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DOCUMENTATION, INFORMATION SCIENCE, AND LIBRARY SCIENCE IN THE USA

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Abstract — Three related questions are addressed: Why was the work of the European documentalists largely ignored in the USA before the Second World War? What was the "information science versus library science" argument about? Technological innovation was a vital force in library science in the late 19th century and again after 1950. Why was it not a vital force inbetween? Examination of the technological background and of the Graduate Library School, University of Chicago, suggests that there was a temporary paradigm change away from design and technological innovation. Arguments over "information science" reflected a reversal of that paradigm.

INTRODUCTION

Any satisfactory account of the cultural and intellectual history of library science in the U.S.A. during the twentieth century will, among other requirements, need to account for three puzzling and, probably, related features:

1. Technical and technological experimentation and innovation, notably by the European documentalists, appear to have been substantially ignored in library science until after the Second World War;

2. There was an intense but generally unsatisfactory controversy known as "information science versus library science" after the Second World War. It had largely dissipated by the late 1970s. What was it really about and why did it happen then?

3. Technical and technological innovation was a vital force in librarianship in the late nineteenth century and again in the late twentieth century, but not, it seems, inbetween. Why?

This paper considers these topics, with special reference to the role of technology in library

science and to the impact of the Graduate Library School at the University of Chicago. Even with the benefit of hindsight, the discussion that follows should be regarded as tentative and speculative.

TECHNICAL AND TECHNOLOGICAL EXPERIMENTATION AND INNOVATION

Technical and technological innovation was a vital feature in librarianship in the second half of the nineteenth century, the formative period for library science in the U.S.A. It has been equally vital during the last third of the twentieth century, but the earlier part of the twentieth century, before the Second World War, was otherwise. There was an expansion of services, especially of public library services in rural areas, and, everywhere, libraries expanded, but the overall impression is of a period of technical and technological stability quite unlike the period that preceded it and also unlike the period that has followed.

Technology in general. From 1900 to 1939 was an exciting period both for technology in general (e.g. airplanes and automobiles) and for information technology. Although we may associate electronics with the proliferation of consumer products after the Second World War, it was the invention of vacuum tubes (cathode ray tubes, diode, triode) around 1900 that launched electronics.

In imaging technology, photography matured greatly after 1900 with major improvements in camera design, standardization of film speeds, rangefinders, electronic light meters, and cinematography. Color photography and color printing were developed. Television imaging made rapid progress from the late 1920s.

In sound and communications technology, radio developed steadily after 1900. Telephone service was extended. The technologies of movie sound tracks and of wire recorders and the regular transmission of television all predate the Second World War.

In computing and control systems, analog computers and increasingly complex punch card applications developed considerably. The highly versatile photoelectric cell was finding practical use in an amazing diversity of applications. (See, e.g., Yates, 1943).

The period 1900 to 1939 was unquestionably an exciting, dynamic one for what is now called information technology (Hall & Preston, 1988; Lubar, 1993).

Technology for documentation and library service. It is widely assumed that technical and technological innovation in library and information science is essentially a recent development. The reality is that, from the turn of the century to the Second World War, at least some practical idealists were very alert to the possibilities for technical inventiveness in bibliography, documentation, and library service as a cursory review will indicate.

The potential of microphotography as a compact alternative to paper was increasingly

recognized. Microphotography also offered a solution to another serious technological constraint of paper technology: the making and distribution of copies. Microfilm achieves compactness, easy reproduction, and transportability. These virtues were noticed by those who worried about the deficiencies of existing library technology. The Belgian documentalist Paul Otlet (1868-1944), for example, proposed the use of standardized microfiche in 1906. He saw microforms not as a replacement for the book, but rather as an expansion of the paper codex into a new and differently versatile form. In 1925 Otlet and the Belgian inventor Robert Goldschmidt (1877-1935) described an easily manufactured "microphotographic library". It comprised versatile "pocket-sized" viewing equipment and a portable cabinet one meter wide, one meter high, and about ten centimeters deep capable of holding, on microfilm, 18,750 volumes of 350 pages each, the equivalent of books that would fill 468 meters of conventional library shelving. (For Paul Otlet see Otlet, 1990, and Rayward, 1976).

In 1925 Emanuel Goldberg had demonstrated microfilm reduction equivalent to putting the entire text of the Bible fifty times over on one square inch of film, an achievement that was not surpassed for many years (Stevens, 1968; White, 1994). This was yet another stimulus to ideas about miniaturized, compact, portable libraries.

The intellectually constraining format of the printed codex, compared with what we should now call hypertext, was recognized, especially by Otlet, who used the phrase "monographic principle" to refer to what is now called hypertext. He was, of course, greatly hindered by having to use pre-computer technology to handle links and nodes. Nevertheless he and his colleagues developed hypertext theory and implemented and provided an information service from elaborate paper-based hypermedia systems early in the century (Rayward, 1994). By the 1930s Otlet and H.G. Wells were talking about designing a "world brain" by which they meant a continuously revised encyclopedia of all knowledge.

The Universal Decimal Classification (UDC) developed by Otlet and his colleagues from 1895 onwards advanced library classification theory and practice beyond the Dewey Decimal Classification. The UDC made explicit provision for Boolean "AND" searching and moved classification theory a long way towards the principles of the facetted classification that were developed further by Henry Evelyn Bliss and S. R. Ranganathan by the 1930s, an important period for classification theory.

During the first half of the twentieth century punch cards, edge-notched cards, and similar mechanical searching devices were developed for simple and Boolean selecting (i.e. searching for arbitrary combinations of index terms) (Casey & Perry, 1951). However, they were not widely adopted for bibliographic purposes. Frits Donker Duyvis (1894-1961), the Dutch documentalist, observed in 1931 that punched card equipment was simply inadequate for bibliographic searching. He noted with foresight that a new type of equipment based on digital circuitry, then being developed for telephone systems, was a more promising line of development for the sheer complexity of the Boolean and faceted subject access techniques developed for bibliographic retrieval from the 1890s onwards.

(Donker Duyvis, 1931, 53).

Donker Duyvis, who succeeded Paul Otlet as the central figure in the International Federation for Documentation, is of special interest in this context. A chemical engineer turned patent official, Donker Duyvis was also deeply committed to efficiency and the scientific management movement. He was co-founder and the founding Director of the Dutch National Institute for Management (NIVE) and served on its executive committee for 31 years (Zuuren, 1964). He was also an ardent advocate of standards, eventually being elected President of the Netherlands Standards Institute (HCNN) (Voorhoeve, 1964). It is important to stress that he, like others, saw documentation, standards, machines, and the pursuit of efficiency as a coherent and significant combination:

> "As a rule efficiency, which in fact includes both standardization and documentation, has been thought of as being less important. This can be explained by the fact that it manifests itself in a less concrete form than the other two and even today presents itself only in the form of a certain attitude of mind, despite the fact that a technique or science of organisation, rationalisation, increase of productivity or whatever it may be called, has developed." (Donker Duyvis, 1955, as quoted in Zuuren, 1964, 60-61).

Donker Duyvis was interested in the application of documentation, efficiency, and standards, not only in libraries and bibliography but also in any arena that included the handling of records. The Dutch national organization for documentation reflected this breadth in its title Nederlandsch Instituut voor Documentie en Registratuur (NIDER) where "Registratuur", usually translated as "filing", would probably be better rendered now as "records management" or "information resources management". NIDER and NIVE were closely allied.

This integrative view of bibliography and documentation, of standards, and of the pursuit of efficiency in information resources management in any applicable context also infused Paul Otlet's life work and his *Traité de documentation* (1934). His specifications for a mechanized workstation were not limited to library needs and he was active, for example, in the modernizing of local government record-keeping techniques ("administrative documentation"). The account of documentation by the French documentalist and librarian Suzanne Briet (1951), while more library oriented, can be read as a modernist tract with imagery redolent of organized mechanical processes harnessing information for social progress (Day, 1994).

The "machine" interests of the European documentalists and their concern with applications of documentation outside of libraries can be seen as being in the same vein as Melvil Dewey's interests in scientific managements and in extra-library applications of techniques developed in bibliography and librarianship. Dewey's Library Bureau supplied award-winning office equipment for non-library contexts. The vertical files now so common in offices appear to have been a transfer from library technology (Yates, 1989, 56-57; also Flanzraich, 1993). Further, we suggest that the present-day repositioning of "library schools" to include, even emphasize, "information management" can reasonably

be seen as also being a continuation (witting or otherwise) of the orientation of Dewey and of Donker Duyvis, Otlet, and Briet.

The examples cited are mainly European but there was also some activity in the U.S.A. before the Second World War. Alexander Rudolph had been building mechanized catalogs (Miksa, 1978). More importantly, Lodewyck Bendikson (1933) and Fremont Rider (1944) explored the merits of microprint. Having noted the dramatic saving of space that would result from using microform texts, Rider asked "Why might we not combine the micro-texts of our books, and the catalog cards for the same books, in one single entity? In other words, why could we not put our microbooks on the (at present entirely unused) backs of their own catalog cards?" (Rider, 1944, 99). The argument was that if you found the catalog card, you would have found the text and, in addition, the storage of the paper collections became unnecessary. Rider foresaw dramatic reductions in acquisitions and space costs from the adoption of his proposed "micro-cards" combining catalog record and text. In a variation on this theme chips of microfilm were sometimes mounted on index entries in punched and edge-notched cards ("aperture cards").

Microfilm and microcard reduced the space required for storing documents but how was one to find them? In the late 1920s and 1930s a brilliant new searching technology emerged. A photoelectric cell with associated digital circuitry could be made to find specified patterns recorded, like a sound track, alongside images of documents on a long spool of microfilm. A selection mask, such as a suitably punched card, would convert a light source into a pattern of small beams of light, which were projected on to a strip of microfilm positioned in front of a photoelectric cell. The photoelectric cell would instantaneously detect when all the beams of light shining though the moving microfilm on to cell were blocked by the passage of opaque marks on the microfilm that matched the particular pattern that was being sought. The faltering of the current from the photoelectric cell would, by means of the circuitry, instigate a copy of the desired record in library applications, count the frequency of occurrence of the code for cryptanalysts, or whatever else needed to be done. To use the speed of light itself to search a compact storage medium was a heady prospect in the days of punch cards, before digital electronic computers had been designed. This early form of electronic document retrieval was designed by 1927 in Germany by Emanuel Goldberg (Goldberg 1932a,b; 1992; Buckland, 1992). By the late 1930's a number of researchers were exploring this technique, which was later popularized by Vannevar Bush, Ralph Shaw, and others as the "microfilm rapid selector" and formed the technological context for Bush's imaginary "Memex" information machine (Buckland, 1992).

The imaginative were also quick to see the emerging technology of television as promising a dramatic enhancement to library services through telecommunications as early as 1925 (Goldschmidt and Otlet, 1925, 6). "But what a revolution for information retrieval and especially for libraries television can bring," exclaimed the German librarian Walter Schuermeyer at the International Congress on Documentation of 1935 in Copenhagen, "Perhaps one day we will see our reading rooms deserted and in their place a room without people in which books requested by telephone are displayed, which the users read in their homes using television." (Schuermeyer, 1936).

Irene Farkas-Conn (1990) has described the concerns for improved information storage and retrieval systems in scientific circles before World War II. The Science News Service was formed in 1920 by the American Association for the Advancement of Science, the National Academy, and the National Research Council, with funds provided by E. W. Scripps. Watson Davis, initially an editor and later the director of Science Service, was an ardent exponent of microfilm and founder of the American Documentation Institute (now named the American Society for Information Science). Another example of interest in these matters in scientific circles was the Committee on Scientific Aids to Learning of the National Academy of Sciences founded in 1937 with Carnegie Foundation support. This Committee was to be a "learning house" for instructional research of technical innovation, including microphotography and "so-called business machines." (Farkas-Conn, 1990, 89). The membership of the Committee included leading scientists and science administrators. In 1937 Vernon D. Tate prepared for the Committee a report entitled *The Present State of Equipment and Supplies for Microphotography*. This report, reprinted as a special issue of the *Journal of Documentary Reproduction*, is a good overview of technical innovation in document storage and retrieval (Tate, 1938).

The purpose of this recital is to establish that interest in technical and technological innovation was not absent in the overlapping fields of bibliography, documentation, and library science during the period before the Second World War. Quite the reverse: one could make a good argument that the features currently assumed of the electronic library of the twenty-first century—compact storage, ease of reproduction, remote access to full text, hypertext, equipment capable of sophisticated searching in complex indexing systems, and other thoroughly contemporary notions—were foreseen and discussed, at least in outline, by practical idealists by the time of the International Congress on Documentation of 1935, *before* the invention of electronic digital computers.

LIBRARY SCIENCE AND TECHNOLOGICAL INNOVATION

However, to establish that inventiveness existed is not to demonstrate that it was adopted or even of general interest. Rather, the reverse seems to have been the case in library science in the twentieth century until after the Second World War. The two principal new innovations in libraries in the U.S.A. were the photostat (projection photocopying on to sensitized paper) from 1912 and microfilming. By the 1930s, the microfilming of newspapers was becoming common and innovative libraries were establishing "photoduplication labs". There was also the wider adoption of nineteenth century developments, particularly dye and stencil duplicating, telephones, and typewriters, and the elaboration of nineteenth century cataloging, classification, and filing rules.

Mussman (1993) has provided a convenient, readable introduction to what was said about technology in the professional literature of librarianship. A few leaders, notably Ethel M. Fair, Hermann H. Fussler, Vernon D. Tate, and librarians active in the American Documentation Institute advocated new technology. But, all in all, the visions of the European documentalists appear to have been largely absent from library science in the U.S.A. New information technology was not ignored outside of

library circles, however. Yates (1993), for example, has described the dynamic adoption of technology in life insurance, another professional field with an interest in quantitative social science methodology.

The question asked is: Why were these developments largely ignored in U.S. library circles before the Second World War? We shall examine the institution that was the unquestioned intellectual center of library science in the USA at that time and a dominant influence until the 1960s: the Graduate Library School at the University of Chicago.

THE GRADUATE LIBRARY SCHOOL, UNIVERSITY OF CHICAGO

The Carnegie Corporation, having been instrumental in transforming medical schools in the U.S.A. early in the century, sought a similar transformation of schools of librarianship. The avowed intent was to create an institution that would be analogous to the Harvard Law School and the Johns Hopkins Medical School. The result was a sensation: endowment in 1926 of a research-oriented Graduate Library School (GLS) at the University of Chicago, offering only a Ph.D. degree. Several factors led the Carnegie Corporation to select the University of Chicago. In particular, Earnest D. Burton, the University's President at the time when negotiations began, was an experienced former librarian (Carroll, 1970, 53; Churchwell, 1975, 63). (Much has been written about the GLS, see, especially, Richardson, 1982; also Carroll, 1970; Churchwell, 1975; Houser & Schrader, 1978).

We shall examine the interests and orientation of the Chicago Graduate Library School on the basis of two examples of the work of the faculty: (i) Pierce Butler's *Introduction to Library Science* and (ii) a content analysis of the first twenty years of their journal, *The Library Quarterly*.

Pierce Butler's *Introduction to Library Science*

In 1933 there appeared *An Introduction to Library Science* by Pierce Butler, one of the faculty of the Graduate Library School. As Lester Asheim, himself Dean of the School 1952-1961, explained in the Foreword to the 1961 reprint, this book

> "...provided the first extended exposition of an approach to library education which was being introduced in the curriculum and research program of the new Graduate Library School at Chicago. Although it was not an official statement of the School's policy, nor even a statement to which all of its faculty would have given unqualified endorsement, it did much to help explain the program and win support for its major objectives." (Asheim, 1961, v).

Butler described it as a "tract for the time" which "should quickly become obsolete" (1933, p. xvi). But, unfortunately, others failed to write the works that would have superseded it, so his tract continued on as a long-lasting bestseller, translated and respected as a classic. Stielow (1994, 339) has stated that it was "the major library research text for the next 40 years". For the purposes of this paper we need to delve below the lively and provocative writing and consider the substance of what

Butler included and the substance of what he left out.

Chapter One is on The Nature of Science. Butler shares the confidence of his time and place that, just as education was believed to be becoming scientific, so also a scientific librarianship will emerge: "So it will be in librarianship. An organic body of scientific knowledge will be built up to account for the complex activities of this social agency." (p. xiii-xiv).

Butler did not have a scientific background, though he was interested in intellectual history. His doctoral dissertation was on views of Irenaeus, a 2nd century Christian writer, concerning the nature of Christ. His professional experience had been as an Episcopal deacon and at the Newberry Library, where his primary contribution was, in his biographer's words and emphasis, "acquiring *typographically* significant works" (Richardson, 1992, 73).

Butler emphasizes the distinction between modern thought, characterized as scientific, with pre-modern thought. His explicit description of the scientific method is narrowly Baconian: One starts with the collection of data, then seeks explanation, and finally evaluates the explanation (p. 14); yet, elsewhere (p. 3), he insists on the primacy of a hypothesis prior to data collection (p. 108). Other chapters examine sociological, psychological, historical, and practical aspects of library service.

What, then, is the substantive content of a library science in Butler's view? The components explicitly identified are: Statistical methodology, the psychology of reading, the history of the book, the history of the library as an institution, the history of knowledge, and bibliographic history. There is also some discussion of the principles of collection development.

What is strikingly absent from this list, as the basket of ingredients composing library science, are the design, the technology, the techniques, and the management skills needed, then as now, to provide effective and efficient library service. The nearest there is to discussion of technical innovation is the single, dubious statement, "Yet invention is only a backwash of science" (p. 7), a view not now shared by historians of technology. Of course, these elements would not ordinarily count, then or now, as "science". On the other hand, Butler, by including history and a concern for the social status of librarians, clearly is not adhering to a narrow definition of science.

Butler gives bibliographic history a special status as the librarian's "basic study". Now-a-days we might regard bibliographic access as the basic study, but it seems anachronistic to interpret Butler in this modern sense, given the way that cataloging and reference work were then viewed. Butler refers to a system "for recording in brief form some of the more essential characteristics of any book. The usefulness of the technical conventions involved is not to be questioned... But unfortunately very little consideration has been given to the principles which give them value" (p. 100). And he is quite dismissive: "Formal bibliography seems to bear the same relation to the history of books that chronology does to the history of any other social activity... Merely to enumerate books and describe them may be a mental activity, but it is not, in the ordinary sense of this term, intellectual.... The

bibliographic records of a library are only an inventory to its contents." (pp. 100-101). Alternatively, if Butler intended bibliographic history to have a narrower meaning, as historical bibliography, then, by implication, cataloging and classification are not part of Butler's library science.

Not only does Butler not mention Panizzi, Cutter, Dewey, Jewett, Bliss, or any other contributor to library science, but he writes as if no such contributions had ever been made. It is as if an introduction to economics made no mention of the names or contributions of Adam Smith, of Lord Keynes, or of any other economist, or any economic ideas derived from them. This makes ironic his often-quoted criticism of librarians as being "strangely uninterested in the theoretical aspects of his profession."

Despite the title, much of the text is neither about science nor scientific aspects of library service. His concern with the social status of librarians is hardly a scientific issue. His plea for a "philosophy" of librarianship is a plea for clarification of the social purpose of libraries. Also, the final exhortation belies the scientific nature of the enterprise: "Certainly none of these things will be possible until librarianship turns its attention from process to function. When it does this it will perceive its phenomena in terms of a library science." (pp. 114-115). Science, as it is normally understood, examines measurable phenomena and processes. Function, in the sense of social purpose, is in the province of managers, politicians, theologians, and other concerned with ethics and social priorities, but not of scientists. Further, simply because it is a tract the whole book is thoroughly unscientific in that it lacks a crucial ingredient of normative science (or any good scholarship): a good faith effort to adduce evidence that might refute the arguments being argued.

But to quibble with *An Introduction to Library Science* is not our real concern and, after all these years, might be considered unfair to Butler. The book *is* what it was clearly intended to be, a good piece of polemic. (That others may have believed that the book really *was* an "introduction to library *science*" is another matter). In any case, Richardson (1992), Butler's biographer, reports that Butler later recanted his views on library "science", coming to believe them to be scientism. (See also Terbille, 1992). Our purpose in commenting on *An Introduction to Library Science* is to demonstrate how limited a view of the scope of library science it represents in terms of content, how shallow the concern with science, and, in particular, how conspicuously absent was any evidence of interest in library technology or technological innovation.

Content analysis of *The Library Quarterly*

The faculty of the Graduate Library School established in 1931 a "journal of investigation and discussion", the *Library Quarterly*. It was to be a "strictly scientific journal" and its primary objective was "to serve as an outlet for the publications of the Graduate Library School and, in part, also for more extended studies emanating from other library schools". (See Richardson, 1982, 80-84). Until 1989 all editors and most members of the Editorial Board were members of the faculty of the School. For these reasons its contents invite analysis as reflecting the faculty's view of library science.

We use a classification of library science used in the *Library Quarterly*. It was devised by GLS faculty member Douglas Waples to characterize librarianship as reflected in the titles of graduate theses and dissertations accepted the library schools at Berkeley, Chicago, Columbia, Peabody, Illinois, Michigan, and Western Reserve (Waples 1933; 1934; 1936). The categories are reprinted in the leftmost column of Table 1. There is no category for technology, other than printing. The second column reprints Waples' data on the distribution of library science theses and dissertations, 1928-1935. (Waples, 1936, 77. See Appendix for additional details.)

WAPLES'S CATEGORIES	Theses		LQ		JDR	
	Number	%	Number	%	Number	%
I. Readers and reading:	[15]	6%	[34]	7%	[1]	1%
A. Fact about reading	2		9		0	
B. Actual reading of groups	6		16		0	
C. Social problems and trends	1		1		0	
D. Psychological problems	1		5		1	
E. Factors in reading selection	5		3		0	
II. Publications:	[84]	32%	[29]	6%	[15]	9%
A. Enumerative bibliography	24		13		13	
B. Descriptive bibliography	32		1		0	
C. Critical bibliography	2		0		0	
D. Printing	25		11		1	
E. Manuscripts	1		4		1	
III. Distribution of reading matter:	[157]	60%	[390]	83%	[45]	27%
A. Publishing and book production	4		17		13	
F. Libraries						
1. Organization and policy	3		33		3	
2. History	20		89		1	
3. Survey	10		31		2	
4. Legislation	3		3		0	
5. Finance	4		12		2	
6. Buildings	3		1		0	
7. Holdings	8		15		5	
8. Personnel and training	21		42		2	
9. Practice-general	3		11		3	
a) Book selection	15		23		5	
c) Cataloging and classification	29		61		2	
d) Reference	2		1		1	
e) Lending and circulation	4		7		0	
f) Interlibrary loans	3		2		1	
g) Educational activities	9		6		0	
h) Extension	7		2		0	
10. Efficiency measures	1		5		0	
a) Social influences	1		6		1	
b) Services to particular groups	6		17		4	
c) Co-operation with other agencies	1		6		0	
IV. Research-sources, data, and techniques	6	2%	15	3%	6	4%
CATEGORIES NOT PROVIDED BY WAPLES						
Technological innovations	--	--	--	--	[102]	60%
a) Survey					59	
b) Applications & Experiment					43	

Totals	262	468	169

Table 1. Content analysis by Ziming Liu, using D. Waples' categories, of selected library science literature: Theses, 1928-1935; *Library Quarterly*, 1931-1950; and the *Journal of Documentary Reproduction*, 1938-1942. See Appendix.

The third column shows the distribution of articles in the first twenty years of the *Library Quarterly*, 1931-1950, sorted into the same categories by Mr. Ziming Liu.

The fourth column shows the distribution of the articles published in the *Journal of Documentary Reproduction*, a technical journal published from 1938 to 1942 by the American Library Association. This journal could be considered somewhat analogous, for its time, to the present *Information Technology and Libraries*. Waples devised his scheme a few years before this material was published (and also before most of the *Library Quarterly* articles) and, to that extent, using his scheme could be considered inappropriate. Nevetheless, the numbers in the fourth column differ markedly from the other two and the subject matter of most of these articles has no place in this categorization scheme of library science. The second column shows how completely dissertation work avoided technological aspects of the field.

It would be difficult to argue convincingly that the faculty of the Graduate Library School could have been *unaware* that technical and technological innovation relevant to library service was an active interest elsewhere. Otlet and his colleagues at the International Institute for Documentation had been publishing tirelessly and repetitiously since 1895 and the American Documentation Institute was founded in 1937. The main manifestation of innovation in library technology in the second quarter of the century was the creation of photoduplication laboratories in progressive libraries, mainly concerned with microfilming texts. Among the best known was the photographic lab in the University Library at the University of Chicago itself under Llewellyn Raney. Raney and Herman Fussler, an early doctoral graduate and instuctor at the Graduate Library School, played an active role in the noteworthy Universal Congress on Documentation in Paris in 1937, at which Emanuel Goldberg, Paul Otlet, H.G. Wells, and other notables presented papers. From 1938 there was good technical journal dedicated to technological innovation, the *Journal of Documentary Reproduction*, and it was published in Chicago by the American Library Association. Fussler introduced a course on microfilm at the Graduate Library School in 1939. The conclusion is that the faculty of the School were not so much unaware as substantially uninterested in the technology and in technological innovation that so excited the documentalists.

The School was famous for being interdisciplinary, yet the faculty were less interdisciplinary than might be supposed. They were very interested in sociology, political science, and education. There was limited interest in what the humanities might contribute to library science (Richardson, 1982, 124). Louis Round Wilson, Dean 1932-1942, brought an interest in library administration. Science itself and, more importantly, engineering appear to have been largely absent. (In this the School reflected the absence of Engineering at the University of Chicago, which was then at the peak of a protracted effort to make social sciences scientific.) The rhetoric of "scientific method" and the assertion of being interdisciplinary masked the fact that their actual interests in library science were limited compared both with Dewey's time and with present-day library science. Houser and Schrader (1978) have criticized the School for not sustaining a scientific approach. We seek to make a different point by invoking the observation of Herbert Simon that:

> "Everyone designs who devises courses of action aimed at changing existing situations into desired ones... Design, so construed, is the core of all professional training; it is the principal mark that distinguishes the professions from the sciences." (Simon, 1981, 129).

The Graduate Library School, at least until around 1950, seems, with hindsight, to have been remarkably uninterested in technique, technology, or even design in relation to the improvement of library service. It would, perhaps, have been unreasonable to have expected a Graduate Library School located at the University of Chicago at that time to have been otherwise. This view was not prevalent outside of library science, witness the Committee on Aids to Scholarly Research. No criticism is intended here of the work that *was* done at the School. However, in the broader context and in relation to the three questions with which we began, it is germane to draw attention to what was *not* done, to the road not taken.

A DIFFERENT GLS?

It had not been foreordained that the Carnegie Corporation would fund a Graduate Library School at the University of Chicago. Harvard alumni on the Carnegie staff had suggested that the funding should go to Harvard. A number of other institutions had aspirations. There seems to have been some idea that more than one such School might be established.

Let us imagine, for the sake of discussion, that a Graduate Library School had been founded at, say, MIT instead of (or as well as) at Chicago. This might have seemed implausible at that time, given the way that libraries were viewed in the 1920s, but several of the earliest library schools had been established at technical institutes, notably Pratt, Drexel, Armour, Carnegie, and Simmons (Carroll, 1970, 7).

In contrast to the GLS at Chicago, there was, at that time (or, at least, a few years later), an interest in technological aspects of library service at the Massachusetts Institute of Technology. From the early 1930s Vannevar Bush, an MIT professor and academic administrator, tried hard to persuade foundations and corporations to fund the development of his "rapid selector" for information retrieval in libraries or elsewhere, using microfilm, photoelectric cells, and digital circuitry to achieve unimaginably speedy retrieval of texts. (For a thorough account see Burke, 1994). Bush's celebrated article, "As we may think", although published in 1945, was written in the late 1930s. Also in the late 1930s at MIT physicist Ralph D. Bennett was interested in storing library texts in microform on large glass plates (Bennett, 1940a, 1940b).

We can surmise rather safely that a GLS at MIT would have had less interest in some of the special interests of the GLS at Chicago, such as early printing, the geography of reading, and the role of public libraries. But the significant difference would surely have been a major emphasis on technique, on technological innovation, and on designing specialized library services for information needs in science, engineering, and industry. We could expect an interest in special libraries, which received little

attention at Chicago (Henkle, 1949), and also, as with the documentalists, an active concern with information problems in contexts outside as well as inside libraries.

How different the development of library science in the U.S.A. might have been if, instead of, or in addition to, the GLS at Chicago, the Carnegie Corporation had established a GLS that included a significant interest in design and in the technological innovations that engaged the European documentalists. We speculate that the faculty of such a school would have been very interested in the innovations of information technology of their time, just as the leading schools of library and information studies are now. A school that included faculty resembling Frits Donker Duyvis would have had an impact different from that of the Chicago GLS. We speculate further that the post-World War II "information scientists", instead of disdaining "library schools", might have been eager to be associated with a technically oriented MIT-based GLS. In addition, the very expensive but chronically ineffectual research and development efforts of engineers (e.g. Vannevar Bush's Rapid Selector (Burke, 1994) and Project INTREX (Burke, in this issue)) might have been productive had there not been an institutionalized and attitudinal separation between engineers and librarians. Contrast the dynamic collaboration between engineers and the insurance industry in devising enhanced information systems before the Second World War (Yates, 1993).

It might be argued that it would have been inconceivable at the time to have endowed a GLS at MIT, but that argument cuts both ways. A proposal for a Ph.D. in Library Science at the University of California, Berkeley, a comprehensive Land-Grant university with several professional schools, was rejected repeatedly and was not approved until 1954 (Carroll, 1970, 210-212). Before the event, it must also have seemed at least somewhat inconceivable for the University of Chicago to have established a Ph.D.-only Library School.

We have used MIT as a hypothetical GLS site for rhetorical purposes. It is not necessary for our discussion to insist that MIT would in fact have been suitable or willing. Indeed, the flawed record and disdainful attitudes of Vannevar Bush and of the later INTREX Project suggest otherwise. Rather, we suggest that what would have made a difference, then as now, would have been at least one GLS in which technically oriented faculty were strongly represented in an environment in which those with social science, humanistic, and technical interests would co-exist and collaborate, in which a Donkers Duyvis would have felt at home.

The direction that the GLS at Chicago took is understandable. Carroll (1970) describes a general desire to move away from the existing "technical" (meaning procedural) training toward something more "scientific" (meaning scholarly and, preferably, quantitative). Others, such as the respected William S. Learned, of the Carnegie Corporation, who was considered a possible Dean for the new School, had a narrow view. For librarians, he advocated a bookish mind, "able effectively to recognise and minister to the needs of individual groups in the use of books. Library technique is a necessary but minor part of the equipment." (Quoted in Churchwell, 1975, 96). The initial GLS faculty had little familiarity with librarianship and much of it, before Louis Round Wilson became Dean, had to

do with exotica such as early printing and Arabic manuscripts. Further, the University of Chicago was at that time a center for the drive to make social sciences scientific through quantative methods. Placing the GLS at the University of Chicago ensured that it too would have this flavor and direction.

Compare the volumes of the *Library Quarterly* for, say, 1935 to 1939, with the proceedings of the congresses of the International Federation for Documentation for the same years. There is a contrast in interests. There were, in effect, two, recognizably different "schools", as commonly develops in academic areas.

To observe that the interests of the faculty of the GLS at Chicago were circumscribed is not to criticize anything they did, least of all to question the enormous and prolonged influence of that School. It had been generously funded with the explicit expectation that it would have a major impact analogous to the Harvard Law School or the Johns Hopkins Medical School. However, their situation was two-edged: what they did not do also had an enormous and prolonged influence.

INFORMATION SCIENCE VERSUS LIBRARY SCIENCE

In the 1950s a change became apparent in US library science literature. (See, for example, Shera, 1957). To attempt to reconstruct, to analyze, and to interpret the post World War II arguments over "information science versus library science" would be an unenviable task beyond the scope of this paper. There were, surely, a number of different factors at work. The effort to win the War and, then, to sustain national interests during the Cold War, generated a new environment with new technology, government-funded "Big Science", and new visions of fortunes to be made.

A major element was the presence of technologically-minded individuals from outside librarianship who were seeking to marshal new technology to solve old problems. This might not have been contentious if, at that time, library science had been well-populated with technologically sophisticated individuals with a store of credible experience and expertise in the problems of and opportunities for technology in library service, documentation, and the management of specialized information. However, the dominant thrust in library science in the U.S.A., led by the influential Chicago GLS, had been away from just these aspects.

The "information science versus library science" wrangling could be viewed as a another change of paradigm, in large measure a change back towards the earlier positions of the European documentalists and, beyond them, to Dewey, Cutter, and the technical and technological innovations of the late nineteenth century. To the extent that this interpretation is correct, the rather circumscribed social science emphases of the Chicago GLS, however desirable, would sooner or later have been diluted or counterbalanced.

Two junior GLS faculty members, Margaret E. Egan and Jesse H. Shera, stated the issue in clear terms. Egan (1953, iii) wrote:

> The attention of librarians during the past few decades has been focussed upon the "revolution" in mass communication and its probable effects upon library service to the general reader. Few have noticed the revolution, similar in magnitude and with perhaps far more serious implications for the library services and organization, which has been quietly taking place in another field--the field which we have here termed "Communication of Specialized Information".

Shera criticized the lack of attention to the technical aspects of library work and "the rapidly accumulating specialized techniques being developed by the documentalists and information specialists". He denounced the GLS itself: "In this revulsion against the technical skills the Graduate Library School must bear a major share of responsibility." (Shera, 1953, 127).

A slow change to "library and information science" ensued in U.S. library schools. Carroll (1970, 22) wrote: "The need to integrate the new studies of information science and documentation into the basic core curriculum has been a continuing challenge to the library schools since the early sixties". What was being introduced "since the early sixties" was, more or less, an updated version of the kind of material that had been present in the FID congresses in the 1930s. The "information science versus library science" wrangling can be seen, at least in part, as the return of library science from the particular direction in which it had been taken in the first two decades of the Chicago GLS.

Unfortunately the change, when it came, was contentious. The tone of the arguments suggests that there was more at issue than the use of technology. The technology of library service had been very stable for half a century. Librarians had experienced growth rather than change. When means stay stable the distinction between means and ends tends to become blurred, with the consequence that any new means may appear to be a threat to accepted ends rather than a welcome additional means. As the sociologist Howard Becker has described, established professional conventions acquire for their adherents an aesthetic of beauty, utility, and effectiveness. So to challenge even the technical conventions of a profession is also likely to be, or to be perceived as, an attack on its mores and its social standing (Becker, 1982, chap 10). Information scientists were perceived by many librarians to constitute this kind of threat until the late 1970s when the "information science versus library science" debate had largely dissipated in places where there was a constructive emphasis on theory, design, and service.

OTHER POSSIBILITIES

We have assumed that more attention could, indeed should, have been paid within library science to technical and technological issues in the period between the two World Wars. This assumption can be questioned. It is difficult to know which technological innovations, if any, would have been have more cost-effective in libraries during this period than actual practice was. Especially during the Depression, funds were short and technological innovation not necessarily a priority.

Another possibility is that the apparent absence of interest in documentation in the U.S.A. was,

at least in part, a matter of semantics. The observations of the French documentalist and librarian Suzanne Briet following a tour of the U.S.A. are of interest here. Briet (1953; 1954) concluded that although the term "documentation" was scarcely known in the U.S.A., its techniques were ably practiced in the form of reference service and special library service both within and separate from large general libraries. Her explanation was that, because these practices had developed earlier within librarianship in the U.S.A. than in Europe, there had not been a need, as in Europe, for the separate term "documentation center". This is a plausible explanation, but it raises other questions, not least about the special librarians and their relationship with and interest in the European documentalists.

CONCLUSIONS

We have examined three different questions concerning library science in the U.S.A. during the 20th century. Why were technical and technological experimentation and innovation, notably but not only by the European documentalists, substantially ignored in library science until after the Second World War? What would explain the intense but generally unsatisfactory controversy involving "information science versus library science" after the Second War World? Why was technical and technological innovation a vital force in librarianship in the late nineteenth century and in late twentieth century, but not, it seems, inbetween?

Our analysis is tentative and raises further questions. However, our conclusion is that these three issues are closely related. One reason design and technology were of limited interest within library science in the U.S.A. in the second quarter of this century is that the most influential academic group was engaged in a vigorous, well-funded drive to develop a new school of thought with a new and different emphasis. By the 1930s the GLS in Chicago and the European documentalists represented different schools of thought with different interests. Such differences are to be expected in any field that is alive.

The period after the Second World War was tension-filled, we suggest, because the dominant non-technological, social science oriented paradigm in U.S. library science, what we might call "the school of Chicago", was challenged, rivalled, and changed by the return, in part from outside of library science, of a serious interest in design and technology. The matters that had interested the European documentalists emerged as a powerful force in U.S. library science twenty years later than in Europe. There were by now new and more powerful machines. There was, after a few years, a new name: "information science". The individuals leading the change commonly come from outside of librarianship and there was little association with war-devasted Europe. The European documentalists of the 1930s, who had written mainly in French and German, were largely forgotten.

We suggest that the temporary de-emphasis of design and technology contributed to a prolonged failure of identity and direction in the academic departments of library and information studies. What can be the purpose of a university-based professional school if research is not centered on the design of improved services? The absence of this central concern leads to a lack of purpose

beyond sustaining a continuity of training in procedures, a preoccupation with "professionalism", and little convincing basis for a research agenda. Absent a central concern with design and technique, a coherent vision for research and for university-based professional education is also absent.

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APPENDIX: Content analysis of selected library science literature, 1931-1950, by Ziming Liu.

The classification and data on theses and dissertations are taken from Waples (1936, 77). The sources in the other columns were the articles and bibliographies published in the *Library Quarterly* volumes 1-20 (1931-1950) and in all issues of the *Journal of Documentary Reproduction* which was published from 1938 to 1942. Additional categories had to be provided to accommodate the latter.

Each article or bibliography was assigned to a single category according to its primary content. The assignment of some articles was debatable. However, even if some had been differently assigned the overall pattern of a substantial difference between the contents of the papers and bibliographies in the *Journal of Documentary Reproduction* (column 4) and Waples' categories and the other two sets of data (columns 1, 2, and 3) would were remained.