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On the Cultural and Intellectual Context of European Documentation in the Early Twentieth Century.

Michael Buckland

Abstract

The late nineteenth century and early twentieth century was a renaissance period of prodigious innovation in Europe across the spectrum of arts, sciences, technology, and social sciences, including major innovations in information and communications technologies. Studies in psychology and in the physiology of perception undermined the separation of body and mind that had dominated science since Descartes. A convergence of art, psychology, and engineering emerged, notably in industrial design and graphics. The principle emerged that form should follow function by being ergonomically and aesthetically, as well as mechanically, suitable. Standardization, collaboration, efficiency, and scientific management ("Taylorism") were central to documentation and manifest in standards (e.g. for paper sizes and office equipment), controlled documentary languages, and well-intentioned idealism. Industrial concentration, corporate research laboratories, increased social control, and more active governmental initiatives provided an environment for documentation and for the rise of totalitarian political regimes.

Introduction

Our concern is with the European documentation movement and, for me, that means primarily the 1890s through the 1930s, more or less, but extending earlier or later when that seems helpful. It requires an effort to understand the social and intellectual context of the empires of the Tsar, the Kaiser, and of Queen Victoria, the First World War, the Weimar Republic, the Great Depression, the assumption of power by the Nazis in Germany, and the different conditions and developments in other countries. These contexts are now outside our direct experience and, in David Lowenthal's phrase, "the past is a foreign country."

Understanding the context is important not only for understanding the life and work of the documentalists, but, also, writing for a modern audience about distant worlds requires explanation and interpretation. In the expectation that most of the papers presented at this conference would be quite specialized, concerned with individuals, particular projects, and specific themes, a survey of the broader context could be useful in setting the scene and providing some perspective, as well as interesting in its own right.

Historians routinely describe their period of interest as being a period of change.

This period was very much a period of change and of considerable complexity. There is a large literature on "Modernism" and "Modernity" and only selected components can be outlined here. Any perspective and any interpretation will be incomplete and partial. This introduction to the cultural and intellectual context of European Documentation in the early twentieth century seeks to characterize the features that seem both significant and relevant to the chapters that follow. Our choices have been shaped by an interest in the work of Paul Otlet (1868-1944) in Belgium, of Emanuel Goldberg (1881-1970) in Germany, and of Suzanne Briet (1894-1989) in France. We note two fundamental features of the intellectual environment in this period, describe some characteristics of the spirit of the times, review some specific interests of documentalists, and add two concluding comments.

Two Fundamental Features

A Renaissance Period

A good starting point is that the late nineteenth century and early twentieth century was a renaissance period of prodigious innovation in Europe across the spectrum of arts, sciences, technology, and social sciences.

A Machinic Zeitgeist

What spirit distinguished *this* renaissance from other renaissances was an ideological emphasis on efficiency, on improved design, on engineering, on standards, systems, and performance. It was the period of Taylorism and of scientific management. This spirit can be referred to as "Technological Modernism" to distinguish it from other aspects of Modernity. In brief, the belief was that technology plus standards plus systems would induce progress. Progress toward liberal ideals for some; progress towards competitive advantage for others.

The accounts of documentation by its leaders, notably the Belgian Paul Otlet (1934) and the French librarian Suzanne Briet (1951; 2006) can be read as a modernist tracts with imagery redolent of organized mechanical processes harnessing information for social progress (Day 2001).

Manifestations

Some more specific manifestations of the times can be identified.

Science and art combined; Mind and Body Reconnected

In this renaissance period, not only did individual fields develop, but also new relationships emerged. In at least some avant-garde circles the past and future separation between science and artistic culture was eclipsed by a sense that these two should be one. Clarke & Henderson (2002) provides some remarkable examples. The artist and architect Le Corbusier later declared, "Tapestries, drawings, paintings, sculptures, books, houses, town plans, as far as I am personally concerned, are only one and the same manifestation on the creative harmony at the heart of a new society where the machine is king." (Le Corbusier 1960).

The separation of body and mind that had characterized modern science from Descartes broke down. Studies of physiological perception, notably of vision, indicated an

unbroken trail from a physical light source through the eyes and the nerves into the brain and its thoughts. (Toulmin (1992) provides a clear explanation.)

Industrial Design

Nineteenth century European art and architecture were largely dominated by historicism, the use of styles copied or derived from the past, especially Greek and Roman styles. This can be seen in romantic and historical paintings and much of the monumental civic architecture of museums, courthouses, and other government buildings. But dramatic new developments in science and technology at the end of the century were matched by comparably dramatic developments in the arts. The Impressionists, in particular, initiated a series of fresh movements in painting.

In Britain, the arts and crafts movement led by William Morris was a turning away from industrial practices and, instead, celebrated personal craftsmanship and medieval themes. The Arts and Crafts Movement was followed, internationally, by Art Nouveau which flourished from 1890 to 1910. German Art Nouveau is generally referred to as Jugendstil. The arts and crafts movement came later in Germany than in Britain, and it differed in lacking both its medieval affectation and its hostility towards industry. Instead of reacting against industry, the goal was to combine artistic sensibilities with the needs of industry in elegant designs that were functional. This new style emphasized graceful flowing lines, often featuring plants and female forms. It had several sources, including Japanese art and psychoanalysis. Viennese Jugendstil was significantly inspired by Freud's discovery of the unconscious. The flowing forms were supposed to express erotic underpinnings (Meggs 1983).

Art Nouveau influenced all of the design arts: architecture, furniture, product design, fashion, and graphics. It affected all aspects of the man-made environment: posters, packages, and advertisements; teapots, dishes, and spoons; chairs, doorframes, and staircases; factories, subway entrances, and houses. Art Nouveau was pivotal. It constituted the transition from nineteenth century historicism to twentieth century modernism. In addition to its characteristic flowing elegance in style, Art Nouveau also constituted a fundamental change in design philosophy. It moved away from mere decoration to a new design principle: the pursuit of unity in decoration, structure, and intended function. Form should follow function. Efficiency and effectiveness were sought, as well as elegance. This trend blended nicely in ergonomic design and what we would now call "human factors." A notable development was in 1907 when AEG, the German General Electric Company (*Allgemeine Elektrizitäts-Gesellschaft*) in Berlin, hired an expert in design arts, Peter Behrens, to take charge of all areas of AEG's visual image: architecture, graphics, and industrial design. Behrens thus came to be considered the first known industrial designer.

Also in 1907, Peter Behrens, Hermann Muthesius, and others founded the influential Deutscher Werkbund in Munich. Vigorously concerned with elevating standards of design and of public taste, the Werkbund was an association which attracted architects, artists, industrialists, public officials, educators, and critics to its ranks. Recognizing the need for standardization and the value of machines, simplicity and exactness were welcomed. The Werkbund sought to forge a unity of artists and designers with industry in order to elevate the functional and aesthetic qualities of mass production,

particularly of low-cost consumer products (Aynsley 2000; Heskett 1986). The Bauhaus, famous for pioneering functional architecture and practical products based on creative design and modern technology and industry, built on an existing trend.

Information and communication technologies are transformed
The 1890s through the 1930s 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. 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. Radio developed steadily after 1900. Television made rapid progress from the late 1920s. Telephone service was extended. The technologies of movie sound tracks, wire sound 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 were developed. The highly versatile photoelectric cell was finding practical use in an amazing diversity of applications (Yates 1943). This was unquestionably a dynamic period (Hall & Preston 1988; Lubar 1993).

High capitalism and industrial consolidation
This period was characterized by the rise of very large and powerful firms: in Germany, for example, AEG, Bosch, Siemens, and Zeiss, and similarly in other countries. Enterprises were less regulated then than now. In Europe companies could grow and form cartels. Manufacturing industries, such as automobiles and photographic equipment, saw very rapid concentration from numerous very small workshops into a few very large firms benefiting from consolidation, capital investment, rationalization, and economies of scale.

Powerful state systems
It was not only a period of high capitalism, but also of high nationalism, high imperialism, and high socialism, reflected in a surge of reinvigorated or invented "traditions" (Bowker 2005, 28-29), in the consolidation of colonial empires, and in the rise of the communist socialist state in the Soviet Union, the national socialist state in Germany, and fascist regimes in Italy, Spain, and elsewhere. Consequences included two terrible world wars. In all of these "high" regimes, a strong sense of loyalty was induced to King and Country, to the Revolution, to the Führer, to Il Duce, or to whoever or whatever personified the state.

The system, the state, had strong claims on the individual and, increasingly, the will and the tools to enforce control. Before the First World War passports were not required in Europe. In 1941 the journal *Dokumentation und Arbeitstechnik* demonstrated the feasibility of a desktop archive containing a dossier on every inhabitant of Germany (Frieser 1941).

Government and Industrial Research Laboratories
The combination of strong governments, advances in applied science and in engineering, large firms, and military technological innovation provided the basis for the rise of major

laboratories for applied research and organized science. The Kodak Research Laboratory in Rochester, New York, and the network of industrial research organizations sponsored by the British Department of Scientific and Industrial Research are good examples.

Concerns Of Documentalists

Some issues were is special interest to documentalists.

Reprographics and Technology for Documentation.

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 even 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 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 document technology. Paul Otlet (1868-1944) proposed the use of standardized microfiche in 1906. He saw microforms not as a replacement for the book, but rather as an evolution 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 (1934 and 1990) and Rayward (1976)). In 1925 Emanuel Goldberg 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 (Goldberg 1925; Stevens 1968; White 1994; Buckland 2006).

Recognition of the intellectually constraining structure of the printed codex, compared with what we should now call hypertext, was recognized, especially by Wilhelm Ostwald, Paul Otlet, and their collaborators. Their idea was that texts could be decomposed into factual statements which could then be (re)arranged and (re)combined to express new ideas as well as old—just as moveable type could be rearranged to form different words. They called this early version of hypertext "the monographic principle" and it provided a basis for a continuously revised encyclopedia that would constitute a "world brain," a phrase used by Ostwald (1912) and popularized by Otlet and H.G. Wells.

They were, of course, greatly hindered by having to use precomputer technology to handle links and nodes. Nevertheless Otlet and his colleagues provided an information service from elaborate paper-based systems early in the century (Rayward 1994).

Standards

The leaders in documentation were deeply engaged in the development of standards.

Paul Otlet and his partner Henri LaFontaine understood the importance of

standards, both for efficiency and also for the interoperability that was a precondition for effective collaboration. They were influential in promoting use of the existing U.S. standard for catalog cards and adoption of the Universal Decimal Classification.

Wilhelm Ostwald, who had a lively interest in the organization of science and of science literature, was inspired by Otlet's dreams and schemes to use his Nobel prize money to found an institution, named Die Brücke (the Bridge), dedicated to solving the problems in the organization of information for universal access. The present international system of standardized paper sizes (A4, etc.) is based on Ostwald's World Format. In the spirit of interoperability the Bridge's main manifesto, on the organization of intellectual work, was published in Esperanto, "everybody's second language" (Bührer & Saager 1911).

Suzanne Briet was significantly engaged in the coordination of standards development in France and, especially, the development of cataloging rules, an effort for which her Salle de Catalogues at the Bibliothèque Nationale provided the secretariat (Birlé 1947).

Emanuel Goldberg chaired the German national standards committee for photographic technology, designed, with Robert Luther, the first national standard for film speeds, and helped define an early standard for television images (Buckland 2006).

Otto Frank epitomizes the close relationship between documentation and standards. He was a founder and longtime executive director the German Documentation Society and published an excellent series of manuals on Documentation under the collective title *Handbuch der Klassifikation* (Frank 1947-60). He was a manager at the German Standards Institute and his doctoral dissertation was on the use of the Universal Decimal Classification for organizing standards (Gering 2004).

Frits Donker Duyvis, who succeeded Paul Otlet as the central figure in the International Federation for Documentation, went one step further. A chemical engineer turned patent official, Donker Duyvis was 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.

Classification and the control of language

The practical, rational organization for rapid cost-effective access to documents in collections had been pioneered by Martin Schrettinger (1808; Buckland 2005) and forcefully advanced by Melvil Dewey (Wiegand 1996).

Language, however, was a fundamental challenge. Not only were documents dominated by texts, but language was needed to "document" their contents and, especially, to describe what they were about. Natural languages are multiple, unstable, and often ambiguous—an affront to the documentalists who believed in order, standards, and control. Their response was to create more orderly artificial languages. One move, "vocabulary control," was to adopt a restricted vocabulary for subject headings with well-defined and differentiated meanings and clear relationships between different terms; a second move was to replace words with an artificial notation, as found in classification schemes, such as Dewey's Decimal Classification. An artificial notation, using numerals, letters, and other symbols had several advantages. It provided a neutral-seeming alternative to the multiplicity of natural languages and the notation could be adjusted to achieve a systematic arrangement independent of the vagaries of the filing order of any given natural language. Also, multiple indexes and multiple languages could be created to lead from any term in any language to the correct classification number, as exemplified by the "Relativ Index" to the Decimal Classification which Dewey regarded as at least as important as the classification itself. Finally, an artificial language allowed the application of an artificial grammar to express syntactical relationships, differentiating, for example, "Man bites dog" from "Dog bites man,"

Melvil Dewey was an ardent advocate of efficiency, spelling reform, standards, and simplification. The modular construction of his Decimal Classification, with standard tables of numeric suffixes for composing representations of complex topics was enthusiastically adopted by Otlet and LaFontaine who, from 1895, developed it further into a more powerful system, the Universal Decimal Classification (UDC). The UDC provided for Boolean AND searching and an elaborate grammar for expressing syntactic relationaships between concepts.

The modular, mechanical construction of the UDC can be seen in the following example[1]:

005.912 Office management. Office services
005.912+657 Office management AND Accountancy
005.912:657 Relation between Accountancy and Office management
005.912/.915 Office management, registries and financial management
005.912=112.2 Office management (written in German)
005.912(075) Primer on Office management
005.912(410) Office management in the U.K.
005.912"1945/..." Office management since World War II
005.912:338.312 Office management and productivity
005.912ICI Office management at ICI [company]

[1] I thank Dr Gerhard Riesthuis of Utrecht for his help with this example.

005.912:001.895 Research on office management

These provide the components for more complex combinations, e.g.

005.912=112.2(075)(410) German language primer on office management in the U.K.

The UDC advanced library classification theory and practice beyond the Dewey Decimal Classification towards the principles of the facetted classification that were developed further by Henry Evelyn Bliss and S. R. Ranganathan and indexing languages emphasizing syntactical relationships in the work of J.C. Gardin, Robert Pagès, and others.

Searching

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). By 1931 Emanuel Goldberg had designed and demonstrated a desktop search engine using pattern recognition to search the indexing assigned to documents stored on microfilm and this was the technology taken up by Vannevar Bush whose speculations on what could be done with it were later to become influential (Buckland 2006).

An expansive view of documentation

An expansive and integrative view of bibliography and documentation, through standards and the pursuit of efficiency, managing information resources in any applicable context was present and visible in Paul Otlet's life work and his *Traité de documentation* (1934). That he went well beyond bibliography and library needs is illustrated by his specifications for a mechanized scholar’s workstation and his involvement in the modernizing of local government record-keeping techniques (“administrative documentation”).

The “machinic” interests of the European documentalists and their concern with applications of documentation outside of libraries can also be seen in Melvil Dewey's interests in scientific management 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 that came to permeate the office landscape appear to have been a transfer from library technology (Yates 1989, 56-57; Flanzraich 1993; Krajewski 2002).

Practical and utopian

There was a moral tone, a deeply-held belief in progress and strong strain of social idealism. Partly this was the lingering effect of Enlightenment ideals; partly this derived from a spill-over of Darwinism into social agendas; and partly this was a natural consequence of economic growth and technological development.

Taylorism was compellingly attractive to a wide range of well-intentioned European professionals who saw in it a means to a better society. Increased efficiency could generate additional wealth. This was desirable not only economically, but also politically because it meant that industrial and economic relationships could evolve away from conflict in a zero-sum game into a collaborative partnership for generating additional shared wealth. Further, the very methods of Taylorism provided a procedural path away from rigid class structures inherited from the past towards a social order based on merit and achievement. Taylorism was a means of breaking with prewar society, a key to a social renewal. Taylorism, therefore, had an attractive moral quality, at least until this optimistic view was undermined by the Great Depression and the rise of fascist states (Maier 1970; McLeod 1985).

Paul Otlet and his partner, Henri LaFontaine, were political idealists, believing strongly in international peace, women's rights, and progress through collaboration. LaFontaine was a successful politician, a Senator in the Belgian parliament, but Otlet himself was not a practical politician. Goldberg was also a practical man, with social ideals, but with no taste for practical politics. So also, reportedly, were Walter Gropius and Le Corbusier, who "believed he could implement a new [social] order simply through the practice of his craft" (McLeod 1985, 426). Such idealism could grow naturally out of the economic and technological progress and long peaceful period from 1815 to 1914, but was contradicted by the rise of fascist states (Day 2001).

Afterword

Although there was a strong and direct American influence in Europe of Taylorism and Dewey's "Library Economy," the professional and organizational development in continental Europe emerged differently. In Europe, although individual librarians, such as Suzanne Briet and Walter Schürmeyer, were involved, documentation was less closely associated with librarianship than in the USA, where the professionalization of librarianship, well-developed schools of librarianship, and a strong Special Libraries Association had developed earlier than in Europe. The *terms* "documentalist" and "documentation center" were not in use in the U.S.A., but the *roles* of documentalist and of documentation center were occupied early on by special librarians and special libraries, even though no courses on documentation or even special library work were offered by U.S. library schools until after the Second World War. Briet had the insight to recognize that this was more a difference in name and appearance than in substance (Briet 1953; 1954; Buckland 1996; Williams 1997)

The spirit of the early twentieth century documentalists is reflected in their concern with the "technology of intellectual work." This phrase, used in French and German (*Technik der geistigen Arbeit* (Frank 1954)), does not have a good equivalent in English and "technology" needs to be seen as including "technique." They were convinced of the importance of the social, economic, and political benefits of making recorded knowledge widely available. The rising flood of documents constituted a grand challenge requiring the development of new and different methods. Efficiency, standards, new technology, and cooperation promised exciting and expansive possibilities. These beliefs resonate closely

with present-day efforts to develop "knowledge management," "ontologies," and the "semantic web," but although the problems are broadly the same now as then, we would fail to understand the documentalists or their achievements unless we remember that their intellectual and cultural environment, as well as their technology, was different from ours.

References

Aynsley, Jeremy. (2000). *Graphic Design in Germany 1890-1945* (Berkeley: University of California Press).

Birlé, J. (1947). 'Quelques aspects de la normalisation française dans le domaine de la documentation', in F.I.D. Conference, Berne, 1947. *Rapports*. (The Hague: F.I.D.) v. 1, 103-107.

Bowker, Geoffrey C. (2005). *Memory Practices in the Sciences* (Cambridge, MA: MIT Press).

Briet, Suzanne. (1951). *Qu'est-ce que la documentation?* (Paris: Editions documentaires industrielles et techniques).

Briet, Suzanne. (1953). 'Bibliothèques et centres de documentation techniques aux Etats-Unis', *ABCD Archives Bibliothèques Collections Documentation* 11, 299-308.

Briet, Suzanne. (1954). 'La formation professionelle des bibliothécaires aux Etats-Unis', *ABCD Archives Bibliothèques Collections Documentation* 13, 337-340.

Briet, Suzanne. (2006). *What is Documentation? English Translation of the Classic French Text*. Translated and edited by R. E. Day and L. Martinet. (Lanham, MD: Scarecrow Press).

Buckland, Michael K. (1996). 'Documentation, Information Science, and Library Science in the U.S.A.' *Information Processing & Management* 32:1, 63-76. Reprinted in Hahn, T. B. and Buckland, M. (eds.). (1998). *Historical Studies in Information Science*. (Medford, NJ: Information Today) 159-172. Also at <http://www.ischool.berkeley.edu/~buckland/20THCENT.pdf> accessed 9 October 2006.

Buckland, Michael K. (2005). 'Information schools: A Monk, Library Science, and the Information Age', *Bibliothekswissenschaft – quo vadis? = Library Science – Quo vadis?*, ed. by Petra Hauke (Munich: K. G. Saur), 19-32. <http://www.sims.berkeley.edu/~buckland/huminfo.pdf> accessed 9 October 2006.

Buckland, Michael K. (2006). *Emanuel Goldberg and his Knowledge Machine* (Westport, CT: Libraries Unlimited).

Buder, Marianne. (1967). *Das Verhältnis von Dokumentation und Normung von 1927 bis 1945 in nationaler und internationaler Hinsicht*. (Berlin: Beuth). DIN Normungskunde 7.

Bührer, Karl Wilhelm and Saager, Adolf. (1911). *La Organizado de la intelekta laboro per La Ponto* (Ansbach: Fr. Seybold).

Casey, R.S. and Perry, J.W., eds. (1951). *Punched Cards: Their Applications to Science and Industry*. (New York: Reinhold). Also 2nd ed. by R. S. Casey, J. W. Perry and M. M. Berry, 1958.

Clarke, Bruce & Henderson, Linda D. (eds.). (2002). *From Energy to Information: Representation in Science and Technology, Art, and Literature*. (Stanford

University Press).
Day, Ronald E. (2001). *The Modern Invention of Information: Discourse, Invention, and Power* (Carbondale, IL: Southern Illinois Press).
Donker Duyvis, F. (1931). '4th Report of the Commission internationale de la Classification Décimale', *Documentatio Universalis* 1/2, 46-54.
Flanzraich, G. (1993). 'The Library Bureau and Office Technology, *Libraries & Culture* 28, 403-429.
Frank, Otto. (1947-60). *Handbuch der Klassifikation* (Berlin: Beuth). 12 v.
Frank, Otto. (1954). *Ratschläge für schriftliche Arbeiten, Vorträge und Veröffentlichungen*. (Stuttgart: Dorotheen-Verlag). Handbuch der Klassification, 9.
Frieser, Hellmut. (1941). Mikrate für Dokumentation. *Dokumentation und Arbeitstechnik* (Nov 1941), 1-2. Also in *Zeitschrift für angewandte Photographie* Jg 39:4 (1941), 57-79.
Gering, Eberhardt. (2004). *Die Gründer der Deutschen Gesellschaft für Dokumentation: Ein Beitrag zur Gründungsgeschichte der DGD*. <http://homepages.uni-tuebingen.de/gerd.simon/gering.pdf> accessed 11 October 2006.
Goldberg, Emanuel. (1925). A New Process of Micro-photography, *British Journal of Photography* 73:3458 (August 13, 1926), 462-465.
Hall, P., & Preston, P. (1988). *The Carrier Wave: New Information Technology and the Geography of Innovation, 1846-2003* (London: Unwin Hyman).
Heskett, John. (1986). *German Design 1870-1918*. (New York: Taplinger).
Krajewski, Markus. (2002). *Zettelwirtschaft: Die Geburt der Kartei aus dem Geiste der Bibliothek.* (Berlin: Kulturverlag Kadmos). Copyrights, 4.
Le Corbusier. (1960). 'Tapisseries Muralnomad', *Zodiac* 7, 56-65. Translation by Musée Rath, Geneva, 2006.
Lubar, Steven. (1993). *InfoCulture: The Smithsonian Book of Information Age Inventions* (Boston, MA: Houghton Mifflin).
Maier, Charles S. (1970). `Between Taylorism and Technocracy: European Ideologies and the Visionof Industrial Productivity in the 1920s', *Journal of Contemporary History* 5:2, 27-61.
McLeod, Mary Caroline. (1985). *Urbanism and Utopia: Le Corbusier from Regional Syndicalism to Vichy.* Ph.D dissertation, Princeton University.
Meggs, Phillip B. (1983). *A History of Graphic Design* (New York: Van Nostrand Reinhold).
Ostwald, Wilhelm. (1912). 'Das Gehirn der Welt', *Nord & Süd* 36:1, 63-66. Excerpts at <http://www.heise.de/tp/r4/artikel/2/2481/s12.html> accessed 5 Oct 2006.
Otlet, Paul. (1934). *Traité de documentation*. Brussels: Editiones Mundaneum. Repr. 1989: Liège:Centere de Lecture Publique de la Communauté Française.
Otlet, Paul. (1990). *International Organization and Dissemination of Knowledge: Selected Essays*, translated and edited by W.B. Rayward. Amsterdam: Elsevier.
Rayward, W. Boyd. (1976). *The Universe of Information: The Work of Paul Otlet for Documentation and International Organization*. (FID Publ. 520). Moscow: VINITI. Also at <https://archive.ugent.be/handle/1854/3989> accessed 9 October 2006.

Rayward, W. Boyd. (1994). 'Visions of Xanadu: Paul Otlet (1866-1944) and hypertext', *Journal of the American Society for Information Science* 45:4, 235-250.

Schrettinger, Martin. (1808-10). *Versuch eines vollständigen Lehrbuchs der Bibliothek-Wissenschaft* (Munich: Author).

Stevens, G. W. W. (1968). *Microphotography: Photography and Photofabrication at Extreme Resolution*, 2nd Edition. (New York: Wiley).

Toulmin, Stephen. (1990). *Cosmopolis: The Hidden Agenda of Modernity* (New York: Free Press).

Voorhoeve, N. A. J. (1964). 'F. Donker Duyvis and standardization', in *F. Donker Duyvis: His life and work* (The Hague: Netherlands Institute for Documentation and Filing), 39-50.

White, William. (1992). *The Microdot: History and Application* (Williamstown, NJ: Phillips Publications).

Wiegand, Wayne A. (1996). *Irrepressible Reformer: A Biography of Melvil Dewey* (Chicago: American Library Association).

Williams, Robert V. (1997). 'The documentation and special libraries movements in the United States, 1910-1960', *Journal of the American Society for Information Science* 48:9, 373-379. Reprinted in Hahn, T. B. & Buckland, M. (eds.) (1998). *Historical Studies in Information Science* (Medford, NJ: Information Today), 173-179.

Yates, JoAnne. (1989). *Control Through Communication: The Rise of System in American Management* (Baltimore: Johns Hopkins University Press).

Yates, R. F. (1943). *The Working Electron: An Introduction to Electronics* (New York: Harper).

Zuuren, P van. (1964). `Donker Duyvis and the NIVE', in *F. Donker Duyvis: His Life and Work*. (The Hague: Netherlands Institute for Documentation and Filing) 51-64.