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HISTORIES, HERITAGES, AND THE PAST: THE CASE OF EMANUEL GOLDBERG

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ABSTRACT: This Conference is concerned with the history *and the heritage* of scientific and technical information systems. History is composed of narratives of the past, always multiple and always incomplete. Heritage includes "received" history, the narratives that are generally known and accepted within the social memory of a community. "The past," "history," and "heritage" may, therefore, differ substantially. Emanuel Goldberg (1881-1970) pioneered some important technical developments in information storage and retrieval, notably microdots and microfilm retrieval technology, but he remained largely absent from the history and heritage of technical information systems. Goldberg's life and work provides an opportunity to examine the mechanisms through which differences between the past, history, and heritage arise.

HISTORY, HERITAGE AND THE PAST

This Conference is concerned with the history *and the heritage* of scientific and technical information systems. This paper will use the life and work of Emanuel Goldberg as a case-study to explore the differences between history, heritage, and the past.

It is useful to distinguish between *the past*, what happened; *history*, accounts of the past; and *heritage*, which is those parts of the past that affect us in the present. What is past is passed. Events that are gone are no longer directly knowable. The past is knowable only indirectly through histories, descriptions and narratives of what happened. For any aspect of the past, there may be many narratives or none. Histories are always multiple and incomplete. Many factors influence what histories are, or can be written.

Heritage is what we have now from the past: The goods that we inherit from our parents, the residues of toxic wastes, memories and artefacts that we cherish and retain, our genetic inheritance, and such culture as we have absorbed and made our own. Included in our cultural, intellectual, and professional heritage are the historical narratives we know and accept, and which help shape our sense of identity.

Our heritage, including our heritage of information systems, is, in a significant sense, accidental. The legacy systems that we use, and which influence what we do, are the consequences not only of past inventions, but also of past decisions about adoption and implementation. Our sense of history is doubly accidental, because it depends not only on what narratives happened to be composed, but also on which ones were accepted, "received," and incorporated into our sense of the past. We will examine and illustrate the relationships between history, heritage, and the past by examining the life and work of Emanuel Goldberg, who made several contributions to information technology during the first half of the twentieth century. His life, his achievements, and how they were known are of interest for a number of different reasons, not least as an example how heritage can differ from history.

EMANUEL GOLDBERG, 1881-1970

Emanuel Goldberg was born in Moscow in 1881. He grew up in a cultured, highly-educated, cosmopolitan environment. His father was a Colonel in the Tsar's army medical corps. Goldberg studied Chemistry and received his Ph.D from Wilhelm Ostwald's Institute for Physical Chemistry at the University of Leipzig in 1906. He had a very successful career in Germany as a researcher, professor, and industrialist. As a researcher and as an inventor, Goldberg contributed to many different aspects of imaging technology in the first half of the twentieth century: photographic sensitometry (the Goldberg Wedge), reprographics, color printing, extreme reduction microphotography (Microdots), optics, camera design (the Contax), movie cameras (the Kinamo), and early television technology. The "Goldberg Condition" is a design principle for photography and movie sound tracks, now better known as the Gamma Rule. By 1926 he had published nearly one hundred scientific and technical publications. In April 1933, when head of the world's largest camera firm, Zeiss Ikon, in Dresden, Germany, he was kidnaped by Nazi thugs and became a refugee. He went to France and worked at the Zeiss Ikon subsidiary Ikonta, in Paris. Then, in 1937, he moved to Palestine, where he established "Professor Goldberg's Laboratory for Precision Instruments," which is now a major Israeli firm, El-Op. He died in Tel Aviv in 1970. (Biographical sources for Goldberg include Buckland 1992; 2002a, 2002b; Strauss & Röder, 1983, v.2, pt 1, p. 388).

MICRODOTS AND DOCUMENT RETRIEVAL

At the Sixth International Congress of Photography in Paris in 1925, Goldberg handed out souvenirs. A small leather-covered box contained a microscope slide bearing a portrait of Nicéphore Niepce to mark the centenary of Niepce having made his first photograph. The portrait was surrounded by a circle of 360 one degree divisions, every tenth numbered. The interval between the divisions was about one micron, 1 Fm, one-thousandth of a millimeter. Goldberg called his image a *Mikrat*, more especially, a *Mikrat nach Goldberg*, a "Goldberg-style microdot." Applied to the microfilming of texts, Goldberg stated that a page of an ordinary book could be legibly photographed on a surface of 0.01 of a square millimeter, which implies that one hundred pages could be photographed on one square millimeter, and 64,500 pages per square inch. Microfilming was not new, but such extreme reduction was and was made possible by an ingenious adaption of a microscope, which, used in reverse, served

as a camera. This novel process was prominently described in English, French and German publications (Goldberg , 1925, 1926a, 1926b; Stevens 1968; White 1992). But for the past fifty years, the invention of this microdot technology has, with rare exceptions, been attributed instead to a mythic Professor Zapp. What happened?

During the same fifty years the iconic founder of Information Science has been Vannevar Bush, who speculated about an imaginary personalized, desk-top document retrieval system, the "memex,"in his celebrated essay "As We May Think," published in the *Atlantic Monthly* in 1945 and endlessly cited ever since (Bush 1945a, 1945b; also Nyce & Kahn (1991) is a good source). Bush's memex is ordinarily thought of in terms of digital computers, but the essay of 1945 was drafted in 1939 and Bush's fantasy was based on his Rapid Selector. This was a document storage and retrieval device that he worked on from 1938 onwards, a microfilm reader with an ability to search for documents by scanning the index terms on the film. (For a detailed account see Burke (1994)). Index terms were encoded in the form of opaque marks on the film adjacent to each document and they were detected by pattern recognition, using a light source, a search card defining the marks to be detected, and a photoelectric cell. Although Bush and his memex are central to the generally accepted account of the origins of information science, he was only one of a number of engineers developing such equipment. Bush's patent application for the rapid selector was denied by the US Patent Office citing a prior patent issued to Emanuel Goldberg in 1931. Descriptions of Goldberg's rapid selector, apparently the first document storage and retrieval system to use electronics, had been widely patented, demonstrated at meetings in Berlin, Dresden, London, and Paris, and published fairly prominently in English and in German (Goldberg 1932a, 1932b, 1992). Yet Goldberg's papers seem not to have been cited, outside of Israel, after 1938 and the very few mentions of his retrieval machine seem to have aroused little or no interest. What happened?

In the early 1930s, Goldberg was a well-known figure. By 1990, he and his work had all but disappeared and these two major innovations in information technology were generally attributed to other, later inventors. How did that happen? We can identify a wide range of general causes and specific ones.

POLITICAL AGENDAS

When the Nazis came to power in 1933, the careers of Jews, especially Jews from Eastern Europe, ended. From March 1933, there was as rash of illegal "arrests" by Nazi party members, which newspapers did not report, even when a leading industrialist was abducted. Any discussion of the fate of the victims was discouraged. During the Nazi period, the achievements of Jew were not going to be recognized. Nor, during the Communist period, would those of a Jewish capitalist.

PERSONAL AGENDAS

The history and heritage of Goldberg's work were directly impacted by actions of three powerful and ambitious men.

J. Edgar Hoover

In 1945 the *Readers Digest* included an article entitled "The Enemy's masterpiece of espionage" by J. Edgar Hoover (1946), boasting about how the FBI had discovered microdots sent by German spies. Hoover stated, correctly, that microdot technology had been developed by a professor at the Technical University in Dresden. But he substituted the name Zapp for Goldberg and added an inaccurate account of the process. Anyone familiar with microdot technology would have recognized both errors. There never was a Professor Zapp in Dresden. There has been published controversy over these microdots, because although Hoover boasted to the White House about the microdots, he did not reveal that the text on them indicated an interest in the defenses of Pearl Harbor (Bratzel & Rout 1982; Young et al. 1983). The mythical Professor Zapp lives on as the unquestioned inventor of the microdot in one book after another in the literature of espionage (White 1990, 191-195: 1992, 49-56).

Heinz Küppenbender

The firm Zeiss Ikon was founded in Dresden in 1926, under Goldberg's leadership. Created through the merger of four existing firms, Zeiss Ikon was the world's largest camera company. Most of the shares were owned by the Carl Zeiss Foundation. A priority for Goldberg was the development of a new 35 mm camera to compete with the Leica. His response was the famous Contax. Heinz Küppenbender was a young engineer who joined the firm few years after it was founded. He was largely responsible for working out the technical details of the Contax under Goldberg's direction. Küppenbender flourished during the Third Reich, becoming head of the entire Zeiss cartel and responsible for the national allocation of raw materials for the optical industry. After a brief denazification, Küppenbender became head of the West German Zeiss Ikon. Küppenbender appears to have consistently emphasized his own achievements relative to Goldberg's, both in terms of credit for the design of the Contax 35 mm camera and more generally (Berthel 2000). A Küppenbender-centric narrative was amplified in corporate publicity and has been echoed uncritically through the years in writings about Zeiss Ikon.

Predictably, a Nazi-period corporate history of Zeiss Ikon published in 1937 did not mention the firm's Jewish founding director, Goldberg (Zeiss Ikon AG. 1937). In 1951, on the twenty-fifth anniversary of the founding of the firm, another corporate history of Zeiss Ikon was published as a special issue of *Die Leistung*, a business magazine (25 Jahre, 1951). This second corporate history showcased Küppenbender and the other current managers, but it, too, made no mention of Goldberg. Even more surprisingly, the erasure of Goldberg is almost total in a recent three-volume corporate history of the Zeiss companies. The second volume, entitled *Zeiss 1905-1945*, was published in 2000 (Walter, 2000). It notes Küppenbender's leadership, but not Goldberg's. The index has entries for two Goldbergs. An entry for "Goldberg, Emanuel" leads only to statement that, in 1933, he was the highest-ranking of Zeiss' Jewish employees. A separate entry, simply "Goldberg," leads to comment that a Jew, a Professor Dr Goldberg, was employed in Paris "until 1933," which is an error for "from 1933." It is not recognized that these two Goldbergs are the same person (Steiner 2002).

This third erasure of Goldberg from the corporate history of 2000 is the more remarkable because it follows a well-known, 900-page history of Zeiss published in 1962 in the communist German Democratic Republic (Schumann 1962). Written from a marxist perspective, it is heavily critical of

Küppenbender and the other capitalist managers of the1930s and 1940s, but it gives an adequate and rather sympathetic account of Goldberg. The 2000 corporate history was published a decade after the collapse of the communist regime at a time when Zeiss was back under capitalist management. In adopting a Küppenbender-centric narrative and rejecting the marxist narrative of 1962, Goldberg's role also got rejected. The 1962 and 2000 corporate histories based their quite different narratives on the same, very complete, and well-organized Zeiss corporate archives in Jena.

The prominent German documentalist Walther Schürmeyer knew about Goldberg's statistical machine. He was familiar with equipment developed at Zeiss Ikon and Goldberg's paper on his statistical machine is in a bibliography that he compiled with T. P. Loosjes (Schürmeyer 1933; Schürmeyer & Loosjes 1937). In 1935, Schürmeyer presented papers at two important conferences: the Congress of the International Institute for Documentation in Copenhagen; and the German Librarians Association conference (Verein Deutscher Bibliothekare) in Tübingen. These two papers were prominently published in prominent journals. In both papers he describes what are recognizably Goldberg's microdot and Goldberg's statistical machine, but, two years after the Nazis had forced Goldberg out of Germany, Schürmeyer names no names and cites no sources (Schürmeyer 1935, reprinted in Frank 1978, 385-397; Schürmeyer 1936).

Vannevar Bush

Vannevar Bush published his essay "As we may think"in the *Atlantic Monthly* in 1945. It was promptly reprinted in *Life* magazine with drawings and the subtitle: "A Top U.S. Scientist Foresees a Possible Future World In Which Man-Made Machine Will Start To Think." The following year it was reprinted in Bush's book *Endless Horizons*. Although the ideas in it were not particularly new, Bush's essay was immediately popular. It has been reprinted frequently and has been cited constantly ever since. The citing of Bush's article has been so extraordinary that it has been a subject of study in its own right (Smith 1981, 1991). One reason is that it is well-written. It stimulates the reader's imagination to go beyond the technology on which it was based. The mythical memex became a symbol of what might one day be achieved if only one were inventive enough, an image of potentiality in information retrieval research and development. There is no doubt that Bush's vigorous and imaginative writing was an inspiration for many readers, notably Doug Engelbart and Ted Nelson in the more promising technological context of digital computers.

An additional reason why Bush's essay became for fifty years an iconic symbol for the application of new technology in an information age is that Bush's personal prestige gave legitimacy to all who invoked his name. Bush had led the scientific effort to win the Second World War and proposed the National Science Foundation. Bush was the "the engineer of the twentieth century," the academic inventor who achieved power in Washington (Zachary 1997a, 1997b). In a world of "Big Science" in which the largest machines brought prestige, there were many who felt a need for legitimacy, either because they were concerned with small machines, such as personal computers, or with "softer" tasks, such as combining components for human-computer interfaces or providing information services. Invoking an association with the towering prestige and slightly folksy image of Bush was attractive to a wide range of writers. Once the pattern was established, others followed suit. Smith in her studies of this phenomenon notes that authors cited "As we may think" even when it was

irrelevant to what they had to say and, occasionally, in a way that indicated that they had not read the essay, which was widely thought to have been about digital computers and even, sometimes, assumed that it was related to networks, instead of an isolated, microfilm reader with a personalized indexing system.

What reveals the popular invocation of the Memex to have been a cultural and political gesture rather than an ordinary technical acknowledgment, is the striking absence of accompanying references to any of the many people who had expressed the same or similar ideas before Bush, even those who are, or were, internationally famous: Wilhelm Ostwald, who had devoted his Nobel prize money to promoting hypertext; Paul Otlet, the founder of the International Federation for Documentation, with visionary ideas about workstations; Watson Davis, of Science Service, a tireless advocate of microfilm; James Bryce, the Chief Scientist at IBM, who built up IBM's patent holdings in electronics and personally received patents for rapid selector technology; H.G. Wells, who, like Ostwald and Otlet, had popularized a machine more ambitious than Bush's under the name World Brain; and, as well, Goldberg, industrialist, authority on photography, and the first of the several inventors who worked on rapid selector technology in the late 1920s and 1930s, before Bush did. These were internationally famous people whose work has been largely overlooked or ignored.

OTHER INFLUENCES

Disciplines and professional fields do not necessarily evolve smoothly and the Second World War marked a profound discontinuity on the development of information services and technology. Stated simply, what had been called "Documentation" was eclipsed by "Information Science." New and different groups addressed the same kind of problems but with new technologies and in new contexts, without much recognition of the technical and intellectual continuities (Buckland 1996). There is little evidence of any interest in the history of information science among information scientists before the 1990s and, even if there had been, the history of technology tends to be written along national lines. Whatever the reasons, the pioneering work and ideas of Europeans active before 1939, even Paul Otlet and Wilhelm Ostwald, were largely ignored and forgotten after 1945. The situation was inhibited by a language barrier. The interesting older work was mostly in French or German, and not available in English. Even without a language barrier, there was, in the USA, a tendency to assume that information science was a new and emerging field in which the USA was the unquestioned leader. With that assumption, there was little to be learned from the work of pre-war foreigners or non-scientists. It has been argued that a temporarily reduced interest in technology on the part of librarians may also have been a contributory factor.

Goldberg's forced departure from Germany and his move in 1937 to the relative isolation of Palestine removed him from international scientific circles. He published little after 1933. His primary interest was to sustain the laboratory he had established in Tel Aviv and, more broadly, to help build a high tech industry in a developing country. His main concerns were with creating urgently needed civilian and military equipment (compasses, refractometers, rifle sights, and much more) and serving as a scientific advisor to the Israeli military.

His lack of confidence in history did not help. "I have no trust in memory or reminiscences," he

wrote to a friend in 1955. "I was always a bad history student and my experiences of life have taught me that it always comes out differently than one might have expected on the basis of the past." At the end of his life he systematically destroyed most his papers, keeping only those few items that had the most significance for him: some photos, some certificates, some offprints of his own publications, and almost no correspondence.

There were also some unhelpful semantic details. Goldberg was active before the phrase "information retrieval" had been coined. He called his retrieval device a "Statistical machine,"which captures the idea of data storage and retrieval and which was the technical term used in the USA for this technology in the 1930s. Bush used the name "rapid selector" instead of "statistical machine." Writing in German, Goldberg used various forms of the word *Register*. His paper announcing his machine was entitled "Das Registrierproblem in der Photographie" (1932b) and the English version was published with the title translated rather literally as "Methods of photographic registration," which does not convey what is important about the content. Further, Goldberg's papers were published in the photographic literature from which the information retrieval literature increasingly diverged as attention shifted away from photostats and microfilm to punch cards and other non-photographic technologies. These features would have tended to conceal his work from anyone who was looking for it, if they were unfamiliar with the earlier work and terminology. An article in *Fortune* magazine says that three patent searches for rapid selector technology failed to retrieve Goldberg's patent for a "statistical machine" (Bello 1960).

There are degrees of being known. In 1949 a new version of Bush's microfilm rapid selector was built by Engineering Research Associates in collaboration with Ralph Shaw, Director of the National Agriculture Library (Photoelectric librarian 1949). Shaw learned that Goldberg held the U.S. patent to rapid selector technology when Goldberg visited him to see the new machine. In a widely read article Shaw promptly and prominently acknowledged Goldberg's patent, and the patent is occasionally cited in subsequent technical literature. So what was known was that Goldberg had developed a patent-worthy invention. Bush, in contrast, was known to have built a working machine, an achievement that carries significantly more prestige. Shaw, and everyone else, seems to have remained unaware of Goldberg's two *articles*, and, therefore, of the fact there had been working prototypes, not just a design. So, although Goldberg's invention was not completely unknown, a patent alone brings little recognition. Frits Donker Duyvis, the very well-informed executive director of the International Institute for Documentation, did knew that a prototype had been developed at Zeiss Ikon, but he did not associate it with Goldberg. He thought that it had been developed by Hermann Joachim, who took over some of Goldberg's responsibilities in Dresden when Goldberg left (Donker Duyvis 1938)

Finally, what history is written depends on who chooses to make the effort to write it, what they decide to write about, whether they can find the suitable sources, and, especially, whether they happen to do so while knowledgeable sources are still alive to help. The primary documentation of Goldberg's professional life was lost in the bombing of Dresden on February 13-14, 1945, when Zeiss Ikon's headquarters was destroyed. Later, the records of his laboratory in Palestine were destroyed in a flood.

CONCLUSION

We have used the life and work of Emanuel Goldberg as basis for reflection on what history is written and which parts of it are received into social memory (See Fentress & Wickham 1992). In this case several factors can be identified that appear to have contributed to erasure:

1. Work in the history of technology tends to be is nation-based, so most historians of technology tend not the be concerned with the history of technology in Germany;
2. There is a strong preference in the history of photography to concentrate on the nineteenth century;
3. The Nazis, on ideological grounds, would not recognize Jewish achievements;
4. Communist German Democratic Republic, on political grounds, would not honor the work of a Jewish capitalist;
5. Three powerful, ambitious men–Bush, Hoover, and Küpperbender–promoted narratives which eclipsed Goldberg;
6. Three out of four Zeiss corporate histories omit Goldberg's work. A fourth, with a marxist perspective, has been discounted;
7. His professional papers almost entirely destroyed by bombs, flood, and burning;
8. Goldberg himself remained alive in relative obscurity;
9. In Information Science, interest in history has been small, uncritical, and accepting of myth. Our understanding of the history and heritage of scientific and technical information systems would have been quite different if there had been more genuine curiosity about the past.
10. Historians prefer to work on what is documented; and
11. Who decides to write a history of any topic is largely accidental. With very rare and small exceptions, nobody seems to have had the interest, the motivation, and the time to write about Goldberg, except for William White, who intended a biography but died before he could write it.

The confluence of all these influences go a long way to explain why Goldberg remained so little known. They are quite diverse and they are also accidental in several senses. Although they influenced what was known about Goldberg, they arose from causes that had little or nothing to with Goldberg or his work. Most of them could easily have been otherwise. If the bombs in Dresden had fallen differently; if Bush, Hoover, or Küpperbender had made more adequate acknowledgments; if the Zeiss corporate histories had been more complete; and so on. If any *one* of these factors had been otherwise, the received history would probably have been significantly different. In the end, Goldberg has finally become known because, by chance, an author became interested, had the opportunity to investigate, and had improbably good luck in tracing the remaining evidence while it was still available. In fact, that one happenstance changed everything in terms of creating a new narrative.

Information science is concerned with understanding and influencing what is known, so, whether our interests are analytical or activist, the mechanisms by which one or another narrative becomes a "received" history is a research agenda of the great intrinsic interest and practical importance. These conclusions should not make us fatalistic, but, rather, should encourage greater professionalism as information scientists and as historians.

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