

From the World Brain to the First Transatlantic Information Dialogue: activities in information and documentation in Germany in the first half of the 20th Century

Thomas Hapke



Thomas Hapke is Subject Librarian for Chemical Engineering at the University Library of the Technical University Hamburg-Harburg and also deputy librarian responsible for the customer services of the library. He concentrates on chemical information, digital libraries, mediating information literacy, and the history of scholarly information and communication. He may be contacted at: University Library, Technical University Hamburg-Harburg, 21071 Hamburg, Germany. E-mail: hapke@tu-harburg.de. Website: www.tu-harburg.de/b/hapke/.

It is not enough to found libraries. It is necessary, by means of lectures and bibliographic lists, to instruct those eager for knowledge in the best methods of utilizing their treasures. And this is by no means so easy as it sounds!¹

Introduction

The growth of scholarly publications, the growing recognition of the importance of the scientific and technical literature as well as the awareness of the internationalization of scientific activities formed a bibliographic movement at the end of the 19th century lasting at least until World War I, if not until today. This 'library and documentation movement' or bibliographic movement² made the attempt to collect, control, organize and distribute all forms of scholarly literature and, in modern words, to rationalize and industrialize information processing. An early famous example is the efforts to publish the *Royal Society Catalogue of Scientific Papers* and the *International Catalog of Scientific Literature*.³

The information and documentation movement in Germany was an international one from its beginning. Already the early German pioneers, like Julius Hanauer and Wilhelm Ostwald, had numerous contacts with people from abroad engaged in information activities, such as Paul Otlet or Jean Gérard. Although there was only limited participation from Germany in the bibliographic conferences at the beginning of the 20th century, the conferences in the late 1920s and 1930s were strongly attended by German documentalists and librarians like Julius Hanauer, Hugo Krüß, Maximilian Pflücke, and Fritz Prinzhorn, to be seen for example in a report on the World Congress 1937 of the International Federation of Documentation (FID).⁴

This paper supplements the principal work in the German history of information and documentation in the first 45 years of the 20th century written by Elke Behrends.⁵ It explores the relations of the chemist Wilhelm Ostwald and his work to the information community of his time and describes – after a stop at the 'Technisch-Wissenschaftliche Lehrmittelzentrale' (Head Office for Technical and Scientific Teaching Materials) and the engineer Georg von Hanffstengel – a wide arc to the middle of the 20th century with the activities of a second German chemist, Erich Pietsch, who was – like Wilhelm Ostwald – a physical chemist by education. Like Ostwald he showed great interest in the history of chemistry and in philosophy and became head of the Gmelin Institute of Inorganic Chemistry in the 1930s. His story is an important part of the history of documentation and information science in Germany.

For Peter Burke one important purpose to describe history is 'defamiliarization ... a kind of distanciation which makes what was familiar appear strange and what was natural seem arbitrary'.⁶ Hopefully this text can also be part of this purpose and remind us of some hidden parts of our heritage as information professionals.

Wilhelm Ostwald and the 'World Brain'

Wilhelm Ostwald can be seen as a member of the bibliographic movement and as one of the predecessors of all the efforts to improve scholarly information and communication throughout the 20th century.⁷ His book on chemical literature is mentioned as an early example of distinct information science literature in the *International Encyclopedia of Information and Library Science*.⁸ Being aware of the information problem and looking for alternatives to the scientific journal in scholarly communication, Ostwald and his fellow activists opened a discussion at the beginning of the 20th century which now, at the beginning of the 21st century, increases in significance as a result of the development of the Internet and the growing number of new electronic journals.

Wilhelm Ostwald (1853–1932) was one of the founders and organizers of physical chemistry at the end of the 19th century. On the basis of thermodynamics and positivism, he developed his 'energetics' which he extended to his philosophy of nature (Naturphilosophie). His so-called 'energetic imperative': 'Do not waste energy, but convert it into a more useful form' was an important foundation for his later efforts with regard to the organization of scholarly work. He resigned from his chair in Leipzig in 1906 to devote more time to philosophy and monism as well as to the international organization of scientific work and to the development of his color theory. In 1909 he received the Nobel Prize in chemistry.

Wilhelm Ostwald's voluminous activities in scientific publication⁹ were the foundation for his later efforts to organize scientific publication and communication. His explicit treatment of meta-science or science of science, especially the organization of science and scientific work, started with the beginning of the 20th century¹⁰ and had its basis in his energetics, in his view on science, and in his research on the history of science.¹¹ Even in 1931 he wrote: 'In conclusion, we ask whether there is a science of science – since it is



Figure 1. Wilhelm Ostwald – by courtesy of Wilhelm Ostwald Memorial and Archive in Grossbothen.

possible to make everything without exception an object of scientific knowledge ...'¹²

Organization of intellectual work

Ostwald's most important contributions and conceptions to the organization of 'intellectual work' include:

- a philosophical concept of order and the realization of the need for standardization, especially expressed in his ideas on paper formats as well as in his activities on a synthetic auxiliary language as a medium for international communication
- the proposal to fragment knowledge through cutting the printed journals and disseminating the single papers, an idea which seems to have been part of the *Zeitgeist* before World War I and which survives in the hypertext structure of electronic journals of today
- the requirement to popularize scientific knowledge as a means of communicating science to the general public.

Order: the need for rationalization and standardization of scholarly communication

The search for harmony and unity as well as the energetic imperative can be seen as the under-

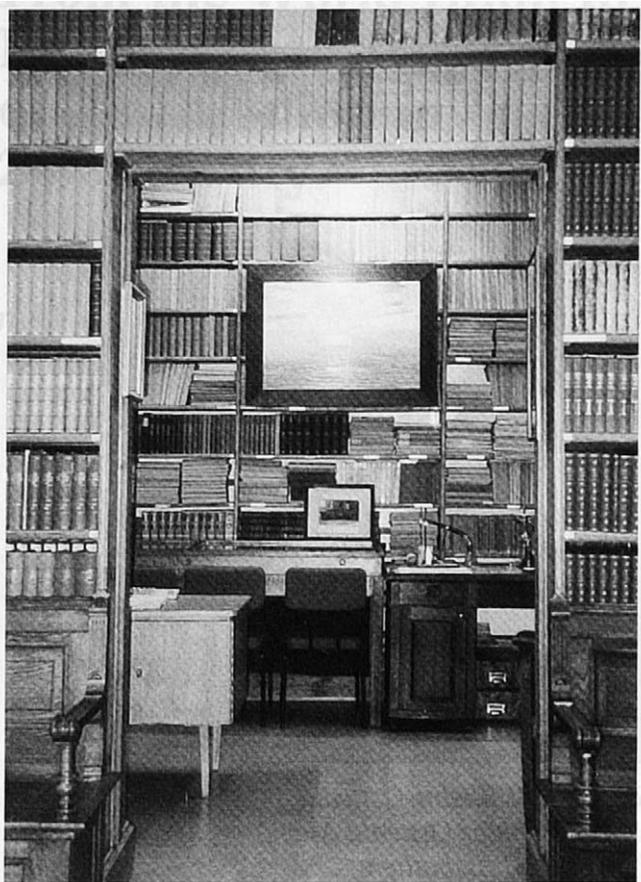


Figure 2. *Harmony through order – the private library of Wilhelm Ostwald in the Wilhelm Ostwald Memorial in Grossbothen.*

lying guiding principles in Ostwald's work after 1906.¹⁵ This is also true for his organizational efforts in scholarly communication. For Ostwald, harmonization meant ordering and organization. For Ostwald, ordering meant concept formulation, a process of abstraction to order the material of our sense organs.¹⁴ A theory of order ('Ordnungswissenschaften', 'Mathetik'), not his energetics, was the basis of his 'pyramid of science' and a foundation of his philosophy of nature. Ostwald applied his ideas of order to languages, paper formats, the sciences, colors and forms. His theory of order, especially the classifying of the sciences was also a small part of the tradition of knowledge organization from the librarians' or information scientists' point of view.¹⁵ Ostwald's activities were discussed and mentioned in the 1920s in two dissertations on 'knowledge management' and on reporting in engineering.¹⁶

Ostwald proposed new standardized formats for all publications. Among the promised advantages of standardizing paper sizes were saving space in desks, bookcases and libraries; the resultant

standardization of printing machines; and reduction in the price of publications, as well as the increased feasibility of assembling personal compilations of published materials. Later, Ostwald's 'Weltformat' was adopted with little change, after a proposal by Porstmann, as a German and international standard (A4 etc.). Another important theme on rationalizing scholarly communication was Ostwald's activity for the development of an artificial or auxiliary language.

Ostwald's philosophy influenced the reception of Taylorism in Germany, visible in the citations of his work in the foreword of the German edition of *The Principles of Scientific Management*.¹⁷ Marion Casey mentioned that the librarian Melvil Dewey can be seen as a predecessor of Taylor in his ideas of efficient management.¹⁸

'Classics' – The proposal to fragment knowledge

In his book about chemical literature Ostwald summarized many of his efforts to organize scholarly communication and predicted new publication formats. The periodical will be split into separate papers because no scientist wants to read the whole periodical. His 'principle of the independent use of the individual piece',¹⁹ or 'Monographieprinzip', was already applied by him since 1889 in the publication of his 'Klassiker der exakten Wissenschaften' ('Classics of the exact sciences') where he republished original scientific works for easy access as separate volumes. In his autobiography he said that the editing of the *Klassiker* was the 'germ for the much later ideas on the technical organization of science'.²⁰ He wanted to counterbalance the growing quantity of journal literature with his selection of papers of lasting importance.

Ostwald's utopian handbook of the future was intended to be 'completely up-to-date at all times'.²¹ It is a predecessor of loose-leaf collections, which today will be implemented through electronic publishing. The necessity to arrange the separates or monographs led back to the problem of ordering. The possibility to give every human being their own book through combining the monographs they are interested in can be seen as one of the first forms of personalization of information.

Before World War I the Jewish journalist Moritz Goldstein wrote an article in the supplement 'Zeitgeist' of the newspaper *Berliner Tageblatt*.²²

Suggesting an encyclopedia on the card-index system this idea was even reported in *Scientific American*. 'This novel encyclopedia would, among other things, show the advantage of renewing itself periodically, like a human organism, and of never becoming antiquated.'²³ There seems to be no direct connection between Ostwald and Goldstein. Nevertheless this episode shows that Ostwald's ideas really belonged to the 'Zeitgeist' before World War I.

Ostwald's idea of substituting the periodical found several followers, especially in the 1930s,²⁴ for example Watson Davis (see the next section) and, based on Davis, John D. Bernal, a British Marxist crystallographer and historian of science, who played a leading role in the Royal Society Scientific Information Conference in 1948.²⁵

Popularization – the requirement to popularize scientific knowledge

Popularization of science can be seen as communicating science to the public. Many members of the library and documentation movement were also popularizers, such as John D. Bernal, Watson Davis or Ostwald. Ostwald's 'holistic' view on science becomes clear when he justified the standardization of paper sheets, which in his view was a practical application of his 'energetic imperative'. Another application for him was the 'uniformity of science itself and the uniformity of scientific thinking with practical life.'²⁶ These last words can be seen as the basis of Ostwald's many efforts to popularize science: he wrote a lot of popular works and moreover took part as an adviser at the building up of the chemical department of the Deutsche Museum in Munich in the years 1904 to 1906. Ostwald saw a museum as a people's university for the improvement of culture.

Watson Davis was the director of the Science Service and the founder of the American Documentation Institute, the predecessor of the American Society for Information Science. The Science Service worked at first as an organization for the popularization of science. Under Davis it broadened its scope to dissemination of science including publication and bibliography.²⁷

One connection between Ostwald and Davis as well as Bernal was perhaps Edwin E. Slosson (1865–1929). For preparing a series of essays for *The Independent*, Slosson visited twelve 'Major prophets of to-day'²⁸ in Europe and the States

before World War I. Among them were Ostwald and H.G. Wells. In 1925 Slosson became director of Science Service as predecessor to Davis.

The 'World Brain'

In 1913 Ostwald wrote: 'Everywhere complaints are made by workers and investigators that it is becoming more and more difficult to obtain a complete survey, even in a comparatively restricted field, of the current scientific production of the day.'²⁹

Ostwald's solution was organization and centralization. This led to the foundation of the Bridge ('Brücke'), the 'Institute for the Organization of Intellectual Work', in 1911 by Wilhelm Ostwald, Karl Bühner and Adolf Saager.³⁰ The Bridge was supposed to be the information office of the information offices, a 'bridge' between the 'islands' where all other institutions – associations, societies, libraries, museums, companies, and individuals – 'were working for culture and civilization.' The organization of intellectual work was intended to occur 'automatically' through the general introduction of standardized means of communication – the monographic principle, standardized formats, and uniform indexing ('Registaturvermerke' by using the Decimal Classification) for all publications – and by means of a 'comprehensive, illustrated world encyclopedia on sheets of standardized formats'.³¹ Close cooperation with the Institut Internationale de Bibliographie (IIB) in Brussels was planned.³²

Because of his many international contacts, many intellectuals from abroad became members of the Bridge. These included, for example, the Swedish chemist Svante Arrhenius, the American industrialist Andrew Carnegie, the Polish-French chemist Marie Curie, the English physicist Ernest Rutherford, the Swedish writer Selma Lagerloef, the French mathematician Henri Poincaré, the Danish Nobel laureate for Peace (1908) Frederik Bajer, the Austrian Nobel laureates for Peace Bertha von Suttner (1905) and Alfred H. Fried (1911) and the Belgian industrialist Ernest Solvay.

For Ostwald the foundation of bibliographical institutions like the Bridge or the planned International Institute of Chemistry, were important means to reach his aims. The term 'Gehirn der Welt' (World Brain), which Ostwald liked to apply for the new organization of the Bridge,³³

had already been used before by La Fontaine³⁴ and by Friedrich Naumann,³⁵ as well as later H.G. Wells.³⁶ Rayward showed that Wells' concept of a World Brain and a World Encyclopedia contained a lot of totalitarian thinking.³⁷ Ostwald was aware of the proximity of his concept of a world brain to dictatorial thinking when he wrote: 'So the total business of science will be regulated through organizational not dictatorial means.'³⁸ It is probably that Wells knew Ostwald.³⁹

The prehistory of the Bridge as the 'Internationale Monogesellschaft' shows a close connection to advertising: Karl Wilhelm Bühner from Switzerland had founded a so-called 'Internationale Monogesellschaft' in 1905. The aim of this enterprise was to raise the artistic level of contemporary advertising. One method to do this was the publication of so-called 'Monos', little cards or leaflets in a standardized format. Monos were something like the many 'Reklamebilder' (advertising picture-cards) existing in Germany, for example from the companies of Stollwerk or Liebig. The 'Mono-System' was planned so that the individual monos would complement each other and, collectively, form a well-designed, comprehensive encyclopedia. The picture side usually contained advertising. The reverse contained a brief statement ['monograph' – that is the reason for the term Mono] explaining the content of the picture, with carefully written advertising slogans of the firms being involved in the system.⁴⁰

In 1908 Ostwald proposed a cooperation between the leading chemical societies in the field of abstracting as well as in the distribution of scientific journals.⁴¹ In 1911 the International Association of Chemical Societies was founded in Paris in Spring 1911 with Ostwald as first chairman. This led to the idea of an International Institute of Chemistry. Here Ostwald applied the principles of the Bridge to his special subject, chemistry. The Institute was planned as a 'small Bridge' with a 'Chemical World Library', an index of chemical substances, of terms, and of persons as card catalogues, an 'Abstracting Department', a collection of chemicals and a bureau of translation which should be later developed into the bureau of an international auxiliary language. 'From the reference department will come eventually the material for the great encyclopedia of all chemistry. In this book everything done and being done in the fields of chemical science and technology will be systematically compiled.'⁴²

The World war put an end to these international cooperations. Lack of money and organizational problems forced the Bridge to close in 1914.

Further connections of Ostwald and the time between the wars

Ostwald's contemporaries in the documentation movement

Simultaneously occurring movements like Taylorism and positivism (especially Ostwald's proximity to logical empirism), encyclopedism and internationalism as well as the arts and crafts movement formed the background for Ostwald's connections to contemporaries and successors in the bibliographic movement.⁴³

Paul Otlet

In 1895 Paul Otlet, a Belgian lawyer (1868–1944), had founded, together with Henri La Fontaine, the Institut Internationale de Bibliographie (IIB) in Brussels. The IIB began to build up a great catalog on cards arranged according the Universal Decimal Classification (UDC) to compile a bibliography of everything that had appeared in print. 'In Germany the IIB was morally supported by the organization of Wilhelm Ostwald, called Die Brücke.'⁴⁴ According to Schneiders the first contact between the Internationale Monogesellschaft, the predecessor of the Bridge, and Otlet was in October 1908.⁴⁵ Later Otlet became the 'Ehrenpräsident' (honorary president) of the Bridge, which should have been the 'Generalsekretär' (secretary general) of the IIB.

The first direct contact between Otlet and Ostwald was probably at the World Congress of International Associations in May 1910. Together with Ernest Solvay, Ostwald was the chairman of a section about standardization.⁴⁶ Citing Otlet in his book *Moderne Naturphilosophie. I. Die Ordnungswissenschaften*, Ostwald discussed in a separate chapter, 'Das Deweysche System', the advantages and disadvantages of using digits or letters for the notation of a classification scheme.⁴⁷ As late as 1929 Ostwald devoted a whole part of the chapter 'Spencer und Dewey' in a popular book about 'philosophy of science'⁴⁸ to the decimal classification and the IIB in Brussels.

According to Rayward⁴⁹ 'It is possible that Otlet's use of the term ['monographic principle'] derives

from his involvement in *Die Bruecke ...*' So it can be said, keeping the origins of the Bridge with the Internationale Monogesellschaft in mind (see above), that one of the important principles of Otlet's contribution to information science originates at least terminologically in advertising.

Hermann Beck

Hermann Beck (1879-?) was another member of the bibliographic movement in Germany. He wanted to establish a German Archive of the World's Literature in Berlin and founded several bibliographic institutes with aims similar to the IIB and the Bridge, e.g. the 'Internationales Institut für Sozial-Bibliographie' in 1905 or the 'Internationales Institut für Techno-Bibliographie' in 1908.⁵⁰ Both intended to combine a subject-oriented central library, a bibliographic card index, an information agency, a bureau of translation and a clipping service, and a bookseller, with international coverage. The names of Beck and Ostwald were also written below an 'Appeal for the establishment of a German Archive of the World's Literature, 1912'. In 1911 Beck wrote a 'Memorial on the Bridge' in which he proposed the union and cooperation of the two enterprises, his 'Archiv' and 'Ostwald's Bridge'.⁵¹

Julius Hanauer

Julius Hanauer (1872-?) worked between 1908 and 1910 at the IIB. After World War I he was librarian at the 'Literarische Bureau' of the company AEG (Allgemeine Elektrizitäts-Gesellschaft) in Berlin. He was the most important promoter of the Decimal Classification in Germany. Erich Pietsch mentioned Hanauer⁵² as the first who published the idea to use (Hollerith) machines for information and documentation.⁵³

Machine-driven organization of intellectual work probably was a point of discussion in Ostwald's family. Ostwald published a paper on 'Inventing systematically'.⁵⁴ Between both parts of Ostwald's paper two other papers can be found, the first on Hollerith machines, the second, called 'Rundschau' (pp.12-15), an essay by his son Walter Ostwald on thinking machines ('Denkmaschinen'). Wilhelm Ostwald developed a theory of means or media for communication; he called them 'Verkehrsmittel', to help memory or intellectual work through organization. Also a notebook or a card index was an 'intellectual machine' for him. A book can be seen in his view as a 'transformator for the creation of intellectual qualities'.⁵⁵

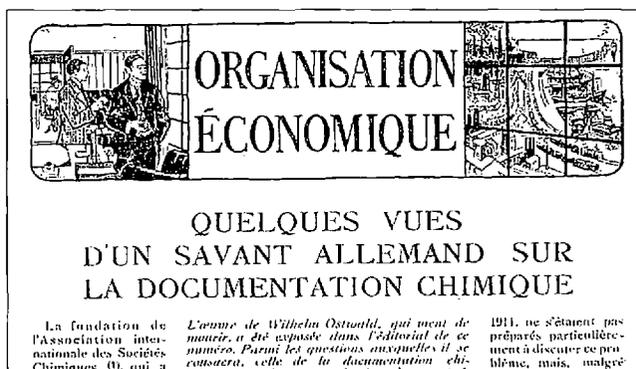


Figure 3. Beginning of a paper of Ostwald in the French journal *Chimie et Industrie* (Vol. 27) published shortly after his death in 1932.

After the war Hanauer reviewed Ostwald's book about chemical literature.⁵⁶ He became engaged in the 'Ausschuss für die Einteilung der Technik' (Committee for the Classification of Technology) of the Normenausschuss der Deutschen Industrie (Standardization Committee of the German Industry) where it was proposed to use the Decimal Classification.⁵⁷

Jean Gérard

In the beginning of the 1930s Ostwald had contact through Hanauer with Jean Gérard (1890-1956), Secretary General of the International Union of Pure and Applied Chemistry from 1920 to 1940⁵⁸ and director of the Office Internationale de Chimie within the IUPAC in Paris.⁵⁹ This office and his *Maison de la Chimie* in Paris came close to Ostwald's ideas of an International Institute of Chemistry.

On January 24, 1932 Hanauer wrote to Ostwald and asked him to receive a visit of Jean Gérard in Großbothen in February, because Gérard would be in Berlin from February 14. 'It is a great honour and pleasure for me to play my part in the realization of one of your organizational ideas, even if you possibly did not think that this would happen in Paris. But you can draw comfort from the fact that it is the more irrelevant where something will be done or collected, the smaller the distance will be and the better the photographic methods [we would say today: the network connections, *T.H.*] will be developed.'⁶⁰ His letter was accompanied by two letters from Gérard.⁶¹

Gérard was one of the founders of the periodical *Chimie & Industrie*. In 1932, one month after the death of Wilhelm Ostwald, a paper appeared

in this French journal with the title 'Quelques vues d'un savant allemand sur la documentation chimique'. The author of this paper was Wilhelm Ostwald.⁶² It was a French translation of parts of Ostwald's Memorial of 1914. Shortly after Ostwald's paper there appeared another one by Gérard: 'L'organisation mondiale de la documentation universelle' in which he proposed a cooperation in documentation on the national level combined with a discipline-orientated cooperation on the international level.⁶³ His Office International de Chimie worked in this sense in the 1930s.⁶⁴

George Sarton

Ostwald's connection to the historian of science George Sarton is also very interesting. In 1913 Sarton founded *Isis*, the important journal for the history of science. Ostwald was one of the first authors in this journal⁶⁵ and belonged to its 'Comité de patronage' (title page of the journal, March 1913). Every issue of this journal contained a section, the so-called 'Synthetic Bibliography for the History of Science'. In the introduction to this bibliography, in the part on 'La crise des bibliothèques', a paper of the Bridge by Karl W. Bühner is mentioned.⁶⁶ Another indicator of the influence of the Bridge on Sarton was the plan to publish this bibliography as 'L'encyclopédie sur fiches'.⁶⁷

The 'Technisch-Wissenschaftliche Lehrmittelzentrale' and Georg von Hanffstengel⁶⁸

Ostwald's ideas influenced the thinking of many German engineers. So it would be interesting to know more about an engineering institution, the 'Technisch-Wissenschaftliche Lehrmittelzentrale' (TWL) (Head Office for Technical and Scientific Teaching Materials), headed by the engineer Georg von Hanffstengel, which was the German contact institution for the 'Institut Internationale de Bibliographie' in Brussels in the 1920s, like the German bibliographic institutions the 'Brücke' (Bridge) or the 'Internationales Institut für Techno-Bibliographie' before World War I. It was followed in the year 1928 by the 'Fachnormenausschuss für Bibliotheks-, Buch- und Zeitschriftenwesen' (Standards Committee for Books, Librarianship, and Journals) of the 'Deutsche Institut für Normung' (German Institute for Standardization, DIN).⁶⁹

The TWL reflected also Ostwald's ideas about the education of scholars and his activities to

improve something we call would today 'information literacy'.⁷⁰ The TWL was proposed by the engineer Oskar Lasche,⁷¹ director of the AEG Turbinenfabrik, and began its work as part of the 'Deutscher Verband Technisch-Wissenschaftlicher Vereine' (German Association of Technical and Scientific Societies) in January 1922. Its main task was to facilitate and create exemplary teaching aids for engineering education. The TWL merged in 1932 with the 'Deutscher Ausschuss für technisches Schulwesen' (German Committee for the Technical School System, DATSCH)⁷² and seemed to exist still in the 1950s, after which it was liquidated.⁷³

The most important teaching aids or media in these times were photos or slides. Both, Lasche and Hanffstengel published papers on the improvement of lectures and talks as well as on the use of photos when giving a lecture.⁷⁴ All slides should have a similar clear design and carried a notation of the Decimal Classification. The tasks of the TWL were centralization, rationalization, and organization of the creation and use of media for engineering education. The TWL collected photos and lent them out. The size of the collection grew from about 1700 in 1923 to about 7,000 in 1926 and to about 12,000 in 1927.⁷⁵ Ideas grew to collect also critical reports of scholars and experts to cope with information overload.⁷⁶ The TWL issued the first German translations of the Decimal Classification as little leaflets, beginning with section 62 (Engineering Sciences).⁷⁷

Georg von Hanffstengel (1874–1938)⁷⁸ studied mechanical engineering in Brunswick and was later professor for the subject 'Materials Handling' (Förderwesen) at the Technical University Berlin. Donker Duyvis wrote later: 'The late Professor von Hanffstengel ... (was) present at these conferences' (two small meetings of representatives of different countries in The Hague in 1924, to re-establish the old organization of the IIB).⁷⁹ In 1922 Hanffstengel published a paper which illustrated in another case the connection between advertising and documentation.⁸⁰ He proposed to publish advertising matters in standardized paper format and to include such valuable information as content that the advertisements could also be used as teaching aids which would be kept permanently and could be found again any time because they were arranged systematically. In some respects he also saw abstracts of publications as teaching aids as well as mediation to the full text or simply as publicity for the full text.

Erich Pietsch: From World War II to the first 'transatlantic information dialogue'

Until 1945

Erich Pietsch (1902–1979),⁸¹ head of the 'Gmelin Institute of Inorganic Chemistry' (1936–1967) and longstanding chairman (1956–1961) of the 'Deutsche Gesellschaft für Dokumentation' (German Association for Documentation, DGD), acted through his numerous international contacts as a German pioneer in information science, especially in the 1950s.

The eighth edition of the *Gmelin Handbook for Inorganic Chemistry* started publication in 1924. In contrast to abstract publications, the compendium of the *Gmelin Handbook* rearranged and accumulated the material according to subject matter and logical sequence – here oriented on the periodical system of the chemical elements and their inorganic compounds – giving also a critical evaluation on the material reviewed.⁸² In 1936 Pietsch became head of the Gmelin, because Richard Meyer, his predecessor, had to resign due to his Jewish origin.⁸³ The Institute was called 'wehrwirtschaftliche und wehrwissenschaftliche Forschungsstelle in der Deutschen Chemischen Gesellschaft' (Research Center for Military Economy and Military Science of the German Chemical Society). During the war Pietsch was engaged in securing access to scientific information without exposing himself more than necessary to secure the work of the Institute. The Institute was destroyed by bombing in 1943.

After the war

The efforts of Erich Pietsch to restart the work of the Gmelin Institute immediately after the war led to many contacts with the occupying powers, especially the USA. Pietsch secured the work of the Institute which moved in summer 1946 from Berlin to Clausthal-Zellerfeld in the Harz mountains and became part of the 'Max Planck Society for the Advancement of Science' (MPG), the former 'Kaiser-Wilhelm-Gesellschaft' (KWG).⁸⁴

In 1948 Pietsch visited the United States to secure funding for the Gmelin. He met among others: Vannevar Bush, Malcolm Dyson, Hans Peter Luhn, Linus Pauling, and James W. Perry. Due to the efforts of Pietsch the Institute was funded by the 'International Advisory Council

on Beilstein and Gmelin' of the International Union of Pure and Applied Chemistry (IUPAC), until 1952 as well as by the 'Committee on Foreign Compendia' of the American Chemical Society (ACS). The main difficulty in these years lay in the complete inaccessibility of recent international literature.

In 1947 the Institute had started experiments in using punched cards for documentation. The Gmelin Institute developed its own system to convert chemical formulae into a machine language code for IBM Hollerith cards. As a result of his visit to the States Pietsch was the author of a chapter in both editions of the book *Punched Cards*, edited by Robert S. Casey and James W. Perry.⁸⁵ Because of these articles the activities of the Gmelin Institute were internationally well known. Although the documentation department of the Gmelin Institute never used IBM punched cards in regular work for producing the handbook, the experiments of the Gmelin Institute led to the use of mechanized documentation in the 'Head Office for Nuclear Energy Documentation' (Zentralstelle für Atomkernenergie-Dokumentation, ZAED) and in the 'Head Office for Machine Documentation' (Zentralstelle für Maschinelle Dokumentation, ZMD) in the 1960s, especially through Klaus Schneider.⁸⁶

This ZAED began its work in 1957 as a 'Clearing House' of the Gmelin Institute on nuclear energy documentation. It moved in 1965 from the Gmelin Institute to the Gesellschaft für Kernforschung in Karlsruhe. In 1978 it became part of the Fachinformationszentrum Karlsruhe (National Information Center for Energy, Physics, and Mathematics, later Specialized Information Center Karlsruhe), which is now part of STN International. After an evaluation by the German Wissenschaftsrat in 1996, the Gmelin Institute was closed in 1997. It was not possible to guarantee for the future the high scholarly value and quality of the *Gmelin Handbook* at a time of decreasing sales and staff reductions.

Since 1947 Pietsch had had close contact with the American James W. Perry. Perry, who worked at the Massachusetts Institute of Technology (MIT) at this time, greatly assisted the Gmelin Institute in the immediate post-war period by arranging financial help through the 'American Chemical Society'. Perry's work at MIT was influenced by the Whirlwind computer project. This was the first time to use a computer other than for calculating, namely for processing information. The first ideas to free the user from

information overload emerged during the Whirlwind project.⁸⁷ In 1953 Perry moved to the Battelle Memorial Institute in Columbus, Ohio, and then in 1955 to Cleveland, Ohio, to build up the Center for Documentation and Communication Research (CDCR), led by Jesse Shera, Allen Kent and himself, in the School of Library Science at Western Reserve University (WRU).⁸⁸

The Gmelin Institute was a partner in the first so called 'transatlantic information conversation' ('Transatlantisches Informationsgespräch') in 1957 at one of the conferences at WRU, the 'Symposium on Systems for Information Retrieval'. A research inquiry was sent via Teletype network to show 'high-speed transmission methods' as well as 'rapid searching techniques', something that we would call today 'online retrieval' or 'online search'. 'Cleveland acted as proxy for the homes of various search-systems'. On April 15, 1957 the following question was sent from Gmelin to Cleveland: 'Does the Ethyl Corporation have information regarding assignment of fuel additive patents to the Standard Oil Development Co.? If do, which patents have been assigned?' This question was used by the systems demonstration of the Ethyl Corporation (Ferndale, Michigan) using machine-sorted punch cards. The answer followed the next day: 'patents assigned to Standard Oil Development Co. 1,589,885 1,820,983 1,857,761 1,882,887 1,9433,808 plus 181 later patents'.⁸⁹

At the symposium James Mack gave a paper on these 'intercontinental guided missives'. He mentioned three reasons for the necessity of this transmission in the future: 'There is a need not only to know, but also to know quickly. This time-factor in research has not yet been established.'⁹⁰ The second was that no information system is self-sufficient, and the third was the growth of information: 'There simply is not enough space available to accommodate in perpetuity all the published information in every place it is needed.' (p. 563)

Pietsch acted as 'Chief editor for the chapters on selection' of a loose-leaf collection, the *FID Manual on Documentation Reproduction and Selection*,⁹¹ which is a good example of international collaboration in documentation in the 1950s, not easily to be found today in libraries and seldom mentioned or cited in the information science literature. Pietsch took part in many other conferences, e.g. the International Conference on Scientific Information in Washington, DC, in 1959.⁹² He was the organizer of the

conference 'Automatic Documentation in Action' in Frankfurt on the Main, Germany in 1959 with strong international participation which laid the foundation for all the German efforts in computer use in libraries and documentation centers.⁹³

Pietsch was of course a leading figure in documentation in Germany. He founded the Committee for the Mechanization of Documentation of the German Association of Documentation (Deutsche Gesellschaft für Dokumentation, DGD) in 1951. He served as chairman of the DGD from 1956 until 1961.⁹⁴ As his follower as DGD chairman wrote: 'He made the state aware of documentation'.⁹⁵ Pietsch tried to popularize documentation not only in politics but as well as in the general and scientific public, also with radio talks.

Conclusion

The stories of Ostwald and Pietsch are further examples of how much of the pioneering work in information and documentation was first done by chemists. The subject 'chemistry' and its information problems urged information pioneers to think about new ideas related to it and to develop new means for the documentation and communication of knowledge. The subject-specific view on information problems also led to international contacts. While Ostwald's work is buried in the past, Pietsch's influence on the German development of mechanical documentation cannot be overestimated.

Although internationalism can probably be viewed as an essential part of documentation and information science and its development, it needs individuals to cross the national borders and to exchange ideas, techniques, and experience. For Germany, Ostwald, Hanffstengel and Pietsch were three of the most important persons establishing contacts with international pioneers of documentation.

Ostwald can be seen as a predecessor of many modern issues (also globalization and internationalization, for example). When he wrote 'Knowledge is the medium of life in the highest sense of the term ...'⁹⁶ he may be viewed as a predecessor of knowledge management. Even in a book about the thematic areas of the EXPO in Hannover, Ostwald is mentioned in the section 'Knowledge, Information, Communication' as a precursor of 'interactive encyclopedic network-

ing'.⁹⁷ The example of the Mono-Gesellschaft as well as of the TWL, but also the activities of Ostwald, Hanffstengel, and Pietsch show that there has been also common ground for information and documentation with popularization as well as with advertising. The proximity of information systems to advertising is illustrated today through theoretical researches like those of Jonathan Furner⁹⁸ as well as through the fact that many retrieval systems, such as systems to locate journal articles, allow the customer to search for products with the aim that the customer should buy, for example, the full text articles or the books.

Like other information pioneers, Ostwald and Pietsch were working for greater accessibility to the results of scholarly communication. Their work was heavily influenced by the political situation before and after the two world wars. Ostwald's concepts to organize intellectual work, order, fragmentation, and popularization survived in some respect until today. But it is also true, as Ernst Bloch wrote in 1952:

Never the same: Every clever thought may already be thought seven times. But if it is thought again, in another time or age and in another situation or under other circumstances, it was not the same anymore. Not only its being thought has changed meanwhile, but above all also the thing itself being thought over has changed in the meantime. The clever thought has to prove newly on it and has to prove itself as a new thought.⁹⁹

References

1. Wilhelm Ostwald, Biology of the savant: a study in the psychology of personality. *Scientific American*, Supplement No. 1862, 9. September 1911, pp. 169–171.
2. See Paul Schneiders, De Bibliotheek- en Documentatiebeweging 1880–1914: Bibliografische Ondernemingen rond 1900, Dissertation, Amsterdam, 1982, and K. O. Murra, History of some attempts to organize bibliography internationally. In: Jesse H. Shera et al., *Bibliographic organization: papers presented before the 15th annual conference of the graduate library school July 24–29, 1950*, Chicago, 1951, pp. 24–53).
3. See A. M. Sorkin, Zur Entstehungsgeschichte des "International Catalogue of Scientific Literature". *NTM*, 1963, 1, 4:67–84, and also Murra, History.
4. Maximilian Pflücke, Dokumentation : zugleich ein Bericht über den Weltkongreß der Dokumentation vom 16. bis 21. August 1937 in Paris [Documentation, at the same time a report on the World Congress of Documentation. ...]. *Angewandte Chemie*, 1937, 50: 955–963.
5. Elke Behrends, *Technisch-wissenschaftliche Dokumentation in Deutschland von 1900 bis 1945 : unter besonderer Berücksichtigung des Verhältnisses von Bibliothek und Dokumentation* [Technical and scientific documentation in Germany from 1900 to 1945: with special reference to the relationship between library and documentation], Harrassowitz / Wiesbaden, 1995. See also T. Hapke, History of scholarly information and communication: A review of selected German literature. *Journal of the American Society of Information Science*, 1999, 50 : 229–232.
6. Peter Burke, *A social history of knowledge: from Gutenberg to Diderot*, Reprinted, Polity Press / Cambridge, 2002. p. 2.
7. See also T. Hapke, Wilhelm Ostwald, the "Brücke" (Bridge), and connections to other bibliographic activities at the beginning of the twentieth century. In: Bowden, M.E., T. B. Hahn, and R. V. Williams (eds.) *Proceedings of the 1998 Conference on the History and Heritage of Science Information Systems*, Information Today / Medford, NJ, 1999, pp. 139–147).
8. In the article of R. T. Bottle, Information Science. In: J. Feather et al. (eds.) *International Encyclopedia of Information and Library Science*, 2nd ed., Routledge / London, 2003 (pp. 295–297), on p. 296 is mentioned: Wilhelm Ostwald, *Die chemische Literatur und die Organisation der Wissenschaft*, Akademische Verlagsgesellschaft / Leipzig, 1919.
9. He published more than 40 books, edited a handbook (*Handbuch der allgemeinen Chemie*) and the 'Klassiker der exakten Wissenschaften', established scientific journals, wrote more than 4000 abstracts and reviews as well as more than 120 scientific papers and more than 10,000 letters.
10. See for example Wilhelm Ostwald, Wissenschaftliche Massenarbeit. *Annalen der Naturphilosophie*, 1903, 2: 1–28
11. Many of Ostwald's papers on the organization of science as a whole can be found in the compilations *Wilhelm Ostwald, Die Forderung des Tages*, Akademische Verlagsgesellschaft / Leipzig, 1910, and *Wilhelm Ostwald, Der energetische Imperativ*, Akademische Verlagsgesellschaft / Leipzig, 1912.
12. Wilhelm Ostwald, Ways of knowledge. *The Thinker*, 1931?, 4?: 53–55, on p. 55. (Also in Berlin-Brandenburgische Akademie der Wissenschaften, Akademie-Archiv (BBAW), Ostwald papers, No. 5868.)
13. Anders Lundgren, Harmony and unity: Wilhelm Ostwald's program for science. Paper at the workshop 'Wilhelm Ostwald at the crossroads of Chemistry, Philosophy and Media Culture'. Leipzig, November 2–4, 2000 (to be published).
14. Paul Ziche, The 'new philosophy of nature' around 1900: metaphysical tradition and scientific innovation. Paper at the workshop Wilhelm Ostwald at the crossroads ...'.

15. In this respect Ostwald was mentioned in some works e.g. by I. Dahlberg, *Grundlagen universaler Wissensordnung*, Verlag Dokumentation / Pullach bei München, 1974, on p. 14, or by E. de Grolier, *Le système des sciences et l'évolution du savoir*. In: J. A. Wójcieszowski, (ed.), *Conceptual basis of the classification of knowledge: proceedings of the Ottawa Conference on the ... October 1st to 5th, 1971*, Verlag Dokumentation / Pullach bei München, 1974 (on pp. 20-118), here on p. 25 and p. 37; and by E. I. Samurini, *Geschichte der bibliothekarisch-bibliographischen Klassifikation*. Vol. 2 (1969), Verlag Dokumentation / München, 1977, on p. 295 and on p. 706.
16. Gustav Schmalz, *Die Methode des Ordners und ihre Anwendung auf technische Zwecke*, Dissertation, Berlin / Verlag des VDI, 1920, and Kurt Schulz, *Die technische Berichterstattung in Deutschland*, Dissertation, Braunschweig, 1930.
17. See Frederick W. Taylor, *Die Grundsätze wissenschaftlicher Betriebsführung*, Oldenbourg / Munich, 1919.
18. See Marion Casey, Efficiency, Taylorism, and libraries in progressive America. *Journal of Library History*, 1981, 16: 265-279. She wrote: "The three most important persons in this study, Melvil Dewey, Frederick Taylor, and Charles McCarthy [1873-1921, organizer of the movement of legislative libraries from 1901 until 1921], share the same characteristics: the desire to conserve time, energy, and human effort; the desire to organize industry, government, and libraries efficiently; the desire to bring order out of a society torn by technology." (on p. 275). Ostwald seems to be the fourth in this list.
19. Ostwald, *Die chemische*, on p. 96.
20. Wilhelm Ostwald, *Lebenslinien*, Klasing / Berlin, 1927, on p. 56 of Vol. 2.
21. Ostwald, *Die chemische*, on p. 93.
22. Moritz Goldstein, *Magazin der Gesamtwissenschaft. Zeitgeist*, 4.8.1913.
23. An encyclopedia on the card-index system. *Scientific American*, 1913 (Sept. 13), 109: 213.
24. Phelps, R.H., and J.P. Herlin, Alternatives to the scientific periodical. *UNESCO Bulletin for Libraries*, 1960, 14: 61-75.
25. There Bernal proposed the centralized national distribution of single papers combined with an announcement of abstracts on cards to subscribers in particular fields, see Harry East, Professor Bernal's insidious and cavalier proposals: The Royal Society Scientific Information Conference, 1948. *Journal of Documentation*, 1998, 54: 293-302.
26. W. Ostwald, *Unser Format. Das Monistische Jahrhundert*, 1912, 1: 104.
27. See Irene S. Farkas-Gonn, *From documentation to information science: the beginnings and early development of the American Documentation Institute = American Society of Information Science*, Greenwood / Westport, CT, 1990, on pp. 12-16.
28. These essays were later published in two volumes, the first in 1914: Edwin E. Slosson, *Major prophets of today*, Little, Brown, and Company / Boston, 1914, and the second under the title *Six major prophets* in 1917. The essay on Ostwald appeared in the 1914 volume on pp. 190-241. See also for letters from Slosson to Ostwald in BBAW, Ostwald papers, No. 4171. On Slosson see also David J. Pfees, *A new voice of science: Science Service and Edwin E. Slosson, 1921-1929*, Chapel Hill, 1979. (Online: <http://americanhistory.si.edu/scienceservice/thesis/>).
29. Wilhelm Ostwald, Scientific management for scientists. "The Bridge." The trust idea applied to intellectual production. *Scientific American*, 1913, 108: 5-6, on p. 5.
30. See on the history of the Bridge also Rolf Sachsse, *Das Gehirn der Welt: 1912*. In: *Mitteilungen der Wilhelm-Ostwald-Gesellschaft zu Großbothen*, 2000, 5, Heft 1: 38-57, also as online version at www.heise.de/tp/deutsch/inhalt/co/2481/1.html.
31. Die Brücke (1910-1911). *Annuaire de la Vie Internationale*, 1910-1911: 623-632.
32. On the IIB see later in this paper.
33. Wilhelm Ostwald, *Das Gehirn der Welt*, Brücke / Munich, 1912.
34. Henri La Fontaine, Une mémoire mondiale. *La Revue*, 1903: 201-208.
35. Friedrich Naumann, *Das Gehirn der Menschheit. Süddeutsche Monatshefte*, 1907, 4: 759-764.
36. The idea of a world or global brain plays also a role as a model for developments in the history of computer technology, see Hans-Dieter Hellige, *Weltbibliothek, Universalenzyklopädie, Worldbrain: zur Säkulardebatte über die Organisation des Weltwissens. Technikgeschichte*, 2000, 67: 303-329.
37. Rayward, W.B., H.G. Wells's idea of a world brain: a critical reassessment. *Journal of the American Society for Information Science*, 1999, 50: 557-573.
38. From Wilhelm Ostwald, Ein Weltreich der Wissenschaft. *Berliner Tageblatt*, Friday, February 6, 1914: Title Page (BBAW, Ostwald papers, No. 5844).
39. Perhaps through Slosson, see above. Wells published also papers in the journal *Nord & Süd* in the 1920s, as did Ostwald.
40. Das Monö. In: *Die Lithographie in der Schweiz*, Verein Schweizer Lithographiebesitzer / Bern, 1944, pp. 253-254, on p. 235.
41. See Wilhelm Ostwald, Berzelius' Jahresbericht und die Organisation der Chemiker (1908). In: Ostwald, *Die Forderung*, pp. 586-594. Translation: Wilhelm Ostwald, Berzelius' "Jahresbericht" and the international organization of chemists. *Journal of Chemical Education*, 1955, 32: 373-375.
42. Wilhelm Ostwald, Memorial on the foundation of an International Institute of Chemistry, *Science*, 1914, 40: 147-156, on p. 154.
43. These connections can be traced back through research at the Archive of the Berlin-Brandenburgische Akademie der Wissenschaften in Berlin which keeps his letters, and through a visit to the Wilhelm Ostwald Memorial, his country house "Energie" in Großbothen in Saxony which hosted his former

- living quarters as well as his library and laboratory. See www.wilhelm-ostwald.de.
44. F. Donker Duyvis, The International Federation for Documentation. *Journal Of Documentary Reproduction*, 1940, 3: 176–191.
 45. See Schneiders, *De Bibliotheek*, on p. 89.
 46. W.B. Rayward, *The universe of information ; the work of Paul Otlet for documentation and international organization*. VINITI & FID / Moscow, 1976, p.180.
 47. W. Ostwald, *Moderne Naturphilosophie. I. Die Ordnungswissenschaften*, Akademische Verlagsgesellschaft / Leipzig, 1914, on p. 296.
 48. Wilhelm Ostwald, *Die Pyramide der Wissenschaften : eine Einführung in wissenschaftliches Denken und Arbeiten* (The pyramid of the sciences: an introduction to scientific thinking and working), Cotta / Stuttgart, 1929, pp. 76–82.
 49. See W. Boyd Rayward, Visions of Xanadu: Paul Otlet (1868–1944) and hypertext, *Journal of the American Society for Information Science*, 1994,45: 235–250, on p. 238. For more on the IIB see the papers by Rayward and others in T. B. Hahn and M. Buckland (eds.), *Historical Studies in Information Science*, Information Today / Medford, NJ, 1998.
 50. See Behrends, *Technisch-wissenschaftliche Dokumentation* ...
 51. See Hermann Beck, Denkschrift betr. ein Zusammengehen des 'Deutschen Archivs der Weltliteratur' und des Bibliographischen Zentral-Verlags G.m.b.H., beide in Berlin, mit der "Bruecke" in Muenchen. Unpublished Source. 1911. BBAW, Ostwald papers, No. 149.
 52. Erich Pietsch, Dokumentation und mechanische Gedächtnis. Arbeitsgemeinschaft für Forschung des Landes Nordrhein-Westfalen, Heft 38, 1954, pp. 33–79, on p. 49. On Erich Pietsch see later in this paper.
 53. Julius Hanauer, The Institute International de Bibliographie in Brüssel. *Belfried*, 1917, 1, 233–236.
 54. Wilhelm Ostwald, Systematisches Erfinden. *Prometheus*, 1912, 24: 5–8,17–21. This paper is one example of others by Ostwald dealing with the organization of education to become a scientist, scholar or savant. See for another one the citation in the beginning of this paper.
 55. Wilhelm Ostwald, *Die Philosophie der Werte*, Kröner / Leipzig, 1913, See on pp. 292–304 and 328–343. Ronald E. Day, *The modern invention of information: discourse, history, and power*, Southern Illinois University Press / Carbondale, 2001, cited Otlet – see on p. 13–20 – with similar metaphors seeing the book as a 'machine' to transform 'thought-energy'.
 56. See Julius Hanauer, Wilhelm Ostwald. Die chemische Literatur und die Organisation der Wissenschaft. *Zeitschrift des Vereins Deutscher Ingenieure*, 1920, 64: 850.
 57. Letter to Ostwald, BBAW, Ostwald papers, No. 1072, May 9, 1920. In the beginning of the 1920s there was a discussion in the *Verein Deutscher Ingenieure* about the system or classification of economics and technology: see the letters between Ostwald and D. Meyer and the VDI in BBAW, Ostwald papers, No. 1983 and No. 4270. See also A. Schilling, Die Stellung der Technik im Rahmen der Wissenschaften. *Technik und Wirtschaft*, 1924, 17: 97–104, who built heavily on Ostwald.
 58. Roger Fennell, *History of IUPAC 1919–1987*, Blackwell / Oxford, 1994. On Gérard see pp. 16–17 and pp. 76–80 and also in Ulrike Fell, *Disziplin, Profession und Nation : die Ideologie der Chemie in Frankreich vom Zweiten Kaiserreich bis in die Zwischenkriegszeit*, Leipziger Univ.-Verl. / Leipzig, 2000, especially pp. 216–224.
 59. See also Fayet-Scribe, *The cross-fertilization*, on p. 187.
 60. From BBAW, Ostwald papers, No. 107.
 61. See BBAW, Ostwald papers, No. 4301.
 62. Wilhelm Ostwald, Quelques vues d'un savant allemand sur la documentation chimique. *Chimie et Industrie*, 1932, 27: 1201–1208.
 63. Jean Gérard, L'organisation mondiale de la documentation universelle. *Chimie & Industrie*, 1932, 28: 209–215. For more on the history of documentation in France see: Sylvie Fayet-Scribe, *Histoire de la documentation en France : culture, science et technologie de l'information 1895–1937*, CNRS Éditions / Paris, 2000, on Gérard especially pp.186ff. and Fell, *Disziplin* ...
 64. Jean Gérard, L'activité de l'Office International de Chimie. *Comptes Rendus de la Douzieme Conférence. Lucerne et Zurich, 16–22 Aout 1936 / Union Internationale de Chimie*, 1936, pp. 64–75, see also on the 'Office international de chimie' and the 'Maison de la chimie' in Fell, *Disziplin*, pp. 299–311.
 65. Wilhelm Ostwald, Genie und Verehrung. *Isis*, 1913, 1: 208–214.
 66. See on p. 128 of George Sarton, Bibliographie synthétique des revues et des collections de livres. *Isis*, 1914, 2: 125–131.
 67. See the foreword to the Ve Bibliographie critique de toutes les publications relatives à l'Histoire, à la Philosophie et à l'Organisation de la Science. *Isis*, 1914, 2: 248–250, and an 'advertising paper' before *Isis*, 1914, 2, which sounds like an advertising leaflet of the Bridge: "Etablir une bibliographie sur fiches, de telle sorte que chacun puisse se constituer l'encyclopédie de son choix: une encyclopédie jamais terminée, toujours vivante et neuve. ... Elle constituera une encyclopédie perpétuelle et éminemment facile à consulter ..." Some letters between Ostwald and Sarton survived in BBAW, Ostwald papers, No. 4174.
 68. This part of the paper is to be understood as a progress report of my research. Hints for further literature or locations to get more information on the TWL and Hanffstengel are welcome.
 69. Marianne Buder, *Das Verhältnis von Dokumentation und Normung von 1927 bis 1945 in nationaler*

- und internationaler Hinsicht : ein Beitrag zur Geschichte der Dokumentation, Beuth / Berlin, 1976.
70. See the citation of Ostwald in the beginning of this paper and his book Ostwald, *Pyramide*, ...
 71. Oskar Lasche, Deutsches Technisch-Wissenschaftliches Vortragswesen, ein Beitrag zur Ingenieurfortbildung, *Zeitschrift des Vereins Deutscher Ingenieure (VDI)*, 1922, 66,1: 1-3. Later this paper was distributed as offprint with the title: Die Technisch-Wissenschaftliche Lehrmittelzentrale beim Deutschen Verband Technisch-Wissenschaftlicher Vereine und ihre Bedeutung für das Ingenieur-Fortbildungswesen, VDI / Berlin. See also F. Romberg, Deutsche Technisch-Wissenschaftliche Lehrmittelzentrale im D.V., *Der Betrieb*, 1921, 4: 172-173.
 72. See: *Zeitschrift für Organisation*, 1931,5: 308.
 73. According to Klaus Thielen: Dokumentation Verkehrswesen. In: *Bausteine zur Geschichte der Informationswissenschaft und -praxis in Deutschland*. Online: www.phil-fak.uni-duesseldorf.de/infowiss/frames/baust/Manthiel.html where is also cited a publication of the TWL in the 1950s: Technisch-wissenschaftliche Lehrmittelzentrale (ed.), *Förderung der allgemeinen technischen Dokumentation auf dem Gebiete des Verkehrswesens*, Darmstadt, 1959.
 74. Oskar Lasche, Leitsätze für Vortragswesen und Lehrmittel. *Der Betrieb*, 1921,4: 169-172; Georg v. Hanffstengel, Lichtbild und Film im Dienste des Maschinenbaus. *Maschinenbau / Wirtschaft*, 1925, 4: W17-W18 (77-78); G. v. Hanffstengel. Gegen die Systemlosigkeit im Vortragswesen. *Zeitschrift für Organisation*, 1928, 2: 33-34; G. v. Hanffstengel, Rationalisierung des Lichtbildwesens. *Zeitschrift für Organisation*, 1928, 2: 257-261.
 75. Georg von Hanffstengel, Die Technisch-Wissenschaftliche Lehrmittelzentrale. *Kölner Blätter für Berufserziehung*, 1927, 3: 362-365.
 76. It was also thought about creating index cards on valuable publications or on important experiences within companies (knowledge management !). See Georg v. Hanffstengel, Nachrichtenblätter in karteimässigem Druck. *Maschinenbau / Wirtschaft*, 1925, 4: W250-W251 (1104-1105). On the use of card indexes in offices and companies and its origins in libraries see Markus Krajewski, *Zettelwirtschaft: Die Geburt der Kartei aus dem Geiste der Bibliothek*, Kulturverlag Kadmos / Berlin, 2002, and my review of this book in: *Bibliothek*, 2002, 26: 317-318.
 77. See: *Maschinenbau / Wirtschaft*, 1922/23, 2: W16 (82).
 78. In Memoriam Prof. Georg von Hanffstengel. *IID Communications*, 1938, 5, 4: 128.
 79. F. Donker Duyvis, *The International Federation ...*, on p. 180.
 80. Georg v. Hanffstengel, Neue Wege der Werbung im Maschinenbau. *Maschinenbau / Wirtschaft*, 1922, 1: 659 (75). See also his book, *Die Reklame des Maschinenbaus*, Springer / Berlin, 1923, containing at the end a chapter called 'New Ways' with a description of the TWL. His book, *Das technische Lichtbild : seine Herstellung und seine Verwertung in Schule, Vortrag und Industrie*, VDI-Verl. / Berlin, 1930, seemed to be itself a promotion for the TWL containing dozens of photos from the TWL collection.
 81. For a more detailed view on Pietsch see Thomas Hapke, Erich Pietsch - International connections of a German pioneer in information science. To be published in the proceedings of the Second Conference on the History and Heritage of Scientific and Technical Information Systems, Philadelphia, PA, November 16-17, 2002, see on the net at www.chemheritage.org/events/event-asist2002.html. For the papers of Pietsch see the Archive of the Max-Planck-Society for the Advancement of Science in Berlin (MPG-Archive), III. Abt., Rep. 0022 Pietsch papers and for the papers of the Gmelin Institute see MPG-Archive, II. Abt. Rep. 38A Gmelin Institute papers.
 82. For a more detailed description of the *Gmelin Handbook* as part of the secondary literature in chemistry see Helen Schofield, The evolution of the secondary literature of chemistry. In: Mary Ellen Bowden, T. B. Hahn, and R. V. Williams (eds.), *Proceedings of the 1998 Conference on the History and Heritage of Science Information Systems*, Information Today / Medford, NJ, 1999 (pp. 94-106, especially pp. 96-98). The history of the Gmelin Institute in detail is described by Bernd Wöbke, Die Geschichte von Gmelins Handbuch [The history of Gmelin's Handbook]. *Berichte und Mitteilungen*. Max-Planck-Gesellschaft, 1988, 3: 9-88; but see also the English paper by K.-C. Buschbeck, The Gmelin Institute. In: *Encyclopedia of Library and Information Science* (Vol. 9, pp. 522-532), Dekker / New York, 1973.
 83. Before his appointment other names were in discussion as successor of Meyer, because Pietsch did not guarantee, "that he supported the National Socialist state anytime without reserve." (Wöbke, 1988, p. 57, German original).
 84. In 1957 the Gmelin Institute moved to Frankfurt on the Main.
 85. E. Pietsch, Future possibilities of applying mechanized methods to scientific and technical literature. In: Casey & Perry, *Punched cards*, 1951, pp. 427-455, and E. Pietsch, Evaluation of mechanized documentation at the Gmelin Institut. In: R.S. Casey, J.W. Perry, J.W. and M. Berry (eds.), *Punched cards : their applications to science and industry*. 2. ed. (pp. 571-618), Reinhold / New York, 1958.
 86. Hans Bauer, Klaus Schneider. *Information : Wissenschaft und Praxis*, 2002, 53: 53.
 87. Michael Friedewald, *Der Computer als Werkzeug und Medium: die geistigen und technischen Wurzeln des Personal Computers* [The computer as tool and medium : the intellectual and technical roots of the personal computer], Verlag für Geschichte der Naturwissenschaften und der Technik / Berlin, 1999. On p. 85f.
 88. There Perry "designed a relay-operated device to search data stored on punched paper tape", the

- WRU Searching Selector, see W. Aspray, Command and control, documentation and library science : the origins of information science at the University of Pittsburgh. *IEEE Annals of the History of Computing*, 1999, 21, 4: 4–20. A present assessment of Perry's work in information science is given by Irene S. Farkas-Conn, *From documentation to information science: the beginnings and early development of the American Documentation Institute – American Society for Information Science*, Greenwood Pr. / New York, 1990, on pp. 140–142, 194–196.
89. Letter from J. D. Mack to Pietsch from 28.3.1957 and further papers, MPG-Archive Gmelin Papers, No. 43.
 90. J.D. Mack, Intercontinental guided missives. In: J.H. Shera, A. Kent and J.W.Perry (eds.), *Information systems in documentation: based on the symposium on Systems for Information Retrieval held at Western Reserve University, Cleveland, Ohio in April, 1957* (pp. 560–571), Interscience Publ. / New York, 1957. p. 562.
 91. F. Donker Duyvis (ed.), *Manual on document reproduction and selection, published by the International Federation for Documentation, printed with the financial assistance of UNESCO (Loose-leaf collection)*, FID / The Hague, 1953–1958 (FID Publ. No. 264).
 92. E. Pietsch, Next steps in documentation following the International Conference on Scientific Information. *Revue de la Documentation*, 1959. 26: 13–14.
 93. Günther Pflug, Automatisierungsbestrebungen im deutschen Dokumentations- und Bibliothekswesen [Automation attempts in German documentation and library science]. *Mitteilungsblatt der Bibliotheken Nordrhein-Westfalens N.F.*, 1966, 16: 75–105.
 94. For more on German information and documentation in these years see also H. Arntz, National Information and Documentation System in the Federal Republic of Germany. In: *Encyclopedia of Library and Information Science* (Vol. 9, pp. 478–492), New York: Dekker / New York, 1973.
 95. Helmut Arntz, Er machte den Staat dokumentationsbewußt : Erich Pietsch zum 70. Geburtstag am 6. Mai 1972. [He made the State aware of documentation : Erich Pietsch on his 70th birthday on May 6, 1972]. *Nachrichten für Dokumentation*, 1972, 23: 138.
 96. Wilhelm Ostwald, Ways, on p. 53.
 97. See A. P. Schmidt, Von der interaktiven Enzyklopädie zum Menschenrecht auf Information. In: Roth, M. (ed.), *Der Themenpark der EXPO2000 : die Entdeckung einer neuen Welt*, Vol. 1., Springer / Wien, 2000 (, pp. 138–143), on p. 141.
 98. Jonathan Furner, On recommending. *Journal of the American Society for Information Science and Technology*, 2002, 53: 747–763.
 99. Ernst Bloch, *Avicenna und die aristotelische Linke*, Rütten & Loening / Berlin, 1952, on p. 9 (own translation).
- Original paper no. 057 presented at the World Library and Information Congress, 69th IFLA General Conference, Berlin, Germany, 1–8 August 2003, in session 152, Library History. English original available on IFLANET at <http://www.ifla.org/IV/ifla69/prog03.htm>.*