Librarians against Machines

Librarians are having difficulty adopting the new
technology because they have no professional philosophy.

Jesse H. Shera

"And further, by these my son, be
admonished: of making many books
there is no end; and much study (or
reading) is a weariness of the flesh"
(*1*). Thus wrote the author of Ecclesi-
astes in a passage that has so often
been quoted that it has become trite,
but which still stands as eloquent, not
to say biblical, testimony to the burden
of literature searching that has plagued
every scholar since the days of the
great Alexandrian library, and perhaps
as early as the time of Assurbanipal's
royal collection of clay tablets at
Nineveh. The proliferation of recorded
knowledge has been a matter of con-
cern to scientists as well as librarians
for many centuries, and one cynic, now
unhappily forgotten, expressed disquie-
tude over the growth of libraries and
cemeteries and proposed cremation as
a solution for both. It was not, how-
ever, until Fremont Rider published
*The Scholar and the Future of the Re-
search Library* (*2*) that concern changed
to alarm. Rider's main purpose, of
course, was to promote the use of
Microcards (micro opaques) as a form
of relief for the library's growing prob-
lem of book storage, and indeed such
micro opaques have become popular,
even commonplace, since he wrote, but
it was his extrapolation of the expo-
nential growth of libraries and their
bibliographic instruments that shocked
the world of scholarship. Rider, who
was writing in the early 1940's, showed
that the major university and college
libraries had been doubling in size every
16 years, and that if this rate of in-
crease were projected into the future,
the Yale University library, which
throughout its history has approached
very closely the statistical norm of all
the institutions Rider studied, would

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"in 2040 have approximately 200,000,-
000 volumes, which will occupy over
6,000 miles of shelves. Its card catalog
file—if it then has a card catalog—will
consist of nearly three-quarters of a
million catalog drawers, which will
themselves occupy not less than eight
acres of floor space. New material will
be coming into it at the rate of 12,-
000,000 volumes a year; and the cata-
loging of this new material will require
a cataloging staff of over six thousand
persons" (*2*, p. 12).

Rider's statistical projections were
eagerly seized by administrators, espe-
cially those concerned with the man-
agement of academic institutions and
industrial research installations, and
there was much loose talk about the
growing costs of literature searching
even to the point of assuming that if
a particular experiment costs less than
x thousands of dollars it would be
more economical to repeat it than to
invest in the costs of an exhaustive
literature search to make certain that
the experiment had not previously been
done. In a widely publicized essay en-
titled *From Freight to Frankenstein,*
Ralph R. Shaw, then librarian of the
U.S. Department of Agriculture, at-
tempted to allay all such apprehen-
sions by challenging Rider's acceptance
of the exponential curve as being de-
scriptive of future library growth (*3*),
but only in the more conservative seg-
ments of the library profession did his
reassuring words have any substantial
impact, and the fright continued wheth-
er or not it led to Frankenstein. In-
deed, proposals for the mechanization
of literature searching, particularly
through the adaptation of computers
to library operations, were only intensi-
fying panic.

Rider's prognostications were picked
up by, among others, Derek J. de Solla
Price who saw in the exponential growth

of recorded scientific knowledge one of
the diseases of science that could lead
to eventual suffocation of innovation
through the proliferation of its own
recorded achievements (*4*). Recent ex-
pansion in library growth may prove
Rider's estimates to have been conserva-
tive. On the other hand, a recent study
of the mathematics literature suggests
that it may be increasing at a rate of
only 2.5 percent annually, thus doubling
in volume approximately four times a
century (*5*). But even such a rate of
growth will pose a serious problem to
librarians.

The Library Problem:
Not Storage But Retrieval

The miniaturization of the printed
word proposed by Rider now seems
crude in comparison to the refinements
that have recently been introduced. The
National Cash Register Company of
Dayton, Ohio, has effectively produced
readable text at reduction ratios of over
48,000 to 1 in area (*6*). But such micro-
scopic printing approaches only the
optical limits of textual reproduction.
In Germany, the physicist G. Mol-
lenstedt demonstrated the possibility of
etching on a thin metal film with an
"electronic pencil" 80 angstroms in di-
ameter letters one to two millionths of
an inch in height; and Professor
Richard P. Feynman of the California
Institute of Technology conjectured that
if organic life is able to store its genetic
information at the ultimate molecular
level by "printing" it in the form of
long "coded" chains in the chromo-
somes, it should also be at least theo-
retically possible to approach such a
level with man's intellectual informa-
tion (*7*). For the foreseeable future, at
least, there would appear to be always
room at the bottom, and the problem
of library storage, however much it
may inconvenience the reader, will not
prove serious.

The serious problem of information
storage and retrieval, then, is not the
storage but the retrieval; for what will
it profit a man if he has the entire
collection of the Library of Congress on
the corner of his desk if he cannot
effectively and efficiently gain access to
its intellectual content? Possession may
be nine-tenths of the law, but that
proportion does not hold for scholar-
ship. The difficulties of information
retrieval arise, not so much from the
swelling body of material but rather

from the complexities of its content. The interdependence of those disciplines which comprise the sciences are destroying the lines of demarcation that once defined the conventional areas of study. Isolationism is no more valid in today's scholarship than for international policy. Yet there is a paradox in these interrelationships that finds expression in Price's "Diseases of Science": the more difficult it becomes for scholars to master the records of science the more vital it is to the welfare of science that such mastery be realized. For generations, the scholar has dreamed of a Utopia in which he would have access to the total store of potentially useful materials and the ability to choose from it only the best documents for his immediate need. The advent of the Hollerith machine and its subsequent refinements made possible by the introduction of powerful electronic computers opened the possibility of storing huge collections of recorded information from which pertinent segments, correlated as the user desires, could be retrieved through the simple typing of requests on a console (8).

Though the majority of librarians, for very good reasons, have been skeptical of this new technology, and some were reluctant to accept the basic premise that machines could be made which are "smarter than men," enthusiasm for mechanized information retrieval spread rapidly during the late 1950's and the 1960's, especially among the engineers, whose vision of automation was unlimited, among scientists who were bedeviled by the burden of bibliographic search, and among executives who were eager to reduce the mounting costs of libraries and library service. When the federal government and other sources of research support began to provide quite substantial support for the exploration of automated information retrieval, the trend of the future became reasonably clear. It also became evident that many scientists were coming to believe that librarianship was much too important to be left to the librarians.

As Ben-Ami Lipetz has shown, these automata have not yet realized the promise of their adherents. Thus he writes in a recent issue of *Scientific American* (9):

The difficulty of handling analytical problems has so far limited the use of mechanical techniques in information storage and retrieval work to applications that never required much analytical judgment on the

part of the humans who formerly did the work. Savings in clerical activities have been great, and performance has been accelerated in such applications. But the human indexer, translator, evaluator, and abstractor are still very much needed—more than ever in view of the increasing rate of production of new records. There is great need for machines to take over significant portions of the intellectual work. Faster, larger, cheaper computers are not the complete answer, although they will certainly be necessary. The major contribution will probably come from enlarged understanding of how human evaluations are made and from increased effort to design improved programs of instruction that will endow machines with analytical abilities simulating human abilities. In a real sense the problem is one of learning how to educate machines efficiently.

Or, to state Lipetz' point another way: the problem is one of learning what it is that we want the machines to do and then designing machines and the appropriate software that can do it efficiently. Lipetz is optimistic about man's ability eventually to develop computers that will be capable of learning human analytical powers, and Herbert Simon, who is a cautious student of the role of automation in our society, believes that "insofar as we understand what processes are involved in human creativity—and we are beginning to have a very good understanding of them—none of the processes involved in human creativity appear to be beyond the reach of computers" (10).

But we are here not primarily concerned with the future of the computer in the storage and retrieval of scientific information. Let us assume, and there appears to be very good reason for such an assumption, that machines can be built which will relieve the scholar of much of the burden of bibliographic search and that they will eventually be able to provide the precise information the user needs when he needs it, and in response to a very simple operation on his part—the pushing of a button, let us say, on a remote console. If this is what we want done, then the engineers can eventually be expected to do it.

Our primary concern here is with the impact of a technological revolution, or threatened technological revolution, upon an activity that has begun to think seriously about its professionalization—the occupation of librarianship. "No less certainly than the civilization of an armed force is based on its weapons system is the civilization of our society based upon the in-

strumentation of the industrial process," writes Elting Morison. "All our economic and social arrangements—how we feel about what we do, which is all that culture is—are founded upon the way our industrial energy is organized. How large a part and what kind of part do we want the computer, with its overriding skill in the analysis of measurable data, to take in the decisions that determine the way this energy will be organized? This is worth thinking about" (11). If one looks at Morison's assertion from the standpoint of an occupational group that is experiencing a rather drastic and potentially far-reaching change, his question is, indeed, worth thinking about.

Librarianship as a Profession

Robert D. Leigh, writing in the late 1940's in his official capacity as chairman of the Public Library Inquiry, took the rather cautious position that librarianship is a "skilled occupation on its way to becoming an organized profession," and added that "like other occupations the librarians have accepted professional status as a goal" (12). Whether or not one believes that the credentials the librarians have submitted for acceptance as a profession are here irrelevant, the important fact is that librarians as an organized group aspiring to become a profession has direct bearing upon their reaction to the technological revolution now taking place in their sphere of social endeavor (13).

Many writers, from a variety of disparate disciplines, have, over the years, identified a formidable list of attributes that define a profession—autonomy, organizational or associational structure, possession of a body of theoretical knowledge, sources and size of financial rewards, service or dedication, possession of special social privileges or sanctions, and many others depending upon the profession or professions taken as a standard (14). But perhaps all of these can be subsumed under the two accepted by Goode (15, p. 36) because they seem to be socially central to the basic concept and are found in all definitions: (i) a collectivity or service orientation, and (ii) prolonged specialized training in an abstract body of knowledge.

The role of the library throughout history has been to maximize the social utility of graphic records for the benefit of society. Hence the librarian

stands as a mediator between man and his records, and librarianship is fundamentally an act of mediation. To this end the librarian must select, or "screen" the "best" materials for his clientele, and organize and otherwise order the flow of information to meet the needs of his patrons. In a very real sense he is, and always has been, an information specialist. Thus, the concept of service, even devoted service, is indigenous in librarianship, and it is difficult to see how, in this respect, he would fail to meet the qualifications of a professional (16). Four of Ranganathan's "Five Laws" of librarianship: every book its reader, every reader his book, books are for use, and save the time of the reader, are all eloquent testimony to the "library faith" of service (17). The American Library Association has long been dedicated to the principle of the best books for the most readers, even to a point that approaches the zeal of the missionary. Collectively librarians have also formulated their own code of ethics, insisted upon the rights of intellectual freedom, the integrity of their book collections, the freedom to read, and have in a variety of ways defined standards of professional conduct and behavior. Admittedly many of these standards do not have the sanction of law as is true for such professions as medicine or public education, but that is largely because the body politic does not feel a sense of urgency about the need for information, does not see the inherent harm in either misinformation or the absence of adequate knowledge. As the dean of a leading medical school once told the present writer, "We all die of a lack of information." But in the eyes of the layman it is cancer, or heart disease, or some other ailment that gets the blame. There is a certain irony in the fact that a culture, such as ours, which places such great emphasis upon science and extending the frontiers of knowledge, should view with such indifference the importance of organizing and servicing that knowledge in the most effective and efficient ways possible. There is irony, too, in the fact that though the public is at long last beginning to recognize the utility of information, librarians are often rejected as proper administrators of it. Therein lies the crisis that confronts librarianship at the present time.

Perhaps the reason for this paradox is to be found in the second point raised by Goode, the failure of librarians to develop a substantial body of theoretical knowledge and a system of graduate education that is truly professional in its orientation and content. The conventional techniques of bibliographic organization used by librarians have been slowly developed over a relatively long period of time, and are based on quite unsophisticated assumptions about the ways library patrons use the card catalog, classification schemes, and other bibliographic apparatus that characterize the majority of library installations today. Though the techniques of bibliographic description have been codified and standardized, largely through the work of the Library of Congress, the subject analysis of library materials, except for refinements in classification and more precise terminologies, have received surprisingly little attention since the days of Charles Ammi Cutter (18). Personal assistance to the reader (reference work) dates only from 1876 and the pioneering efforts of Samuel Swett Green of the Worcester, Massachusetts, Free Public Library (19). Thus the sudden upsurge in the production of scientific literature and the complexities that characterize its use, together with the growing dependence of science upon recorded knowledge, have caught the librarians professionally off base and quite unprepared for the intrusion of a new technology that has been known variously as documentation, information science, automation, and information storage and retrieval, despite the obvious fact that the storing and retrieving of recorded knowledge had been the librarian's unique responsibility for many centuries. That librarians were thus caught was largely due to the unfortunate fact that they have never given much consideration to the theoretical foundations of their procedures, nor developed a research program that would advance such theory or explain and improve its applications. Librarians know very well *how* to do what they do, but they never concern themselves to any great extent with *why* they do it. They understand the *Können*, but the *Wissen* has escaped them. Their discipline is a vast accumulation of technical details rather than a body of organized abstract principles that can be applied in concrete situations, a body of knowledge that is known and understood by all members of the guild and one which the librarians themselves alone have created.

Because librarians have not devoted sufficient attention to the theoretical considerations of their work, and because they are not truly professional, they have largely failed to grasp the meaning of the dilemma in which they find themselves. As Philip Ennis has shown, the library is a part of the total communication system in society, particularly that part which relates to communication among scientists and other scholars and between the scholar and the general public. At the same time, the library is itself an organization that encompasses a variety of physical entities, human beings, and social relationships. All of the library's relationships are subject to technological change and are interdependent. Thus a technological innovation that may well meet the needs of one may not necessarily be beneficial or acceptable to the other (20). Microfilm, for example, that effectively solves the librarian's difficult problems of acquisition and storage may result in serious inconvenience to the patron, and a computer which might admirably solve the patron's searching problem may result in serious dislocation of functions within the library staff.

In the drive of an occupation toward professional status a substantial amount of attention is devoted to education and the establishment of professional schools, and accrediting bodies are created to watch over standards of educational performance. Too frequently these standards are more concerned with the outward manifestations of academic achievement than with the intellectual content of the discipline to be taught: the amount of study required beyond the baccalaureate degree, the number of the faculty who hold the doctorate, the extent of "research" activity as indicated by faculty publication, and other considerations that can be reduced to statistical quantification. Lip service is given to creativity and innovation, but excessive departure from traditional course content may well be regarded with considerable suspicion.

For almost a century librarianship has been struggling to divest itself of its training-class and apprentice origins. In 1923 C. C. Williamson urged that library schools should be integral parts of universities in order to enrich the intellectual content of their curricula but the change brought little marked improvement (21). Library schools remained largely isolated units in the university complex and their faculties were not in the mainstream of academic life.

In 1926 the University of Chicago established, with the support of the Carnegie Corporation, a graduate library school with the first doctoral program in librarianship. This school has made a major contribution to the improvement of professional education for librarians, though it has always been a target for the conservatives. Nevertheless, many of its graduates introduced the "Chicago philosophy" into librarianship, and its program of study, superficially at least, was widely copied. Slowly and painfully library education has been scrambling upward; certainly it has more intellectual content than it possessed in the days when Williamson wrote, but it has not yet achieved a true synthesis between *Wissen* and *Können*.

A Profession in Change

Into the librarians' comfortable and tidy world of rules, techniques, and standardized procedures there burst, following the close of the Second World War, the spectre of automation with its band of nonlibrarians—engineers and other scientists who brought with them a strange new vocabulary and a vision of computers as push-button libraries that could master the rising flood of paper record. The librarians had always been Utopians in the conventional sense that they were concerned with people, service to the book needs of the individual from the preschool child to the aging adult. Librarians, then, were people-centered. But these "New Utopians," to use Boguslaw's phrase, were "concerned with non-people and with people-substitutes. Their planning [was] done with computer hardware, systems procedures, functional analyses, and heuristics . . ." (22). Moreover, the librarians were strongly humanistic in their point of view. The humanities had long been the gate of entry into librarianship, and indeed many librarians were fearful and distrustful of science. They had turned to librarianship for the very reason that they were self-consciously inadequate in science. Even the statistical approach to librarianship, that at the University of Chicago had received such wide attention during the 1930's, had caused considerable concern. In its initial manifestations automation was received by librarians with little more serious attention than if it had been the scientific fantasy of a Rube Goldberg

or a Buck Rogers. But Robert Maynard Hutchins is right when he wrote in a recent syndicated column that the computer cannot be treated "as though it were just another invention, whereas it cannot be compared with any mechanical device in history. It adds a new dimension to the powers of man and to human life. To suppose that so fundamental a change can leave the economic system (and, one might add, librarianship) virtually untouched is to ignore the radical nature of the new instrument that mankind now has at its disposal. I believe that wherever the computer establishes itself—and it is rapidly doing so everywhere—it will eventually reduce labor as we have understood it and may reduce it almost to the vanishing point" (23). The impact of this new mechanism on a branch of organized human activity that is aspiring to professional prestige, then, is worthy of serious thought.

Impact of Technological Change

Marshall McLuhan, who welcomes rather than fears or criticizes technological change, holds that, on the evidence of technology's past encounters with human society, cultures are shaped more by the media through which men communicate than by the content of their communication. With the historian Harold Innis and most cultural anthropologists and students of evolution, McLuhan believes that it was the invention of hand tools and spoken language that differentiated man from the beasts and that these innovations led to the development of the human brain as distinct from the brain of all other species (24). Whether this sequence is historically right or not no one really knows; it is the old hen-and-egg mystery and probably the egg theory of hens is potentially as valid as the hen theory of eggs. But certainly McLuhan is right in drawing attention to the relationship between tools and mechanisms and the values held by men in organized societies and their subcultures.

Though Americans recognize that technological change is inevitable, and indeed, welcome and encourage it, they remain in large measure appalled by the possible consequences of their ingenuity. Consciously or unconsciously men seek refuge in the continuation of old patterns of behavior although quite different conditions maintain because of the introduction of new mechanisms.

Thus: in the Socratic dialogue, *Phaedrus*, Socrates sets forth the argument that the invention of the alphabet "will create forgetfulness in the learners' souls, because they will not use their memories; they will trust to the eternal written characters and not remember of themselves. . . . You give your disciples not truth, but only the semblance of truth; they will be hearers of many things, and will have learned nothing; they will appear to be omniscient and will generally know nothing" (25). Fear is especially strong among those occupations that are service oriented, or when the innovation comes from without the occupational group or subculture. Thus librarians were especially apprehensive over the invasion of the documentalists and information scientists. Their first response was a pretense that it did not exist; their second, logical rational refutation; and their third, and extreme stage, the resort to *argumentum ad hominem*. Behind all these, of course, lie the fears of loss of professional identity, unemployment, and to use Schumpeter's term, "the gale of creative destruction" (11, p. 6). Even in those areas where automation promises almost immediate relief from burdensome detail, the computer is not always accepted with enthusiasm. Resentment can easily replace reason, especially when the benefits come from those who are outside the culture group. The engineers do not really understand library problems, so the argument goes, and it has sufficient validity to delay the benefits that fresh insights from nonlibrary disciplines might bring.

But technological innovation does not have to be disruptive; it is not necessarily a hostile force dislocating comfortable routines. It can provide the intellectual "kick" that propels librarianship into new dimensions of service. That librarians are deeply troubled by the new technology can be directly attributed to their devoting excessive attention to the techniques of their craft, and to their neglect of the fundamental questions that they should have been asking. The computer could force them, at long last and in self-defense, to examine the philosophical implications of librarianship, and it could also condition them for accommodation with areas of inquiry which previously have not been thought to be related to their work.

If librarians, then, are to take advantage of the new technology they

must first extend the boundaries of their thinking which has been channelled and confined for so many generations, and accept into the body of their professional knowledge ideas that at first may seem alien, if not hostile. The profession must be particularly alert at its margins, and sensitive and responsive to change to insure open and clear communication with all relevant sources of innovation—physiology, psychology, behavioral science, as well as the humanities. With such infusion librarians will be in a much stronger and more strategic position to ask the right questions and formulate their own body of theoretical knowledge. But as librarians must seek unity with the scientific world, so also must librarianship seek unity within itself. Communication must be established among the several subsystems, the school librarians, the public librarians, the academic librarians, and that multifarious cluster of activities carried out by special librarians, documentalists, and information scientists. Librarianship must also develop a sound research policy that is directed toward the solution of fundamental problems, not a series of statistical exercises in which counting and tabulating masquerade under the guise of scientific inquiry. Quantification and research are not synonymous, and the slavish following of a methodology, however good the design, does not guarantee valid results. Today, librarianship is not research-oriented, but it must become so if the *why* is properly to be related to the *how*. "We have all the answers," Archibald MacLeish once told his staff at the Library of Congress. "It's the questions we do not know."

Finally, practice must be made more responsive to theory. By its very nature innovation begins by destroying traditions, patterns of thought, and habits of behavior, which people have long cherished and to which they have become accustomed. This period of stress engendered by the destructive force of innovation can probably never be eliminated, but it must be decreased to the minimum by increasing the absorptive power of the profession, by intensifying the professionals' hospitality to change.

In simulating and promoting all of these professional needs of the librarian, the computer and the intellectual forces that it represents can be a powerful ally and effective catalyst. It should neither be feared as a competitor nor con-

demned and ridiculed because it has not yet achieved the intellectual capabilities of the human being. Whether the computer can ever be "taught to think" is not a matter of concern here; the important point is that it can compel the librarian to ask the right questions about what he really should be doing, and it can direct his thought to the right answers to those questions. Alfred North Whitehead sees society as a proper balance in the conflict between conservatism and innovation: "There are two principles inherent in the very nature of things, recurring in some particular embodiments whatever field we explore—the spirit of change and the spirit of conservation. There can be nothing real without both. Mere change without conservation is a passage from nothing to nothing. Its final integration yields mere transient nonentity. Mere conservation without change cannot conserve. For after all, there is a flux of circumstances, and the freshness of being evaporated under mere repetition" (*26*). On the other hand, Elting Morison sees society moving toward a new unity: "We have been isolated human beings, selfish, combative, ignorant, helpless. But now for several hundred years the great evolutionary hormones of knowledge and technology have been pressing us, almost without our understanding it, into power, prosperity, communication, and interaction, and into increasing tolerance and vision and choice and planning—pressing us whether we like it or not, into a single coordinated humankind. The scattered and competing parts are being bound together" (*11*, p. 303). Librarians should not belittle or inveigh against the new Utopians and their machines. To say that science is not the sum of human culture is not the same as saying that it is unimportant or alien to culture. Librarians must not emphasize conservation at the expense of change; they dare not forget that the Luddites eventually were put to death. "The fault, dear Brutus, is not in our machines, but in ourselves. . . ." Or, to quote that eminent social philosopher of our own day, Pogo, "We have met the enemy on the field of battle and they are us."

References and Notes

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59; C. F. J. Overhage, *Science* **155**, 802 (1967).
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11. E. E. Morison, *Men, Machines, and Modern Times* (M.I.T. Press, Cambridge, 1966), p. 78.
12. R. D. Leigh, *The Public Library in the United States* (Columbia Univ. Press, New York, 1950), p. 192.
13. William Goode agrees with Leigh that librarianship is moving along the professionalization continuum, but doubts that it is likely to achieve the status of a profession because the general public will probably not permit librarians to attain the degree of collective self-control demanded of truly professional groups [see W. Goode in *Professionalization*, H. M. Vollmer and D. L. Mills, Eds. (Prentice-Hall, Englewood Cliffs, N.J., 1966), p. 33].
14. Everett C. Hughes takes the position that professions apply an esoteric skill, or body of esoteric skills, to the giving of a service; that professions are practiced in complicated organizational structures which are complex forms of group or associational activity; that the clients are drawn from society at large; and that the profession is concerned with the distribution of its services as well as with their production [see E. C. Hughes, *Library Quart.* **31**, 336 (1961); see also M. L. Cogan, *Harvard Educ. Rev.* **23**, 33 (1953)].
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16. Goode's argument (see *15*, p. 41) that the librarian is not a professional person because he gives his patrons "what they want" instead of what they "need" is a mere playing with semantics.
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