Memories of microfilm, murmers of digitization[1]

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Resumo
This paper is a case study examining the history of microfilm's development into a standard storage technology for academic libraries. Microfilm's evolution reveals a history of trans-Atlantic tensions involving intellectual property and shifts in global power. Many of the same controversies exist today between Google and libraries. Copyright issues, concerns for the preservation of library materials, and dreams of the library of the future are features of both past and present dialogues concerning access and storage of library materials. By putting the past in dialogue with the present, this analysis of microfilm's development offers an historical perspective on the current Google Library Partners program.

Palavras-chave: Microfilm, Google, Library, Google Library Partners Program, technology.

Introduction

"Little Boy" and "Fat Man" fell upon Hiroshima and Nagasaki on August 6th and 9th of 1945, the same year Vannevar Bush's article, "As We May Think," received two printings in *The Atlantic*. Bush, a leading figure in the United States' scientific research community, pushed for the marriage of science and military during World War II. His article called for scientists to transition from wartime pursuits toward advancing the "task of making more accessible our bewildering store of knowledge" (Bush, 1945, p. 101).

Microfilm was the technological backbone of Bush's Memex, a device envisioned to store all "books, records, and communications" and serve as "an enlarged intimate supplement" to human memory (Bush, 1945, p. 102). The miniaturization of knowledge in microfilm form invoked a sense of wonder from the moment of its invention to Vannevar Bush's well-known vision of the Memex, an early prototype of the personal computer (Nyce, 1994). An overlooked modern technology, microfilm once invoked visions of the technological sublime just as certainly as digitization does today.

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of the same controversies exist today between Google and libraries. Copyright issues, concerns for the preservation of library materials, and dreams of the library of the future are features of both past and present dialogues concerning access and storage of library materials. By putting the past in dialogue with the present, this analysis of microfilm's development offers an historical perspective on the current Google Library Partners program.

Very little has been written about the history of microfilm. Even less has been written about the politics concerning how the business of microfilm came to have such widespread adoption in the United States and around the world. Microfilm was, for the twentieth century, an adaptable medium for storage and transmission that advanced thanks to strategic moments of piracy and government intervention. This chapter will tease out tensions between the history of innovation, intellectual property, and the evolution of the library to better understand what Google's offer to digitize books for free means for libraries of today. It begins with the early history of microfilm, the medium's invention, and ends when the technology becomes an accepted facet of library space.

The Invention of Microphotography

1853 was a pivotal year for the spread and advancement of microphotography. William Sturgeon, a scientist known for his experiments with electricity, died and his friend Dr. Joule commissioned a sculptor to carve a tablet in his memory. J.B. Dancer, the inventor of microphotography, was commissioned to photograph the tablet before its installation in a church. The sculptor delivered the tablet to Dancer's home where he made both a standard negative and then copied that negative with his microfilm camera, producing a positive image only a sixteenth of an inch in length. Dancer originally began creating microphotographs by installing a microscope lens on a camera while experimenting at his optical shop in downtown Manchester. Dancer gave away several microfilm copies of the Sturgeon inscription to scientists in the area. Six years later, these gifts would defend Dancer as the inventor of microphotography in England (Luther, 1959).

Dancer was a businessman and inventor in the bustling cityscape of Manchester. Among "the crunching wheels of machinery, the shriek of steam from boilers, the regular beat of the looms," Dancer created a new novelty product, microphotos (de Tocqueville, 1958, p. 76). Popularity for Dancer's product grew until the manufacture of microphotographic slides formed the larger part of his business. Other photographic

inventors in the area began to experiment with microphotography independent of Dancer's work. As the practice grew, questions arose as to the true inventor of the new medium fascinating nineteenth century citizens of Manchester. The fight was not over who had the first patent. The fight was over who had the most creative mind. The fact that Dancer gave away several copies of his work to friends and colleagues would be pivotal evidence in future arguments concerning the invention of microphotography. It was an industrial era representation of the power of publicity and its intersection with the right social network (Benkler, 2006; Hyde, 2007; Bruns, 2008).

By 1854 the editor of Manchester's *Photographic Journal* began selling microphotos as novelties to the crowds independent of Dancer's work. A few years later in 1856 Dancer applied for a patent on a more refined version of his process. As arguments arose concerning who truly invented microphotography, Joseph Sidebotham of the Manchester Photographic Society rose in 1859 to defend Dancer as the true inventor. In a paper entitled, "On Micro-photography," Sidebotham spoke before the Society to make claims on behalf of his friend and colleague (Luther, 1950a). Other scientists seeking to claim the invention as their own only had published accounts of their work as their evidence. Sidebotham had the Queen of England. Not only did Dancer give microphotographs of William Sturgeon's inscription to artists and friends, he was the first to microphotograph the Queen. Thanks to good publicity, Dancer could claim microphotography as his unique invention in 1853. The gifted images of William Sturgeon's death inscription served as anecdotal testimony to Dancer's early inventiveness. His images of the Queen further removed any doubt that Dancer was the true inventor of microphotography.

The Invention of Microfilm

It was a triumphant day for guerrilla marketing. A most unusual ring was found on the Champs-Elysées and brought to reporters assigned to the area. Looking into a tiny peephole, the reporters discovered an image. The next day Paris's pages were filled with prose about a new invention that would let the owner gaze at their beloveds privately. Of the invention, the reporters wrote, "Nothing could be more extraordinary...than to find in the setting of a ring…a portrait…the size of a carte de visit" (Luther, 1959, p. 35).

Dagron was an unremarkable Parisian portrait artist who left the French countryside at an early age to study chemistry and physics, the science supporting photography. Looking for a product to lift his shop out of a slump, he turned to microphotography.

Dancer's microfilms had traveled to Paris in 1857 via Sir David Brewster. Upon seeing them, the Parisian shopkeepers quickly got to work incorporating microphotographs into opera jewelry, with an attached magnifying glass to improve viewing. Seeing the potential of the new invention, Dagron filed a patent (Luther, 1950b).

France No. 23,115 was the first French patent granted for microfilm on June 21, 1859. Dagron's design differed from others in its sleekness. The magnifier and film were so compact they could be built into the keys men used to wind their pocket watches. Dagron's invention, an improvement upon the work of local shopkeepers who kept the magnifying glass on the outside, revolutionized the way Parisian men viewed naughty images of women.

Dagron was a very savvy businessman. It was he who dropped the ring. The very next day Dagron entered the police station to claim it after priming the newshawks for the hunt. Paris was again abuzz with tales about the ring. First the press flocked to the product. Then they flocked to the man. Dagron assured them that the novelties would be available at his Parisian shop for a good price. According to Ross King's *The Judgment of Paris: The Revolutionary Decade That Gave the World Impressionism* (2006), Dagron created both the device and content for it. *The Surprised Bathers* and *The Joyful Orgy* were a few of his biggest hits. Porn profits and popularity were not enough for Dagron. As his business matured, he began to sue his competition.

In an effort to retain his monopoly, Dagron and Company filed a lawsuit against the Martinache Company, charging invasion of his patent in the summer of 1861. Martinache had successfully filed patents for his own microfilm viewer on April 4th and May 7th of 1861. Dagron lost in his company's lawsuit against Martinache, but then appealed. When his appeal failed, he offered to purchase Martinache. On July 23rd Dagron and Company purchased the Martinache Company for roughly $45,504.49 USD (Luther, 1959).

While Dagron and Company's lawyers were busily involved in patent fights, one of the employees created a new process for the production of microfilm, M. Berthier. Berthier filed for French patent No. 50,469 on July 18, 1861 for a process that improved image viewing by shifting the focus of the eyes. The process was an adaptation of work developed by Sir Brewster of England. A patent was granted nevertheless. Dagron filed a patent for his worker's invention in England (Zubatsky, Krummel, Veaner, 1983).

Fights between Dagron's company and his competition continued. He brought suit against a group of fifteen opticians in Paris who created similar microfilm viewers. The

lower court ruled in the opticians' favor, but this was not enough. Dagron appealed. Justice M. de Lelain-Chomel did not waste time. After reviewing the decision of the appellate court, he ruled in favor of the opticians thus dismissing Dagron's patents and breaking his company's monopoly over microviewers. In the long and bitter fight, the opticians requested both damages and publicity. The opticians wanted the ruling to be published in the press and posted all over Paris. The judge dismissed these pleas. Dagron paid only the costs of the court trial (Luther, 1959).

Louis Dagron, credited as the first to invent microfilm, successfully courted the Parisian press through a strategic use of publicity. This publicity boosted the popularity of his product, microfilm viewers that looked like tiny pieces of jewelry. This device was a great conduit for the local porn industry. Dagron's business produced both the device and the content for viewing. As Dagron grew into Dagron and Company, the company began to file lawsuits against competition. The failed lawsuit against the Martinache Company resulted in a merger of Martinache with Dagron. Dagron lost in a bitter patent battle between his company and a group of opticians who sold a similar micro-viewing device. The loosing side attempted to seek damages that included embarrassing publicity. The judge dismissed the pleas. Dagron and Company paid all court costs.

Microfilm at War: The Franco-Prussian War

Dagron and his company met with continued success after the court case. Dancer left the business of microfilm to research respiratory diseases and broader concerns linked to public health in industrial England. Dagron continued to expand the business of microfilm. He won an honorable mention for his microphotographs at the Universal Exposition of Paris in 1867. The scientific press continued to marvel at Dagron's work. One article wrote, "those astounding 'microscopic photographs' invented by M. Dagron, whereby he places a monument on a ring and a portrait on a pinhead" (Luther, 1959, p. 44). His business expanded into America, and Dagron became the court photographer for Emperor Napoleon III.

In Prussia, Otto von Bismarck, General von Moltke, and the Prussian General Staff began the Seven Days War to test out theories developed by Karl von Clausewitz. Clausewitz used historiographical research to examine the Thirty Years War of 1618 – 1648, a war fought primarily in what is now Germany. The Thirty Years War destroyed entire regions and bankrupted most combatant powers. Episodes of famine and disease significantly decreased the population of the German states, Bohemia, the Low Countries

and Italy. Clausewitz developed theories of war that merged Hegelian dialectical theory with systematic views of science from Enlightenment thinking. In his writings, he rejected the Enlightenment view of war as chaotic muddle and opted for a multivariate approach involving the complex interplay of the economy, technology of the age, the social characteristics of the troops, and the commanders' politics and psychology (Clausewitz, 1873; Sumida, 2008).

The war was a swift way for Otto von Bismarck to shift power away from Austria and toward Prussian leadership. It was a move to unite northern German states and exclude Austria. It emboldened Napoleon III, the Emperor of France, who saw Bismarck's maneuver as an excuse to flex France's military muscle. On July 19, 1870, Napoleon III declared war against the Prussians. It was an embarrassing folly for the French empire. Krupp steel artillery, efficient railways, and a series of swift victories in eastern France culminated in the Battle of Sédan, where Napoleon III was captured with his whole army on the second of September. The war continued as out of the rubble emerged one man who would proclaim the dissolution of the Empire and the birth of the Third Republic. He called for continued resistance against the Prussians. Léon Gambetta, a one-eyed, thirty-two year old anti-imperialist sparked a bit of public rhetoric that struck a chord within the hearts of the humiliated French. The war continued. This time, France would fight with their scientists (Wawro, 2003).

The Prussians besieged Paris and left it isolated from the rest of the French world. Under the rhythmic boom of Prussian guns, the Parisians hungered for news no matter how trivial. They wrote letters, but the messengers of these missives faced death at the hands of Prussian forces or at the cause of Krupp artillery (Sheppard, 1871). Desperate in their isolation, they turned to the best scientists Paris had to offer. René Dagron, the photographer and Albert Fernique, professor of engineering, were a few of the men who would leave in a balloon named *Niepce*, for the man noted for producing the world's first known photograph. Another balloon, aptly named the *Daguerre* for the daguerrotype photographic process, held M. Nobécourt, an expert in the care of messenger pigeons, Jubert, the pilot, Pierron, an engineer, M. Pierron's dog, and pigeons trained to carry news back to Paris (Hayhurst, 1970).

The *Daguerre* and *Niepce* faced perilous conditions. The *Daguerre* and all those within were the first casualties of modern industrial warfare. Bismarck consulted with Krupp, the armament maker, regarding these ballooned blockade runners. Krupp had a

simple answer: use our product. It was a long-range, breach-loading artillery rifle used four years previously in the Battle of Sadowa, the battle that ended the Seven Weeks' War of 1866 (van Crevald, 1977). The first casualties of industrial warfare fell from the sky with one push of a button.

Dagron and crewmates successfully made it to Tours to meet Gambetta and the rest of the French government. At Tours, Dagron and crew photographed government dispatches, shrunk them to a minute size, printed them on lightweight collodion membranes, and fitted the microfilms into canisters strapped to the legs of carrier pigeons (King, 2006). A forest ranger was able to recover one mailbag from the lost *Daguerre*.

Not all members of the Daguerre crew passed on. From the wreckage of the Daguerre, six pigeons would again be called to battle. These pigeons were released to convey microfilmed news to Paris. Six identical messages were sent on each bird, "Large blue and yellow balloon fell at Joissigny. Prussians captured balloon, voyagers. Have been able to save a mailbag and six pigeons" (Luther, 1959, p. 57). The redeployed pigeons faced wind, shells, and Prussian fighter falcons along their way. Other pigeons would not redeploy for the French. Captured by the Prussians, they would be used to send false information to a beleaguered Paris.

Pigeons as Data Transmitters

Paris was not the first to employ pigeons as data messengers. The history of the pigeon as a data transmission medium dates back to Noah. Out of the Ark flew a pigeon. Julius Caesar used pigeons in the conquest of Gaul. Greeks used them to convey the names of victors of Olympic Games. In ancient Baghdad, merchants used a pigeon postal service. In the early years of telegraphy, pigeons were used to fill in the gaps when there was a lack of wires. Paul Julius Reuters, the founder of Reuters wire service, flew pigeons bearing news and stock prices between Brussels, Belgium and Aachen, Germany in 1860 (Blume, 2004; Humphries, 2009). Reuters' pigeons could best the train by two hours when the wires were down.

The Rothschild family made a fortune in the markets thanks to timely news received via pigeon. Victory for Napoleon at Waterloo meant that British debt would be devalued. A British win would cause the value of British debt to rise. The stakes were high. The Rothschild family had been using pigeons to communicate for some time across the vast reaches of their financial empire. Nathan Rothschild received work in London of the British

win. British debt was undervalued. Rothschild bought. Even the government would not find out of the win until the next day (Ferguson, 2000).

Harold Innis (1951), James Carey (1989), and James R. Beniger (1986) have written of the telegraph's importance in reshaping human life. Electronic communication, once harnessed through the telegraph wires, increased the speed and efficiency of commerce. Carey wrote that thought could travel by the "singing wire" (1989). From the human imagination flew new visions for the transmission of knowledge, commerce, and scientific information. For Innis, the telegraph destroyed the monopolies of the press, post, and political power. Beniger wrote of a history of crisis and control as steam power and electricity reformulated the daily habits and practices of bureaucracy. Innis, Carey, and Beniger wrote of the telegraph, but missed the importance of the pigeon.

The pigeon remained a vital form of communication for Northern powers even until World War II. As a source of data transmission, the pigeon was superior on many accounts. Pigeons bested railroad communication by two hours for the transmission of financial data (Humphries, 2009). Pigeon messengry was a trusted source of data transmission because it developed throughout centuries as a practice of artists and experts. Pigeons did not depend upon coal, oil, rubber, copper, steel, or industrially processed goods to function. Pigeons needed only the organic substances of food and expert care. Before Dagron's microfilms, the pigeon-human communication network could not transport massive amounts of information, with mass representing both amount and weight. A pigeon could only carry so much without hindering its flight. Reducing the size of government information meant reducing the weight of heavy communications. The pigeon, once harnessed with canisters full of microfilm, became an effective answer to retain communication between Tours and Paris under the bombardment of Krupp artillery.

The robustness of the pigeon network was upheld by the pigeon's natural ability to find home. This ability was exploited by animal trainers seeking to develop swifter birds. Competitions showcased breeders that developed the swiftest breed. These competitions resulted in the modern Homing Pigeon, a breed that continues to be flown in races throughout the world (Blechman, 2007).

The pigeon as a tool of communication in wartime flies between the realms of common practice and patentable science (Hyde, 2010). Both Dancer and Dagron were given temporary monopolies on the knowledge and process of photographic image reduction. The practice of animal husbandry, reliant upon the apprenticeship model, is a

product of education from expert trainers. Fellows like M. Nobécourt were either autodidacts who followed the work of others, were trained by an expert pigeon fancier, or a combination of both methods. The line between patentable and not patentable is not distinct when tracking the development of microfilm as a medium for entertainment and communication in a time of war. For example, M. Berthier's invention that received him French patent No. 50,469 was only a minor improvement upon Sir Brewster's work (Ardern, 1960).

Each inventor relied upon open sharing of scientific knowledge to create patentable works. Animal husbandry, the practice that created the swift homing pigeon, existed since the domestication of animals. Pigeon fanciers do not rely upon patents for their work. It would be an absurd thing to do. Yet, the practice of pigeon fanciery significantly altered the genetic expressions of the species. For ten thousand years humans bred pigeons for amusement, art, commerce, and war. A patent was not filed for the process. Animal husbandry brings to question tensions inherent in the historical invention of the scientist as individual author. It would be easy to distinguish the pigeon breeding as a common practice, as noted in Lewis Hyde's *Common As Air* (2010). However, as Eva Hemmungs Wirtén notes in *Terms of Use: Negotiating the Jungle of the Intellectual Commons* (2008), the mere idea of a public domain or a commons is only understood through the dynamic power relations shaping everyday life. One author does not exist for the production of the homing pigeon. It was a product of multiple authors working over a large wingspan of time. This form of collaborative authorship complicates the neat distinctions of scientific authorship cemented into law in the early industrial era. At this point in history, only the concept of "God" would be granted a patent for the evolution of the pigeon.

The End of the War

Despite the best efforts of Dagron, the pigeons, and pigeon fanciers, Paris fell to the Prussians on the 28th of January 1871. The Third Republic signed the Treaty of Frankfurt by May 10th, 1871 during the time of the Paris Commune uprising. Information networks were not isolated to pigeons and Dagron's microfilms. Before the outbreak of war, Karl Marx wrote in five days an address for the International Workingmen's Association against it.

Untold in a story centered on Dagron and his patents are the actions of the Parisian workers who invaded Palais Bourbon at news of the loss at Sédan. Gambetta and the Government of National Defence (GND), which grew from the worker uprising, continued the war effort. In Marx's first address, he opposed the Franco-Prussian war of 1870. By

Marx's second address, after the GND took power, he wrote, "Vive la Republique!" (Marx, 2009). Now Paris had to be defended to honor the rise of the workers to power.

The Paris Commune briefly ruled Paris from March until May 28, 1871. Both Marxists and Anarchists claimed it as the working class's first achieved rise to power during the Industrial Revolution. The 1871 Treaty of Frankfurt ruled the lives of the paysans of Alsace and Lorraine, both territories ceded to the Prussian empire as a result of the war. The residents of the region had until October 1st, 1872 to decide between remaining in the region to become German citizens or leaving to remain French (Howard, 1990). And what of the pigeons? The pigeon post ended on February 1st, 1871. The last pigeons were released on the 1st and 3rd February. The remaining pigeons became the official property of the state. They were sold as racing pigeons for an average price of only 1 franc 50 centimes. Two pigeons, reported to have made three journeys, were purchased by an enthusiast for 26 francs (Luther, 1950b).

Microfilm Crosses the Atlantic

By April of 1871, the pigeon post microfilms were sold in the United States where microfilm found new life on the new continent. Dagron and Dancer entered their twilight years as the United States began to rise as a new global power. By March of 1887, the Franklin Society of Philadelphia contracted with the Century Company to microfilm over 25,000 page proofs to protect against loss. That summer Dagron published a lengthy description of his microfilm processing method in the *Philadelphia Photographer* and *The Camera*. By November, Dancer would pass on at the ripe old age of 75 (David, 2012).

The next years of microfilm's life in the United States began much like the medium's birth in England. In 1889 Eastman began manufacturing nitrocellulose film, the material used as a propellant for firearms and rockets as well as for movies and x-rays. Edison contributed to the growth of the film business by adopting Fordist production methods. He promoted the standardization of the 35 mm film reel. It was not long before new patents would be granted for old processes. By March of 1890, The United States Patent and Trademark Office would grant Patent 448,447 to an inventor by the name of Madsen. By 1900, the team of Jansen, Gardiner and Kandler received U.S. Patent No. 655,977 for a check microfilming camera (DeSola, 1944).

The check as an invention to be microfilmed was itself a product of a long evolution. A check is simply a written order to a bank by a depositor at that same bank to pay a third party a sum of money from the depositor's account. The check, dependent upon

paper and ink, enabled the spread of swifter commercial transaction. It also enabled fraud. To keep commerce honest, banks held large archives filled with used checks. Even with the invention of insurance companies to protect contents of case of fire, damage, or other "Acts of God," a secure filing system of bank archives was needed to keep a depositor's trust. If one company should sue another for violation of any particular law, the financial documents of that company would need to be reviewed. Bank librarians had to be prepared for these events. In addition to storing paper money, handling daily transactions including debts, credits, and deposits, the bank's archives were vital to the litigious society developing around modern commerce (Beniger, 1986).

The storage of historical financial data in the form of the paper check was a financial burden. A mounding amount of checks needed to be stored and easily retrieved. Offsite storage meant another rent, increased insurance payments, increased travel costs, and an employee to keep the site secure. Microfilm lifted the hefty costs of offsite storage needs by shrinking the space required to control bank check documentation and keep check fraud at bay.

Microfilm first came to America as it did in Paris and Manchester, as a novelty good. Five years after the end of the 1870 Franco-Prussian War, the "microscope-bijoux" found a new audience at the summer Centennial Exposition in Philadelphia of 1876. By 1900, microfilm retained a minor novelty market and expanded into the market for information storage and retrieval. The need for microfilm responded to the expanding use of paper in American everyday life. The daily news first began daily periodicity in response to the flow of market data and then evolved into the penny press. Advertising became such a prominent feature of the marketplace that specialized trade journals developed by 1865. Patents expanded to include the process of labeling by 1870. The first publicity stunt was born in 1889 to promote Quaker Oats' new product, Aunt Jemima's ready-made pancake mix (Beniger, 1986).

Aunt Jemima was the creation of Billy Kersands, the African American comedian, songwriter and minstrel show performer who wrote the first version of his hit song "Old Aunt Jemima" in 1875 (Manring, 1998). It became Kersands' most popular song and Aunt Jemima became a regular trope of American minstrelsy (Kip, 2010). The Quaker Oats company appropriated the popular image to sell its new line of ready-made pancake mix to a mass consumer audience. To quote from the song,

> The monkey dressed in soldier clothes,
> Old Aunt Jemima, oh! Oh! Oh!

Went out in the woods for to drill some crows,
Old Aunt Jemima, oh! Oh! Oh!
The jay bird hung on the swinging limb,
Old Aunt Jemima, oh! Oh! Oh!
I up with a stone and hit him on the shin.

(Kersands, 1875)

Dewey and the Invention of the Modern Library

The cusp of the new century brought amazing transformations that increased access to knowledge. European institutions of higher education remained dominant, but by 1861 Yale University became the first American university to grant a Ph.D. The form and format of modern life had shifted dramatically in the years that spanned microfilm's invention and eventual trip across the Atlantic to the new rising global power, the United States. It was at this time that both England and the United States began to develop public library systems.

In England, both elites and reformists saw public libraries as a means to quell the mob. In 1838 a radical reform movement called the Chartists began their own cooperative lending libraries directly competing with commercially focused subscription libraries. Radicals, elitists, and the publishing industry found common ground supporting a movement for public libraries. By 1850 the Public Libraries Act became law in Great Britain (Battles, 2003).

The ability to advocate for public libraries at all came with a dramatic rise in the sheer number of books, a feature created through the industrialization of book production. Gutenberg's bible is the reference point for the beginning of religious modernity but it was the publication of Jacob Abbott's *The Harper Establishment; or, How the Story Books Are Made* (1855), that revealed the importance of labor to the reproduction of the book. The industrial age turned field workers into a waged labor. Cities became home to crowds and more books were produced through industrialized processes. Abbott's book revealed the process behind the production of the modern book. The actual mechanisms of production involved the orderly assembly of waged workers segregated by gender into the industrial space. Industrializing the process of book production increased both the speed of publication and the amount of books printed. The mechanics of production mystified the book. The end user could not create the industrialized book nor had knowledge of the labor conditions used for its production.

Just four years after Great Britain's Public Library Act passed, the Boston Public Library opened in the United States. Libraries were built upon a vision of open access to information, yet the 1876 report *Public Libraries in the United States of America* (1960)

showed that American libraries rarely had more than a few hundred books. European libraries like the Bibliothèque Nationale de Paris and the central libraries of England held vast volumes. In the United States, large quantities of books could only be found in few designated spaces. Harvard's Library began with Massachusetts' clergyman John Harvard's 1638 donation of 260 volumes. After the War of 1812, The Library of Congress was rebuilt with Congress's $23,950 purchase of Jefferson's 6,487 books (Collins, 2009).

With the vast aggregation of books, libraries contended with organization troubles. The small commercial subscription library had no need for shelves. These libraries proudly displayed their books. Larger libraries, supplied by national copyright decrees or large endowments, crafted organizational schemes for their boundless supply. Each library used its own idiosyncratic organizational structure. Harvard's Widener library still retains an organizational structure separate from most library organizational schemes. Matthew Battles writes, "The 'Aus' class contains books on the history of the Austro-Hungarian Empire; the 'Ott' class serves the purpose for the Ottoman Empire. Dante, Molière, and Montaigne each get a class of his own" (Battles, 2003, p. 104). Organizational schemas are a form of poetic world-making (Warner, 2002). Widener Library's organizational structure reflects values of cultures past and present, a culture that continues to support the invented ideal of the romantic individual author. Without getting lost in the argument of the author's invention, it is easy to see that Widener's organizational system continues to support the reign of Montaigne.

For Melvil Dewey, famous library reformer and noted philanderer, efficiency was the main problem facing library organization. As a young student library assistant at Amherst College, Dewey was frustrated with the disorganization of Amherst's stacks. Many libraries were suffering under the weight of explosive amounts of information. New books zoomed to the shelves. Older organization schemes simply would not work in the new knowledge economy. Dewey set out to combine two popular methods to reorganize knowledge. Numbers wedded epistemological categories to produce the Dewey decimal system (Battles, 2003).

Dewey's appreciation of efficiency expanded far beyond library stacks. Born in 1851, Dewey's parents named him Melville Louis Kossuth Dewey after the Hungarian reformer Lajos Kossuth. Later in life Dewey dropped his foreign-sounding middle name as a part of his advocacy for a simplified spelling system. In his system, words ending in –ck

were shortened to –k. His name change, to honor efficiency, helped him efficiently assimilate into the dominantly white Anglo-Saxon culture of America's elites.

Dewey was not the only librarian creating advanced classification systems, but he was the most scandalous. By 1883, Columbia College hired Dewey as their head librarian. His first order of business was to advocate for women to join his new library school, a part of his plan to professionalize the field. At the time, women were segregated into a special separate college at Columbia. Advocating for women's equal entry was revolutionary for the time. Without seeking permission from the trustees, Dewey opened the library school to women (Wiegand, 1996). Two years later, Columbia closed down his school and he had to move to another University. Dewey's advocacy earned him accolades among elite social reformers. It also helped him position down the role of the librarian, one of his goals for redesigning the library space. Dewey felt women were ideal for repetitive library work. Women were obedient. Women did not cause trouble. Dewey was crafting the female machine, an obedient search engine to obey his categories of organization.

Many students in Dewey's first class dropped out. Dewey groped and attempted to kiss female colleagues. He did not control his sexual impulses. One particular stenographer, hired to work at his Lake Placid retreat, became of interest to both he and his second wife. Dewey hired her based on the recommendation of New York City Episcopal Bishop Howard Chandler Robbins. Of her Dewey wrote in his simplified spelling system that she "was betr looking than I expected." One summer Dewey kissed and caressed the stenographer in public. His second wife, Emily McKay Beal, recognized trouble and wrote to the young woman, "that if she had eni objection whatever she had onli to say so & it wdn't be repeated" (Wiegand, 1996, p. 353). While young women were allowed at Dewey's resort, Jews were not. Jews were barred from the summer resort he founded in upstate New York. Under the cloak of an active public life, Dewey hid anti-Semitism.

Dewey's library vision did include room for women who could achieve high status in the public sphere. Mary Wright Plummer was that woman. Born of elite status in the Quaker community of Richmond, Indiana, she graduated from Wellesley and was one of Dewey's first students at Columbia. Upon graduation she helped launch the Pratt Institute Library School. By 1904, Plummer became the director of Pratt Institute's Free Library, the first free public library in Brooklyn (Wiegand, 1996). She developed the first children's room and began training librarians in youth services. Plummer evolved the librarian from the role of efficient machine to the role of surrogate mother (Garrison, 1979).

Dewey's construction of the woman as information retrieval machine was just one contribution to the development of modernity's newest category of labor, the information professional. Outside of the United States, documentalists from Belgium, the Netherlands, and India developed alternative methods of information organization that would out-math Dewey's hierarchical classification system. From bookshelves to workers, Dewey's library was based on complete standardization and control. The backbone of the search system, Dewey Decimal Classification (DDC), was given both copyright and trademark protection by the United States government.

Beyond Dewey: Europe and the Universal Library

Mathematically, Dewey's system was based on simple decimal categorization. In 1895, Belgian documentalists Paul Otlet, Henri LaFontaine, and other colleagues developed the Universal Decimal Classification (UDC) as an improvement to DDC. Their system advanced library classification theory by expanding the code beyond categories and numbers. UDC incorporated Boolean "AND" search as well as special symbols to further subdivide categories for more specific information retrieval. Brackets, plus signs, colons, and more were included in the UDC system, making it a machine readable format.

The Boolean backbone of the UDC system developed through the work of mathematician Sir George Boole. His 1854 mathematical treatise *The Laws of Thought* laid out an advanced logic system inspired by Jewish and Indian mysticism. In *Equations from God: Pure Mathematics and Victorian faith*, Daniel Jared Cohen wrote of Boole's belief in the mystical unity of the number one. He believed that the mind had an "innate sense of 'Unity' that it constantly uses to synthesize its understanding of the world" (Cohen, 2007, p. 77). *The Laws* was never intended as a purely mathematical vision. It was intended to extend and perfect Aristotle's *Prior Analytics*, a logical system based on the premise of the syllogism. Boole created a rhetoric for modern times. He created a rhetoric with symbols and numbers.

Boole's work remained obscure for many years with no immediate practical application, until documentalists Otlet and LaFontaine began to use principles outlined in *The Laws* to construct a new vision of document organization. By 1895, Paul Otlet and Henri LaFontaine joined together to analyze Dewey's published classification scheme. Otlet and LaFontaine met at the Society for Social and Political Studies in 1891, a Brussels organization that attracted many of the most astute Belgian thinkers. While LaFontaine was fifteen years older than Otlet, the two shared a history of life in the legal professions and an

interest in advancing document organization. Otlet's adolescence was filled with anxiety and frustration over his inability to find his papers. Early in his teens he began creating classification schemes for his own work. By 1934, he published his grande oeuvre *Traité de Documentation* (1934), a book that dreamed the visions of Vannevar Bush's memex far before its invention by Vannevar Bush's pen (Buckland, 1996).

By March of 1895, Otlet made a formal request to Dewey to use and develop his Decimal classification. Dewey did not respond immediately, but later replied allowing Otlet to translate his Decimal classification scheme for a European audience. Otlet and La Fontaine did much more than translate. They went far beyond the boundaries of Dewey's permission to develop an international movement for a more robust library classification system (Rayward, 2008).

The pair quickly dedicated themselves to the project of universal classification by organizing a conference to bring together librarians, editors, publishers, and other members of the public to discuss their new effort to advance bibliographic search. The haste was not out of the mere joy of discovery. The Royal Society of London set out to advance their own international bibliography format. The Belgians were no competition for The Royal Society, which had "unassailable authority and prestige," (Rayward, 1975, p. 46). Otlet and La Fontaine knew that The Royal Society had planned their International Conference on a Catalogue of Scientific Literature to be held in 1896 in London. Otlet and La Fontaine publicized their International Conference of Bibliography as a cooperative endeavor, a collective discussion of like-minded individuals to be had in September of 1895 (Rayward, 1994).

The plan was purposeful. La Fontaine and Otlet knew that by organizing an event far in advance of the The Royal Society of England it would give them a chance to present their work to The Royal Society as a fact of existence, rather than as speculation. The haste provided their work with necessary legitimacy and garnered the support of the Belgian government, which kept a watchful eye on the project. The Royal Society's International Conference on a Catalogue of Scientific Literature in 1896 was not just a meeting of scientific and publishing minds. The British government used the conference as a tool to assemble government representation from across Europe.

The work of the International Conference of Bibliography granted legitimacy to the work of Otlet and La Fontaine, allowing them to further their endeavors through establishing the International Institute and Office of Bibliography (IIB). The creation of this

official post attracted like-minded scholars and scientists from across the European region. For La Fontaine, it helped him achieve a seat on the Belgian Senate in 1895. The pair would continue their work advancing bibliographic tools and facilitating cooperation and standardization. As the project developed, European scholars turned to microfilm as the medium of choice for document storage and retrieval.

Microfilm became the medium of choice after a considerable amount of preparatory invention by Otlet in terms of document organization. Key to the created structure of the UDC were Otlet's dreams of universal organization of knowledge. Otlet proposed "…the creation of a kind of artificial brain by means of cards containing actual information or simply notes or references" (Otlet, 1990 [1891], p. 16). By stripping a scientific article or book chapter into minutely subdivided cards, these organized bits could be rearranged into a daily updated alphabetical catalogue.

By 1903, Otlet foresaw that the emergence of what he simultaneously termed the "Biblion", "Universal Book", or the "Source" from the process of breaking down knowledge from the level of the paragraph and sentence into the level of the subdivided category. Otlet's Biblion would "…constitute a systematic, complete current registration of all the facts relating to a particular branch of knowledge…formed by linking together materials and elements scattered in all relevant publications" (Otlet 1903, p. 83). Otlet's ideas formulated an early plan for a hyperlinked documentation system.

Otlet searched endlessly for an automated means to access the multitude of data amassed by breaking books and articles into their subdivided parts. Emanuel Godlberg's work with photographic image reduction provided immense potential for Otlet and the project of universal document classification. Goldberg was born in Moscow, Russia, in 1881. By 1906 he received his doctorate from the University of Leipzig with a dissertation that examined the kinetics of photochemical reactions. As Goldberg progressed in his work he became the first Managing Director of Zeiss Ikon, then controlled by the Carl Zeiss Foundation and a company best known today for its high-end camera lenses. While working at Zeiss, Goldberg retained a Professorship in the Institute for Scientific Photography at Dresden's Technical University. By 1925 Goldberg demonstrated an extremely high microfilm reduction rate, equivalent to putting the entire text of the Bible fifty times over on one square inch of film. This achievement was not surpassed for many years (Buckland, 1996).

That same year, Otlet and Belgian inventor Robert Goldschmidt described an easily manufactured "microphotographic library". Otlet recognized the potential of microphotography for information retrieval and proposed the use of standardized microfiche by 1906. The filmed versions of books and articles were not meant as replacements, but as supplements to extend access to information far beyond constraints of the printed codex. Otlet and other colleagues began the seed for hypertext theory, an early pre-cursor to the World Wide Web protocol developed by Sir Tim Berners-Lee while he was a graduate student. Otlet and Goldschmidt's microphotographic library easily resembles an early dream of a World Wide library built from microfilm. The library consisted of pocket-sized viewing equipment and a portable cabinet only three feet high and three feet wide. Otlet and Goldschmidt's portable cabinet library could hold 6,562,500 pages of text (Buckland, 2006).

In addition to a dream of filmed hypertext books linked through universal classification, the adoption of microfilm solved another technical constraint of paper technology: the making and distribution of copies. Book technology was heavy. Film technology was light. Mass became a key variable in library development. A massive amount of books amassed through industrial processes constructed a desire to decompress the masses of books. Miles of books could be contained in one small, portable cabinet. The dreams built on microfilm in 1925 laid the foundation for what Otlet and H.G. Wells would call by the 1930s a "world brain" (Hahn & Buckland, 1998).

Beyond Dewey and Europe: Ranganathan and the Universal Library

Otlet and La Fontaine built a new categorization scheme using Melvil Dewey's decimal classification without seeking permission, though Dewey had United States copyright protection and only granted the Europeans permission to translate, not expand upon his work. The UDC developed with no lawsuit from Melvil Dewey, bringing together scientists, archivists, librarians, bibliographers, documentalists, and government officials from across Europe to tackle the problem of document organization. Otlet, La Fontaine, and others involved with IIB advanced information retrieval systems by adding new symbols and Boolean logic to decimal classification. While Europeans and Americans both began dreaming dreams of a "world brain" Shiyali Ramamrita Ranganathan, India's "Father of Library Science," found Dewey's system intellectually lazy (Ranganathan, 2001).

Ranganathan was born in the South-Eastern region of British-ruled India to a family in the Brahman community. His father passed away when he was just six years old, and he

was raised by his schoolteacher grandfather and two elementary schoolteachers. His life was steeped in Hindu religious lore at an early age. Ranganathan began his professional life as a math educator, earning both a B.A. and M.A. in mathematics in addition to a teaching license, affording him positions at universities around the region. Like today, teachers were poorly paid. His attempts to request higher pay rates for teachers failed and, at the encouragement of a friend, he applied for the well-paid head librarian position at Madras University in 1923.

The University of Madras created the position to oversee their poorly organized collection. None of the applicants for the job had any formal training, including Ranganathan. With his track record of teaching and scholarship, he was able to obtain the position of head librarian with his only knowledge of the field coming from an Encyclopedia Britannica article read just days before the interview (Rajagopalan, 1988). The life of head librarian was a life of limited activity in comparison with the lively world of the classroom. Within a week, Ranganathan attempted to leave the post. With the persuasion of the University president, he remained and was later sent to London to study their library system (Ranganathan, 2001).

It was in London where Ranganathan became extremely dissatisfied with the disorganization of the library in Madras, viewing it as "backward." Studying for nine months at the School of Librarianship of University College, then the only graduate degree program in library science in Britain, he closely observed the way libraries throughout England were organized to serve a broad spectrum of the population. He also observed a lack of efficiency among the libraries. Each library developed proprietary organizing systems for particular kinds of catalogued items (Kumar, 1992).

In his studies he set to examine and critique the work of library organization. With a mathematical mind, he created an advanced classification scheme that would far outpace the work of Melvil Dewey. Ranganathan found Dewey's decimal classification scheme a work of "intellectual laziness." Devising what he termed the "Acknowledgment of Duplication," he showed that any system of classification of information necessarily implies at least two different classifications for any one data point. He used the DDC to state his case. As the Dewey Decimal Classification system relied upon arbitrarily constructed hierarchies, Ranganathan showed that depending upon the prejudices of the one classifying, a book could be classified with two completely different DDC numbers (Ranganathan and Kaula, 1992).

In a 1964 recording, Ranganathan reminisced on his correspondences with Melvil Dewey. In 1931, Ranganathan published his first book *The Five Laws of Library Science*, and sent Dewey a copy for his review. Ranganthan was surprised to receive a letter from Dewey in 1932, a response to his work. In it, Dewey wrote, "You say you write in your book that the DC has been mangled…Let me know the addresses of the libraries. I am going to sue them in a court of law." It was true that Ranganathan had addressed improper use of Dewey's classification system in his book. Dewey's threat to sue, with protection of the United States Copyright office, was not without warrant. What Dewey writes next to Ranganathan reveals much about himself, library culture of the time, and his acknowledgement of the failures of his system.

Dewey's letter continues with a word of advice. In Ranganathan's recording he remembers, "Then came the sentence, very good advice to me: 'I find you are designing a new scheme of classification. Let me tell you how dangerous it is….It's very dangerous. I have suffered" (Ranganathan, 1964). After warning him of the promises and perils of librarianship, Dewey asked, "Why do you think of doing another scheme of classification?"

The next lines reported by Ranganathan (1964) attest to Dewey's own known fears of the drawbacks of his system. He states,

> I know that DC is fully American, or at best Anglo-Saxon, and I know that I have not provided adequate placings in it for Indian thought and culture. Instead of doing a new scheme, why don't you write out a schedule in classics, Indian literature, Indian thought. I shall incorporate it in DC. (1964)

Ranganathan's *Colon Classification* (CC), published in 1933 was the first faceted classification system for information retrieval. It was inspired by a set of Meccano toys Ranganathan saw in a store in London. Known more popularly in the United States as the Erector Set, the Meccano were a system of re-usable metal strips, girders, plates, axles and gears. It was a toy model that revealed the inner working of industrially mechanized capitalism (Brown, 2007). Using specific punctuation marks to communicate a particular characteristic of a work, CC took a priori five different facets of a work: personality, matter or property, energy, space, and time (Ranganathan, 1965). Beyond Dewey's arbitrary categories, Ranganathan crafted a system that divides subjects into mutually exclusive categories.

From this history, it is not hard to see how culture influenced the structure of each information ecosystem. Dewey created a proprietary structure built on arbitrarily constructed hierarchies. Without Dewey's permission, Otlet, La Fontaine, and other

Europeans advanced information categorization beyond Dewey's proprietary system enabling specialized document search. The Europeans violated Dewey's copyright protections to do their work. Dewey did not sue Otlet or the IIB for their work as it did not interfere with the market for his system.

Advancements in microfilm technology gave Otlet and others the ability to envision the creation of a "Biblion," a book of all books. Beyond the boundaries of the United States and Europe, Ranganathan advanced library classification by pointing out the prejudices inherent in Dewey's structure. As Ranganathan continued to publish and grow in his position as Librarian at the University of Madras, he lobbied for free public libraries throughout India and for the creation of a comprehensive national library. He also began a movement toward Open Access for knowledge.

Four of the five laws of Ranganathan's first book, *The Five Laws of Library Science*, include desires for open access to information. While the term "open access" is one yet to be fully theorized, Ranganathan's work provides an entry point to begin a history of the term. The book that frightened Melvil Dewey, exposing the prejudices of his system, also included a value for what Ranganathan called an "Open Access System" (1963, p. 300). Ranganathan's vision of the library widely differed from the dreams of his American and European colleagues. His five laws, foundational for the advancement of library organization, are simply:

1. Books are for use (Ranganathan, 1963, p. 26).
2. Every readers his or her book (Ranganathan, 1963, p. 81).
3. Every book its reader (Ranganathan, 1963, p. 258).
4. Save the time of the reader (Ranganathan, 1963, p. 287).
5. Library is a growing organism (Ranganathan, 1963, p. 326).

If a book cannot be found, a book cannot be used. If libraries are not open to the public, how will readers read? If the public is a public of growth and change, than the library must also be a growing organism. *Colon Classification*, his next work, tackled the challenges laid out in his *Five Laws*. If libraries are to be open, they are of no use to a public if the knowledge a user seeks cannot be found. What value is knowledge if it cannot be retrieved? While Otlet and H.G. Wells dreamed of the "world brain," Ranganathan dreamed as well. His *Five Laws* challenged the static inefficiencies of England's library system. It also envisioned a library beyond the Jeffersonian "Universal" ideal (Battles, 2003). Instead of a library focused on book aggregation, Ranganathan's library was reader-focused.

Microfilm Goes Mainstream

This next section focuses on microfilm as use of the medium matured in the American context, becoming the standard storage technology for libraries, information industries, and the government. This section will naturally be selective, choosing key moments to illustrate an important point in time where widespread changes in the information ecosystem led to changes in the way libraries managed the information explosion of the twenty-first century (Cmiel, 2005; Virilio, 2000).

The Invention of On Demand Print

It was the quintessential eureka moment. Ted Schellenberg, an assistant to Professor Robert C. "Bob" Binkley, came to the University of Michigan's campus in Ann Arbor to discuss Binkley's new book *Methods for Reproducing Research Materials* (1934). Binkley taught history at Western Reserve University in Cleveland, Ohio and wrote the book while chairman of the Joint Committee on Materials for Research of the Social Science Research Council and the American Council of Learned Societies (Binkley, Luther, and Fisch, 1948). Eugene Powers worked for Edwards Brothers, a small publishing company that specialized in printing limited-edition university textbooks, and often corresponded with Binkley taking care of the second edition of his manuscript. All three, Schellenberg, Power, and Binkley, were enthusiasts for the potentials of microfilm.

Over dinner, Schellenberg and Power discussed the latest techniques for copying books. According to Eugene Power's biography (1990), Schellenberg told Power about a new camera designed by Captain R.H. Draeger of the United States Navy. Draeger had been assigned to China and wanted to leave with a large number of books, "more than he could afford to buy" (p. 25). He mounted a camera on a mast over a flatbed, placing an open book beneath a glass cover. With a camera that held one hundred feet of film and automatically advanced after each click of the shutter, Captain Draeger left for China with over one hundred books on 35 mm film. Whenever he wanted to see his book on the page, he used the film to enlarge and print to paper. If done today, this would be called piracy. For Eugene Powers, it inspired a new business model.

Draeger's camera remained on use by the Bibliofilm Service, a private, non-profit subsidiary of the Science Service that made microfilm research available to anyone who needed it (Cmeil, n.d.). Draeger's camera was an adaptation of George McCarthy's flow camera, a camera invented by the former banking executive in 1928 to rapidly copy checks

to help banks stem the tide against check fraud. As Schellenberg showed Power sample rolls of film made from the flow camera later that evening, Power got his flash of insight.

Traditional publishing houses of the time maintained warehouses with finished copies of works to be rephotographed from the original to fulfill a book order. This was the life of out of print (OOP) books. Draeger's adaptation of McCarthy's flow camera meant that books could be quickly photographed and placed on microfilm. With speed came an efficient new way to keep OOP books in circulation at a lower cost. Power had come up with an idea for on demand print.

Power immediately got to work on an idea that he felt would revolutionize the publishing industries and access to scholarly information. He went to Bill Edwards, head of Edwards Publishing, with the idea to expand the market for his publishing house. This was the kind of work Power was hired to do. A recent MBA who chose to stay in Ann Arbor while his wife pursued a career in higher education, Bill Edwards hired Power for his ability to see markets where markets had not yet been found. Yet, Edwards was skeptical about Power's plan (Power and Anderson, 1990).

Power had created a vision for a new library subscription service. Most American libraries did not have access to the vast quantities of research held in European libraries. With titles that dated back to the medieval period, European libraries had established short-title catalogues (STC). STC books were bibliographic reference books that held references to existing works in short title form. Often these books covered incunabulas and early printed ephemera. Some works included early magic books and advertisements for these magic books. The short title innovation itself was a means to reduce the amount of information found in the titles of older works, too long for the quick skimming eye of the modern audience. Powers planned to photograph STC books from the British Museum and offer the titles on positive film annually for $500, roughly one-half cent per page.

Upon arriving in England in 1935, the British Museum offered the enterprising American STC books from the Museum as well as the Bodleian Library at Oxford and the University Library at Cambridge. By Spring of 1936, Power announced what he deemed in his autobiography as "the first use of microfilm as a publishing medium" at the American Library Association (ALA) meeting in Chapel Hill, North Carolina (p. 30). By fall of that year, six libraries had already subscribed to his service. Power created a new market for Bill Edwards' publishing business. Edwards supported the endeavor with minimal output of his own. Bills needed to be paid. Power's new business innovation was just beginning to create

a steady stream of revenue for the company. As it was his idea, Power had to continue his regular sales work during the day while spending his nights creating positive microfilm prints in a makeshift darkroom rented from the rear of a funeral parlor. He could have outsourced this part of the operation, saving him time and late nights in a photo lab, but he did not receive the quality he desired from other businesses in the area. For the extra work, Power charged Edwards six cents per foot to develop photographs for the new STC subscription service.

Power's late nights among the caskets and embalming odors lead to the establishment of University Microfilms in 1938. Better known today as ProQuest, Power expanded the company to publish doctoral dissertations by 1939. To this day, each university has a publishing requirement for the creation of the thesis. In 1938, when Power started his business, a graduate student had to pay an additional $300 fee to satisfy the University of Michigan's publication requirement. Publication via microfilm, in Power's eyes, saved valuable time and resources for both libraries and graduate students. It also created a new industry dependent upon library dollars, the subscription service.

Microfilming Europe

It was the fall of 1938. Eugene Power headed out to New York City for the American Philosophical Society and the American Council of Learned Societies' joint meeting to discuss scholarly publishing. Keyes Metcalf of the New York Public Library and Charlie Rush, associate librarian at Yale, were in attendance. Power spoke often about what was possible with microfilm. During the second day of the meeting, a note was handed to Power, "Next time you are in New York, come and see me – Frederick Keppel" (Power and Anderson, 1990, p. 100). Keppel was the head of Carnegie Corporation.

Two weeks later Keppel leaned back in his chair and asked Power,

> What would you *like* to do if you could?
> Well, sir, I would like to go to Europe and visit the principal libraries there and arrange to place a copy camera in each of them so I could form a network to obtain research materials. An American scholar would then be able to contact us and request documents from a foreign library and we could obtain them quickly and inexpensively for him via microfilm…
> When you get ready, let me know, and I will send you the money.
> (Power and Anderson, 1990, p. 101, emphasis in original)

In the months that followed Power traveled to Europe with his wife, Sadye, establishing connections to microfilm contents at The Hague, the Bibliothèque Nationale de France (BnF), the Munich Library, the Laurenciana Library in Florence, and the Vatican.

His friend Jean Le Roy of the BnF joined he and Sadye in Switzerland on the way to the International Federation of Documentation meeting in Bern. In Bern, Power was the only American and, according to his biography, the only voice speaking up for the importance of microfilm. The attendees had other thoughts on their mind. "What if there is a war?" One attendee asked. Dr. Kruse, the head librarian of Staatsbibliothek in Berlin, replied, "There will be no war" (Power and Anderson, 1990, p. 109 – 110).

By September 3rd, 1938 Britain declared war on Germany. Hitler invaded Poland on August 31st, 1939. A German submarine sunk passenger ship *Athenia* on September 1st with many human casualties. Power had feared the rise of Hitler while working at libraries throughout Europe, knowing the regime's tendency for book burning. Eighty percent of his business came from European libraries. At the declaration of war, he felt the last three months of work was for naught. His friend and colleague at the Bibliothèque Nationale, Jean Le Roy, would be dead months later. When Nazi soldiers occupied Paris in mid-June, they physically threw Le Roy out of the BnF. He died from injuries.

Microfilm: 1940 – 1950

At the onset of war, Power and University Microfilms depended upon revenue generated from microfilming dissertations and subscriptions to STC content. Microfilm was seen as the new breakthrough technology of the time. It was light, compact, versatile. During the war, Power's business created new and innovative ways for soldiers to read books. Books, when microfilmed, could be projected onto walls. Power's not-for-profit company, Projected Books, used projection so immobilized soldiers could read books by having them projected on to the ceiling (Power and Anderson, 1990).

In a time filled with eBook fascination, it is hard to imagine how much the world of books opened with the adoption of microfilm. A pass-time of Victorian Era society, the book remained a robust form of entertainment during the war years for both middlebrow and highbrow culture (Radway, 1997). While television and radio gained prominence as vehicles of leisure in both domestic and ambient spaces, innovative marketing efforts by publishing industries kept the book alive as a trusted vehicle for entertainment and publisher profits (McCarthy, 2001; Spigel, 1992; Striphas, 2009). To microfilm meant to expand the potential uses for books, not replace them. Printed works remained trusted sources for knowledge and entertainment. Other than Eugene Power, no one bragged about personal collections of microfilm. They bragged about their bookshelves (Striphas, 2009).

Like Parisians during the Franco-Prussian war, soldiers globally desired access to the daily news during WWII, interrupted by literal breaks in information. In war, data transmission ends when the messenger dies. Microfilm kept works in circulation. *Leningrad*, Dmitri Shostakovich's Seventh Symphony, was written during the city's siege in 1941. The score had its United States premier on July 19th, 1942. Both Russian and American audiences saw it as a symbolic act of defiance to Nazi militarism and totalitarianism. Shostakovich always felt that Toscanini, then the premier conductor of the NBC Symphony Orchestra, butchered the performance. The witnessing audience of NBC's national radio broadcast was enthralled by a performance Shostakovich saw as a "hack job" (Volkov, 2004). The score premiered in the U.S. by travelling out of the U.S.S.R. on microfilm.

In this time period, microfilm moved from experimental medium to taken-for-granted technology. With the invention of the microfilm reader-printer, microfilm became a permanent fixture in the academic library and an efficient storage vehicle for the new American corporate enterprise, the information industry. Microfilm was big business for big data (Diebold, 1945).

By 1945 microfilm became a global industry with its own national trade association, the National Microfilm Association. NMA was headed in its years of existence by a group of men called "Microfilm Pioneers" (NMA Archives, 2012). Microfilm revolutionized the way librarians, scientists, archive specialists, and businesses viewed document storage and retrieval, creating the possibility of instant information (Gossard, 1960). Vannevar Bush's "As We May Think," published a set of dreams already woven through years of microfilm's movement from avante garde technology to mundane mode of data storage and transmission.

Christopher Jenck's 1955 article for *The Harvard Crimson*, "120 Miles of Books," mused on the transition from Keyes D. Metcalf, the "professional librarian," to Paul H. Buck, "the scholar." It also tells well the problems of the postwar library and the library of today. Metcalf had a simple goal while head librarian: make more books available with less money. He succeeded. The staff went underpaid, the catalogues were disorganized, services to readers were cut, but Harvard had more books! Less money and more books meant more organizational problems for libraries and a lowered standard of living for library staff. Paul H. Buck was left to manage the mess. For libraries across the nation, microfilm became the

panacea for the massive problem of amassed books and scientific information (Cmiel, 2005).

Of Microfilm and Google Books

What is a chapter on the early history of microfilm doing in a dissertation on the Google Books project, a project aimed at scanning and digitizing the world's books? The trouble with the question is that it anticipates its answer. The relationship Google has established between libraries to scan books and information all over the world is new only in the medium of operation. This chapter narrates the explosion of two information bombs. The first was the industrial revolution and the second was World War II. Each explosion of information wrought massive changes to libraries. From small shops to anarchic collectives, libraries were far from quiet institutions (Battles, 2003). They were enmeshed into the politics of those envisioning them.

Dancer, Dagron, Dewey, Ranganathan, Otlet, Power, Bush – all of these men crafted dreams of the library's future. If all the world is a stage and we are but mere players, who or what is a Google? Is it a Ranganathan or an Otlet for computerized times? Is it Power, selling microfilm subscription services as a business model and microfilming books during the war?

The purpose of rummaging through archives is to find new ways of seeing old narratives. History repeats itself, but never in the same form. Our modes of expression change. Media change to fit and shape expression. Forms of social cohesion remain mundane. The family, the state, and the body of the individual remain facets of everyday life, in experience both modern and postmodern. War remains. States remain. The library remains because the library is eternal (Borges, 2000).

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Digitization, less commonly digitalization, is the process of converting information into a digital (i.e. computer-readable) format, in which the information is organized into bits. The result is the representation of an object, image, sound, document or signal (usually an analog signal) by generating a series of numbers that describe a discrete set of its points or samples. The result is called digital representation or, more specifically, a digital image, for the object, and digital form, for the In an era of digitization, NARA continues to microfilm records because microfilm is a low-cost, reliable, long-term, standardized image storage medium. The equipment needed to view microfilm images is simple, consisting of light and magnification. The medium has a life-expectancy of hundreds of years. Digital images, on the other hand, consist of a wide variety of machine codes that require computer hardware and software to be made visible. To avoid the obsolescence of changing computer technology, digital images must be reformatted periodically. The cost of maintaining microfilm is small comp