# The E-Memory Revolution

## The rise of digital records of daily life means unmatched access to our pasts, presenting both challenge and opportunity to libraries

### By Jim Gemmell & Gordon Bell -- Library Journal, 9/15/2009

When Stanford University obtained the Buckminster Fuller archive, it heralded it as "one of the most extensive known personal archives in existence." Taking up 2000 linear feet of shelf space, including hundreds of thousands of pages and over 4000 hours of audio/video, Fuller's collection does indeed sound impressive. But Fuller, considered an eccentric for leaving behind such an enormous corpus, will be put to shame by the vast repository of electronic memories (e-memories) created by the average Joe of the next generation. And these e-memory archives will take up a lot less shelf space.

We are on the cusp of an era in which, if you choose, you can create e-memories of everything, forget nothing, and keep them in your own personal archive. You can have what we refer to as Total Recall. Souvenirs and mementos will belong to another era. More and more is being recorded about each one of us than ever before, and it is bound increasingly to include reading habits, health, location, and computer usage. Archivists, who are already beginning to deal with digital curation, will have to grapple less with physical objects and more with the potential analysis and distribution of the information those objects represent. And library patrons will be a new breed, "a digital person," with their own personal digital libraries of everything they've ever read, seen, and heard.

Three streams of technology are merging to bring about an imminent Total Recall revolution. The first is recording technology, beginning with the already ubiquitous digital cameras and cell phones that include cameras. They are the first few drops in a coming deluge of sensing devices that will include location-tracking, environment-sensing (for example, temperature and humidity), and biometric sensing (via on-body devices today and someday via in-body devices). Furthermore, the trail of one's digital transactions can tell a detailed story—and not merely itemized credit card bills but phone call logs, email in-boxes, web browsing histories, movie rentals, and much more. We already have more digital records than we realize.

The second technology stream is the rapid increase in capacity and corresponding decrease in price for digital storage. Imagine an archive of everything you ever read or wrote—books, articles, web pages, emails, letters, and so on—along with ten or 20 pictures a day and several hours of audio each day. Already, this would easily fit on a $100 hard drive. In a few years, it will fit in your cell phone. A few years after that, rolling video nonstop throughout life will be possible. We already have more digital storage than we realize.

The third stream is powerful software to take advantage of a lifetime of e-memories. Searching for words in your e-memories, like Google does on the web, is only the beginning. It will be possible to find things by cross-correlation, such as the document you read while in Phoenix, the picture taken by a relative, or the email you sent on that particularly cold day. And data-mining software will crunch through your life-log, finding patterns, trends, and connections. This third stream is where the most dramatic developments are occurring now.

**Creating e-memory legacies**

We don't expect very many people will record audio and video continuously throughout their lives. But virtually everyone will record much more audio and video, and the overall digital trail they leave behind will be even more expansive and detailed than it is now. Imagine if your great-great-grandfather had left behind as much video and audio as Buckminster Fuller, allowing you to hear the sound of his voice, identify his favorite sayings, and watch his mannerisms. Think also of looking through all his correspondence and seeing all his travels in detail down to each walk down the street. Suppose you could find ancestors similar to you and examine a detailed record of their health, including what they ate, how much exercise they took, and even a full history of their weight, blood pressure, blood glucose, and heart-rate—recorded daily or even moment by moment.

With enough information about a person, it even becomes possible to simulate their responses in a dialog. Researchers at Carnegie Mellon University, Pittsburgh, have a program that lets you ask questions of Albert Einstein. You can chat with a virtual George Bush or Bart Simpson at MyCyberTwin.com. The scope of what you can discuss with Einstein, Bush, or Simpson is limited only by the source material. With a more comprehensive transcript of one's life, a very realistic simulation could be done. Imagine asking your great-great-grandfather about his first date with your great-great-grandmother.

**Fundamental human values**

Total Recall will impact more than just personal legacies; the legacy of research projects will also be revolutionized. In the past, a paper or two might be all that survived of a large research effort. In the future, all of the data, notes, and correspondence will be preserved. Others will study it and add their own observations. Someone may apply a fresh approach to the old data. This new paradigm is already being tried in the world of science, yielding deeper insights and sometimes revealing flaws in earlier published work. And it should be just as relevant in other fields, for example, history, where access to original source material will proliferate.

For the historian, e-memories will require mastering new computing skills. There will be far too much material to view—you don't have enough time to watch even one other person's life in its entirety. So, historians will become adept at using data-mining to ferret out the novel from the mundane and the significant amid the trivia. Their scholarly community will draw increasingly on the technologies of database search, wikis, and Facebook. The human values that guide their interpretations will always be fundamental, of course, but they are bound to change as e-memories in a Total Recall world give an increasingly finer grain to our understanding not only of ourselves but of other people in other ages.

**Following story trails**

The way that history and science—indeed any information—are consumed will change. Whatever the topic, the entire corpus in gory detail will be available. The first organizational step, though, will need to be in summaries and "story trails." Summaries may be authored, but more often they will be automatically created. We will want them even for our own life corpora, because being intimately familiar with a vast collection will not prevent it from being intimidating. Consider the automatic summarization made possible by a system from Dublin City University, Ireland, that discerns between the novel and the mundane from among tens of thousands of photos, GPS data, and other sensor values. Its output is a summarized diary that highlights the interesting part of your day.

Story trails will take you from artifact to artifact with a narrative to guide you. Think of it as a History Channel show but an interactive one that lets you browse around like you surf the web and where you can look at more than just the few seconds of video or a handful of selected photos. Imagine following a narrative of basketball star Michael Jordan's life and being able to follow up on one brief mention to watch a game he played as a teenager. Every stat is available, every second of every game, every interview. You end up in his baseball career and discover stories by others that provide fascinating perspectives. And you find they take you off on other trails through history. By following up their trails you end up deep in baseball lore and eventually looking at historic pictures of Yankee Stadium.

A foretaste of this new way of consuming information comes from the World Wide Telescope, which includes authored guided tours through the universe. You might be taking a tour of spiral galaxies, stopping for a view of each galaxy to hear details, and then virtually flying through space to the next galaxy on your tour. You arrive at Andromeda and notice that it is also part of a tour of galaxies visible via amateur telescopes; clicking on that tour icon branches you off on a new trail through the universe. And at any point you can just roam around the stars as you please.

**Innovations in learning**

A further change in information consumption will be the widespread adoption of electronic textbooks. While promised for years, e-texts are finally on the rise, with some colleges already offering textbooks on Kindle book readers and the governor of California advocating their adoption. E-texts will have many advantages, but an overlooked point is that they will put computing power into the hands of students, enabling them to create their own learning e-memories. The e-text should know what has been read and what hasn't. It can enable electronic highlighting and note-taking. It will record lab experiments and conversations with the teacher. Increasing use of electronic book readers and the ubiquity of notebook computers will propel the ascendency of e-texts, which will open the door to a new world of learning with Total Recall.

This will also impact all lifelong learners. The mother of an ADD son will have her own personal e-library of articles, books, advice, and notes that she will continually extend and reflect on as she gains greater insight into his particular needs. The youth baseball coach will ruminate over a corpus of practice plans, game footage, coaching seminars, and suggestions from his colleagues. The entrepreneur will have her own blend of college courses, seminars, articles, and life experience that she will grow and evolve over time.

**Library patrons in the Total Recall era**

All these changes mean a drastic alteration in the library patron of tomorrow. Imagine a patron today arriving with a truckload of books, magazines, and clippings, several helpers, and even a few librarians from other libraries. Virtually, electronically, this will be the Total Recall patron. In a way, patrons will be the librarian of their own not insubstantial library. Still, most will lack expertise; they will likely be asking for help with advanced search, data-mining, and making connections in the virtual world to the right experts. Patrons will ask for help building new connections with their truckload of e-memories, as it were, and may well give a librarian some access to their own memories to get this help.

And patrons won't just want to borrow works; they will want to absorb them into their e-memories. Precious little will be able to protect copyright from personal copying: recording from pages, screens, and speakers will go from possible to trivial as miniaturized cameras and microphones meet powerful software to manage the recorded content. Bootleggers may be caught, small-scale sharing of copyrighted works may occasionally be detected, but personal copies will never be discovered.

**Digital curation challenges**

Digital archives come with their own unique challenges, particularly data loss, data decay, and data entanglement. Backup and replication, thanks to market demand and competition, are rapidly approaching the affordability and ease of use that should make data loss a thing of the past. Data decay and data entanglement are more problematic.

Data decay occurs when the format you stored something in becomes obsolete and unreadable. It is hard to imagine a library owning every program needed to open every file type ever known. Rather than lose everything from an old spreadsheet, it is desirable to at least have a "print" version of the spreadsheet. The ability to calculate is lost, but at least the version as it would be printed can be easily retained in e-memory. Other interactive documents might be captured as video. In any event, care must be taken to preserve digital artifacts in formats likely to be long-lived and to be constantly converting them into the latest generation of formats to avoid obsolescence. We expect software services to react to market demand to perform such conversion.

Data entanglement refers to the intermingling of work and private life and the competing claims on e-memories that ensue. When we eventually part company with Microsoft, where we are currently both researchers, it will no doubt request that we perform an e-lobotomy of those memories associated with the company. However, the demarcation is not always clear. Are memories en route to a business meeting personal or corporate? And chat transcripts from our private accounts may mention company business, while corporate records could contain such personal tidbits as happy birthday greetings.

We question to what extent people will actually comply with requests for e-memory purging, but whatever they do it is clear that data entanglement will be a thorny issue for the digital archivist. Just rounding up all of the bits of a person's life will be problematic as these lives are captured and archived on their own systems, on social web pages such as Facebook, and are part of other people's lives or organization archives. Yet, all of these bits, such as an occasional email missive, are needed to complete the stories.

Another issue is simply finding enough storage space. For an individual during his/her life, storage is not an issue, but any attempt to keep all the data stored by all individuals forever

seems hopeless even though we have just come through a decade when storage has doubled annually. We cannot project continued exponential increases in storage capacity into the indefinite future. Nor can we count on increasing population to deal with storing past generations—especially when population grows most quickly in poor countries. No, storage will be finite, and we will have to answer who will get in the digital lifeboat. Do we want one full life or two half-lives? Will we trim video quality for one to make room for another? Or delete the repetitious bits: "same commute to work as usual—video/GPS/auto information deleted"?

However we answer such questions, many more lives will still be digitally preserved, each in ever-greater fidelity.

**Your life as a library, not a museum**

Most physical artifacts will collect dust prior to being ultimately discarded or sold as antiques. Digital artifacts will be found and enjoyed and collect no dust at all. One woman we know sells tiaras on eBay. In the 20th century, she could never have found enough customers to make a business of it. In the Internet era, she has global reach. The Beatles have made a lot of additional money by selling outtakes and obscure videos of themselves. The interested student of history will soon be finding digitally stored artifacts of, say, World War II in far greater quantities than is now possible. People looking for an ancestor whom few others care about will be especially advantaged. E-memories are just so much more accessible.

We horrify archivists when we talk about digitizing things and then throwing them away. Of course, one need not destroy the physical object after making a digital copy, but one of the most enjoyable aspects of Total Recall is the reduction of clutter; it is especially satisfying to shred one's papers and eliminate rows of filing cabinets and shelves. When curators come to deal with our archives, they will surely find hundreds fewer physical objects because of Total Recall. But they will have hundreds of thousands of additional digital artifacts. Whether you agree that is a highly positive trade-off, it is surely coming.

The benefits of e-memories will extend across the life of the individual and throughout society. These benefits, along with the technological trends that make e-memories affordable and convenient, make the Total Recall era inevitable. Your life, in so far as it is information, is about to become totally accessible to you. The skills and passions of librarians will be invaluable in this new age.

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