

environment is an increased pluralism in available information resources, a parallel diversity of facilities for selecting from these information riches is essential.

The tools and methods of selection and evaluation must become more diverse and flexible. Today, virtually all evaluative information is intended for direct human consumption; a person reads a review or rating service and then perhaps makes a decision to acquire a product or use a service. It seems clear that in order to manage the overwhelming and dynamic flood of information that will occur in the networked environment we will need to develop software tools to help us in selecting information resources and navigating among them. Encoding and knowledge representation for evaluative information, and in fact even the definition of appropriate data on which to base selection decisions are areas in which research and innovation are desperately needed, along with all of the accompanying issues of algorithm design for software to assist in such decision making ; indeed, the lack of progress in this area may prove to be a significant limiting factor achieving the promise of a large scale networked information environment.

14. Directories and Catalogs of Networked Information Resources

As networked information resources multiply, one of the central issues will be locating appropriate resources to meet various needs for information [Lynch & Preston, 1992]. There are many tools that have evolved for identifying various types of information resources for various purposes, and many organizations that produce these tools for many reasons.

Libraries have played a role in this area through their collections (and the choices they have made in selecting and acquiring these collections), their catalogs, and the bibliographies and directories that they make available to their patrons. However, in the electronic environment, the role and content of these tools for locating and identifying information are changing. One important and problematic issue is the relationship between library catalogs and networked information resources. In the print world, one can distinguish the catalog, which describes and provides access to material held by a given library from the *bibliography*, which defines and provides access to the literature on a given subject without regard to where that literature is held (and typically does not provide the user of the bibliography with any information that would help this user in physically obtaining access to material listed in the bibliography) [Buckland, 1988] .88

⁸⁸ **Basically** for economic reasons, the coverage of library catalogs is typically limited. Since the early part of the century, libraries have typically been unable to afford to catalog the individual articles in journals that they receive, so they only catalog at the journal level. Bibliographies (or abstracting and indexing databases, which are simply the electronic successors to printed bibliographies) are used to obtain access to journals at the article level; library catalogs are then used to determine if the library holds the journal containing the desired articles. So-called online library catalogs today typically at large research libraries offer access not only to the library's catalog, but also to some abstracting and indexing databases (bibliographies); a few systems offer the ability to view the bibliography as a form of catalog by permitting users to limit searches to articles in journals held by the library. This is accomplished by having the library's online information system link the library's catalog database to the journal titles covered by the abstracting and indexing database. A few systems, such as the University of California's MELVYL system, or OCLC's EPIC/FirstSearch service have gone a step further and also linked the journal holdings of other universities to these bibliographies, thus in some sense transforming the bibliography into a union catalog of holdings in a specific discipline (though not a comprehensive one, since there are undoubtedly journals

Some leaders in the library community have discussed the transition to networked electronic information as a transition from the role of libraries in creating physical collections to a new role as providers of access to information that may be physically stored anywhere but is available through the network. In this new environment, the role of the library catalog in permitting users to identify relevant electronic information is problematic. One scenario calls for libraries to include in their local catalogs descriptions of networked information resources that the library chooses to logically "acquire" (either simply by selecting them and placing descriptive records for them in the local catalog, or in the case of fee-based services paying some type of license fee, or subsidizing transactional usage fees on behalf of the library's user community in addition to adding the descriptive record to the local catalog). An alternative scenario calls for libraries to simply provide their users with access to external catalogs, directories or bibliographies of networked information resources and to assist patrons in accessing these resources; in this scenario the "selection" or "acquisition" decisions of the library are accomplished at two levels: first, by the choice of external databases that they offer their patrons which describe available networked information resources, and secondly by the extent to which the library allocates both staff and financial resources to helping patrons to use different networked information resources, and to subsidize the costs incurred by use of these resources. Complicating the picture in either case is the inevitable development of various directories and bibliographies of networked information resources by other organizations that will be accessible to the library's patrons, in some cases for free and in other cases for fee.

It is also important to recognize that there will be a lengthy transitional period where libraries may provide access to directories of information resources and abstracting and indexing databases in electronic form, but during which most of the primary material, such as journal articles, will continue to exist in printed form. Linkages from electronic directories, bibliographies, abstracting and indexing databases, and online catalogs to the print holdings of libraries will be of central importance for at least the next decade. Experience has shown that these linkages are difficult to establish without human editorial intervention by simply matching on unique numbers such as the International Standard Serials Number (ISSN); yet the establishment of such linkages reliably will be of central importance in providing access to current library resources. Additionally, such links are essential in making effective, economic interlibrary loan and document supply services feasible.

Realistically, it seems likely that libraries will seek a compromise solution with regard to the representation of networked information resources in their local catalogs, probably including descriptive records for resources that they believe are important enough to spend money acquiring access to on behalf of their user community and for some carefully selected free public-access resources deemed to be of significance to their patrons. For access to other resources, patrons will be guided to external databases on the network, and libraries will develop policies about the extent to which they will subsidize and assist use of these external directories and the resources listed in them by various segments of the library's user community (in much the same sense that university research libraries today will go to considerable lengths to obtain access to

relevant to the discipline that are not covered by the producers of the abstracting and indexing databases). So, there is already growing ambiguity as to the boundaries between bibliographies and catalogs.

arbitrary material through interlibrary loan or purchase for faculty,⁸⁹ for example, but might charge students for a similar service if they offer it at all).

Not all identification or use of networked resources will take place through libraries, of course. Just as today people also identify and/or acquire material by reading advertising, browsing in bookstores, scanning book reviews, joining book clubs or by word of mouth, similar routes will be taken to electronic information resources. The only cause for concerns here are those of balance. While university research libraries are actively addressing access to networked information resources, the vast majority of public and school libraries lag far behind and lack the resources or expertise to address these new information sources; indeed many such libraries are today struggling just to survive and to continue to provide their traditional services. For many people without access to major research libraries, the primary routes to identifying networked information of interest may not be through libraries at all, but rather through information services on the network. But the level of these network information services has been disappointing, up till now; perhaps in future competing commercial services will improve the level of service, but at the cost of reducing equality of access.

But consider: while libraries, depending on their mission, budget, and patron community will vary in scope and depth of collections, one of the primary tenets of library collection development is to provide a broad, diverse, and representative selection of sources on areas that are within the scope of the **library's** mission. It is unclear to what extent other groups providing directories of networked information resources will reflect these goals of libraries; some directories will undoubtedly be forms of advertising, where a resource provider pays to be listed and is listed only upon payment of such a fee. Some databases of resources may be essentially the electronic analog of bookstore inventories, with all of the criteria for inclusion that such a role implies. Other directories may be built as "public services" by organizations with specific agendas and specific points of view to communicate. Services will develop that provide very biased and specific selection criteria for the material that they list in their directories; this will be a very real added value for their users, who in some cases will pay substantial sums for the filtering provided by these review and evaluation services. There is nothing wrong with such directories; indeed they provide real value, offer essential services, and also ensure the basic rights of individuals and organizations to make their points of view

⁸⁹ Specific mention should be made of the changing nature of the use of interlibrary loan to permit a library to obtain material on behalf of its users. Consider first the major research library; historically, interlibrary loan was used primarily as a means of providing fairly esoteric research materials to faculty when they were not held by the local library. With the growing inability of even research libraries to acquire the bulk of the scholarly publications in a given area, we are seeing the use of ILL even to support requests from undergraduates. ILL is no longer used simply for esoteric research materials. Another important issue is the independent scholar—this might be an individual conducting independent research, a staff member at a small start up company that does not have a library, an inventor, or even a bright high school student: in all of these cases, the information seeker will most likely use a local public library and the ILL system to obtain access to the research literature. Such requests are relatively rare, and a decade or two ago were accommodated fairly routinely through the ILL system when they occurred; today, with the increased emphasis on cost recovery as a reaction to the overloading of the ILL system, the barriers to access by such disenfranchised patron communities are multiplying rapidly. There is a real danger that within the next few years the research literature will be essentially inaccessible to those library patrons who are not part of the primary user community of a major research library. This is a major threat to equitable access to knowledge, and one that may have some serious long-term societal implications, ranging from frustrating bright young students through handicapping the independent inventor or scholar.