

having a major influence on the growth of information and educational service programs:

Facsimile and data transmission devices; use of other electronic communication distribution systems (on a twenty-four hour basis); self-learning aids; cartridge-loading sound recording and video playback units; miniaturization and simplification of all forms of communications equipment; expanded capacities for storage of ideas and information both in microtext and computer tape form; dial-access devices; use of laser beams for transmission of information; satellite relay of TV signals; expanded use of microwave systems.

Because of new technology, it is unlikely that future communication and information services will be much concerned with either the input or final shapes of most messages. Transmission will be virtually instantaneous and printed media may well be bypassed except when temporary records are required. Use of individual response devices will become widespread and, in education, will probably be much in vogue.

As increasing reliance is placed upon larger and larger data "banks" stored in remote computer cores, the library and publishing functions may come close together for customized delivery of encyclopedic information, medical diagnoses, financial analysis, remote instruction, and management guidance. Access to remote data reservoirs will be achieved through individual interface with computer terminals. At least such is the shape of the future depicted soberly for publishers by Paul D. Doebler and Jules S. Tewlow.¹

For librarians, all of this means that the future is calling for new institutions no longer concerned with supplying specific media but rather with providing access to recorded knowledge and communication services generally: recorded knowledge that may be distributed on demand by light beam pulses or via microwave technology drawn from data banks stored in electronic memories or new microforms and which may be searched out, retrieved, transmitted, and/or reproduced as required.

Acceptance of this or any similar view of the future requires a substantial personal reorientation on the part of many librarians and calls for a willingness to acknowledge the need for professional evolution—if not revolution—across the board in libraries, library schools, and within the library profession at large. In the future, the competence of those performing the library function will no longer be measured in terms of specific media backgrounds as such but in terms of subject

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mastery and communications expertise. Needed to manage library services in the future will be several new classes of personnel including specialists in communications analysis, production, packaging, and evaluation; systems designers and analysts; and dynamic distributive program administrators. All must be thoroughly familiar with ways in which the various forms of recorded knowledge can be acquired, stored, retrieved, distributed, and used with maximum effectiveness.

With the shift from a materials-oriented operation to one concerned with knowledge as such, and with the increased handling by librarians of more or less discrete ideas and information, the library cliché, "Books are Basic," no longer applies. Of course, there should and will continue to be places in libraries to enjoy the world of books as objects as well as purveyors of knowledge. But somewhere between the nostalgic librarian-bibliophile, who sees increasingly that books are threatened and cries out with growing frequency, "Damn the machine!" and the rather more antiseptic personality of that he or she who can find in blinking lights and the whirr or whine of a computer attributes which generate affection, somewhere between these two is the realist who, in future libraries, will develop and establish new service programs which will make available both traditional access to books and reader's advisers as well as modern "computer tutors," and which will have mechanized information storage, retrieval and transmission facilities far superior to those now employed.

Such facilities are needed urgently. The knowledge explosion and related information-handling problems acknowledged widely in more recent years did not arrive suddenly. More than two decades ago it was noted by Fremont Rider that libraries do not grow in size arithmetically but tend to follow an exponential or parabolic curve, and that those located in better established American universities—at least the small number for which a few reliable statistics can be advanced—have doubled in size approximately every sixteen years since 1830. Bearing out Rider's conclusions in the main are results of a study completed in 1965 at Purdue. Purdue reported that for fifty-eight larger research universities, the average period of doubling since 1950 had been seventeen years, while the rates of annual acquisition had actually doubled in from nine to twelve years.² When extrapolated to 1980, these figures suggest that holdings of larger research libraries in the United States could average three and three-quarter million volumes each.

Obviously, library doubling results from rates of publication. The

literature published in any normal field of scientific endeavor can be shown to increase exponentially and to double in quantity in from ten to fifteen years. Whatever the validity of estimates sometimes used to scare trustees and library administrators into approving larger and larger library budgets, the presses of the world do in fact now spew out some 2,000 pages of new text each minute. During the past eight years the number of monographic titles published annually in the United States has more than doubled. In scientific and technical fields, more than 75,000 journals are published regularly around the world and, in the United States alone, there are produced approximately 25,000 new technical papers every week along with 400 books and 3,500 articles.³ Experts have estimated that as much new technical knowledge may actually be generated and reported in the next thirty years as has been accumulated in the entire past history of mankind.

Given predictions of this magnitude it can be realized that, in the future, more knowledge than all that has been produced to date may well be distributed in non-traditional forms and formats. Production of more standard fare—books, journals, motion pictures, discs, slides, photocopies—will, of course, continue in the foreseeable future and at an accelerated pace. But such products will, of necessity, be outstripped by newer means of generating and storing knowledge, notably within computers.

In short, for some time we have known it to be unlikely that any library in the world (or any comparable agency) could ever hope to obtain, store and make available in an organized manner even a significant fraction of civilization's printed records, not to mention the growing and, indeed, staggering volume of newer communications records which will be "published" in non-print form. Thus, at the close of the 1960's, the world is threatened with an eventual drowning in mountains of words, pictures and other forms of communication and with suffocation by communications uncontrolled, disordered, out of sequence, and capable of being lost like individual grains of sand on a beach.

But the information problem is not caused only by the sheer bulk or massive weight which recorded knowledge has attained, although statistics relating to it are most impressive in themselves. There is another important problem and that is the problem created by the terms in which most librarians describe their jobs, plan buildings, and train and use their personnel, i.e., how they define the library function.

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The Professional Challenge. The challenge which now must be put to those concerned is that of assuring continuing and easy access to recorded knowledge regardless of its rate of growth, present mountainous proportions, and growing variety of forms. As indicated previously, this is the most important work to be done. Responsibility for doing the job belongs with the communication and information service professions and, with respect to prerecorded ideas and information, it should be the chief business of those performing the library function, the conduct of which increasingly must take into account such a proposition as this—to paraphrase C. Ray Carpenter of Pennsylvania State University—if the most important inter-relationships which exist when the library function is performed are those which help attain a productive proximity between knowledge and those to whom the availability of such knowledge is essential, then in the long run, it will prove more efficient and effective to move information to people than to move people to information.⁴ Obviously, such a proposition has major implications for development of library service and recruitment and training of library staffs to serve the future adequately. Current proposals for expansion of “mail order” library service involving home or office delivery and regular use of book catalogs, telephones, and the postal service are early steps in this direction.⁵ Another premature but promising step in the direction indicated is the use of teletype service to expedite interlibrary loans.*

* Recent reports issued by the Duke University Medical Center covering a six-library network, show the promise of TWX service. The following statements are quoted from a report forwarded to the author by Warren Bird, chief of the Library Systems and Communications Division:

The number of requests directed to others within the Group increased by 84% after the co-operative agreement. At the same time there was a 34% decrease in the number of requests directed to the National Library of Medicine. One of the primary goals of the co-operating Group was the increased use of regional resources as first choice for supplying material not in the library.

[Results also show] a substantial decrease in the time required to receive a loan from another member of the Group and from NLM. Vagaries in mail handling between a library and its local U.S. Post Office contribute considerably to variations in loan receipt time. This decrease in time was due to the conscious effort to process requests promptly, the use of TWX for increasing the speed of the interlibrary loan communications and the increased use of first class mail for photocopies.

The costs [of operating the service] suggest that a library in the southeastern United States should budget approximately two dollars for each interlibrary

But lest there be later misunderstanding, let us stop a moment and define the library function clearly, keeping future communications technologies in mind. "Performance of the library function" means the conscious interruption (as a unique and distinct professional contribution) of the total stream or flow of recorded ideas and information; the selective drawing off of manageable amounts for storage, later retrieval, and distribution to individuals or groups in whatever media forms or formats might be required and are appropriate to satisfy known or anticipated needs; the giving of advice concerning the availability and use of such materials; and the exercise, in behalf of producers as well as consumers, of both feedback and critical functions about the communication resources provided. To put it more specifically for one type of library, performance of the library function on a university campus should mean provision of the full range of recorded communication and information services (including necessary reproduction) required to sustain instruction and research.

So defined, the library function cannot be recognized easily when it is pictured simply in terms of traditional library buildings, staffs or materials. Rather it represents a dynamic, decentralized process better conceived as a set of communications networks or systems and subsystems which harness all types of modern technology and cross language as well as geographic barriers.

The Library of the Future. Looking toward 1975 and beyond, it seems likely there will arise, assisted by modern technology and to be administered as new institutions, several new types of communications service agencies which will be assigned rather broad responsibility for acquiring, producing, storing and making available not only the world's literature in print but also the full record of society as recorded in other media. Also to be considered is the growing emphasis placed on development of the library as the student's instructional home through the creation of study facilities and the "library college" type of programs. Such possibilities have already been explored in the United States and Canada; and they suggest development of several new types of academic and community institutions to replace traditional libraries and related service groups. Such agencies may, as single new units or using coordinating arrangements, pool

loan transaction to be handled via TWX. Against this cost should be weighed improved service to readers, saving of time for library patrons, and potential savings resulting from cooperative acquisitions which become practicable as interlibrary loan service improves.⁶

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their talents and facilities to devise new communications service programs capable of operating within local or regional economic restrictions to render the full variety of services needed including production, distribution, training for use, evaluation and research. If such proposals seem unfamiliar or futuristic, the ideas they represent have already been considered, e.g., in the plans for Columbia, Maryland,⁷ and in EDUCOM and in the very new centers for learning resources developed by secondary schools and junior colleges.

But simply because librarians are now conceiving their problems in words formerly used only by systems analysts and discussing them professionally in languages derived from cybernetics and coenetics, or because the "productive proximity" recommended by Carpenter can be attained today more readily than in the past with the aid of modern electronic devices, the bibliophile and his "room full of books" (culled from the stacks and preserved carefully for the occasional qualified scholar) are not outmoded. On the contrary, the last quarter of the twentieth century must, in library terms, be anticipated as the age of both manuscript and facsimile, of both fore-edge paintings and electronic displays, of some individuals browsing leisurely among books covering subjects of general interest and others doing detailed and virtually instantaneous searching, scanning and analysis via computer.

"What will libraries look like in the future?" The question is less perceptive than, "How may the library function be carried forward?" A single but important error about future library development has cropped up. The error is reflected in such a statement as: "The sort of library I envision doesn't exist anywhere today, at least not in one place, although various aspects of it can be seen by viewing libraries separately in places where they are now developing." The point is that in the future it will probably be less and less necessary to have all the pieces of a library program in one place so long as the program parts can be linked together in networks and the resources of each part deployed to support an over-all system. The library of the future is not wisely conceived as a place at all, but rather as a far-flung network composed of units of various sizes and types, each of which may perform similar as well as different functions, but all of which will be linked together electro-mechanically. Within the system at any one time will be vestiges of past service programs for both the bibliophile and the antiquarian; but there will also be avant-garde approaches to use of communications technology including tele-

facsimile and high-speed voice transmission aids capable of sending and receiving over a thousand words per minute; electronic carrels distinguished by their typewriter-like keyboards and connections to an on-line, time-sharing computer; audio jacks and sets of earphones; and individual TV display units capable of being augmented electronically through use of a light pen.

Less dramatic technically, but no less important to library planning for the future, will be adoption of new book storage techniques which employ more compact shelving arrangements.⁸ The minute neither the physical book nor its content must be placed in special arrangements on shelves to assist location, a library's capacity can be multiplied more than three times without difficulty. Also, more libraries will share common storage facilities in which may be placed the 15 to 20 percent of collections normally used infrequently. They will also establish cooperative units which will house materials used heavily, especially in situations where several institutions (for example, schools and colleges) find it convenient to save dollars by establishing a common facility which may very well have unique features no single agency can afford.

Cooperative planning for specialization in purchasing and provision of information services will increase (augmenting the long-established Farmington and P.L. 480 plans) as will the establishment of special centers for joint processing of books and other materials and for provision of bibliographic information. While it is hoped that the costs of cataloging—a major barrier to library development—will be alleviated by changes in Federal service programs and development of automated service, under the sponsorship of the Library of Congress, such results will not be achieved overnight. Indeed, the Library of Congress presently catalogs only about 50 percent of materials of interest to universities and, as yet, has provided no subject index to its Union Catalog. The high cost of processing library materials (often double the purchase price) will force increasing cooperation. Thus, assuming real bibliographic enterprise and initiative, there is hope that one day many larger libraries in the nation will be able to do entirely without card catalogs.* First, however, there must be available author, title and subject indexes to appropriate accumulations covering the forty thousand book titles issued each year. Actually, this number of titles is rather slight when compared to the total number of publications issued annually in periodical, pamphlet or report form. Furthermore,

* This hope was expressed recently by Eric Moon, editor of *Library Journal*.

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there is as yet no really adequate index, catalog or guide to newer media; it is hoped the new computerized edition of *Educational Media Index* scheduled for publication by McGraw-Hill in 1968 will fill this void.

Doubtless, those who manage the library function in the late 1970's and after will make extensive use of microtext forms—those presently available, some just on the horizon, and others still hardly more than dreamed of which appear, however, theoretically feasible and may reduce fantastically the physical volumes of space required for storing the world's knowledge. (Witness new grainless emulsions and what Verac has already done with 140 diameter reduction.) Micro-storage network service, such as that developing in St. Louis, will undoubtedly help overcome such typical library problems as mutilation, decay, space shortages, and excessive duplication. But the economics of converting older materials, not to mention of issuing new materials in the future, do not argue solely in terms of microforms or computer storage.

One comparatively recent study has suggested that books (even those printed on paper with high acid content), when kept in cold storage, ^{9, 10} can last more or less indefinitely. Paper deterioration was originally one of the chief reasons for converting to microfilm. Permanent papers are not in use and aerosol de-acidification is not practiced widely; nor do current binding methods help. Therefore, it may still be cheaper to build cold storage facilities for books than to pay even the present costs of converting to microform all materials on hand in a major library. ^{11, 12} Finally, libraries still do not have available a pocket reader in which one can insert high density micro-materials and render them truly readable.

Nor has the stage yet been reached when all library functions can be performed by new generations of computers operating dozens or hundreds of remote terminals in an on-line, time-sharing fashion. Furthermore, when such systems do become available, they will not stand up well alone. Hence, the library of the future, as the author sees it, will be composed of printed materials and computer storage units with a broad range of new media in between. And a guess is that for a long time to come most patrons will prefer hard copy over other forms for home reading or viewing.

It is true that library programs of the future will be affected in major ways by the concurrent instructional revolution, which is stimulated by and is itself stimulating radical changes in American edu-

cation and, in particular, is encouraging the individualization of teaching programs through use of programmed learning aids and computer-assisted study plans. Long before 1975, when more than 60,000,000 persons will be enrolled for credit in formal education courses (excluding private vocational study),¹³ and when it will cost the nation some sixty billions of dollars annually to support its formal education activities, libraries maintained by schools and colleges must become very different indeed. Publication of scientific and technical journals in non-print form (most likely on computer tape or disc pack), the contents of which will be reproduced only on demand, will also create a revolution of sorts and has already led to major legislative problems relating to the copyright law.

As suggested previously, the communications revolution now promises the technical means to deliver information, without any important time lag, from central storage areas to widely decentralized locations. And, in the wings, is a practical communications technology capable of transmitting information on a world-wide basis at a price which can be afforded. Within a decade, there will be in use commercial computer satellites which accommodate 42,000 voice-data channels or two dozen television channels in any desired combination.¹⁴

As a consequence, many designs have been proposed for the shape of library buildings in the next decade. But what one finds most often in such designs is a local facility which is both a conventional library and a computing center, with modified audio-visual service areas sandwiched between the two. Library designers have not faced up to what could be a more desirable as well as much less expensive approach to regional or perhaps even national implementation of the library function. What is needed is the designing of information processing networks for which the usual local library unit could simply become a modest terminal. Perhaps work now being done by the special task forces of EDUCOM, a national organization concerned with such problems in behalf of member universities, will yield designs of this character. Certainly, the Educational Communication System designs (prepared for the National Association of Educational Broadcasters),¹⁵⁻¹⁸ which proposed three interconnected operational systems to share information in education by audio units, teletype, facsimile and slow-scan TV, also suggest possibilities. But the problem is cost. Estimates for starting even the simplest network operations in the first year exceed \$500,000. EDUCOM proposals for EDUNET (a national information network service) call for initial expenditures of several millions of dollars to launch that effort.

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Obstacles and Handicaps. The chief stumbling block on the road to realizing the type of library programs pictured is, of course, the lack of money. Even the new Federal bills proposed for current support of education and libraries are deficient when all the needs have been inventoried. Questions to be asked now are "How important does one consider the library problem in relationship to other things?" and "Are Americans willing to pay for solutions proposed?"

Many feel the health professions are likely to show the way to the library future more rapidly than will other groups because of their greater public prestige and the high premium normally placed on the study of medicine and related fields. Furthermore, in the health professions, innovations can be adopted universally in two years or less while the normal time lag in other fields may still be thirty years or longer. Libraries planned for the future—especially those intended to serve medicine, dentistry, public health and psychology—are already being so designed and arranged for accessibility* that, in addition to serving students and their families, specialists, technicians, nurses and others affiliated with a given institution, they will also make bibliographic, advisory and counselling services available to practitioners working in the field. As the argument runs, unless such help can be obtained it is the field practitioners and their patients who will suffer from the lack of needed information. Thus, the need is urgent and library programs designed to meet it cannot be passive. In a situation such as this, proper support of the library function quite literally becomes a matter of someone's life or death.

But lack of funds is not the only obstacle to sound development of the library function. A long list of other handicaps which slow development could be compiled. For instance, there has been continuing failure on the part of the U.S. Office of Education to establish and maintain a stable program for supporting new media research and demonstrations sponsored by libraries. In addition, located in schools and universities and in far too many research organizations are entrepreneurs who, as individuals, care little or nothing about educational benefits but engage in media service research as "grantsmanship" from which some material advantage and/or prestige may derive. Similarly, too many professional training programs are *gadget-*rather than *problem-*oriented. Funds granted to support both library and educational media institutes are too often used to pay (off) "consultants." Commercial pressures for legislation, government operation,

* Significant approaches to ideas in this area have been outlined in several papers, articles, and addresses by Dr. James Miller, principal scientist for EDUCOM.

and local purchase of instructional media have been stronger than ever in recent years and have yielded millions and millions of dollars annually in new profits to publishers and to A-V equipment manufacturers and distributors. However, they have yielded questionable payoffs toward real improvement of teaching and learning.

Foundation funding in the field of educational communications still tends to be based on potentials for high project visibility and research workers may encounter difficulty in publicizing unfavorable results and reporting findings accurately. The potentials of computer-assisted instruction, while rich, and indeed very promising, have been overrated and are currently leading too many school and college administrators down primrose paths at great expense and with little chance for turning back.

"Massaged" by the words of Marshall McLuhan, the current media mania among professional educators has been given far more attention and credence than careful study and assessment. And multimedia "pie in the sky" is a fantasy shared by too many audio-visual enthusiasts; that is, promises advanced for national communication networks involving satellite-relay transmission say nothing at all about the worth of that which eventually is to be transmitted. Educational communication jobs have been inflated in terms of both job descriptions and salaries far beyond any real importance they have or the abilities of those available to fill them.

But there *is* a new field emerging, behind all the rhetoric and reports of the more typical media service conventions attended by publishers, librarians, and other educational communications personnel. And, if present trends toward increasing Federal subsidies and the general spread of computer technology offer reliable evidence, it is long past time to acknowledge basic changes needed in the scene. What should be done? At least these things

Basic Changes Needed. First, new kinds of training should be offered. Taking cues from the elementary and secondary schools, and from junior colleges and some universities which are developing new instruction material or learning resource center programs which suggest future displacement of traditional libraries and other media service agencies in favor of more general communication service programs, professional education should be revised radically to recruit and train the new personnel needed to manage such agencies. In the author's opinion, it is safe to conclude that, with few if any exceptions, no present graduate school of library and/or information science is now

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producing the kinds or number of personnel needed. Building on strong preparation in that synthesis of social sciences concerned with communication problems, including psychology, sociology, social psychology, anthropology, and linguistics, full undergraduate and graduate curricula aimed at producing several levels of personnel will be required as well as new, advanced study programs which will make possible student specialization in broad areas involving the communication arts and sciences, systems analysis and control, and the principles of administration, as well as afford opportunities for training specialists in media production arts and crafts. It is true that relevant programs are evolving in the library schools at the universities of Chicago and Pittsburgh, and at Drexel; and the audio-visual and educational communication training programs featured at, for example, Syracuse, Michigan State, Indiana, and the University of Southern California, to name a few, again promise opportunity for relevant study of computer-assisted information and instructional services. Also noted should be good work done during the many recent summer institutes supported by Federal assistance and conducted for librarians and educational media specialists.

As stated above, needed by the library profession as a whole is more adequate representation of new media interests within the American Library Association. Perhaps a new division should be requested. The Information Science and Automation Division does fill the void partially. But judging from fairly recent reports, it can be assumed that this unit will be absorbed for some time to come with the automation of library housekeeping and bibliographic routines (e.g., design of computer-based acquisition, circulation and cataloging systems) and will find it difficult to look toward newer horizons. In any case, ALA headquarters in Chicago badly need the services of one or more specialists who will study developments in the field, keep the profession well advised, and counsel with individuals and groups on ways to develop improved, local, and new media service arrangements consistent with future needs. At present, no one really knows who is doing what where in audio-visual library service.

At the Federal level, a "National Communication Service Agency" should be established, operating outside the framework of the present Federal Communications Commission and probably independent of the Office of Education. Such an agency is needed to foster development of both educational communications service and research programs and to assist the work of other organizations, whether public or pri-

vate, which are now or are likely in the future to become significant sources of production, distribution and/or storage of public communication resources. This agency also would assist in coordinating such agencies as the National Center for School and College Television and the new public television network; and in evaluating educational technology as developed under auspices of the Educational Products Information Exchange (EPIE). Agency personnel would also be expected to raise an effective voice on matters relating to educational communication services, including the many copyright dilemmas. Such an agency could appropriately be asked to encourage international co-production and exchange of ideas and materials and to cooperate in professional studies of education aimed at developing national curricular approaches with implications for media use. It would keep a sharp eye on the growing number of private mergers of publishing and electronic firms and their market operations and, of special importance, such an agency could provide an effective channel for implementation of recommendations to be proposed by the President's Commission on Library Resources which is to submit a report in a very few months.

In conclusion, to summarize the chief points which have been expressed: what will be important tomorrow is the library function, *not* the library as a physical institution. In contemplating the library function, the concepts of media will give way to a greater concern for knowledge as such—its assessment, storage, retrieval and rapid transmission. In the future, the traditional rejection by librarians of newer media will no longer have meaning and will disappear as a basis for intra-professional controversy. New training programs must be mounted to equip library personnel to manage new agencies to perform redefined library functions. And changes taking place in the field should be reflected organizationally within such professional bodies as the American Library Association. At the Federal—and perhaps even international—levels there is needed a new approach to developing and coordinating educational communication and information services. For many years librarians have worried about professional service responsibilities for providing audio-visual materials and other “new” media. Now, however, such concerns are antique and are being replaced by the more meaningful questions which relate to costs and the practical problems of handling ideas and information regardless of form. Answers given to these questions imply development of new communication and information service agencies which

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will perform the library functions, but which may well be managed as institutions considerably different from what we know today as libraries.

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