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A Social History of Technology in Libraries

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A Social History of Technology in Libraries – by Richard Hacken

(Play Arabic clip from speech synthesizer on iPhone)

Je vous remercie de m'avoir invité a être ici.

Thank you for inviting me to be here. I would like to present a social history of technology in libraries over the past 30 years, plus what the future may bring, obviously from my perspective as a librarian. You may not know *who* I am, but just five years ago I didn't know who I was, either, not in a sense of historical heritage. That was when I went to a DNA genetic testing facility. The DNA signature is unique and, if read on certain chromosome markers, can include clues about ethnic origins from thousands of years ago. So from just a bit of saliva in a cup, scientists were able to inspect my Y chromosome and predict that I belonged to the E-M96 haplogroup. To say it more simply, with over 94% certainty the ancient origin of my father and my father's father, and so forth, was in Morocco. So it's been a long time, but my DNA is happy to be home. I have never been in Morocco before, but Morocco has always been in *me*.

In effect, those data were taken from biological data warehousing perpetuated through the ages, an information system that did not degrade or disappear, an system that needed no 2.0 or 3.0 upgrades, no Beta testing, no magnetic tape, no hard drives. That information was stored, renewed and passed along, transmitted on intergenerational DNA. What is a simpler means of faithfully reproducing information than to let it pass down naturally through the ages with no conscious thought or need to preserve it? Two scientists of the European Bioinformatics Institute recently published an article in *Nature Magazine* about a workable idea for using DNA as a data storage medium. They calculate that the 3 zettabytes (three billion trillion bytes) of digital data now present on earth might conceivably be stored in DNA of incredibly thick density within a space of less than 100 cubic meters. Of course, having the concept is one thing, but carrying it out with encoding and retrieval machines is a totally different challenge.

As an academic librarian, I gather relevant materials in analog and digital formats for students and professors; my specialties are European Studies and Linguistics. I am not a computer scientist. I have worked with digital formats for the past twenty years or so, having digitized historical documents from archives in France and Italy and having organized and formatted web portals for European history and German literature, first in html and then converting them to wiki format. That does not make me an information technology specialist; it makes me a dabbler and a dilettante who uses simplified tools to get documents onto the Internet.

I reserve a high degree of admiration for those who start at zero, or start at ones and zeros, to build sophisticated cybersystems of social value and usefulness. I take for granted each new IT advance – each new database, each new interface refinement, each step toward user-friendly access and customization – but my own understanding is limited to the “black box” concept of technology. I know somebody has to design and implement the hardware and software, but my main interest is in using a simple input and getting the exact output from it that I need, that 1594 letter of King Philip II, that communiqué of the Supreme Headquarters Allied Expeditionary Force Europe on the day after D-Day 1944, that report on the 1848 revolution in Monaco. The tools to make this possible are not automati like my chromosomes, and sometimes I forget that. Many forget that. It must be discouraging that users of information systems often ignore systems accomplishments when things go right, but they will certainly complain when something goes wrong. So I stand before you today to say “thank you.” What would we do without those black boxes we dilettantes rely on? In the next couple of days I hope to gain a glimpse into that black box, to make it slightly more transparent.

Pardon me if I quote a popular musician of the late twentieth century, Frank Zappa, who advised us: “Remember: information is not knowledge; knowledge is not wisdom; wisdom is not

truth; truth is not beauty; beauty is not love; love is not music; music is the best.” Whether you agree with the statement or not, it does point out that in the pursuit of what makes us most human, the beginning point, the basis, the foundation, starts with the supply of information.

There is some confusion over terminology. Do data only become information when they are organized? A book just published from MIT Press has the title: “*Raw Data is an Oxymoron.*” Is the alphabet an example of raw data or does it carry information independent of language? In any case, a skilled writer can combine those few variables of alphabet data into beautifully organized and even life-changing information. It would not surprise me to learn that among us today are eloquent poets of the algorithm.

Speaking of “algorithm,” I am told that the word came into French and later into English from a mangled Latin mistransliteration of the original Arabic source: “al-Khwarizmi,” the mathematician whose works introduced sophisticated mathematics, including “algebra,” to the rest of the world. We have met in a part of the world that has known the principles for producing well-designed algorithms for more than twelve centuries. So it is natural that many of you carry this tradition forward.

What technological progress have I seen over the past thirty years as a librarian? These past thirty years have been absolutely incredible and exciting. I could not have picked a better time to see new techno-realities of librarianship radically shape the profession, comparable in scope to the Gutenberg revolution nearly six centuries ago when printing was developed. The 1990s produced the term “digital incunabula” to describe the parallel between early printed books of the 15th century that only imitated parchment manuscripts and late 20th century electronic copies of documents that only imitate print books. Now we’re moving forward to born-digital generations.

The word “technology” itself has evolved in meaning across the centuries. In pre-history, the discovery and use of fire was a life-changing technology, as was the invention and refinement of the wheel. Yet, as history progressed to the middle of the twentieth century, the technologies used by libraries seemed almost as close to the fire and the wheel as they were to today’s electronic environment. For example, microfilm was a reliable storage technology, but it was not user-friendly. It required a machine using fire and the wheel to be read: the fire of a lightbulb and a wheel cranking the film into position for magnification.

When I joined the library in the early 1980s, library users found access points for physical delivery of books, journals and microfilm (that is, authors, titles and subjects) in a card catalog. The individual cards (show) were printed and then corrected by hand with the typewriter. Finding journal articles involved reading through a series of bibliographies or indexes, likewise printed on paper. These were, in effect, early databases made of trees.

But then, the electronic age began to make its slow way into the library. Huge computers, equipped with a fraction of the computing power of one of today’s smartphones, had previously been housed in air-cooled rooms, but computer sizes and prices were dropping quickly while efficiency and storage capacities were expanding. About the time that personal computers came to the market, librarians devised a code known as MARC, which stands for Machine-Readable Cataloging, opening the doors for progressively more advanced online catalogs. One fine day, we held a ceremony in the library and removed the card catalog, selling off the wooden boxes.

In 1984, the year George Orwell had predicted for a scary new world of mind control, a different kind of box was brought into my office. It was not a black box, but a cream-colored box, a Macintosh computer with a cute little Apple logo on it. It had no hard drive, and the operating system had to be loaded from a diskette every time I used it, but it was a start. Soon

after, generation after generation of Online Public Access Catalog (OPAC) came and went, expanding to include circulation and acquisition modules into an integrated library system. Search capabilities increased to Boolean logic and keyword searching; but the result of the search still required the trek to find a book or journal printed on paper. It was incredibly difficult to connect to remote libraries via FTP protocols and dial-up networks over telephone lines, so we had to wait for the public expansion of the World Wide Web until use of remote library catalogs became less problematic.

The most recent library catalog systems have included more sophisticated search technologies, such as relevancy ranking and a faceted search to narrow results. At the same time, hundreds of proprietary auxiliary databases lead us to articles and other objects on any topic from agriculture to zoology. The phrase “discovery tool” came into being for cumulative technologies that search local catalog holdings along with global sources found elsewhere, and the results are aggregated into one output. Later, my colleague Mat Miles will speak of his experience in creating such a tool.

The big news in all this, of course, is that the catalogs and discovery tools have often ceased to be dead-end destinations. No more cul-de-sac. In a growing number of cases, the library-user no longer has to copy down the location for a physical object and then walk elsewhere to find the book or journal article. The digital object, whatever it may be, is immediately accessible and can be delivered with a mouse click. The remote user can access materials from home or any wired location around the world even when the library happens to be closed. Many items are also audio-enabled or linked to video. An added bonus now is the capability for collegial academic cooperation in the cloud, virtual seminars, online conferences, and document storage where scholars can work collaboratively even when they live and work far

from one another.

For a library, some of the little-known advantages of an electronic book over a print copy are economic in nature. Physical books require shipping costs, which raise the price of a book. Physical books take up physical space, which requires housing, shelving, building expansion and maintenance. Physical books are either acquired for library users or they aren't acquired. If they're acquired, they may not be used, ever. If they're not acquired, they may be needed immediately. But with a new program for electronic books called "Demand-Driven Acquisition," we can make thousands of online books available to our users through the library catalog. If nobody decides to use that book, or if somebody only scrolls through the table of contents and reads a page or two, there is no cost to the library. Only when a reader gets seriously into reading the e-book does this trigger an automatic purchase. Thus, the reader has the choice of what to read, and any and all of the electronic books remain available. In practice for the year 2012, our library ended up purchasing only about 5% of the titles that it put in the catalog. Some of those may be read and purchased next year, or the year after. But meanwhile we have access to a wider universe of readily available reading materials with no storage costs, no shipping costs and no purchase price unless they are actually used. Plus e-books will likely not be lost or stolen. Physical books do still have advantages, though, and if a user requests the cellulose version of information, we respond gladly.

Just as exciting as digital books and journals are the efforts of archives and libraries to place online their most unique and rare holdings, giving 24-hour access to materials previously only available through a visit to a rare-book room in a far-off country with limited hours and strict rules of use. This includes the ability to compare various documents online instantly, one from the Royal Library in Sweden, one from the National Archives of South Africa, without leaving

the comfort of your own workstation. It was such a growing body of digitized documents in all areas of study that was the impetus for me to create the webportal finding aid “EuroDocs” in 1995 for primary historical documents online.

Some may say that the library will no longer be necessary as an institution when progress reaches a certain point of universal information access. To a certain extent that may be true, in that the physical library may lose some of its central importance. But librarians and archivists are trained to provide access points and reference help and bibliographic assistance, and these services are needed just as much in the virtual information age as they were inside the walls of one physical building. I recall a professor asking me as early as 1990: “Is the entire library digitized yet?” The answer was no then, and the answer is obviously still no. But it’s closer than it was, and librarians keep a finger on the pulse of academic needs.

If libraries are not yet museums of extinct artifacts, there are pressures that they need to respond to. One of these pressures is the seamless access provided by search engines like Google or Bing. Because these search programs are so simple and smooth to operate, users may wonder why the local library catalog seems less intuitive. So we librarians, along with our information systems personnel, have to work towards providing the ease that users have become accustomed to, while still offering the more complex features that academic topics require.

Information retrieval devices themselves are becoming more portable, smaller and closer than ever to the person owning them – from gigantic mainframes in some cold and distant office park in the mid-20th century to the first home computers in the 1980s to the popularization of portable laptop computers in the 1990s to advanced-capability smartphones and tablets in the first decade of the 21st century. (*Hold up iPhone*) The idea of being able to carry around a handheld device with powerful connections with much of the world’s knowledge is very empowering,

approaching the ideal dream of researchers from decades and centuries past. Accordingly, our university and our library have developed apps for both the iPhone and the Android, with which the student can search the library catalog, access databases, reserve a study room, see which books are checked out, contact a librarian, or connect to study guides, which themselves contain links to databases for many fields of study (Engineering, French studies, Sociology, Linguistics, and so forth).

For my own work, I can use the smartphone for types of work that have never been possible before. In the 1980s I went to Paris in order to purchase antiquarian out-of-print books for the library collections. Whenever a dealer showed me an interesting and promising book, though, I didn't know if our library already owned that book. I had no way to check the catalog that was 6,000 miles away. Today I can carry my smartphone or my iPad into a used-book dealer's shop and check the catalog in real time to see if we already own the 1900 edition of *La Rihla du Marabout de Tasaft*. If we don't own that, I know I can safely purchase it.

Now, in the second decade of the 21st century, we are seeing the arrival of smart watches and smart eyeglasses. Smart eyeglasses (*fiddle on temple*), which Google will put on sale at the end of this year, will have all the functions and connections of a smartphone, but with a small screen attached to the front of a pair of glasses. With wearable computing like this, information will be brought closer and closer to our senses, but it may disrupt normal social conventions to an even great degree than smartphones did. As librarians and IT designers, we can follow the technology and provide resources to whatever devices our users are wearing or watching or carrying.

Last year I was curious about flying to Istanbul someday, and so I went into an airline website and checked the pricing for a flight there. Within a few hours, banner ads started showing up on a number of other websites I visited, inviting me to sign up for a flight to Istanbul.

An age has arrived when you have your own unique, customized Internet once you've logged in and identified yourself knowingly or unknowingly. Having your own personal Internet means that the advertisements, the navigation choices and perhaps even the variety of spam messages are targeted specifically to you. The type of artificial intelligence developed and refined by commercial firms might be able to inform library services, too, in less privacy-disturbing ways. Perhaps once we know that a student is majoring in Linguistics, for example, there may be a way to make access for that student visible and smoother to the database *Linguistics and Language Behavior Abstracts*.

Let us work together, we librarians and you, information systems engineers, developers and problem-solvers, to craft not just search engines, but retrieval machines that can enrich mankind and meet various needs, some of which are clear and some of which we may not even be aware of yet.

An American Indian medicine man by the name of Sun Bear said: "If your philosophy doesn't grow corn, I don't want to hear about it." That may be a good question to ask ourselves: how do our planning and our work nourish and take care of our people? Information systems are well placed to do just that, and to solve big social problems. Feeding the hungry by distribution models and fighting disease by international databases of contagion are certainly priorities, but so are a number of other problems that could be attacked, such as identifying, tracking and diverting meteors such as the one that recently exploded over Siberia.

On a planet getting smarter by the year, at least in terms of information technology, any progress has to be connected to the word "social." Our life together in local and global communities is the basis from which all else arises. A well-designed algorithm translated into beautifully efficient lines of program code and compiled into an application free of bugs and full

of logic may bring an aesthetic pleasure and a sense of professional pride, but it takes on an even more valuable aspect when it satisfies the *urgent practical* needs of our fellow citizens. This may occur within the walls of a library, or increasingly, simply connected online to the great and shared “library without walls.”

In the past we have seen information contained in separate and individual silos, boxed-in silos for separate libraries, isolated silos for separate databases, proprietary silos for separate countries. The social future will hopefully continue to open up and combine more silos into one central world knowledge bank. This is something that will require crowdsourcing to tweak, hearing the voice of the people, cyberdemocracy. User groups and focus groups, formal or informal – those user requirements mentioned earlier by Professor Bellatreche – will be valuable guides to the form and content of what information systems can contribute to society. Please follow the voice of the users and your own best instincts. Be practical. Help build a better world.