by Matt Hannigan,
Indianapolis-Marion County Public Library

IN THE BEGINNING

When the editor asked me to write this history of the last twenty years of searching it wasn't because I'm the senior statesperson of online in Indiana. That title rightly belongs to Ann Van Camp (formerly of the IU Medical Library, now an independent searcher). Nor am I the intellectual backbone of Indiana's online community. That honor goes to Becki Whitaker of the Indiana Cooperative Library Services Authority (INCOLSA). Becki is online's nearest approximation to Star Trek's Mr. Spock. My role has been more like that of Forrest Gump or Jar Jar Binks — I just happened to be along for the ride. And what a ride it has been! One can picture future Carl Sagans and Jacob Bronowskis speaking of this era and the birth of the computer with the same breathless prose formerly reserved for the invention of the wheel. I can envision schoolchildren 200 years from now summing up the twentieth century this way, "That's when they invented the computer and the Internet. I think there might have been a war or something too."

In this article I want to give you a little flavor of the incredible changes which have led us from the days of Medline, ERIC, thermal printers, and dumb terminals to Pentiums, iMacs, the Web and, of course, Project Inspire. On this journey we'll talk about the early days of the big bibliographic utilities, the changes in search strategies and the learning curve both patrons and librarians have labored through.
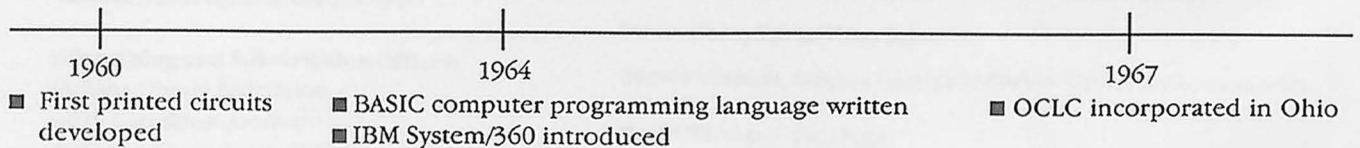
You can't miss the timeline that runs through this article. What I find remarkable is how fast all of this stuff occurred. I sometimes feel like one of those cartoon characters who is left standing in his union suit after being whirled about in the dust of the Road Runner or Speedy Gonzalez.

When I first started my career in libraries back in 1978, a young scholar would drive to the library, find a parking space, locate the proper division, find a periodical index, guess at a subject and finally identify and locate an article on the history of the Punic War. These days the same young student jumps out of bed, logs onto the Net, types some keywords into an EBSCO database — and in a few moments is reading an article on the history of MTV. Ain't progress grand?

THE PRE-HISTORY OF ONLINE

Some tech histories trace the development of the computer back practically to the Pharaohs. In my research I found one writer who argued that the history of e-mail goes back 170 years to the invention of Morse code and the telegraph! Online has a more recent history. The two men who could conceivably be called the "fathers" of online are more nearly contemporaneous. Although the serious application of computers to document retrieval did not begin until the late 1950s, the intellectual foundation of online was laid a lot earlier — first in the work of Paul Otlet (1868-1944), and later that of Vannevar Bush (1890-1974).

TIMELINE

1960	1964	1967
■ First printed circuits developed	■ BASIC computer programming language written ■ IBM System/360 introduced	■ OCLC incorporated in Ohio

Otlet was a Belgian lawyer, bibliographer and "internationalist" (a charming Victorian-era word one doesn't see much these days). Bush had an amazing resume as one of the main inventors of analog computers in the 1930s, and later as Franklin Roosevelt's principal science advisor.
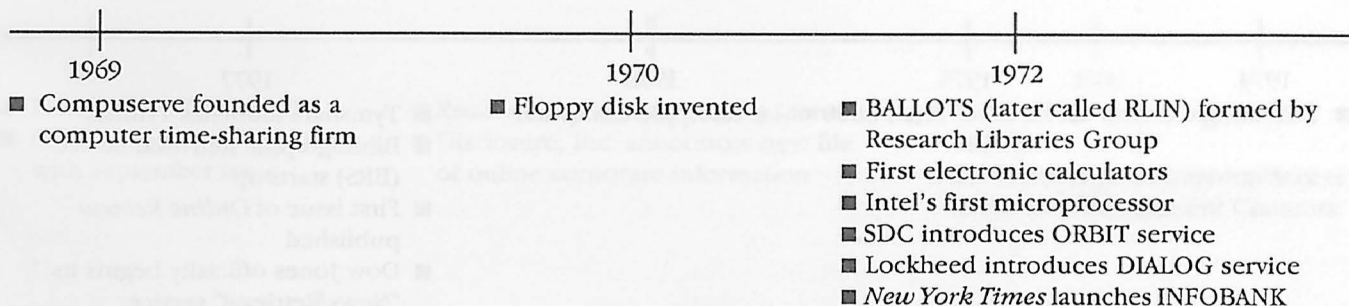
Otlet and Bush were motivated by an information explosion that was a by-product of the industrial revolution. Otlet was looking for a way to organize the vast literature of the social sciences, and Bush was likewise concerned with the literature of the sciences. Otlet was pretty much of a washout as a lawyer, but he became a bibliographer of some note, his imagination fired by the uses to which 3" by 5" cards could be put. In a 1934 monograph, *Traité de documentation*, Otlet speculated about the possibility of inventing new kinds of intellectual machines based on the notion of a desk in the form of a wheel surrounded by a mobile filing cabinet. Otlet also envisioned this desk having machines to transform speech into print and the reverse. Further, he opined that the newly created television would allow remote texts to be viewed at the desk (there may be a lesson here for our use of the Internet in the way early thinkers saw television as an educational medium). Bush expanded on Otlet's ideas in a 1945 article titled "As We May Think" appearing in the *Atlantic Monthly* of July 1945. Bush described a machine he called "memex" that could use associative links much as we see on the Web today. Bush saw the memex as a device in which an individual stores all his books, records, and communications, and which is automated for high speed and flexibility. This device, as Bush saw it, would be a desk with keyboard, screen and sets of buttons and levers. The information was to be stored on microfilm.

Bush, Otlet and others fired the imaginations of many researchers, but these ideas had to wait for technology to catch up. And it is interesting that even Bush envisioned microfilm as the storage medium, despite his background in analog computers. Some of the technological wonders necessary for their prognostications to be realized included:

1. An availability of vast amounts of bibliographic data in machine-readable form.

2. Mainframes with abundant cheap storage.

3. The creation of easy-to-use retrieval software.

4. Presence of a worldwide telecommunications system.

5. The invention of inexpensive terminals, microcomputers, and interconnecting equipment.

6. Really, really, smart librarians ;<).

The first of these conditions was met in the early 60s. The space race and national defense needs caused a rapid increase in government-supported research. The related expansion of university research led to an exponential growth in the number of scholarly papers published. The challenge of keeping track of all of this mish-mash prompted libraries, government agencies and industry to develop improved means of bibliographic access. Governmental agencies like the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA) and the National Library of Medicine (NLM) provided funding for some of this effort. NSF promoted database services at several not-for-profit agencies, NASA was looking to fulfill their mandate to transfer space technology to the private sector and the NLM began to develop systems to support the health service community. These efforts grew from the databases already in existence as print products. All of them used batch processing for searches — meaning you submitted a request and waited — and they stressed current searching rather than retrospective. Users, typically academic, submitted profiles to such groups as the North Carolina Science and Technology Research Center and the Knowledge Availability System Center at the University of Pittsburgh. These services were important from a development standpoint, but they reached only a tiny percent of the nation's researchers. These early projects provided work for what at the time were very tentative efforts on the part of two companies who were later to become major online bibliographic utilities —

TIMELINE

1969	1970	1972
■ Compuserve founded as a computer time-sharing firm	■ Floppy disk invented	■ BALLOTS (later called RLIN) formed by Research Libraries Group
		■ First electronic calculators
		■ Intel's first microprocessor
		■ SDC introduces ORBIT service
		■ Lockheed introduces DIALOG service
		■ *New York Times* launches INFOBANK

Lockheed Information Systems and the System Development Corporation (SDC). These two firms won contracts to develop software to search databases from NASA, National Technical Information Service (NTIS), Educational Resource Information Centers (ERIC), and NLM (Medline).

Online services like Lockheed and SDC would later offer users the chance to interact directly with the database, building and altering search strategies with immediate computer-generated feedback. (You found nothing, puny human!) Searching moved toward retrospective content rather than current awareness. With the rise of the commercial vendors, the federal government became less involved in direct support but agencies such as NTIS, ERIC, NLM and NASA continued to provide grant fees to researchers, journal publishers, and indexers. These indirect subsidies in turn led to relatively inexpensive databases that the commercial vendors could offer.
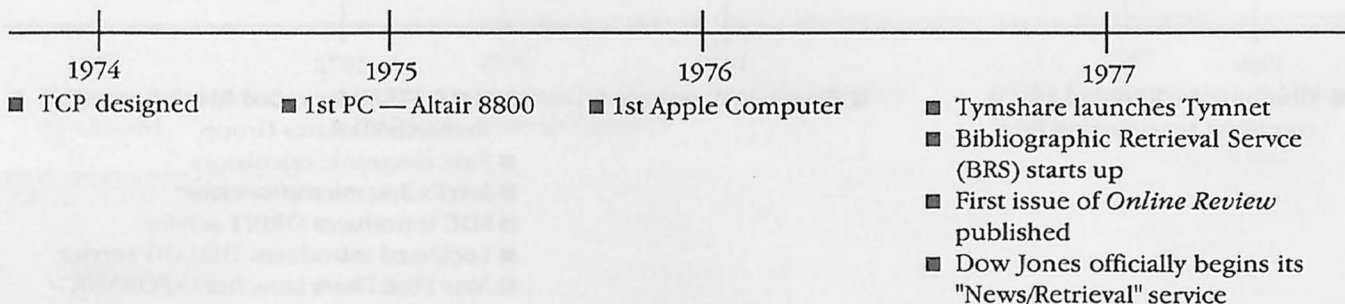
SEA CHANGE OF TECHNOLOGY : FROM THE SILENT 700 TO PENTIUM SCREAMERS

There are probably hundreds of articles comparing the societal impact of the computer to that of Guttenberg's invention of moveable type in the 1450s. (As with many inventions, the Chinese actually came up with moveable type much earlier, but their alphabet was little known outside of China, and they didn't leave us any cool bibles.) Ironically the technology of printing remained fundamentally unchanged for more than 500 years until the invention of the computer. And interestingly, some of the earliest applications of the computer in the printing industry led to the development of online databases. During the early 1960s it became feasible for publishers of large information services, such as abstracting and indexing publishers, to use computerized phototypesetting. Citations or abstracts were entered into a computer, which then massaged the data, and finally output typeset material ready for printing. This saved time and money for publishing, and had the side benefit of creating databases.

The earliest machines for database searching were cousins of the machines used for data entry in the printing industry. A terminal was hooked up to a phone via an acoustical coupler (basically a couple of rubber cups on the back of a terminal with all the technological sophistication of a plumber's helper) that could accommodate the telephone handset and relay the data over the phone line. My own first attempts at online searching were done on a portable machine of that type called a Texas Instruments Silent 700. This is a machine roughly the size of a modern laptop. Its quiet operation was perhaps the only thing to recommend it. You'd dial up the vendor, wait for the tone and wrestle the handset into place. Speed was 300 baud, down in the range of your basic three-toed sloth. The TI Silent 700 could (quietly) spit out illegible characters on a spool of thermal paper roughly the consistency of waxed paper. Later, here at I-MCPL we graduated to a GE Terminet 1200, more than four times as fast as the TI and weighing roughly the same as a Volkswagen Beetle. These early machines were dumber than a box of rocks and relied on the power of the vendor's computers for processing. Searching was done online, but print output was typically ordered offline. Citations were printed overnight and sent the next day via snail mail. There was very little full text online, so you had to get hard copy somehow. If your library didn't own the magazine, you combed through OCLC or the *Union List of Serials* and sent a paper inter library loan form. When discussing searches with patrons I would often hear something like this, "Let me get this straight, you do the search for me, the results may or may not be relevant, I have to wait a couple of days for the abstracts, you may or may not have the full text, and I have to pay you an amount you can't tell me until after you've done the search?" Yeah, right.

The first microcomputers didn't produce a lot of excitement in the online community. Memory was minimal, there were no hard drives, and search software was poor. In fact the first search software for micros worked by turning that expensive micro into yet another dumb terminal. However as the personal computer came into its own, and search software such

TIMELINE

1974	1975	1976	1977
■ TCP designed	■ 1st PC — Altair 8800	■ 1st Apple Computer	■ Tymshare launches Tymnet ■ Bibliographic Retrieval Servce (BRS) starts up ■ First issue of *Online Review* published ■ Dow Jones officially begins its "News/Retrieval" service

as ProComm, Crosstalk, and Smartalk was developed, more searchers began to search using PCs. The micro-computer brought with it the ability to upload and download search strategies, to print locally while offline, to e-mail results, to sort and edit output into a true report, and the chance to play Pac-Man or Aster-oids when nobody was looking.

On the way to the current state-of-the-art Pentium-driven, high clock speed, huge hard drive, massive RAM, networked machines we now take for granted, there were a number of technologies which were somewhat less than successful. Bubble memory, video-disks, tape drives and 5.25 inch floppies have all been relegated to the scrap heap. One technology that just won't go away is the CD-ROM and its dreaded stablemate, the CD-ROM Local Area Network. Much like a garage-built dune buggy, databases on CD-ROM take constant tinkering — loading new disks, installing new software versions, messing with menus. In 1990 accord-ing to the *Gale Directory of Databases* there were 409 CD-ROM databases available, compared to more than 4600 in 1999. Like the much loved, much loathed fax machine, the CD-ROM LAN is the visitor that just won't leave the house.
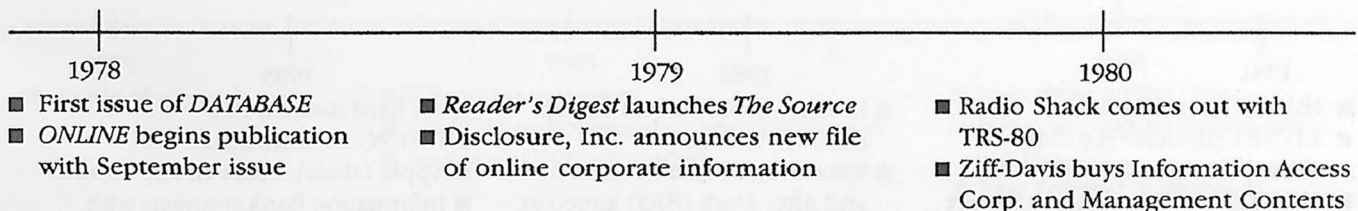
THE TUMULTUOUS BIRTH OF AN INDUSTRY

For a Vietnam-era war protester like myself it came as something of a shock to discover how closely allied the birth of online was to the military-industrial complex and the Cold War. For instance the aforemen-tioned Vannevar Bush was a co-founder of defense contractor Raytheon, as well as the overseer of the Manhattan Project in his capacity as Franklin Roosevelt's science adviser. As to the Cold War connec-tion, both Lockheed and SDC were primarily defense contractors. Another major vendor/producer, the New York Times Information Bank, had no apparent defense connection. Infobank came to life in 1972 as an online index to the newspaper's morgue. However there is a great Cold War story Jeff Pemberton related in *Online* back in 1983 about his work as a sales associate for Infobank. According to Pemberton the first two custom-ers of the Times service were the Central Intelligence Agency and the Defense Intelligence Agency. Not far behind them was the Soviet Embassy in Washington. When Pemberton went over to the embassy to show the new toy to the embassy staff (including Ambassador Anatoly Dobrynin) he tried to give a live demonstra-tion. When he brought up his first abstract, it was practically unreadable, due to connection problems. However these weren't the kinds of connection problems we librarians would later face. Pemberton surmised that the phone line was tapped by every spy in Washington. Fortunately the embassy staff reacted with laughter, and we don't have to remember Pemberton as the librarian who started World War III.

Interestingly neither of the two men who headed up the online divisions at Lockheed and SDC, Carlos Cuadra (SDC) and Roger Summit (Lockheed), at first had much luck convincing the decision makers at their companies that online document retrieval had any economic future. In an attempt to persuade his man-agement of the commercial potential of online, Cuadra mailed a questionnaire to several thousand subscribers of an NTIS current awareness service. The question-naire was meant to assess the potential interest outside of SDC for using online. One of the recipients of the survey was a librarian at Lockheed, who promptly forwarded it to Summit. This survey and the implicit threat of competition from a rival were enough for Summit to goad his management into launching Lockheed Retrieval Service in 1972. (To that point Lockheed managers had been planning to dump Lockheed's DIALOG service, which they eventually did, selling it to Knight-Ridder in 1988 for the hefty sum of $353 million bucks.) Later that same year SDC came out with their ORBIT database. Another early major vendor was Bibliographical Retrieval Service (BRS), introduced in 1977 as a lower cost alternative to SDC and DIALOG.

Both DIALOG and SDC at first only provided access to the ERIC database, an offering which didn't exactly take the library community by storm. Both quickly grew until today DIALOG has more than 600 databases (a goodly hunk of the 5500 online databases currently available per the *Gale Directory of Databases*). SDC begat Orbit and was later subsumed by Questel, owned

TIMELINE

1978	1979	1980
■ First issue of *DATABASE*	■ *Reader's Digest* launches *The Source*	■ Radio Shack comes out with
■ *ONLINE* begins publication with September issue	■ Disclosure, Inc. announces new file of online corporate information	TRS-80
		■ Ziff-Davis buys Information Access Corp. and Management Contents

by France Telecom Multimedia. The current incarnation, Questel/Orbit, has survived by specializing in patent, trademark, and scientific databases. Such reinvention is necessary in an industry with all the stability of nitroglycerine stored in a kangaroo's pouch.

THE FAILURE OF MEDIATED ONLINE SEARCHING (OVERPRICED AND UNDERUSED)

It may seem odd to use the word failure in the context of online searching. As I am typing this at my reference desk, I am looking out at a room where at least eight patrons are on computers, some searching the Internet, others using CD-ROM databases (well okay, probably several are just slogging through chat rooms). By most measures, even ignoring the Internet, our patrons have enthusiastically embraced computerized searching of databases. But in the majority of libraries mediated online searching never really caught on with the masses. When libraries first began offering computerized database searches and typically passing on some of the costs to their patrons, only a relatively small number of patrons in public libraries took advantages of these services. (Academic and special libraries did a much brisker business, and some special libraries still do a lot of mediated searches.) Some patrons were uncomfortable with shelling out cash for searching which always had seemed to them to be free when performed manually. Some academic librarians talked about the "pizza rule" — that no student would be willing to pay more for a database search than for a large pizza. The price structure of online searching in those days (usually paying for clock time) meant that you had to be pretty skilled in searching, so the patron had to turn the actual search over to the librarian. That required a pretty carefully orchestrated verbal thrust and parry between librarian and patron. For very complex subjects it meant that the librarian had to receive a crash course in a technical subject from the patron, while the librarian had to convey to the patron some of the search logic and limitations. In those days bibliographic databases were rarely full text, so the best the patron could hope to receive was a printout of relevant citations along with the usual pain-in-the-neck

retrieval issues. Do we own the article(s)? Is that volume at the library? Do I have to wait a couple of weeks for interlibrary loan? By that point the patron may well wish they had opted for the pizza instead.
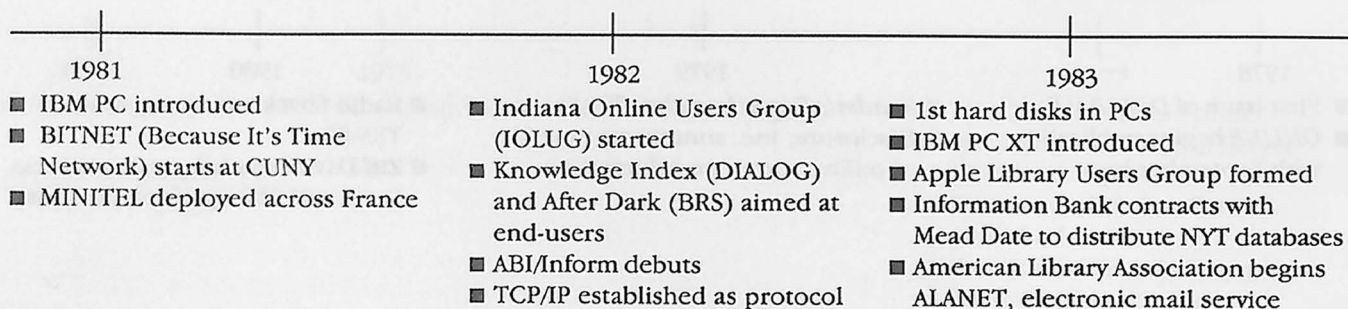
At my library we attacked the problem as one of marketing. We put up signs advertising our fee-based database service, put articles in our newsletter, contacted the media, and shamelessly hawked the service at the reference desk. For all the response we received we might as well have been offering root canals. More successful were so-called quick-and-dirty searches, done in response to a reference query and treating a database as just another source. Back in the mid-1980s at I-MCPL we were performing about ten free searches per day as part of a normal reference search, but only a few fee-based searches per month.

THE RISE OF THE END-USER

Perhaps I shouldn't have been so surprised at the lack of response on the part of our patrons to mediated searching. The earliest online databases were designed with the assumption that searching would be done by end-users, presumably at their place of work. MEDLINE was designed for use by clinicians, NASA/RECON was meant for aerospace engineers, and LEXIS was created for attorneys' use. However developers underestimated the amount of effort and time spent in mastering the use of such systems, and it quickly became the norm for search intermediaries, librarians, to handle most search chores.

Later there was an attempt to once again reach end-users through the use of front-ends or gateways. These were software programs which were supposed to make different systems easier to search, and in some cases, be used on systems of more than one vendor. The big utilities also tried to expand their customer base to end-users. To this end DIALOG introduced Knowledge Index and BRS began the After Dark service. These feature-impaired versions of DIALOG and BRS were marketed to professionals such as doctors and business people at greatly reduced prices during off-peak evening hours. Ultimately librarians became the major

TIMELINE

1981	**1982**	**1983**
■ IBM PC introduced	■ Indiana Online Users Group (IOLUG) started	■ 1st hard disks in PCs
■ BITNET (Because It's Time Network) starts at CUNY	■ Knowledge Index (DIALOG) and After Dark (BRS) aimed at end-users	■ IBM PC XT introduced
■ MINITEL deployed across France	■ ABI/Inform debuts	■ Apple Library Users Group formed
	■ TCP/IP established as protocol	■ Information Bank contracts with Mead Date to distribute NYT databases
		■ American Library Association begins ALANET, electronic mail service

users of these services, logging on at night to save money when they worked the late shift at the reference desk.

Other search services were introduced which were aimed directly at the end-user. Services like The Source and Dow Jones News Retrieval finally had some luck marketing to end-users. The relative success of these early vendors set the stage for the rise of Compuserve, Prodigy, Genie, and ultimately America Online. People began to have a taste for doing research from their home computer.

Many libraries experimented with some kind of end-user programs. These experiments were most commonly tried out in academic and special libraries, and involved training a few eager and bright patrons on some systems. But what finally prompted large-scale end-user searching within the library was Infotrac from Information Access Corporation (IAC). IAC first introduced Infotrac as a microfilm reader — basically a machine devoted to a general magazine index on film, updated monthly. Soon Infotrac introduced a database which ran on an IBM PC using two floppy disk drives, and eventually switched to CD-ROM. Infotrac products offered several important enticements that made end-user searching workable. Libraries could pay one fixed price up-front and let patrons search to their heart's content without additional charges. The search interface was easy to use — quite a rare accomplishment in those days! A library could even pair Infotrac databases with a collection of full-text articles in film cartridges. Infotrac and other early CD-ROM products from such companies as Silver Platter and UMI taught me some (admittedly cynical) lessons about what the public really wants as opposed to what I thought they needed:

- ❖ Quality is no substitute for ease of use.

- ❖ Any charge for a library service is too much.

- ❖ Patrons will usually choose an easy search method over a better but more difficult one.

- ❖ Bad data is better than no data.

- ❖ Most patrons would rather do it badly themselves than have you do it well.

- ❖ Poor search skills can still lead to good results.

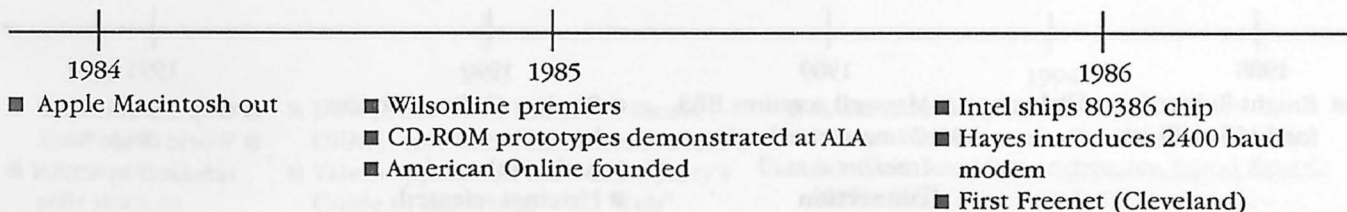- ❖ People would rather print junk than transcribe anything good.

CD-ROMs in the library were (and still are) a great source of electronic information for our end-users, but several factors were leading to end-user searching at home. People were increasingly buying PCs for home use, schools were raising the general level of computer literacy, vendors were making better search interfaces, and some libraries were providing dial-up access to databases. However the great end-user revolution awaited the incredible growth of the Internet, and more particularly, the World Wide Web.

THE INTERNET AS *DEUS EX MACHINA*

There is a concept I remember from my time spent in World Lit in college called *Deus ex Machina* (literally God from the Machine). In Greek plays, when playwrights were looking for a resolution to the plot they would sometimes introduce a divine being who would bring order to the chaos of the plot. As the plays were acted on stage this divine being was introduced into the action by the use of a machine which lowered them onto the stage. Later this came to be more generally used in lit as any arbitrary plot device that artificially brings a resolution to the action, taking all the characters (and the reader) by surprise. This is kind of an interesting metaphor for the effect of the Internet not only on online searching, but also on many industries. Even though the Internet had been around since 1969 when it was introduced by the Advanced Research Projects Administration as ARPANET, practically nobody predicted what it would become.

Database vendors were slow to embrace the Internet, except in the sense of offering the Internet as an alternative path to dial-in. I had the good fortune to hear Barbara Quint (editor of *Searcher Magazine*) speak at an Indiana Online Users Group (IOLUG) meeting a few years ago. I remember a great line she had about some database vendors whose prices were quite high, "At the next bend in the road, they're going to fly off the back of the truck." Here's what her comment

TIMELINE

1984	1985	1986
■ Apple Macintosh out	■ Wilsonline premiers	■ Intel ships 80386 chip
	■ CD-ROM prototypes demonstrated at ALA	■ Hayes introduces 2400 baud modem
	■ American Online founded	■ First Freenet (Cleveland)

makes me think of. If we view a patron's access to the information within a database as a marketing problem, we have too many vertical layers in the market. An author writes a piece, persuades a journal publisher to publish it, an indexer indexes it, a library buys an index, a patron comes to the library, the librarian instructs the patron in the use of the index, patron identifies the article, sees if the library carries it, and that it is not stolen or at the bindery, finally the patron hears the voice of the writer. This is the worst sort of vertical market, and every layer in between, (hopefully, excepting the librarian), can be viewed as an impediment to the fundamental communication between writer and reader.

At first blush something like what the Internet has become could be a vendor's dream. Simply hang out your shingle in the form of a web page and wait for the world to beat a path to your URL. But suddenly the product that you had been charging so dearly for can be deemed irrelevant. Why pay Disclosure for a report when there is Edgar? Why use a Dun and Bradstreet file to locate a company when there are sites like Hoover's, Switchboard, and CompaniesOnline? Why learn a complex proprietary language when search engines are so easy to use? Libraries like my own are contributing to the vendor's nightmare by bypassing vendors, contracting directly with database producers, and providing "free" access to our patrons via the Web.

It is too early to tell the ultimate effect of the Web on patrons' access to online databases. On the plus side the Web has created a lot of competition holding down prices of databases, it offers new search models that are easier for patrons, and it allows access where patrons need it — at home and at work. Still, it has its limits. The Web is growing at an enormous rate. Latest estimates suggest that the biggest of the search engines trap less than 15% of the 800 million pages on the Net. That percentage only reflects the publicly available Web. Proprietary content of vendors and database producers is hidden behind firewalls and is completely invisible to the major search engines. Yet another limit has to do with competition for limited resources. Our need to talk to others and our desire to be entertained by the lowbrow far exceeds our desire to do research. Will there be room on the Internet for research when the bandwidth becomes clogged by people downloading streaming video re-runs of Gilligan's Island?
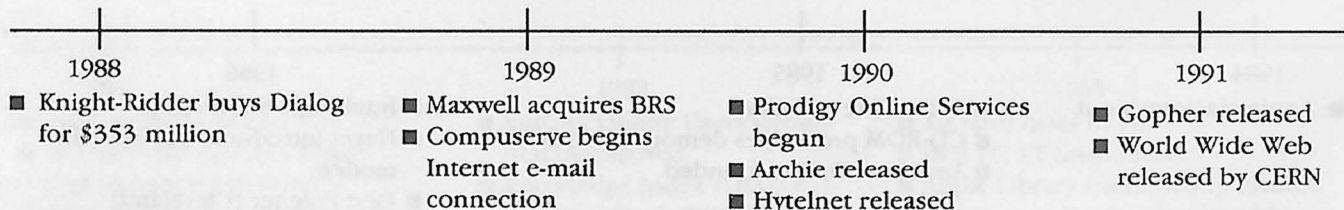
THE AGONY AND ECSTASY OF THE LIBRARIAN

One of my favorite *New Yorker* cartoons shows a group of peasants gathered around a huge computer, carrying torches and shovels — recreating the climactic scene from the movie Frankenstein. That cartoon conveys the fear and anxiety of many librarians brought on by the introduction of online searching, but misses that little voice inside that said that maybe the monster had a friendly side.

In the early 70s while the DIALOGs, SDCs and INFOBANKs were just getting started, most librarians were helping patrons the traditional way. We marched our patrons to a paper index like *Reader's Guide*, or (shudder) *Chemical Abstracts*, and painstakingly walked them through the steps in using printed indexes. The persistent patron who suffered through the limitations of a paper index was rewarded with a list of citations that one then attempted to retrieve in the periodical stacks. I say attempted because of one of Murphy's laws — if it isn't at the bindery some youthful miscreant has probably purloined the article. (A favorite student trick was to keep a bit of dental floss in one's mouth — the wet floss was laid between the leaves of a bound periodical, weakening the paper enough to allow the article to be quietly torn from its moorings.)

Librarians in academic libraries usually had their first taste of online in the mid-1970s, and most public librarians first encountered online databases in the late 70s or early 80s. In the early days of online searching in libraries most of us were ripped by two conflicting emotions. One was fear — of the unfamiliar, of having to learn new techniques, of being "left behind". The competing emotion was a kind of elation brought about by basking in the new-found respect accorded us by patrons who needed us for our recently acquired knowledge of searching. The advance of online technology has been pretty confusing for librarians. First we thought we would be the great search interme-

TIMELINE

1988	1989	1990	1991
■ Knight-Ridder buys Dialog for $353 million	■ Maxwell acquires BRS ■ Compuserve begins Internet e-mail connection	■ Prodigy Online Services begun ■ Archie released ■ Hytelnet released	■ Gopher released ■ World Wide Web released by CERN

diaries (a select few were). Then we became tutors, helping our patrons in their role as end-users. More recently we thought we might become the great organizers of the Internet, or serve a role as electronic docents guiding our patrons through the complexities of search engines and databases.

It would be easy to quote some well-known statistics that would seem very discouraging to the future of librarians. A superficial skimming of such data indicates that we serve an elite subset of the general population, most people are reluctant to ask for our help, and our answers are about as accurate as Jeanne Dixon's prognostications. I come down on the side of those who believe that there is always room for a profession whose goal is to help people find answers. As long as people continue to be curious, I see a role for librarians.

THE NEW MATH OF SEARCH STRATEGIES

I have no idea if the human desire for organization has a biological basis. Did Peking man have his collection of spears carefully mounted by size on the cave wall? Did the Neanderthals stack bones by size and color? Modern man (or woman) is a fiend for organization. Human intellectual endeavor in the last century has forced us to carefully think through the organization, dissemination and retrieval of information. At home you might get away with storing stacks of magazines and newspapers in the basement with post-it notes marking the articles you don't want to forget, but in the library we need something a bit more formal. Cataloging, classification, indexing and abstracting are the noble, if tedious, tasks that have traditionally allowed us to find that great recipe for elephant ears. Library schools produced legions of librarians who could navigate print indexes with ease, confident in their mastery of title, author, and subject searching. Online first introduced librarians to concepts that were alien to us — Boolean logic, proximity, sorting, keyword-in-context, field limiting, etc. There was a massive re-training of librarians that needed to be done in order to bring us up to speed. In this state we were very fortunate to have INCOLSA and its talented staff to help. The library schools too began to churn out students
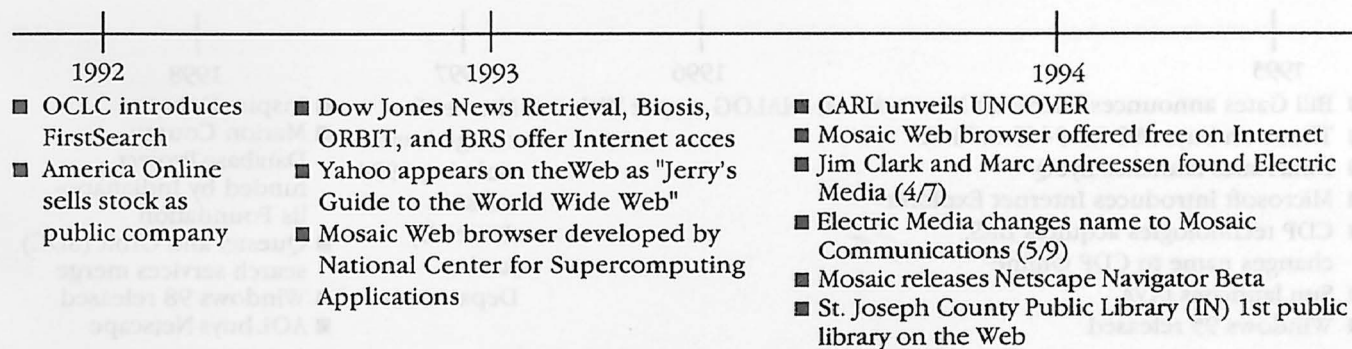
who had been weaned on Nintendo and for whom the computer was no more intimidating than a toaster.

Our notions of searching online had to change when databases started including not only citations and abstracts, but in many cases the full-text of the article. Full-text databases were sometimes thrown together with few subject headings or actual indexing. It's great to have full text databases, but it does mean one must be more cautious in structuring a search, relying more on proximity operators, and being more exact in the choice of terms.

We finally have reached a point where most librarians can throw together a pretty good Boolean search of the ((librarian* and (salary* or wage*)) not peanuts) variety. The problem with Boolean searching is that it is very hard to teach to patrons. The arrival of the Web has brought with it a new set of search strategies for us to learn and to teach our patrons. Two of the more clever of these are natural language and relevance ranking, really two sides of the same coin. Type in a question (How much wood could a woodchuck chuck if a woodchuck could chuck wood?), or string together a bunch of relevant terms (woodchuck chuck wood), and the system performs a Boolean "or", and ranks the results by relevance based on such things as the number of occurrences of the terms, their proximity to one another, their frequency, or their location in the document. The beauty of this type of searching is that it can be mastered by a child, or even by a library director. Another new search concept brought to us courtesy of the Web is the equally clever "query by example". Find a relevant hit by any means, click on it, and the system displays other hits having the most words in common with the relevant hit.

These new search methods are pretty cool, at least in theory, but as was true with Boolean, we are searching for ways to correct the two major types of search errors — failing to find anything relevant, and more commonly, finding too much of the irrelevant. Some web search engines have been throwing in popularity of sites as a relevance criterion, but substantial improvements will probably require some kind of intelligent

TIMELINE

1992
- OCLC introduces FirstSearch
- America Online sells stock as public company

1993
- Dow Jones News Retrieval, Biosis, ORBIT, and BRS offer Internet acces
- Yahoo appears on theWeb as "Jerry's Guide to the World Wide Web"
- Mosaic Web browser developed by National Center for Supercomputing Applications

1994
- CARL unveils UNCOVER
- Mosaic Web browser offered free on Internet
- Jim Clark and Marc Andreessen found Electric Media (4/7)
- Electric Media changes name to Mosaic Communications (5/9)
- Mosaic releases Netscape Navigator Beta
- St. Joseph County Public Library (IN) 1st public library on the Web

agent, a software program with artificial intelligence and learning qualities that can assist a patron in a search. In the meantime, we librarians can find gainful employment by advising our patron that he isn't likely to find anything on experiments with dolphin intelligence by typing in "Flipper smart fish". It's nice to still be needed.

BEYOND Y2K

This section of the article exists so that not so very many years from now a librarian can look through this issue of *Indiana Libraries*, and get a good laugh from what I have to say about the future. In the very first general meeting of the Indiana Online Users Group I remember very well when an earnest young man stood up and announced sanctimoniously and knowingly that it would be 50 years before end-user searching made any inroads into our work as librarians. (Yes it was me!) Duh.

There are lots of articles written on the future of libraries. Some say that we will go the way of black-smiths and milkmen, while others predict a role on the forefront of computer connectivity. Will we become a video store, a place for kids to play Nintendo, or a kind of continuing ed school for the digital illiterati? There is much less written on the future of online, but the two factors that I think will loom large are the gradual migration from the venerable codex to the electronic book, and more online offerings of audio, video, and still graphics.
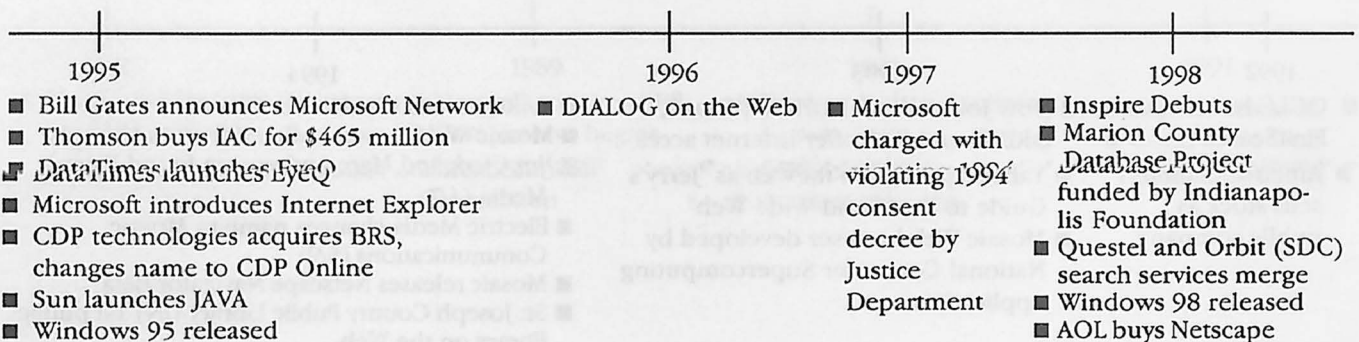
The history of online searching to this point has largely had to do with magazine articles, directory information, and statistical data. The book is the next obvious candidate for online access. Remember that the original online databases came about because computer typesetting had already pretty much created the files. The same is true these days with books. An author writes a book, frequently in electronic form, and submits it to the publisher. If it's not already electronic, some struggling college student will make it so. At that point there would seem to be no technical reason it couldn't be made available to libraries or bookstores

electronically. (I used the phrase "would seem to be" because of a conversation I had with a couple of sales people from Netlibrary. In their experience there are such a plethora of proprietary formats among publishers, that Netlibrary still has to painstakingly scan in most books whose rights they acquire.) Let's ignore for a moment the implications for the circulating collections of libraries that the advent of the electronic book might imply. However think of the reference power you'd have if you could search through the full text of books to find answers to reference queries! If you could limit a search to all the books published on French cooking in the last ten years and then search for a recipe for Crème Brulee, that would be pretty neat. Given 50 million monographs in the Library of Congress with an average length of 200 pages, we have the potential of accessing 10 billion pages of text, twelve times the current size of the Web.

The days of an online world composed largely of text are numbered. Some search engines are already offering limited search capability for non-text information like audio, video and software. For such searches to work well a lot of thought will have to be given to how one looks for sleds which resemble the one in Citizen Kane, or for a musical passage similar to Eine Kleine Nachtmusik, or a picture of Elizabeth Dole wearing a fake arrow-through-the-head.

We are certainly a lot closer to Otlet's and Bush's vision of a wired scholar. Perhaps "memex" won't be a large workstation, but something more akin to Maxwell Smart's shoe phone, or Dick Tracy's wrist communicator. If so maybe the current popularity of working from home will evolve to working from wherever you wish — mountaintop, beach, or garden. Now that's something worth sticking around for.

TIMELINE

1995	1996	1997	1998
■ Bill Gates announces Microsoft Network	■ DIALOG on the Web	■ Microsoft charged with violating 1994 consent decree by Justice Department	■ Inspire Debuts
■ Thomson buys IAC for $465 million			■ Marion County Database Project funded by Indianapolis Foundation
■ DataTimes launches EyeQ			
■ Microsoft introduces Internet Explorer			
■ CDP technologies acquires BRS, changes name to CDP Online			■ Questel and Orbit (SDC) search services merge
■ Sun launches JAVA			■ Windows 98 released
■ Windows 95 released			■ AOL buys Netscape

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