve intensive
and purposive seeking of information, while the trial and acceptance stages may require much less in the way of information input.

The same situation applies to research projects (Egan and Henkle [9], Hertz and Rubinstein [10], White [11], Griffith et al. [12]). Different stages can be identified: the idea or problem stage, the methodology stage, and the presentation stage (White [11]). Hertz and Rubinstein [10] showed that different types of information will be needed throughout the life of the project: conceptual, empirical, procedural, stimulatory, policy and directive ("leadership") information. Clearly, the type of information needed is related to the research stage, although certain types (stimulatory, policy, directive) may apply to more than one stage. Studying academic economists, White found them more likely to use formal sources of information—printed materials—at the methodology stage and least likely at the presentation stage. Informal sources—conversations or correspondence with colleagues—were dominant in all three research stages, most clearly in the presentation stage. It is possible that libraries and information services are best able to deal with the more concrete information needs of the methodology stage of research and will not do as well with the more abstract needs associated with the problem and presentation stages.

Finally, studies of the general public indicate that personal lifestyle is a major factor influencing the probability that information needs will occur and that appropriate sources of information—e.g., libraries—will be consulted. The person who is active and involved—in hobbies, organizations, volunteer work and so on—is also likely to read, seek information and be a user of libraries. By the same token, involvement may be a predictor of the need for scientific and technical information as well. One aspect is involvement within the organization: those with multidimensional activities (e.g., affiliated with more than one department or serving on several committees or task forces) may generate more needs for information than those whose functions are more restricted. However, even outside involvement may play a significant role. It is possible that those who are active outside the organization will be more inquisitive in it and will thus generate more information needs and place greater demands on information services.

Will an information-seeking act occur?

That an information need arises in someone's mind, and is recognized, is not in itself enough to cause an information-seeking act to occur. Although it seems not to have been studied, one suspects that a person is more likely to seek information when he believes that it exists and is recorded somewhere. The less likely that the answer is recorded somewhere, according to some individual's perceptions, the less
likely he is to seek it. Related to this is his past experience in seeking information. If he has frequently been unsuccessful in the past he may be sufficiently discouraged to forego an item of information even if he perceives it to have some real value to him. Some other important factors may come into play here. Perhaps people are more likely to attempt to satisfy an information need that can easily be formulated as a demand on some information service than they are one more nebulous and conceptual and thus hard to describe. They may also be more likely to seek information that supports their views or results rather than information that is contradictory. Some evidence of this can be found in the fact that the principal motivation behind citation appears to be persuasion (Gilbert [14], Brooks [15], Cozzens [16]).

Beyond these, the factors that most clearly influence the probability that an information-seeking act will occur have to do with the rewards associated with possessing the information, the cost of obtaining it, and the tradeoff between rewards and costs.

Whether or not a particular information need is converted into a search for information may be largely dependent on its expected value. In some cases, the expected value can be considered in actual monetary terms. At the institutional level, finding a cheaper material or production method might save a company millions of dollars and finding the information needed to secure a contract may sometimes be worth as much. Even at the individual level, a piece of information may have a monetary value: consumer reports might save a citizen several hundred dollars in the purchase of a car or major appliance and finding the cheapest available airfare might also be worth a considerable amount of money to the prospective vacationer.

In other cases, of course, it may not be possible to put a direct monetary value on a piece of information. Nevertheless, having the sought information will frequently bring some other form of reward such as saving the seeker’s time (which could often be converted into monetary terms) or improving his comfort or convenience. Sometimes the reward may be rather intangible; e.g., impressing one's peers or superiors. For example, Wilson and Streatfield [17] have pointed out:

... affective needs in particular may be satisfied (at least partially) by the process of communication rather than by the information communicated. For example, the upward-striving executive may make a point of communicating information to superiors not because of the intrinsic worth of the information but because of his need to demonstrate his competence. (Page 173).

1. Brember and Leggate [13] have suggested that success rates for document delivery in libraries may be distorted by the fact that users will not bother to look for items they do not expect to find.
Whether the rewards associated with having various items of information are tangible or intangible, it seems very probable that individuals, consciously or unconsciously, will try to compare these rewards with the cost of attaining them. As Mason [18] has claimed, the cost-reward theory of behavior will apply to the information-seeking situation as much as it does to others. People usually act with their own self-interest in mind; therefore, the greater the reward expected from some item of information, the more actively it will be pursued. In a scholarly environment rewards are usually related to the productivity of the individual, as measured in publishing activity, so those who publish most can be expected to be active seekers of information. Orr [4] presents some evidence of this for the biomedical field.

King et al. [19] and Repo [20] have prepared extensive summaries of studies related to the value of information, drawing from the literature of several fields, including economics, accounting, and management science. Repo claims that the value of information can only be determined retrospectively. That is, one cannot know how valuable it is until one acquires it and applies it. Thus, information tends to have a long-term rather than a short-term value. Of course, this point has been made by others, including Lawrence [21], who puts it this way:

> It is only after the message has been received, the impact analyzed, the appropriate action taken and the true state of the world obtained that one can put a value on the message. (Page 17).

Hayes and Erickson [22] point out that, while the costs associated with obtaining information may be quite evident, the returns tend to be long-term and uncertain. This is re-emphasized by Dunn and Boyle [23], who show that the searching of online databases involves an element of risk since it is by no means certain that one will find the information sought. The other side of this coin is that the risks of not seeking information will usually be greater than the risks associated with negative search results.

Of course, the cost of obtaining information can be considered in other than direct monetary terms. The time involved in using an information source, and the ease with which it can be used, will significantly influence the decision whether to seek an item of information or not, a point made cogently by Mooers many years ago.

Undoubtedly, personality factors will also influence the decision to seek information. The individual who is lazy or unambitious is not likely to be an active pursuer of information. The attitudes of one's superiors or peers will exert another important influence. These can work for or against the search for information. In some cases peer pressure may force an individual to seek information that he might otherwise be inclined to do without. Alternatively, if
supervisors or peers are not themselves active seekers of information, this is likely to discourage even the more ambitious employees (Slater [24]). Moreover, a supervisor may judge the use of libraries or information centers not to be a legitimate activity to pursue on the institution's time. Mick [25] encountered this phenomenon in a study among engineers and scientists:

Most of our respondents, particularly those at lower grades, spent considerably less time on information work than they wished because they felt management did not approve of information work on the job. (Page 23).

In their study of the information-related attitudes and behaviors of 560 scientists and engineers, Mick et al. [26] found that respondents consistently reported spending less time on the gathering of information than they felt they should.

The environment in which individuals operate, then, will greatly influence the type of information they need as well as their information-seeking behavior, a topic touched upon by Blom [27]. Hanson [28] concluded that information needs were determined more by the type of organization in which a person works than by his discipline.

**Will a particular information source be selected?**

Better empirical data exist on this question than on the other two discussed. Hardy [29] suggests that two models of information-seeking behavior exist. The **cost-benefit** model suggests that people select information sources based primarily on their benefits (rewards), with cost as a secondary criterion. The **least-effort** model suggests that they select sources that require the least effort to use, even if they have to sacrifice some quality in the information obtained. Much evidence exists to support the latter model. Poole [30], after reviewing dozens of studies of information-seeking behavior, confirmed that the now famous Mooers' Law applies, but Poole expanded on it in his avoidance/least effort theory:

1. A first principle of human behavior is to avoid pain.
2. All human behavior has the purpose of problem solving.
3. In solving problems, man will calculate the possible consequences of his acts.
4. In solving problems, man will attempt to reduce all negative consequences of his acts to a minimum.
5. One negative consequence of the expenditure of effort in problem solving is the discomfort of fatigue.

6. So as to minimize the probability of fatigue, man will attempt to minimize his expenditure of effort.

7. By expending least effort, man seeks to avoid pain. (Page 95).

Various levels of accessibility have relevance to information seeking (Wilson [31], Dervin [32], Culnan [33]). Societal accessibility refers to the need for society to provide certain types of information, allocating the resources necessary to satisfy these information needs. Institutional accessibility refers to the need for organizations that can provide the desired information to a particular individual or group. Psychological accessibility refers to the "friendliness" of the information source. Intellectual accessibility refers to the individual's capacity for understanding information resources and of using them effectively. Bibliographic accessibility refers to the extent to which published sources of information are collected by libraries and information centers and covered in databases in printed or electronic form. Physical accessibility relates to the ability of the individual to have easy physical access to an information service and the resources it provides.

Numerous studies have examined how the accessibility or convenience of facilities, services or materials affects their use. A review of the literature reveals four recurring findings as noted by Allen and Gerstberger [34]:

1. For the typical user, perceived accessibility is the single most important determinant of the overall extent to which an information channel is used.

2. The more experience a user has with a channel, the more accessible he will perceive it to be.

3. After the user finds an accessible source of information, he will screen it based upon other factors (e.g., its technical quality).

4. High motivation to find specific information may cause a few users to seek out less accessible sources of information.

For the typical person, those information sources perceived to be the most accessible or convenient are used the most. One obvious example is the effect of distance on library
use. All other things being equal, the closer an individual is to a library, or other information service, the more likely he is to use it. This is as true for information services in science and industry (e.g., King Research [35]) as it is for public libraries (Palmer [36]). Use of materials within a library can also be increased by making them more accessible. Moving materials from closed stacks to open shelves will increase their use; moving materials from the regular stack to a prominent display will increase their use; moving materials closer to the entrance will increase their use. Moving specific services (e.g., an information desk) closer to incoming traffic may also significantly increase their use. On the other hand, physical accessibility is now decreasing in importance as more and more information sources can be consulted remotely through computer and telecommunications facilities.

That the source of information most likely to be selected is the one most accessible or easy to use manifests itself in many ways, including the fact that personal collections are frequently judged to be of major importance (Soper [37]) and that interpersonal sources (central scientists, gatekeepers, boundary spanners, opinion leaders, consultants) are usually preferred to more formal sources—which also reflects the fact that the interpersonal sources are considered authoritative and reliable.

The accessibility of an information source is a matter of individual perceptions. Perception of accessibility may affect willingness to use an information source more than actual accessibility (Culnan [33]). Perceptions of the accessibility of an information center may be influenced by physical barriers such as limited parking, stairs to be climbed, or lack of public transportation, and by psychological barriers (e.g., junior employees in a company may perceive the company library to be intended only for managers). Perceptions of accessibility can vary widely from one individual or group to another. For example, D'Elia and Hutkins [38] discovered that some faculty members found a document delivery service at a major university to save them time, while nonusers of the service thought it was faster and easier to get the documents from the library themselves.

Another manifestation of this is the fact that some individuals are reluctant to approach librarians or other information specialists because of misconceptions concerning their accessibility. Several studies have shown that some people will not ask a librarian for assistance because they perceive that the librarian is "busy" and, thus, unavailable to answer their questions (e.g., Swope and Katzer [39], Westbrook [40], Durrance [41]).

Experience with a particular source of information can change a person's perception of its accessibility or ease of use. Many existing studies support this principle. People who were exposed to libraries as children tend to use them more than people who were not so exposed; most users of reference
services and online searching services are repeat users, people who have already been exposed to and satisfied with the service they received (e.g., Bayer and Jahoda [42], Warden [43], Weech and Goldhor [44]); the more experience people have with information sources in general, the more accessible they perceive them to be (Allen and Gerstberger [34], Kremer [45])—e.g., frequent library users are less likely than moderate users to consider distance from the library as a barrier to use (Zweizig and Dervin [46]).

Several studies have demonstrated that people tend first to choose the information sources that are most accessible and then to screen them for other selection criteria, such as technical quality (Allen and Gerstberger, [34], Kremer [45]), and relevance (Hardy [29]). However, a few individuals, those with a strong motivation to seek out a particular item of information, may look to less accessible sources to meet their specific needs. It is quite clear that, in the selection of an information source, various tradeoffs exist. The most accessible source is not necessarily the most accurate and the cheapest may not be the one most up-to-date. Allen and Gerstberger [34], Rosenberg [47] and others have generally found that perceived accessibility is the major factor governing the selection of an information source. O'Reilly [48], studying decision makers, discovered that accessibility, rather than perceived quality, was the factor that most clearly determined the selection of an information source. However, Summers et al. [1] found that educators put the quality of a source (authoritative, accurate and objective) and its appropriateness (responsive to my problem; likely to have the information I need) before accessibility. Not surprisingly, Halpern and Nilan [49] found that factors of authority, expertise or trust were judged more important than ease of use in selecting an information source in a health care situation or other "serious life situation" (e.g., mental or legal problems).

Accessibility is a source-related factor. Other source-related factors that would influence the use of an information product or service include its reputation (reflected in such attributes as authority, accuracy, trust, objectivity and expertise), its appropriateness to a particular need, its currency, its cost, and the extent to which the service actively promotes itself. Conflicting evidence exists on the extent to which cost influences use. Some studies have reported that the demand for information services (e.g., online searches) is quite sensitive to cost, but Summers et al. [1], and Halpern and Nilan [49] found cost to be a relatively minor factor influencing source selection. Dunn and Boyle [23] go so far as to suggest that an inverse relationship may exist between the cost of an information service and its perceived value—that the more expensive services are assumed to be of higher quality. Presumably, the cost of a search for information will always be balanced against the anticipated value of the information. Cost may be considered completely negligible if the perceived value of the solution to a problem is very great.
Another source-related factor has to do with the form in which information is presented to the user. Ease of use is important here too. Users want a response that is appropriate to their needs—e.g., in a form they can understand—and that will save them time. Most users will not tolerate a low degree of relevance and they want a product that will allow them to judge relevance and value as easily as possible. Many would like services to be more selective and evaluative, able to indicate which sources are most reliable. Services that provide authoritative review and synthesis are considered especially valuable (Faibisoff and Ely [50]).

Besides the source-related factors, some user-related ones will also influence the decision on which information source is selected. Presumably, these would include the time and financial resources at the user's disposal and how rapidly the information is needed. A factor of major importance is the user's previous experience with the source; one that has given good results in the past will likely be used again while one that has failed in the past is unlikely to. Other factors influencing the selection of an information source include peer influence—the tendency to go to a source used or recommended by colleagues—and various personal characteristics of the user; e.g., certain individuals may choose the source they perceive to be most prestigious, which may not always be the one most appropriate, those who are technology-oriented may prefer to go to databases in electronic form even when access to a printed source may be cheaper and more appropriate, and individuals who lack self-confidence may be reluctant to discuss any information need with an information specialist because they are afraid to disclose what they interpret to be their own ignorance.

It is quite possible that other personality factors may influence the selection of an information source and that a knowledge of the literature of cognitive psychology and learning behavior might be useful to the managers of information services and the designers of information systems. Chafin [51] suggests that the Driver-Mock model of cognitive style, which relates to the decision-making process and recognizes the existence of four types of individuals (decisives, flexibles, hierarchics and integratives), might be relevant to the study of the behavior of users of information services. Tucker [52], on the other hand, classifies decision makers as cybernetic, rational or adaptive; she also believes that information specialists should organize information differently for each type. This is all rather speculative and it appears that little, if any, real research has been done on cognitive style as a determinant of the selection of information sources.

1. The theory of least effort/pain avoidance also suggests the hypothesis that, as abstracts and synopses become more and more available (e.g., in online databases), consultation of the complete text increasingly declines.
Some other considerations

Factors relating to the probability that an information need will arise, that it will be recognized as such, and that an individual will seek to satisfy the need, are not under the direct control of managers of information services. Nevertheless, it is important for them to understand that these factors exist and have a significant effect on the need or demand for information services. The system (source) factors, of course, are more directly under the control of the managers of the service, but even these are quite heavily affected by outside influences—for example, technological improvements and external costs—that are not directly controllable by the information service.

It is not likely that an information center can directly influence the need for information within the community served. But it can certainly influence the demand for information service through recognition of the system factors that influence demand, through the continuous evaluation of the extent to which the services provided match needs existing within the community, and through the evaluation of the extent to which demands are satisfied promptly, accurately, and completely.

It should be recognized that demands placed on a formal information service are quite likely to relate to information needs that the requester has been unable to satisfy elsewhere. More than likely, he will first have tried to obtain the information from a more accessible source—a personal collection of some kind or some other individual. This suggests that the requests that come to the information service may err on the side of the difficult rather than the easy. On the other hand (as suggested earlier), users may not approach information services for information needs that are hard to conceptualize, and thus to formulate into some type of request, and for needs that they feel the service is unlikely to be able to satisfy. It is possible, then, that most requests received by an information service are middle of the road—neither very easy nor very difficult.

The designers and managers of information services must understand and be prepared to adapt to the changing environment in which scholarly activities take place. A major element of the changing environment today is the increasingly interdisciplinary nature of research. This has significant implications for information services, for scholars will increasingly need information in fields foreign to their own backgrounds and experience. More importantly, interdisciplinary research challenges the very structure of existing information services. To take one obvious example, the departmental library structure within universities may be becoming obsolete. Indeed, to support interdisciplinary research an academic library may need to organize its collections around projects rather than along disciplinary lines.
Implications

What does all this mean for the information services of the future? The most important lesson, perhaps, is that we must not let technology lull us into a false sense of security. It is easy to become dazzled by the increasing power and sophistication of computers, telecommunications and related technologies and thus to assume that these advances will solve all problems of information access in the future.

Lancaster and Li [53] point out that technological advances have been impressive and that they have greatly improved access to sources of information. However, they question whether information has become more intellectually accessible. In fact, they suggest that information may be no more accessible today than it was fifty or even a hundred years ago. This is because of the growth of the literature, its scatter, and the increasing twigging of knowledge.

It is clear that, as the literature on some topic grows, it becomes increasingly scattered. This scatter has several dimensions: more countries and languages are involved, more documentary forms exist, and more journals contribute to the literature. As the literature becomes increasingly scattered, its accessibility declines. That is, the more literature that exists on some topic, the more difficult it becomes to identify, locate, collect, survey comprehensively, or search to find items on specific subtopics.

The improvements that have occurred in information handling may be enough to compensate for the growth of the literature but not to increase its accessibility. Scientists today may have about the same level of access to the literature relevant to their research interests as their counterparts of fifty years ago; this despite the fact that an individual's area of specialization is likely to be much more narrow. Lancaster and Li suggest the existence of a "law of constant accessibility of information": improvements in information handling merely allow us to keep our heads above water. While a particular innovation may substantially improve access in the short-term, in the long-term the level of accessibility remains more or less constant.

Evidence does exist to support the hypothesis of the constant accessibility of information and to suggest that our technologically sophisticated information systems may not be as effective as we suppose them to be. For example, Martyn [54] has compared the results of his recent survey of research scientists with the results obtained in a similar survey he performed more than twenty years earlier. The later survey indicates greater awareness of the importance of information, and greater use of information-gathering methods, but no corresponding increase in the perceived usefulness of the methods. More significantly, the number of cases in which scientists discover relevant information too late to be of maximum value to them seems to be increasing rather than decreasing.
Just as disturbing is a recent study by Davison et al. [55], which reports on the results of searching techniques used to compile a comprehensive database on costs and modelling in information retrieval. Forty different sources were drawn upon and 6098 relevant items were located. Of these, however, about two-thirds were unique to only one source and thus missed by the other 39. Printed bibliographies were found to be the most productive sources and the online search of databases gave the worst results (only 5% of the relevant references retrieved).

Somewhat related to this are the results of a study now being undertaken by the author (Lancaster, in preparation [56]). The study involves performing searches on selected topics in the online catalog of a very large academic library. The results of these searches are compared with reading lists on the topics prepared by subject experts. If the expert reading lists can be assumed to contain items that are in some sense "the best," the online searches retrieve relatively few of the best items. More importantly, it appears that very little could be done to make these items more retrievable: storing contents pages, book indexes, or even complete text, would make rather little difference since many of the items are relevant by analogy rather than otherwise. Seemingly, even today, the only way to find the best readings on some topic is to consult an expert. Looked at in a different way, it might make more sense for large multidisciplinary libraries to abandon all attempts to provide subject access in their catalogs and instead provide online access to databases of specialized bibliographies prepared by subject experts.

Finally, the fact that Swanson [57] [58] has documented several cases in which the relevance of one body of research to another has not been detected through conventional approaches to information retrieval suggests that the information systems of today may be very far from what one would like them to be.

It is clear that technology in and of itself will not create the "state-of-the-art scientific, technological or industrial information center of the coming decade." If information centers of the future are to become more responsive to the needs of potential users, they must offer a higher level of information service than they do today and they must adapt to the information-seeking preferences of these users rather than expecting the users to adapt to system constraints.

Mick et al. [26] have addressed this latter point:

> Effective transition into the information age will require switching from information systems that are technology and content driven to information systems that are user driven. (Page 355)

They point out that there is no "typical" user of information. Instead there exists an "incredible variation in individual information behavior." In the design of future information systems one must recognize that the individual user is "part of a number of informal information systems and ... concentrate on
interfacing with those systems ..." Hick et al. are certainly correct in this although they offer no clear guidance on how this interfacing is to be achieved.

It is a fact depressing to the information profession that "consulting a librarian or other information professional" appears consistently low in the ranking of information-seeking activities by a wide variety of communities. The librarian is still viewed as primarily a collector and a custodian and is frequently regarded as a lower level professional in the science and technology community. The library profession carries much of the blame for this since its education has traditionally emphasized the institution (library or information center) instead of the real professional expertise of the practitioners—the role, not of collector/custodian, but of information consultant. Even the organizers of this conference can be faulted for emphasizing the future information center rather than the future information professional.

If the information professionals of the future are to be judged more useful to the science and technology community than they have been in the past, they must devote more attention to understanding the information needs and information-seeking behavior within this community, and be prepared to offer services that build upon and enhance existing mechanisms rather than competing with them. In some cases, this may mean the identification of existing gatekeepers within an organization, or even the deliberate creation of such gatekeepers (e.g., Yates [59]), and the organization of certain services around them. More importantly, perhaps, the information professional must himself become a recognized and respected gatekeeper. To achieve this he must operate outside the walls of the institution—library or information center—and establish himself as a true information consultant, serving as an integral member of the research team (Neway [60]).

The role of information consultant, of course, implies more than physical closeness to the constituency; it implies a higher level of information service that emphasizes quality rather than quantity. That is, the information specialist must be capable of performing a clearly value-added function that involves various forms of "information analysis" and "quality filtering," including the evaluation of information sources and the synthesis and repackaging of information.

As Horton [61] has pointed out so clearly, it is skilled human resources that are the capital assets of the information age, not information technology. The question we should be addressing today is not "what is a state-of-the-art information center?" but "what is a state-of-the-art information consultant and what must we do to produce such people?"
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