The Microform Revolution in Libraries

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Chapter 1

Microphotography and Early Applications in Libraries

The bewildering variety of microform products and services that are available to industry and education today derive from the invention of John Dancer of Manchester, England, who in 1839 installed a microscope lens in a camera and created the first microphotograph.[1]

A renowned manufacturer of cameras, microscopes, and telescopes, Dancer treated microphotography as more of a curiosity than an integral part of his business, and he gave his handiwork away to friends and acquaintances as if the photographs were merely amusing novelties.

Other artisans in London experimented with microscopic photographs, which often took the form of individual portraits attached to rings and other jewelry. The invention soon traversed the Channel and Parisian jewelers and opticians added new twists by placing miniscule photographs in opera glass watch charms. One of the more successful entrepreneurs producing such novelties was Rene Dagron, who employed as many as one hundred and fifty workmen.[2] He and his competitors operated some thirty factories churning out microphotographic trinkets, and their success is probably in no small measure due to the variety of photographic art for which Paris is so justly famous.

The years passed uneventfully for Dagron until 1870, when microphotography was transformed overnight into a subject of national importance. When Napoleon III surrendered the French Army at Sedan in 1870, the Franco–Prussian War was

only six weeks old. The Army of France lay down its arms, but the people of Paris mobilized and defiantly barricaded the city. For the ensuing five long months, Paris was surrounded by Prussian troops. All commerce and communications between the city and unoccupied France were cut off. The populace was reduced to near starvation and the pet population vanished, as did increasing numbers of rats whose satisfactory preparation taxed the culinary skills of Paris's finest chefs.

Under such conditions, the people were frantic for support and news from unoccupied France. Neither was possible with the Prussians controlling all access to the city. The Parisian Postal Service tried to reopen communications. First, they sent homing pigeons off with messages, but the number of dispatches they carried was woefully inadequate. Next balloons loaded with mail were set adrift. This proved highly successful, but unfortunately the traffic was one way. It was one thing to leave Paris and land in unoccupied France, but quite another to balloon toward Paris and set down safely in a target covering only six square miles. Scores of balloons left Paris during the siege; only five returned carrying mail and messages for the city's defenders.

Even messenger dogs were put into service to run the blockade. However, by this time conditions were so bad in the city that any stray dog was immediately snatched up for the stew pot and, despite the government's warning to watch for canine messengers, the experiment had to be abandoned because of the dogs' extremely high mortality rate.

Enter Rene Dagron. Since homing pigeons proved to be more successful than any other method of reopening communications, attention soon focused on a method of increasing the volume of dispatches. The Post Office Department approached Dagron and enlisted his photographic skills. In November 1870, Dagron departed Paris in a balloon loaded with his cameras, chemicals, and assistants. They overflew German lines and, after a series of episodes worthy of the Three Musketeers, finally arrived safely in Tours.

Using 35mm microfilm Dagron photographed letters and official dispatches, reducing them in size so that the films weighed only one twentieth of a gram. Yet each contained at least four thousand messages. The films were then inserted in goose quills

and attached to the tail feathers of pigeons. Each bird could carry as many as eighty thousand messages across German lines. By the end of the war Dagron's "Pigeon Post" delivered more than two and one half million messages to the people of Paris.[3]

Dagron's services could not prevent the eventual capitulation of Paris in late 1871, but the microfilm copies of communication from unoccupied France did buoy the spirits of thousands of Parisians who otherwise would have been cut off from all contact with friends and family outside the city. The photographer returned to Paris and continued his work and further experimentation with microforms. He won several awards for his exhibits at the World's Fair and maintained an active business until his death in 1900.

Dagron's experiments with microfilm paved the way for applications in commerce and education. The medium also was particularly well adapted to the passing of clandestine communications, and soon microfilm became indispensable to the espionage craft. Dragon's greatest achievement, however, was in pioneering records management with microforms and proving that large volumes of information could be processed and easily transported on film. His "Pigeon Post" was so successful that it was modernized and reintroduced by the U.S. Army Air Corps during World War II as a means of transporting an ocean of mail across the Atlantic. The Army made microphotographs of G.I. letters in Europe, flew them to the United States, and restored them to original size at the point of destination. In this way one hundred and fifty thousand letters, that in original form filled thirty-seven mail bags weighing 2,575 pounds, could be filmed and shipped in only one bag weighing forty-five pounds.[4]

Six years after Dagron's death, Robert Goldschmidt and Paul Otlet published an article in the *Bulletin of the International Institute of Bibliography* in which the possibility of copying books on sheet or roll microfilm was explored. The authors suggested that books could successfully be copied on small sheets of film, a prototype of microfiche. They even specified the use of "Headers" or large print descriptive data (title, author, etc.) that could be read without magnification on the top of each card. They also described the attributes of roll microfilm, particularly in regard to economies of storage.[5]

Twenty years passed with scant attention to Goldschmidt and Otlet's ideas, and in 1925 they republished their 1906 paper emphasizing again the significant savings made possible by microforms. Shortly thereafter, George McCarthy filed a patent in the United States for a new system of microfilm processing and retrieval. He subsequently sold his ideas to the Eastman Kodak Company, which formed a new division—the Recordak Division—headed by McCarthy. McCarthy's invention made it possible to microfilm cancelled bank checks and viewing machines were designed for use in searching and reading documents. This process was marketed under the trade name Recordak, and it soon found wide acceptance in banks, insurance companies, and then libraries.

Although the development and acceptance of microforms occurred much faster in commerce than in education, the potential benefits to libraries were not entirely ignored. As described by Eugene Power of University Microfilms, the primary applications were: (1) a means of protecting books, manuscripts, and documents against loss and unnecessary use; (2) securing permanent copies of ephemeral material; (3) obtaining copies of material in distant depositories; (4) reducing the space occupied by a collection of materials in traditional formats; (5) original publications of scholarly and technical material; (6) republishing material in short supply or out of print.[6]

The League of Nations Committee of Library Experts investigated the suitability of microfilm for documentation in 1928, the same year in which the Recordak microfilm camera was introduced. With the subsequent development of the Leica camera, many individual scholars began microcopying manuscripts and archival material. Many American researchers made microcopies in Europe and then brought them back to their own libraries, so that by the early 1930s several research libraries including Harvard, Yale, and the Library of Congress were building microform collections and were accepting orders for film copies.

In 1935 the United States Government took the first step in what eventually became a massive microform program with the filming of some 300,000 pages of the hearings of the National Recovery Administration and the Agricultural Adjustment Agency. This project was conceived when several American libraries requested copies of the paper hearings.[7]

The joint financing by several libraries of the NRA and AAA hearings led to many cooperative projects aimed at acquisition of rare and expensive resources. In 1935 Eugene Power began filming English books printed prior to 1550—the beginning of the *Short Title Catalogue Series.* A short time later Power founded University Microfilms and initiated *Dissertation Abstracts* and the filming of doctoral dissertations, thereby assuring the firm a long and mutually profitable association with the library community.

In *The Scholar and the Future of the Research Library, a Problem and its Solution* published in 1944, Fremont Rider pointed out the exponential rate of growth in research libraries and argued that microforms were the most rational solution to the problems of storage for growing collections. Rider predicted that by the year 2040 the Yale University Library would own more than 200 million volumes taking up more than six thousand miles of shelving. The library's card catalog would occupy eight acres of floor space and a cataloging staff of more than six thousand would be required to process the more than twelve million volumes received annually.

Rider's answer to the danger of libraries transformed into Augean stables, was to produce 3 × 5 inch micro-opaque cards of each item owned by research libraries. The front of each card would contain cataloging information for the individual document fully reproduced on the reverse of the card, thus the entire library could be housed in a standard card catalog obviating the necessity for traditional book stacks. Items could be circulated simply by placing a call slip in the correct position of the catalog for any particular document. Or the patron could reproduce a copy of the card in a duplicator, leaving the original card for other users. Rider argued that savings in space with his program would approach 100 percent because bookstacks would be required for only a few reference books.[8]

Rider's ideas dropped like lead weights in bottomless wells of the library community. No library converted its holdings to micro-opaques. And when the Readex Microprint Corporation developed the 6 × 9 inch opaque Microprint card in 1950, attention focused on the production of esoteric research materials with secondary regard for the space saving qualities of the medium.[9]

The Microprint produced by Readex contained text printed

by offset on calendered paper at a reduction of 12–18 diameters. The smooth surface of calendered paper facilitated printing of the miniscule letters, and the low cost of production (opaques are the least expensive microform to produce, particularly in large editions) triggered many publishing endeavors, notably the *British Sessional Papers* and *Three Centuries of English and American Plays, 1500–1800.*

These initial projects by the country's first micropublishers were illustrative of the future direction microform publishing would take for the library market. The filming of rare and scattered information sources was widely acclaimed by scholars, for microforms—despite the unfamiliarity of the new medium and the inferior quality of early reading devices—facilitated transfer of information that was usually inaccessible in original formats. They also were clearly superior to some original formats, as with newspapers where film is vastly superior to bulky and deteriorating paper copies.

Resistance developed, however, as microforms intruded on the market traditionally held by publications widely available in paper. Although the costs to libraries of maintaining many information sources in microform are substantially lower than with paper (e.g., serials), the grudging acceptance of any revolutionary new technology is no less formidable in the library community than in society at large. Nor was acceptance aided by the confusing multiplicity of microforms, the generally low quality of reading devices, and the fact that library needs seemed secondary to manufacturers of microform systems who rapidly exploited the commercial and industrial markets.

Despite these obstacles, the generous funding of libraries during the 1950s and 1960s stimulated increasingly larger microform collections in all types of libraries, especially academic. By 1970, the member institutions of the Association of Research Libraries were reporting more than half a million microform units per library.[10] If the acquisition rates for microfilm, microfiche, and microcards were translated into page equivalents, these libraries each were adding more than 500 million pages of microform every year,[11] and the proportion of microforms to books in research libraries was approaching twenty-five percent.[12]

The continuing development of microform technology un-

doubtably will increase the ratio of microforms to books. The marriage of the computer and the microtext is revolutionizing information storage and retrieval. Today, Vannever Bush's 1945 vision of an ideal scholar's library—a desk sized carrel containing reproductions of all the papers and books of interest to any scholar—does not seem so preposterous.[13] *The New York Times* Information Bank combines a computer, printer, and microfiche duplicator with the capability to provide a researcher in Alaska with information on any subject imaginable from the files of *The Times* in New York City.

The next stage of evolution could be the "duplicating" or "desk top" library where most reference tools would remain in book form but other materials would be miniaturized. In this library no copy would ever be missing or in circulation, for copies would be duplicated and given or sold to users on demand. A microform master copy would remain in the library at all times for duplicating purposes, and users would build personal microform collections at lower cost than is now possible with printed copies. Low cost, portable microform readers could be loaned or leased by libraries, or patrons could purchase personal units.[14]

The "duplicating library" concept creates complex problems of copyright and equitable renumeration for authors and publishers. But the problem is scarcely insurmountable, and duplicating libraries may soon develop in logical progression from original publishing in microform and "packaged libraries." Collections of general and specialized materials offered in packages, such as ERIC, PCMI, Library of American Civilization, etc., gained wide acceptance, particularly in new libaries that needed to build learning resources and could do so at lower cost with microforms than with expensive and often unobtainable originals. Small and medium sized academic libraries frequently purchased such collections to support graduate research or to supplement existing collections. And research libraries are increasingly interested in converting from paper to microform. The enormous potential to achieve savings by duplicating microforms for users rather than circulating books, the increased accessibility (approaching one hundred percent) of materials that will be available when needed, the vast decentralization of cultural resources made possible by duplication of microforms

enabling every city to have a library as rich as the New York Public—these are compelling reasons why microforms are and will continue to be an expanding galaxy in the library and educational universe.[15]

The opportunity for dynamic growth in the use of microforms exists in all of the library community, and especially in academe. Reading for pleasure undoubtably will continue to be the private domain of printed material for a long time to come. But motives other than pleasure dominate educational reading, and the relative inconvenience of utilizing microforms is preferable than doing without. Such a choice is now commonplace in many academic libraries whose economic condition has been steadily deteriorating during the decade of the seventies. Enormous potential for growth also exists with the tens of millions of students in elementary and secondary schools where innovative programs already have demonstrated the comparability, and in some cases superiority, of microforms vis à vis traditional learning and teaching materials.[16] The pervasive acceptance and acquisition of electronic media by our children is too widely felt to need restating here; it is merely one more nail in the coffin of Gutenberg technology. For, as Kleukens and Goebel predicted more than thirty years ago in, appropriately, Mainz, Germany, we have entered a third technological era in communications dominated by film and electronic media, and thus the chronicled history of microforms is but one page in an ongoing epoch.[17]

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Chapter 2

Microformats and Associated Library Collections

The complex assortment of microforms in libraries is a reality that no amount of pleading for standardization is likely to change. If form follows function, as it ideally should, long runs of newspapers will continue to appear on roll microfilm, just as monographic collections increasingly will succumb to reproduction on microfiche. Intended use should dictate the choice between sheet or roll film, as well as the reduction ratio, contrast, and film type. The Recordak system was designed to film bank checks which do not require frequent retrieval. Substituting microfiche for the 16mm film on which checks are processed would only increase costs and complicate filming and retrieval of the records. Technical report literature appears almost exclusively on low reduction microfiche. These reports are monographic in nature and benefit from the unitization that fiche affords. Convenience of use would not be as great with film as it is with fiche. These are examples of how specific microforms were designed or evolved to meet specific needs. Further evolution should ideally follow the maxim that microforms should be designed to follow function and probable frequency of use.

Microformats can be conveniently categorized as either roll or flat mediums. Within the two forms there is a myriad assortment of frame sizes, orientations (internal formats) and reduction ratios. Roll films in standard 100 feet lengths at reduction ratios of 24.1 contain more than 3000 pages of material. Flat mediums (4 × 6 fiche, microcard) hold about 100 pages in medium reduction ratios (18–24×) and up to 6000 pages in ultra-high reduction ratos.

MICROFILM

Roll microfilm is usually 100 feet in length and 16mm or 35mm in width. In libraries, materials that are published in long runs (e.g., newspapers) frequently appear on microfilm. In recent years roll microfilm loaded in cartridges and cassettes has replaced some microfilm on reels because of the speed and ease of handling packaged film. Cartridges are self-threading containers. Unlike cassettes they have only one film core and must be rewound after using. Cassettes, on the other hand, can be removed from the viewer at any time with any frame remaining

Figure 1

in a reading position for future reference. Sixteen millimeter film is commonly used in cassettes and cartridges.

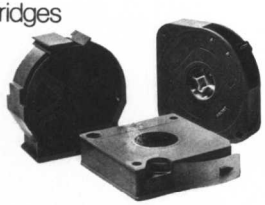
Cartridges and cassettes are normally used in motorized readers and, although more expensive, they clearly are superior to reel microfilm in many applications since they permit rapid and convenient searching and extracting of information.

Microfilm begins with the selection of a book or some other material to be photographed. Fine grained, high contrast film is used to make microfilm, and there are three types of photosensitive coatings routinely used on these films—silver halide, diazo, and vesicular.

Microfilm master copies usually are silver halide film, long

Figure 2

cartridges

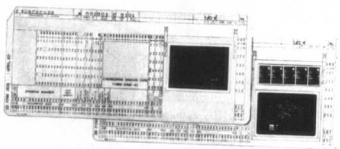


Microfilm cartridges function as "convenience packaging" for rolls of microfilm. Unlike microfilm on reels, which require threading, cartridges can be self threading. Microfilm in cartridges is well protected, and not subject to fingerprints and other possible sources of damage.

ultrafiche

Ultrafiche contain images reduced more than 90X, thus permitting thousands of images per fiche. Ultrafiche offers the advantage of storing more information in less space than a standard microfiche.

aperture cards

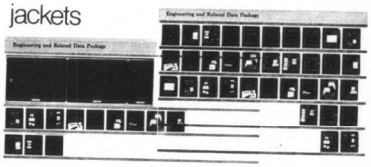


Available in many sizes—with the tab size (82.5mm x 187.25mm or 3¼" x 7⅜") most commonly used - - they combine key punched data and access information with microfilm. Aperture cards may contain a single image, or up to eight page-size images on one 35mm frame.

cassettes

Microfilm in cassettes gives added convenience to the handling of continuous rolls of microfilm. Each cassette contains two film cores—the feed and the take-up. There is no need to rewind a cassette when it is removed from the reader. Any frame may be held in viewing position for further reference at a later time.

jackets



A jacket is a plastic carrier with single or multiple sleeves or channels designed to accept strips of 16mm or 35mm film. Jackets both protect the microfilm and also facilitate organization of material. Images may be copied or read directly from the jacket without removing film. Jackets can be visibly titled for quick, easy file reference.

micro-opaques

Similar to microfiche in configuration, micro-opaques are, as their name implies, images on opaque stock. Therefore, images may be stored on both sides. Unlike microfiche where transmitted light is used for blowback, opaques use reflected light.