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Збірник тез доповідей
IV Міжнародної науково-практичної конференції
ІБІТ 2022

30 листопада 2022 року

Міністерство освіти і науки України
Державна служба України з надзвичайних ситуацій
Львівський державний університет безпеки життєдіяльності
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У збірнику опубліковано матеріали IV Міжнародної науково-практичної конференції "Інформаційна безпека та інформаційні технології". На основі теоретичних та експериментальних досліджень представлено інноваційні підходи у сфері кібербезпеки та інформаційних технологій. Обговорено та запропоновано сучасні шляхи щодо захисту інформації як на особистому, так і на державному рівнях.

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За точність наведених фактів, самостійність наукового аналізу та нормативність стилістики викладу, а також за використання відомостей, що не рекомендовані до відкритої публікації відповідальність несуть автори опублікованих матеріалів.

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Секція 2

ІНФОРМАЦІЙНІ ТЕХНОЛОГІЇ

Напрям 11

ОРГАНІЗАЦІЯ БАЗ ДАНИХ І ЗНАНЬ

UDC 004:001.102:929

THE BIRTH OF THE INFORMATION AGE: PAUL OTLET

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Annotation. *Described the activity by Paul Otlet, who formulated the concept of universal understanding the concept* "*document*" *and the general principles of the theory of documentation and became the founder of informatics as a science that comprehensively considers the issues of the theory of information and communication, as well as the organization of the processes of collecting, storing and information searching.Given Paul Otlet's achievements and inventions: The Universal Bibliographic Repertory, The Universal Decimal Classification (UDC), Mundaneum.*

Keywords: *Paul Otlet, document, bibliography, 'Treaties on Documentation', International Federation for Information and Documentation, Mundaneum.*

Анотація. *Описано діяльність Поля Отле́, який сформулював концепцію універсального розуміння поняття* "*документ" та загальні засади теорії документації і став фундатором інформатики як науки, що всебічно розглядає питання теорії інформації і комунікації, а також організації процесів збору, збереження і пошуку інформації. Згадано винаходи Поля Отле́: Універсальний бібліографічний каталог, Універсальна десяткова класифікація (УДК), Mundaneum.*

Ключові слова: *Поль Отле́, документ, бібліографія,* "*Трактат про документацію", Міжнародна федерація з інформації та документації, інформаційне сховище* "*Mundaneum".*

Paul Otlet, in full Paul-Marie-Ghislain Otlet, (born August 23, 1868, Brussels, Belgium – died December 10, 1944, Brussels). Paul was the oldest child in the family. His mother, Marie, died at the age of 24. He didn't go to school till the age of 11, his father hired tutors instead before entering secondary school at age 12. Father believed that classrooms were a stifling environment. Paul Otlet was educated at the Catholic University of Leuven and at the Université

Libre de Bruxelles, where he earned a law degree on 15 July 1890 [15] (Fig. 1, 2, 3), see the video [17].

Fig. 1. Paul Otlet, 1888

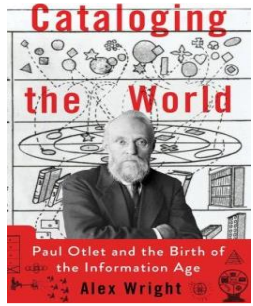

Fig. 2. Book by Alex Wright

Fig. 3. A collection

In 1891 he met the lawyer and future Nobel Peace Prize winner Henry La Fontaine (1913 in recognition of his contribution towards the peace movement) (Fig. 4), marking the beginning of a long-standing collaboration. In 1895 Otlet and La Fontaine established the International Institute of Bibliography and announced plans to create a Universal Bibliographic Repertory that would serve as a global clearinghouse for bibliographical data. Despite considerable resistance from other European librarians, they pressed forward with their plans, creating a headquarters for the institute and obtaining recognition and a small subsidy from the Belgian government [16].

Fig. 4. Henry La of index cards. Fontaine, 1916

They wrote to the creators of the classification and asked for permission to modify his system. And soon they began to work and created the Universal Decimal Classification. The same year they created a headquarters for the institute and obtaining recognition and a small subsidy from the Belgian government [3, 15, 27]. In 1895 Otlet and La Fontaine began the creation of a collection of index cards, meant to catalog facts (Fig. 3), that came to be known as the Universal Bibliographic Repertory. Soon this collection had more than 15 million entries [16, 15].

In the late 1800s and early 1900s Otlet pioneered the field of what we today call information science, but what he called documentation. A hundred years before the development of the Internet, Otlet used terms like web of knowledge, link, and knowledge network to describe his vision for a central repository of all human knowledge. It is fabulous introduction to pre-digital information classification. We can use this video in students' groups in the con-

ditions of university. It will give the students a visual appreciation of pre-digital classification and organization of information (Fig. 3) (see the video [1]).

In 1904, Otlet and La Fountaine began to publish their Universal Decimal Classification [19] (see the video [21]).

In 1906, Otlet and the chemist Robert Goldschmidt, had proposed "micro-fiche" as a standard format for a "micro-photographic book". Later on, they proposed a portable library of "micro-photographic books" [19].

In 1907, his father died, and family struggled to maintain all parts of the business. They created a company "Otlet Brothers", Paul became the president of the company [7].

In 1910 Otlet and La Fontaine established the Union of International Associations, a federation of 132 international organizations that would play an important role in the formation of the League of Nations [19, 27].

The same year they created plans about the "city of knowledge", which Otlet originally named the "Palais Mondial" ("World Palace"), that would serve as a central repository for the world's information [19, 27], (Fig. 5, 6).

Fig. 5. Otlet with his Mundaneum team

Fig. 6. Paul Otlet, Henri La Fontaine(left) and Mathilde Lhoest (his wife) outside the gates of Palais Mondial, in Cinquantenaire (Brussel), 1930

In 1913, La Fontaine won the Nobel Peace Prize (Fig. 4), and invested his winnings into Otlet and La Fontaine's bibliographic works, because they were suffering from lack of funding [16] (see the video [17]).

During World War I, Paul spent a lot of time trying to bring about piece. In 1914, he published a book, "La Fin de la Guerre" ("The End of War") that defined a "World Charter of Human Rights" as the basis for an international federation…

After the end of World War I, they asked the Belgian government to sponsor the project in hopes that it would form the intellectual bulwark of a new "World City" that would bolster Belgium's case for making Brussels the headquarters of the nascent League of Nations. The Belgian government granted space for the installation – which Otlet eventually began referring to as the Mundaneum [33, p. 59], see the video [14].

After failing in its bid for the League of Nations headquarters, the politically unstable Belgian government began to lose interest in the project, eventually closing it in 1934 [15, 16, 19].

Paul Otlet wrote about his theories of organizing information on a grand scale. His two major books were the Traité de documentation ("Treatise on Documentation") in 1934 (Fig. 7) and Monde: essai d'universalisme ("World: Essay on Universalism") in 1935, in which Otlet described his vision for a worldwide information network that in many ways presaged the creation of the World Wide Web more than 50 years later [19, 27] (Fig. 8). Otlet's primarily female staff answered information requests by hand. Without the digital luxury of keyword searches, a single query could take painstaking hours, even days, of sifting through the elaborate index card catalog (Fig. 9), see the video [13].

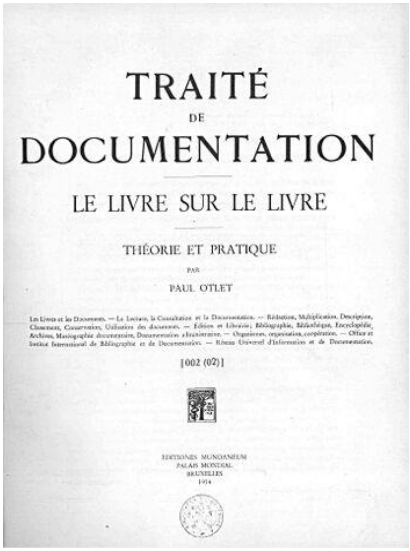

Fig. 7. Traité de documentation, 1934

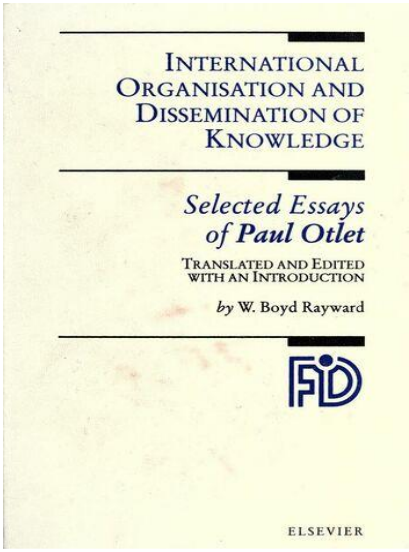

Fig. 8. Selected Essays by P. Otlet, 1990

Fig. 9. Otlet's primarily female staff

The library catalog card is one form of the popular 3×5 index card that served as a filing system for a multitude of purposes for over two hundred years (Fig. 10). The original purpose of the index card and its subsequent development represented the early stages of information theory and practice. Additionally, as becomes clear below, without the index card as the first functional system for organizing complex categories, subcategories and cross-references, studies in the natural sciences would have never gotten off the ground [5].

Fig. 10. Printed library catalog card

The index card became the indispensable tool for both organizing and comprehending the expansion of human knowledge at every level (Fig. 10). Along with several important intermediary steps, the ideas that began with index cards eventually led to relational databases, document management systems, hyperlinks and the World Wide Web.

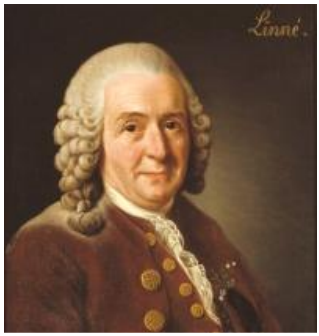

Fig. 11. Carl Linnaeus

The Swedish naturalist and physician Carl Linnaeus (1707–1778) is recognized as the creator of the index card (Fig. 11). Linnaeus used the cards to develop his system of organizing and naming the species of all living things. Linnaean taxonomy is based on a hierarchy (kingdom, phylum, class, order, family, genus, species) and binomial species naming (homo erectus, tyrannosaurus rex, etc.). He published the first edition of his universal conventions in a small pamphlet

called "The System of Nature" in 1735 [5] (Fig. 12).

Fig. 12. Linnaeus' "*The System of Nature*"

While index cards continued to be used in Europe, an important step forward in information management was made in the US by Melvil Dewey (1851–1931), the creator of the well-known Dewey Decimal System (or Dewey Decimal Classification, DDC). Used by libraries for the cataloging of books since 1876, the DDC was based on index cards and introduced the concepts of "relative location" and "relative index" to bibliography [5] (Fig. 13, 14).

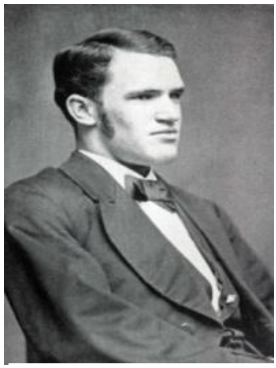

Fig. 13. Melvil Dewey

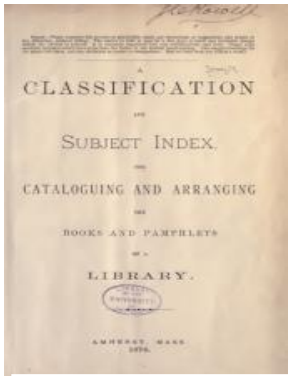

Fig. 14. The 1st edition

By the end of the nineteenth century the Dewey classification system and his 3×5 card catalog were being used in nearly every school and public library in the US. The basic concept was that any member of society could walk into a library anywhere in the country, go to the card catalog and be able to locate the information they were looking for [35].

While Dewey's classification system became the standard in US libraries, others were working on bibliographic cataloging ideas, especially in Europe. In 1895, the Belgians Paul Otlet (1868–1944) and Henri La Fontaine founded the International Institute of Bibliography (IIB) and began working on something they called the Universal Bibliographic Repertory (UBR), based on index cards. Funded by the Belgian government, the UBR involved the collection of books, articles, photographs and other documents in order to create a one-of-a-kind international index.

Otlet and La Fontaine made an important conceptual breakthrough over Dewey's approach. In particular, they conceived of a complex multidimensional indexing system that would allow for more deeply defined subject categories and cross-referencing of related topics: the content of bibliographic collections needed to be separated from their form and that a "universal" classification system needed to be created that included new media and information sources (magazines, photographs, scientific papers, audio recordings, etc.) and moved away from the exclusive focus on the location of books on library shelves (Fig. 15), see the video [18].

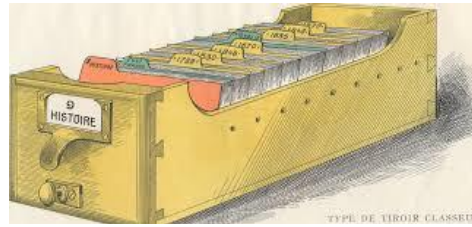

Fig. 15. Otlet's ingenious index card system

The UDC (the Universal Decimal Classification) by Otlet and La Fontaine extended Dewey's cataloging expressions to include symbols (equal sign, plus sign, colon, quotation marks and parenthesis) for the purpose of establishing "links" between multiple topics. This was a very significant breakthrough that reflected the enormous growth of information taking place at the end of the nineteenth century. By 1900, the UBR had more than 3 million entries on index cards and was supported by more than 300 IIB members from dozens of countries [5, 31] (Fig. 16, 17).

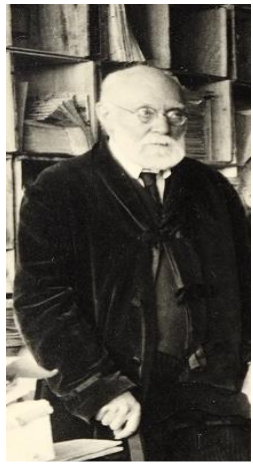

Fig. 16. P. Otlet. of Dewey's bibliographic classification system

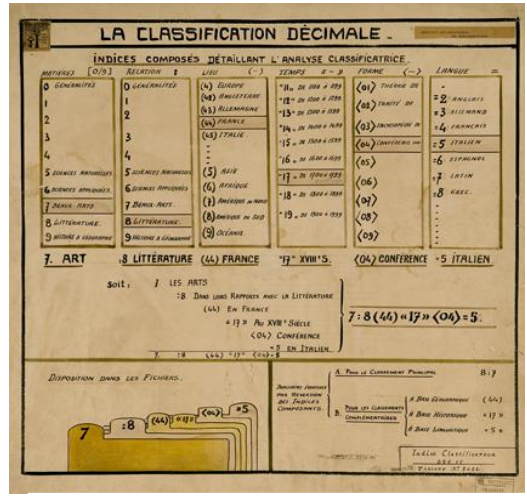

Fig. 17. An explanatory schema of the UDC index formation in French, 1920

Fig. 18. is an illustration of the path of information from a book (A), via the Universal Bibliographic Repertory (RBU) (B), and from there to classification in individual libraries catalogues (C) and shelves (D). At the centre of it is an index card, carrying the important information, plus decimal code [29].

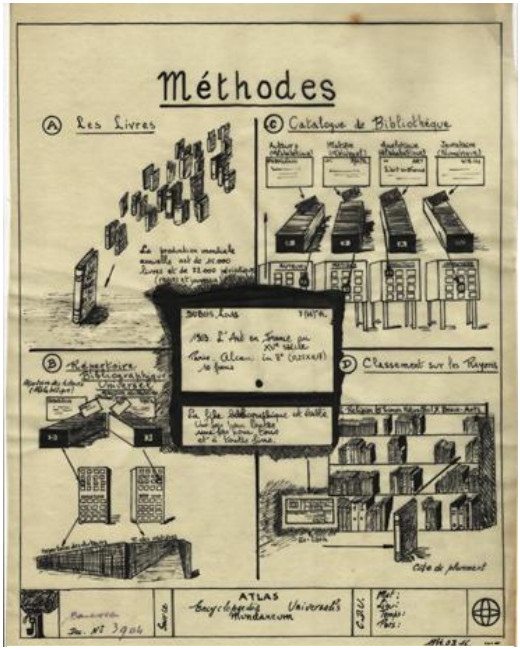

Fig. 18. Method

Within a year's time, the two men and a team of volunteers had gathered 400,000 entries recording books, speeches, sheet music, medical journals, museum pieces, even newspaper and poster advertisements. By 1896, Otlet opened the doors on a mail-in research service: users would pay a small fee to request information on any number of topics, while staff would copy relevant note-cards, and send them back by delivery service. In essence, Otlet and Fontaine were on their way to turning their bibliography into a steampunk version of Wikipedia [34], see the video [20].

Over the next decade, as their bibliography swelled to millions of entries, simply organizing data into broad categories was not enough. Otlet sought to create a classification system and subsequent search mechanism that could intersect several subjects, and in 1904 he published a more polished version of his Universal Decimal Classification system (Fig. 15, 18), see the video [6]. Basically it was a hierarchical card catalog system, sort of like the Dewey Decimal System on 'roids'. To handle retrieval, Otlet devised an algebraic algorithm based on category and subcategory identification numbers, complete with a set of relational operators. He had created his own analog search engine almost 90 years before Archie was developed… The jewel of Otlet's vision for the new "global village" would be the Mundaneum, a vast repository open to the public,

that would house the now 12 million 3×5 index cards and accompanying filing system [34] (Fig. 19, 20), see the video [45].

Fig. 19. A Mundaneum media room

Fig. 20. A reproduction of Otlet's original Mondotheque desk

In 1910, Otlet and La Fontaine shifted their attention to the establishment of the Mundaneum in Mons, Belgium. Again with government support, the aim of this institution was to bring together all of the world's knowledge in a single UDC index and by 1924, the Mundaneum contained 18 million index cards housed in 15,000 catalog drawers (Fig. 9). But during the Depression and lead up to World War II, Paul Otlet realized that further management of the card catalog had become impractical. He began to consider more advanced technologies – such as photomechanical recording systems and even ideas for electronic information sharing – to fulfill his vision [35], see the video [2].

A massive center for documentation and communication, the Mundaneum aimed at hosting all human knowledge and facilitating worldwide sharing through the connection of universities, governmental institutions, and individuals. It was also meant to embody the idea of promoting peace among nations. The information would have been classified on indexing cards under the Universal Decimal Classification, developed by Otlet, and the institutions would have merged shelves

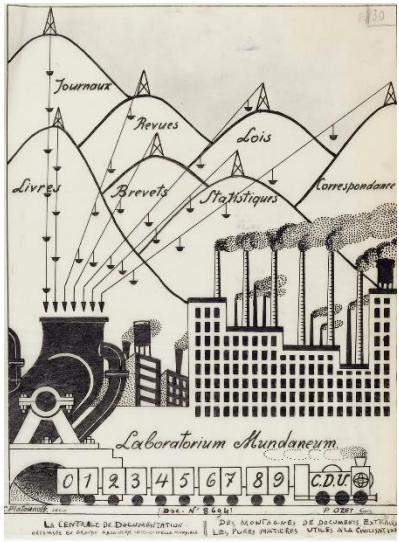

Fig. 21. Plan of the Mundaneum

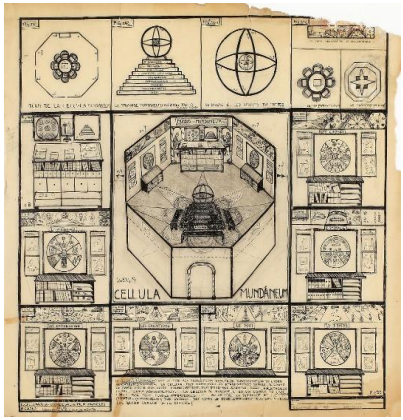

Fig. 22. The center of the Mundaneum (1935)

and printed documentation with screens and telephones allowing users from all over the world to ask questions (see the video [28]). A first version of the project was indeed realized and hosted in 150 rooms of the Palais du Cinquantenaire in Mons, a location offered by the Belgian government [4, 30], see the video [12], (Fig. 23–25).

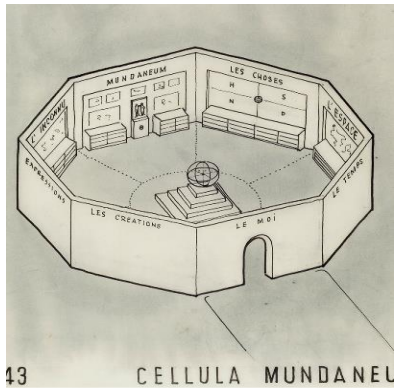

Fig. 23. Laboratorium Mundaneum: Powerhouse of Documentation. C. Platounoff on commission of Otlet (28 Dec 1937)

Below we present a Video game: *Mundaneum Web 1895 in the Mundaneum Museum* (Fig. 26, 27) located in Mons in a magnificent Art Deco building (Belgium) [30]. The trilingual game Mundaneum Web 1895 on tablet provides a journey through the museum: our very founder, Paul Otlet, rediscovers a new youthfulness and guides visitors Upon finding each featured location or object in the museum, little games are unlocked at geolocated landmarks. These fun and instructive challenges allow to learn a little more about the founders of the Mundaneum, Paul Otlet and Henri La Fontaine, and their project: to gather together all of the world's

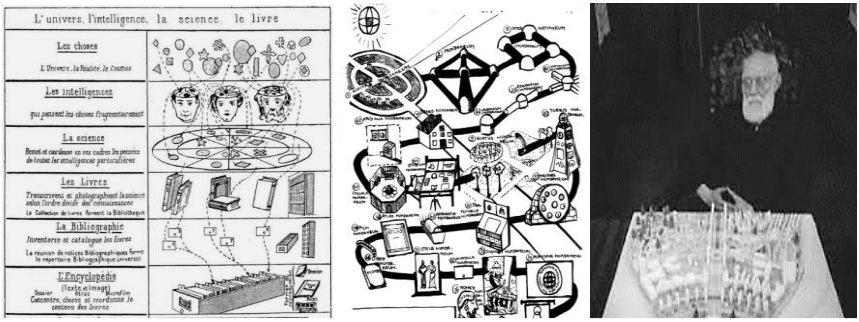

Fig. 24. Paul Otlet: Universe, Intelligence, Science, Book. Species Mundaneum, 16 Jan 1937

Fig. 26. Photograph of Otlet sitting behind a scale model of the Cité Mondiale designed by the Belgian modernist architect Stanislas Jasinski in 1941

knowledge. The various purposes of the game:

– To discover the museum space of the Mundaneum.

– To learn who its founders are and how their inventions worked (sheet, archive, ...).

– To get the best score possible [32].

The Mundaneum consists of a ground floor overlooked by two modular floors on demand, a glass conference room overlooking a brand new courtyard at the back of the museum and a terrace. The Mundaneum is today a center of private archives and a museum space recognized by the Wallonia Federation. In the basement of the building are 6 kilometers of archives which are made available to researchers around the world. The museum space hosts a permanent exhibition and major temporary exhibitions all year round recognized internationally by the UNESCO World Memory Program and the European Heritage Label [9].

Fig. 27. The Mundaneum Museum in Mons (Belgium)

In brief. Otlet's monumental collection was predicated not on ownership but on access and sharing – while amassing it, he kept devising increasingly ambitious schemes for enabling universal access, fostering peaceful relations between nations, and democratizing human knowledge through a global information network he called the "Mundaneum" – a concept partway between Voltaire's Republic of Letters, Marshall McLuhan's "global village", and the übermind of the future [26].

Otlet was more than a bibliographer, encyclopaedist, and founding father of the discipline of "documentation". He was also a sociologist, an internationalist, and an untiring promoter of his conception of "universalism" or "mondial-

isme", of the Mundaneum and the Cité Mondiale [33, p. 58] (Fig. 28), see the video [10].

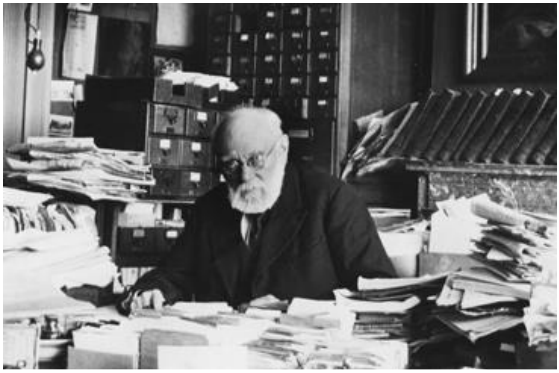

Fig. 28. Paul Otlet in his office in the 1930 s

While Otlet did not by any stretch of the imagination "invent" the Internet – working as he did in an age before digital computers, magnetic storage, or packet-switching networks – nonetheless his vision looks nothing short of prophetic. In Otlet's day, microfilm may have qualified as the most advanced information storage technology, and the closest thing anyone had ever seen to a database was a drawer full of index cards. Yet despite these analog limitations, he envisioned a global network of interconnected institutions that would alter the flow of information around the world, and in the process lead to profound social, cultural, and political transformations [26].

And while he might well have been flummoxed by the anything-goes ethos of present-day social networking sites like Facebook or Twitter, he also imagined a system that allowed groups of individuals to take part in collaborative experiences like lectures, opera performances, or scholarly meetings, where they might "applaud" or "give ovations" [26].

In summary. *First dimension* in Otlet's work that may be called visionary is the way he approached "information" as consisting of "morselized", quantifiable, and coded units or pieces of information. Otlet's idea to record information in separate chunks or units according to the "monographic principle" foreshadowed, in a certain sense, the present tendency to conceive of information as detachable and manipulable units or atoms of content, whose retrieveability has become more important than the information itself [33, p. 61].

A second level on which Otlet's utopia still resonates with our present times is the similarity between his vision of a collective, mechanical brain, on the one hand, and the emergence of a global brain that some theoreticians and philosophers observe to be emerging today. From the "collective, mechanical brain" of Otlet, the "superorganism" of Herbert Spencer (1820–1903), the "world brain" of H. G. Wells (1866–1946), the "noosphere" of the French philosopher and Jesuit priest Pierre Teilhard de Chardin (1881–1955), different scholars have tried to conceptualize in terms of evolutionary, humanist, and organicist models what seems to be an emergent cognitive [33, p. 61].

Thirdly, Otlet's ideas about the Cité Mondiale (Fig. 26) (see the video [8]) resonate with some of the trends that characterize current European planning politics. Otlet's idealist activism for the location of international organization in one world capital seems outdated in that the capital of Europe is today in fact a superposition of the three official capitals (Luxembourg, Strasbourg and Brussels), a network of cities hosting European Agencies, and a rotating European Capital of Culture. Yet, even within this new paradigm of a polycentric capital, the process of centre formation within the European Union continues, as well as the competition for that matter between political, cultural, and economic centres [33, p. 61].

Otlet's idea of collective intelligence working toward a common good presaged modern concepts like crowdsourcing and "cognitive surplus" as well as initiatives like Singularity University [26].

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НАПРЯМ 11.
ОРГАНІЗАЦІЯ БАЗ ДАНИХ І ЗНАНЬ

НАПРЯМ 12.
ТЕХНОЛОГІЇ ВІЗУАЛІЗАЦІЇ ДАНИХ

НАПРЯМ 13.
ОПЕРАЦІЙНІ СИСТЕМИ

Наукове видання

ІНФОРМАЦІЙНА БЕЗПЕКА ТА ІНФОРМАЦІЙНІ ТЕХНОЛОГІЇ

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