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FAST COMPANY

NOVEMBER 2006

PLUS

[GENIUS IN A BOX]

WHAT IF YOU NEVER FORGOT ANYTHING?

How Microsoft's Gordon Bell Is Reengineering Human Memory (And Soon, Your Life and Business)

HOW VIRAL MARKETING CASTS ITS SPELL

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112 MPH IN 1st GEAR: ELECTRIC CARS GET JUICED

"PEOPLE SAY WHAT I'M DOING IS REVOLUTIONARY. I SAY NO, IT'S EVOLUTIONARY. IT'S HAPPENING TO YOU. IT'S HAPPENING AS YOU SPEAK."

—GORDON BELL
Senior researcher, Microsoft Research Labs

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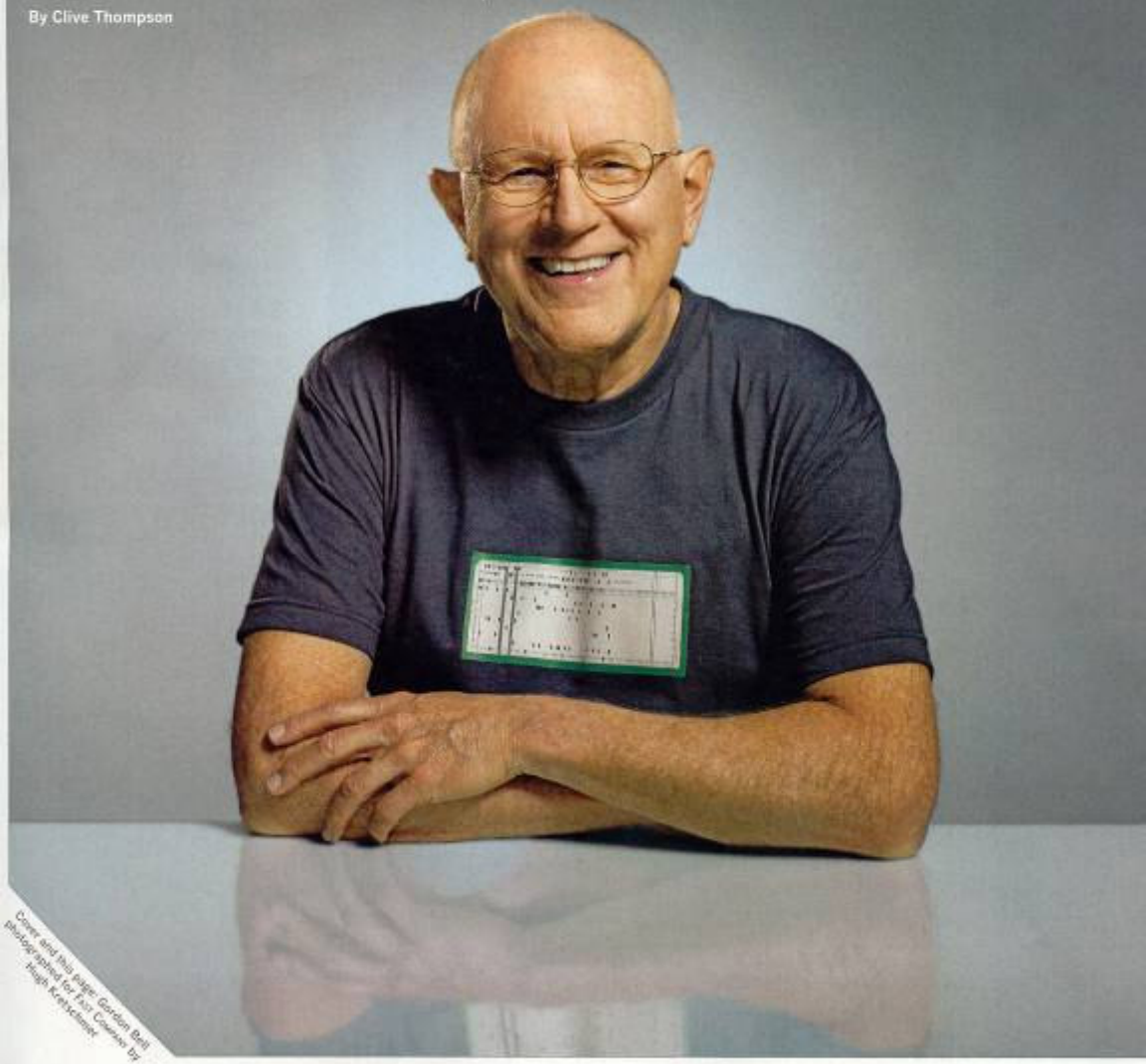
Microsoft researcher Gordon Bell doesn't forget a thing—because for seven years, he has been cramming every detail of his life into a computer. It's a crazy experiment with huge ramifications. And it looks like we'll all be part of it sooner than we think.

By Clive Thompson



Cover and this page: Gordon Bell photographed for Fast Company by Hugh Kretschmer

Styling by Micah Bishop; prop styling by Shannon Amos; grooming by Sherrie Long

LETTER

FROM THE EDITOR

The Persistence of Memory

The subject of this month's cover story, Gordon Bell, has embarked on a little experiment with huge implications: He's recording and preserving essentially everything that happens to him—every phone call, every email, every conversation, every document that comes his way. It's scrapbooking on silicon steroids. Bell accumulates 1 gigabyte of information a month, and, because he has been at it for seven years, he has a heck of a lot of data (though he describes his trove in saltier language). All that information would be useless without new ways to store, categorize, search, and manipulate it. And that's why Bell's artificial brain is, in turn, sparking a frenzy of game-changing innovation by researchers and developers at his employer, Microsoft, and elsewhere.

It's an astonishing story. Bell is a compelling character whose work will have profound implications for businesses ranging from search to software to artificial intelligence. And it will make you think in new ways about what it means to be human.

What it made me think is this: Gordon Bell is a brave man, because he's willingly depriving himself of one of the mind's two greatest safety valves—the ability to forget. (The other release, of course, is sleep, a temporary form of forgetting.) Sure, I can see the advantages, because I'm a bit better at forgetting than I'd like to be. My memory for names and certain kinds of facts, never particularly sharp, seems to have grown worse with age, increasing busyness, and mounting preoccupation. So a little assist from a hard drive might make me more efficient, and might keep some things from slipping by me.

But I'm also awfully grateful that time has dimmed my recall of some things, like the grueling details of my parents' final illnesses. And who wouldn't want the power of selective forgetting? I'd love to be able to erase the memories that still make me cringe with embarrassment, or regret, decades after the fact.

So I'm not sure that I'd want to live the way Bell does. Problem is, the world is moving his way, as contributing writer Clive Thompson's story makes clear. From security cameras to blogs, credit reports to MySpace pages, we're increasingly leaving traces wherever we go, willingly or otherwise. "Go Google yourself" is not a rude suggestion. It's an invitation to discover your permanent public record, the memories of you that will never be forgotten.

And successful technologies have a funny way of creating their own justification. As methods like the ones Bell is exploring spread, the social and business pressures to employ them will mount. In an age of computer-assisted human memory, it may one day be as unacceptable to claim you've forgotten something as it is, in our time of pervasive cell phones and BlackBerrys, to say you're unreachable. It'll be a world that will take some getting used to.

Mark N. Vamos

Photograph by Dennis Kleiman

Photograph by Hugh Kretschmer

a HEAD FOR DETAIL

GORDON BELL FEEDS EVERY PIECE OF HIS LIFE INTO A SURROGATE BRAIN, AND SOON THE REST OF US WILL BE ABLE TO DO THE SAME. BUT DOES PERFECT MEMORY MAKE YOU SMARTER, OR JUST DRIVE YOU NUTS?

By Clive Thompson

Styling by Micah Bishop; prop styling by Shannon Amos; grooming by Sherrie Long

Gordon Bell

will never forget what I look like. He'll never forget what I sound like, either. Actually, he'll never forget a single detail about me.

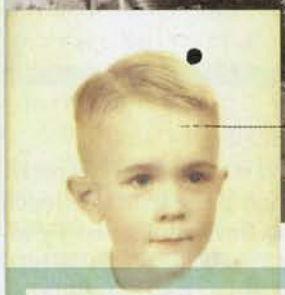
That's because when I first met the affable 72-year-old computer scientist at the offices of Microsoft Research Labs, in Redmond, Washington, he was carefully recording my every move. He had a tiny bug-eyed camera around his neck, and a small audio recorder at his elbow. As we chatted about various topics—Australian jazz musicians, his futuristic cell phone, the Seattle area's gorgeous weather—Bell's gear quietly logged my every gesture and all my blathering small talk, snapping a picture every 60 seconds. Back at his office, his computer had carefully archived every document related to me: all the email I'd sent him, copies of my articles he'd read, pages he'd surfed on my blog.

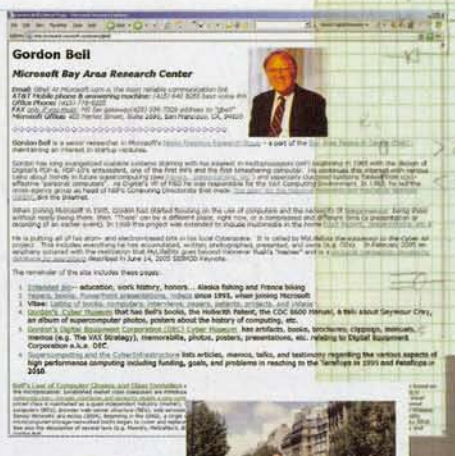
"Oh, I've got everything," Bell said cheerily. And when I saw him the next day, down in his cramped personal office in San Francisco, he offered to give me a glimpse of the memories he'd collected. He plunked down in front of his computer, pulled up a browser, typed in "Clive Fast Company," and there they were: Hundreds of pictures of the meeting scrolled by on his screen, and the sound of our day-old conversation filled the room. It was a deeply strange feeling. My random chitchat is being preserved? For all eternity? He nodded, pointing to a mundane Dell computer parked beneath his desk. His massive store of data. His "surrogate brain."

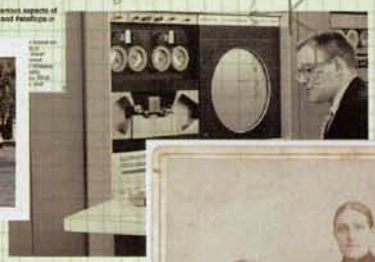
Because I'm not the only thing Gordon Bell will never forget. His goal is never to forget *anything*.

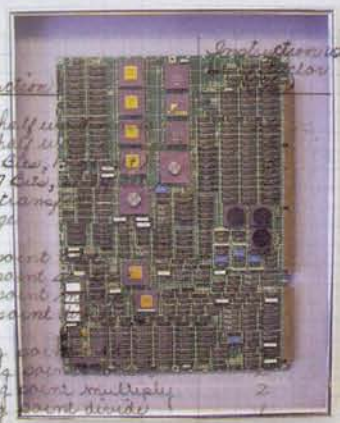
A FEW OF THE THINGS ON GORDON BELL'S MIND

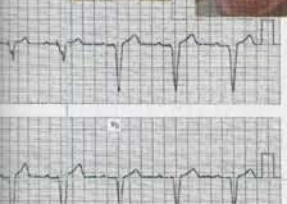
From ancestral photos to his MIT diploma to his robot driver's license, it's all in there. And we do mean *all.*

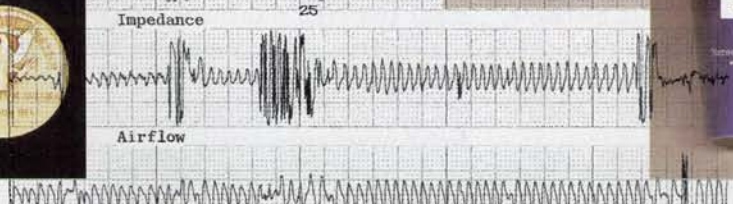












All images courtesy of Gordon Bell

"WE'VE COME TO A TIME WHEN MACHINE MEMORY CREATES IDEAS WE'VE NEVER CONSIDERED."

For the past seven years, Bell has been conducting an audacious experiment in "lifelogging"—creating a near-total digital record of his experience. His custom-designed software, "MyLifeBits," saves everything it can get its hands on. For every piece of email he sends and receives, every document he types, every chat session he engages in, every Web page he surfs, a copy is scooped up and stashed away. MyLifeBits records his telephone calls and archives every picture—up to 1,000 a day—snapped by his automatic "SenseCam," that device slung around his neck. He has even stowed his entire past: The massive stacks of documents from his 47-year computer career, first as a millionaire executive then as a government Internet bureaucrat, have been hoovered up and scanned in. The last time he counted, MyLifeBits had more than 101,000 emails, almost 15,000 Word and PDF documents, 99,000 Web pages, and 44,000 pictures.

"And that," he cackles, "is a s--tload of stuff."

That load has endowed Bell with the ability to perform supernatural feats of memory. He can dredge up the precise contents of an inspirational note above his desk 30 years ago (a set of aphorisms, including "Start many fires"). He knows who passed him on the street on the way to work four weeks ago. And when someone disputes his recollection of a conference call the previous day, he can end the argument by pulling up the audio stream and listening to it again. Instantly.

"It gives you kind of a feeling of cleanliness," Bell tells me. "I can offload my memory. I feel much freer about remembering something now. I've got this machine, this slave, that does it."

It gives his mind the chance, he says, to be more playful, to have more energy for creative thinking. But it is also a double-edged sword. Bell suspects MyLifeBits might be slowly degrading his real, carbon-based brain's ability to remember clearly. When you have an outboard mind doing the scut work, you tend to get out of practice. "It's like doing arithmetic," he says. "Who does it anymore? You've got pocket calculators for that. I know I can do long division. But I haven't done it for a long time."

It's a crazy experiment. But perhaps its craziest aspect is that soon you'll be part of it too—whether you want to be or not. The way Bell sees it, computers and the Internet are now rapidly becoming capable of storing everything you do and see. Hard-drive space has exploded in size, and every day people are recording more and more of their lives: We blog about our thoughts, upload personal pictures to Flickr, save every email on our infinitely expanding Gmail accounts, shoot video on our cell phones, record phone calls straight to our hard drives when we use Skype.

"People say, 'Oh, what you're doing is revolutionary!'" Bell says. "I say, 'No, no, it's *evolutionary*. Because it's happening to you. It's happening as you speak.'"

So what will life be like when nothing is forgotten? Provocative as that question may be, it's hardly theoretical. The thinking behind MyLifeBits and other lifelogging research is already seeping into our lives. It's changing the way our search engines work. It's affecting corporate strategy. And the power of machines to create boundless memory—and to augment and even transform human thinking—is only going to become more pronounced. We've arrived at a time when the memory of machines creates ideas we've never considered.

Clive Thompson covers technology for numerous national magazines. He's a Fast Company *contributing writer.*

PAPERLESS TRAIL

You could trace the notion of perfect recall back to 1945, when presidential science adviser Vannevar Bush published a provocative essay in *The Atlantic Monthly* entitled "As We May Think." Bush argued that man's mind could be perfected by technology. He envisioned a device called a Memex, "in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility." A user would wear a "walnut-sized" camera on his forehead, capturing everything he saw, then sit down at his Memex to browse thousands of personal letters, newspapers, and encyclopedias instantly. It would be, Bush argued, "an enlarged intimate supplement to his memory."

MyLifeBits was born from a much humbler idea: Bell was sick of carting around stacks of paper. He was a veteran of the computer revolution—indeed, he helped kick-start it in the 1960s and 1970s by building the first refrigerator-sized "minicomputers" for DEC, a pioneering computer firm. In the 1980s, he helped the government bootstrap the Internet into existence, then worked as an angel in Silicon Valley, growing wealthier and wealthier as his investments took flight. Hired in 1995 by Microsoft Research Labs, a wing of the company devoted to designing the future of computers, Bell was given carte blanche. He decided to become the first person in history "to truly go paperless."

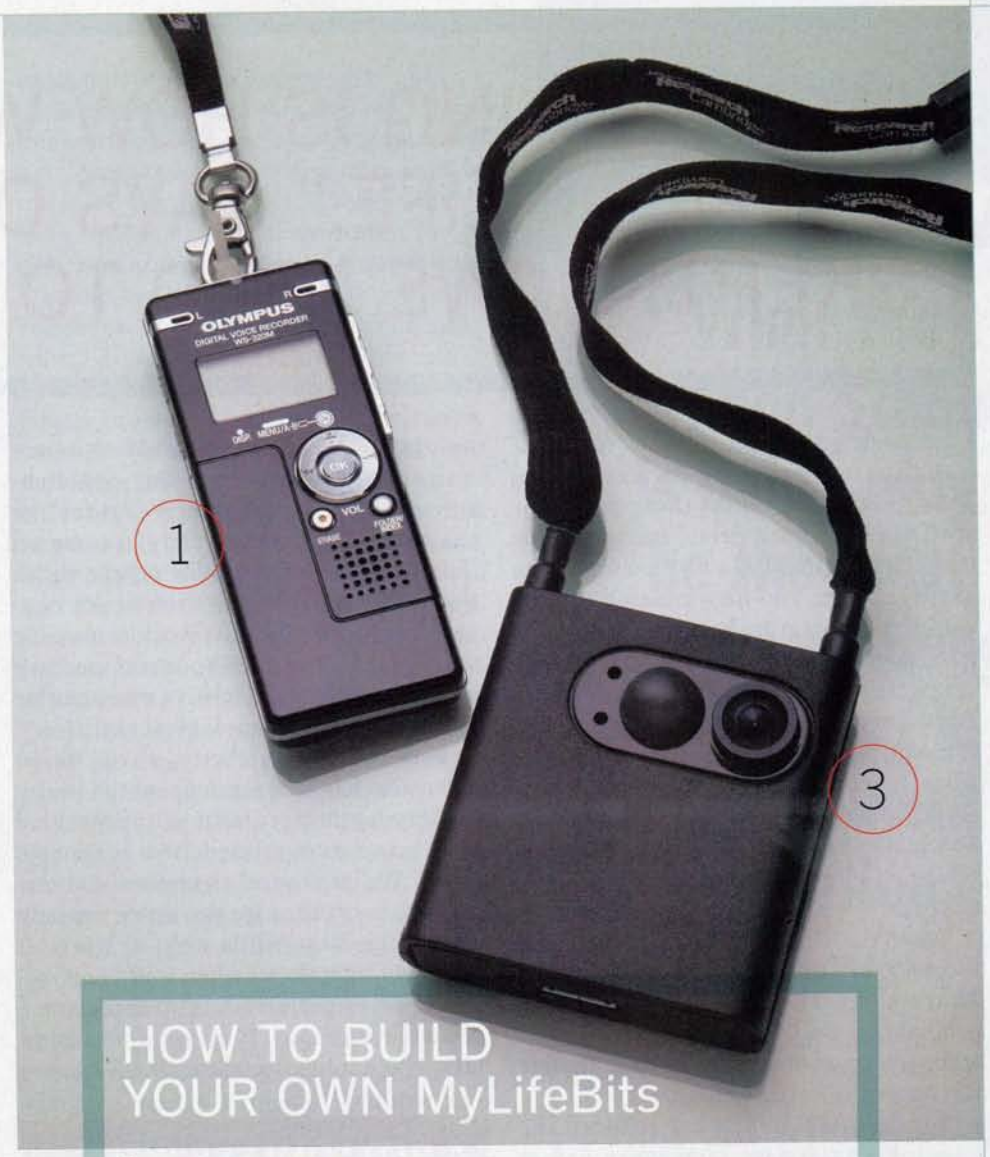
So he bought a scanner, and his poor assistant Vicki, a witty, motherly 56-year-old, began the arduous slog of making PDFs of four enormous filing cabinets' worth of stuff. The archive begins with photos of Bell's mother's birth in 1900 and basically never stops, sucking in everything from the sublime to the ridiculous: Bell's medical records, his Japanese-made notebooks filled with his elegant sketches

of computer circuitry, phone bills, stickie notes, a copy of a "robot driver's license" he got a couple of years ago.

His appetite whetted, Bell decided to store even more data. So he turned to two Microsoft researchers, Jim Gemmell and Roger Lueder, who built software to automatically save digital copies of everything Bell generated: chat transcripts, every Web page he looked at, even records of his keystrokes. Then Lyndsay Williams, a Microsoft inventor in Cambridge, England, came up with an even more radical idea: the SenseCam, which creates a visual record of his life, like a personal security camera. It would snap pictures either at regular intervals or when triggered by a meaningful event, such as when its infrared detectors sensed someone standing in front of Bell, or when its light sensors saw that he'd entered a new room. A tagalong GPS device stamps each picture with its geographic location.

At first, Bell was worried about filling up his hard-drive space too quickly. He accumulates 1 gig of information a month, and at that clip, the average MyLifeBits for an 72-year-old person would require 1 to 3 terabytes—a hefty amount of storage. But by 2000, driven by teenagers' insatiable desire to store MP3s and video clips, hard drives had dropped radically in price and grown enormously in capacity. Bell figures that in a few years, even a cheap cell phone will have enough space to store your entire existence. "We've gone from this period of scarcity, when you had to always go, 'Jeez, I can't keep this video file because my hard drive is full,' to the opposite," Bell says. "I tell people, 'Never throw anything out. You'll never have to worry about space for the rest of your life.' "

Slowly, in often subtle ways, MyLifeBits began to affect Bell's life. During a phone call to discuss a heart problem last year, Bell couldn't follow his doctor's flood of jargon—but he could listen to the call again and decode it at his leisure. A friend passed away; Bell was able to pluck a piece of 20-year-old correspondence from the mists for his eulogy. Meanwhile, the presence of the SenseCam and audio recorder began creeping out his "significant other," who wasn't sure she liked having everything set in stone. "We'd be talking, and she'd suddenly go, 'You didn't record that, did you?' " Bell chuckles. "And I'd admit, Yeah,



HOW TO BUILD YOUR OWN MyLifeBits

1 AUDIO RECORDER | Bell uses an Olympus digital recorder to capture everyday conversation. Easily available off the shelf.

2 VOICE RECORDING | A modified phone tap captures MyLifeBits phone calls and routes them onto a hard drive. Buy one at Radio Shack, or use Skype for online phone calls and HotRecorder (www.hotrecorder.com) to record them.

3 PICTURES | The Microsoft SenseCam snaps pictures of everything Bell looks at all day. A Webcam trained at your desk can automatically snap pics while you're sitting there, but on the road, you'll need to snap digital shots manually.

4 WEB BROWSING | MyLifeBits automatically stores a copy of every page Bell views. The free "Slogger" extension for Firefox will do the same for you (https://addons.mozilla.org/firefox/143).

5 EMAIL | Bell never throws away email. Use Gmail (www.gmail.com), or buy a 250-GB hard drive for your computer, and you can hold a lifetime's worth of email.

6 PAPER DOCUMENTS | Bell uses a Fujitsu scanner to turn every month's buildup of paper—letters, bills, everything—into PDFs. Almost any autofeeding scanner will do the same for you.

7 FINDING STUFF | MyLifeBits has a suite of experimental search tools to help Bell find things. You can use free Google Desktop search (http://desktop.google.com) or Windows Desktop Search (www.microsoft.com/windows/desktopsearch/hp1.mspx). PC users can also try PHLAT, an experimental tool from Microsoft (http://research.microsoft.com/adapt/phlat/default.aspx). Mac users can buy DEVONThink for truly intelligent searching (www.devon-technologies.com). —*CT*

Photograph by Hugh Kretschmer

"FORGETTING IS HOW WE MAKE SENSE OF LIFE," SAYS ONE SKEPTIC. "WE NEED TO FORGET."

I did. 'Delete it! Delete it!' "

Bell also discovered he was getting annoyed by experiences that couldn't be stuffed into a hard drive. During a ride in a cab in Australia, a tiny security-cam surveyed him, and he wondered why he couldn't automatically get a copy of the feed. And books, in particular, drive him crazy. "I virtually refuse to own any books at this point," he complained at one point. "I mean, I get them, I look at them, I occasionally read them. But then I give them away, because they're not in my memory. To me they're almost gone."

TOTAL RECALL

IF IT'S NOT IN YOUR DATABASE, it doesn't exist. That's the sort of eerie philosophical proposition Bell's project raises. He has a superhuman brain: Does that change the nature of being human?

For Bell, MyLifeBits has reduced the nagging anxiety we face every day at work. We meet an important stranger and panic about whether we'll remember her name and position. We browse through Web pages, wondering absently if we should take the extra few seconds to bookmark something for future reference. These tiny but draining bits of mental toil have fallen from Bell's cognitive load—a luxury even for me as I reported this piece: Copies of his old memos from DEC? The list of people he considered hiring a few years ago to head up Microsoft Research, with handwritten notes on their strengths and weaknesses? He had pristine copies at hand.

Martin Conway, a psychologist and memory expert at the University of Leeds, argues that projects like MyLifeBits can actually improve mental health by freeing our brains to be more productive and more creative. "We're moving into an age when technology is going to massively enhance our cognitive abilities, our problem-solving abilities," he says. It's rather like the way Google has already become an indispensable part of how people think about things—sitting at their desks, constantly tapping into the world's massive trove of information. "Your real memory becomes a sort of executive manager for all these other technological abilities."

Personal-productivity guru David Allen also has long argued that the frailty of everyday memory is the primary source of stress for overburdened corporate types. We sit around anxious about our to-do lists because we can never entirely remember them (while we're at work) or entirely forget them (when we're not).

Yet Bell's project has also made some observers nervous. It may not be a good idea, they argue, to tamper with human memory—because it's such a powerful part of what makes us who we are.

"I'm a big fan of forgetting," says Frank Nack, a German computer scientist who published a critique of lifelogging experiments last winter. "It's how we make sense of life, how we interpret things. Everybody is building a life story; we all need to forget certain stages. I don't want to be reminded of everything I said." Forgetting, he points out, is key to cultural concepts like forgiveness and nostalgia. Sure, we lose track of most of what happens to us—but that natural filtering process results in what we call knowledge and wisdom. When memories are only a click away, Nack says, they're cheapened. Without the difficult act of pulling something from the crannies of the mind, we become like the hapless high-school student who gets 2 million hits for a search on "World War II" and has no way of prioritizing them.

James L. McGaugh, a memory expert at the University of California, Irvine, points to the sad spectacle of Funes, a character in a Jorge Luis Borges story who suffers a head injury that renders him incapable of forgetting. "He says, 'My mind is like a garbage heap.' That's what it'd be like," McGaugh adds. "You have to watch what you wish for with memory."

As Bell's significant other realized, if everyone had a record of every conversation, it could turn everyday life and work into a maddening series of *gotchas*. Imagine that prig in your weekly meeting confronting you with an ill-advised comment you made three months ago. (On the other hand, imagine having a handy record of your boss's promises about when, precisely, he'd get that report back to you.) College graduates are already getting a taste of life in a world of persistent memory. Last spring, many found themselves getting turned down for entry-level jobs after prospective employers Googled them

A BOTTOMLESS WELL

The cost of a gigabyte of computer memory, over time

1956	$10 million
1980	$233,000
1990	$7,700
2000	$13.30
2006	$1

Sources: ALTS LLC and *PC World*. Figures not adjusted for inflation.

and unearthed tales of debauchery—with photos!—on their MySpace pages. Some corporations already erase all email older than a few months for fear of suffering the fate of Enron or Microsoft, companies that had humiliating years-old correspondence subpoenaed.

What's more, knowing that everything is being logged might actually turn us into different people. We might be less flamboyant, less funny, less willing to say risky but potentially useful things, much as politicians on-camera tamp down their public statements into stifled happytalk. "There'd be a chilling effect," particularly early on, says Mark Federman, former strategist for the McLuhan Program in Culture and Technology, a high-tech think tank. "We'd all be on our best behavior. Reality would become reality TV."

As for Bell, he acknowledges that all this remembering could have a downside. "Fifty years from now, do you want to know that, gee, I visited a porn site today?" he asks with a smile. And when it comes to corporate information, he admits that "ownership, deniability, privacy, expungability—they're important." Microsoft hasn't yet objected to all of its sensitive corporate memos going into Bell's off-site brain, but he suspects that day will come. When he eventually retires, he says, he'll be in the weird position of having to shave those memories off and give them back. "I'll need a lobotomy," he says, only half joking.

Still, Bell insists the trend toward total memory isn't going away. More and more, it is happening automatically. Those tens of millions of bloggers and Flickr users—all out there recording their thoughts and pictures—have clearly decided that there's enormous value not just in capturing those thoughts but in sharing them with the public. The choice isn't whether you'll join the revolution but whether you'll embrace it.

SHAPING CHAOS

FOR ALL OF ITS MACHINE MUSCLE, Bell's virtual memory wasn't quite what I imagined. When I first heard about his work, I expected someone who would dazzle me mentally, pulling off feats of recollection like some cyborgian savant: *Quick—give me the name of a random seatmate on a flight last July! List all the ingredients from that stroganoff you made back in college!* And indeed, hanging out with a mnemonist could be quite unsettling. One day, Bell was trying to describe to me a superb jazz-trumpet performance he'd attended in Australia the week before, then realized he didn't have to—he just found the audio file of the event and played it, the sinuous solo blasting out his computer speakers. (He concedes, sheepishly, that it probably wasn't quite legal to record the event.)

MyLifeBits is now so big that it faces a classic problem of information management: It's hellishly difficult to search, and Bell often finds himself lost in the forest. He hunts for an email but can't lay his hands on it. He gropes for a document, but it eludes him. While eating lunch in San Francisco, he tells me about a Paul Krugman column he liked, so I ask him to show it to me. But it's like pulling teeth: A MyLifeBits search for "Paul Krugman" produces scores of columns, and Bell can't quite filter out the right one. When I ask him to locate a phone call from one of his colleagues, he hits a bug: He can locate the name of the file, but when he clicks on it the data are AWOL. "Where the hell is this friggin' phone call?" he mutters to himself, pecking at the keyboard. "I either get nothing or I get too much!"

Granted, MyLifeBits is an experimental demo, and thus naturally unstable. And even when his system is failing, Bell remains pretty bemused about everything, displaying the perpetual geniality of all brilliant, accomplished, wealthy older men who've long ceased to care what anyone thinks of them. Still, as I watch the hunt for the missing call, it feels like some creepy sci-fi version of Alzheimer's, or a scene plucked out of a bleak Philip K. Dick novel: Our antihero has an external brain with perfect recall, but it's locked up tight and he can't get in—a cyborg estranged from his own limbs.

This turns out to be the central question behind MyLifeBits: Yes, it's possible to store a lifetime of memories, but what do you do with them?

To figure that out, I made a visit to Mary Czerwinski, a principal research scientist at Microsoft Research Labs whose team has developed "Facetmap," an audacious piece of software designed to visualize the contents of Bell's cybermemory.

When I meet the energetic, hyperverbal

continued on page 110

Rotman

"What the Rotman School is doing may be the most important thing happening in management education today."

— *Peter F. Drucker*
(1910 – 2005)

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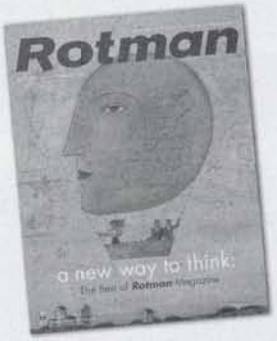

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A HEAD FOR DETAIL

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Czerwinski, she pulls me over to a massive 3-foot-by-3-foot LCD monitor on her office wall. On-screen there's a collection of colorful blobs representing different parts of Bell's life. There's a blob for people, another for calendar dates, and a bunch for different types of documents like email or Word files. She shows me how it works: If you click on any blob, it instantly expands to show you everything it contains. Click on the blob for "Jim Gemmell," Bell's main collaborator, and you'll see a blob containing all their email traffic, another with documents that mention Gemmell's name, and a third with events where he appears. The more data in each category, the bigger the blob, "so you can quickly see which area has had the most action," she notes.

But the truly intriguing part about Facetmap is that it shows how Bell's information is connected. I start poking around, clicking on Gemmell's blob, then drilling down to a particular email Bell sent him on February 25, 2005. As I zoom in, the software automatically creates new blobs showing everything else Bell did on that day—emails to other colleagues, photos Bell took, Web sites he viewed. It feels like flying freely through Bell's memories, flitting anywhere I want. And it re-creates those same loosey-goosey linkages that tie memories together in our real-life minds. Were this my own computer, I could zip back to read a *Wall Street Journal* article from three months ago, then teleport over to all my email from that day, then notice I'd forwarded the article to someone along with a couple of cool ideas, ideas I'd forgotten I'd ever written. It's like software for productive daydreaming.

Facetmap is based on a truth psychologists have long understood: We organize our memories by time and people. Those categories, Czerwinski says, are the pathways into the forest and the portholes from one memory to another.

"The way you remember things is associative," she says. "You think, 'There's all this stuff in my life that's related to Clive, or to Gordon.' Or you think, 'There's all this stuff that happened last fall.'" If you vaguely remember a book but can't recall the title or author, the first thing you're likely to begin with is the friend who told you about it; so you hunt through all the emails you got from him.

One of Czerwinski's colleagues at Microsoft, Susan Dumais, analyzed how people search for things on their computers and found that about one-quarter of the queries were for someone's name. She also explored ways to use "landmark" events to index our memories. "You'll think, 'Oh, I'm sure it happened right before the wedding, or just after Hurricane Katrina,'" Dumais says. She developed an experimental piece of software that embedded those landmarks into search tools so that you could, say, start with a major event and then see all the email or Web pages you looked at that day. It drastically improved the ability to find things in the distant past, she says.

These sorts of tricks are already helping Bell find his memories. Gemmell has written a piece of software that works much like Facetmap. It's less graphical (it looks more like a regular Windows search) but just as powerful, as Gemmell illustrated with an example during my visit to his office: At one point last year, Bell had considered selling some property, so he surfed a bunch of real-estate Web pages and chatted with Connie, his broker. A few months later, he wanted to revisit those pages but couldn't figure out the right key words to bring them up. He had Connie's number, though, so he located the copy of his call to her. Then he checked the rest of his activity for that call, and presto: There were the Web sites, too.

"It works via how your memory works," Gemmell says. "It's like, 'I don't remember the specific words on that real-estate page.' My memory is just, 'It's the page I saw when I was talking to Connie.' We have to make 'search' more like the way we actually think."

INSTANT REPLAY

I CAME AWAY FROM THESE DEMOS eager for this stuff to come out of the lab and into the world. But the fact is that our everyday search tools are already moving slowly in this direction. In the past year, free "desktop search" programs by Google and Microsoft—which scour your hard drive—have begun incorporating sophisticated filters that let you work in similar ways: You can start by looking for a person, then find all the memos you've written to them, then quickly zoom in on a day.

One day when I met Bell in San Francisco, I got a chance to see his life through his eyes. He'd worn his SenseCam to work that day, and when he plays the images back rapidly, it's like watching a crude, stop-motion movie: buying coffee at Starbucks, grabbing a paper, entering his building, and finally dropping down at his desk.

"If you lose your keys, you can scroll back and figure out where you put 'em," he jokes. In fact, Bell seems like the sort of guy who might lose his keys a lot. He'd regularly get halfway through a sentence, then cut himself off and race along another tangent, only to have his hamster brain veer away halfway through that thought, too. *The guy's obviously crazy-smart,* I thought. *But no wonder he loves having a camera record the messy details of life.*

Yet here's the problem with the pictures: They pose an even bigger search dilemma, because computers can't "see" the contents of a photo. It's impossible for Bell to hunt for "pictures of my desk at work," or "that tall blond guy I met at the party"; at best, he can sort them by date or GPS coordinates. And while he has added keyword "tags" to many shots, it's time-consuming and still not terribly accurate. Even he admits he rarely peruses any of his thousands of SenseCam pictures.

So are all those photos a waste of memory? Or can that kind of exhaustive visual record actually be worth something?

Alan Smeaton, a professor of computing at Dublin University, thinks it can. After hearing about Bell's project, Smeaton got Microsoft to lend him a few SenseCams and gave them to his students, who began wearing them all day long. They discovered an intriguing psychological effect: If, at the end of each workday, they spent a minute scrolling through the thousands of pictures the SenseCam had taken—a high-speed replay of their day—it had the effect of stimulating their short-term memory.

"You actually remember things you'd already forgotten," Smeaton says. "You'd see somebody you met in a corridor and had a two-minute conversation with that you'd completely forgotten about. And you'd go, 'Oh, I forgot to send an email to that guy!' It's bizarre. It improves your recall by 100%."

In fact, "refresher" imagery is so powerful that it seems to help restore recall in people who have very little memory, or none at all. Ken Wood, a computer scientist in Microsoft's research lab in Cambridge, gave a SenseCam to a UK woman who had lost her short-term memory due to encephalitis. She began wearing it to events she wanted to retain. After each of them, she

reviewed the pictures several times over the course of the following two weeks. When the researchers quizzed her a month later, she still had "significant recall."

"She was over the moon," Wood marvels. "Totally thrilled."

SILICON CORTEX

CONSIDER FOR A SECOND HOW, precisely, we think. We use our memories all the time, of course, often by "active" remembering—scrolling through our minds to locate a tidbit. But much mental labor is passive. We think about something in the background, subconsciously letting a problem brew. Then we suddenly hit upon an interesting combination of things, a new way of thinking about a problem: the elusive, all-important epiphany.

What if our computers had their own intelligence, and could do that background work for us? What if they could mine our memories for new ways of thinking? And what if they could prioritize the vast heaps of material in the backs of our minds, shaping the informational chaos that often leaves Bell so baffled? A memory system that could think on its own would unlock the lifelog's full potential.

Already Bell and Gemmell have played around with this effect using the SenseCam data by developing a screen saver that displays random snapshots from their personal archives. Bell finds it oddly mesmerizing: Pictures of long-ago birthdays or family trips will trigger waves of nostalgia, he says. But Czerwinski predicts that a similar screen saver could become a killer app in the office. When you're working on a project, the screen saver would cycle randomly through any documents, pictures, emails, or Web pages pertaining to your work—and you would see if the unpredictable combinations inspired fresh ways of understanding it. "You'd see some memo you wrote two years ago and think, 'Oh, right, that was a good idea. Why didn't I follow up on that?'" she says.

But the real goal is "to discover things that even you didn't know that you knew," says Bradley Rhodes, a computer scientist with Ricoh Innovations. In the lifelogging community, Rhodes is famous for creating the "Remembrance Agent," an experimental piece of software, as a PhD student at MIT. The Agent sits in the corner of your screen and pays attention to everything you type; every few seconds it checks inside your hard drive to see if it can find anything relevant. If it does, it alerts you in the corner of your screen by showing a line or two of the related document.

The connections the Agent discovers are surprising, often valuable. When Rhodes first started using it, he'd begin writing an email to ask a colleague a question, but before he could even push "send," the Agent would reveal that a long-forgotten document on his hard drive already contained the answer. Other times, a colleague would email him a question and the Agent would remind Rhodes that he'd been asked that once before and had forgotten to reply. "So, in mid-email, I realize I have to switch gears and apologize and go, 'Sorry for not getting back to you.' It actually would change my behavior," he says. By actively reminding you of things from the past, "it keeps you from looking stupid." Now there's a killer app.

After using the Remembrance Agent for a while, Rhodes got a reputation for uncanny recall. "I'd have people emailing me saying, 'Hey, Brad, I know you've got this augmented brain. Can you answer this?' And sometimes I could." He imagines the Agent as particularly useful for lawyers and other paranoid execs drowning in paperwork. They could cram every sensitive email and memo related to a corporate crisis into their computers and let the Agent monitor them on the periphery.

One of Bell's Microsoft allies is also investigating whether artificial intelligence could be used to find hidden patterns in memory. One day last summer, I visited Eric Horvitz, an expert in machine intelligence at the Research Labs, to see his "Lifebrowser." The Lifebrowser's goal is to automatically identify the most significant events in your life, so that when you scroll back through your history, it shows you only the most important highlights.

The software starts by having you "train" it by rating different things on your computer as significant or negligible. But then you turn Lifebrowser loose, and things get really interesting. It begins to observe your daily behavior and rank your documents and calendar events. Horvitz has given the software to members of his team at Microsoft, and Lifebrowser has already discovered several intriguing things about how we work. Unusual events—"atypia"—tend to be the ones that people most want to remember. Intuitively, this makes sense: Sudden, unexpected news, good or bad, is highly meaningful; a large cluster of pictures from the same day usually means you saw something odd or important—pluck one of them out, and it's likely to be a rich memory. (In contrast, regular meetings are virtually never remarkable. "No one ever needs to remember what happened at the regular Monday staff meeting," Horvitz notes dryly.)

He pulls me over to his computer screen to see his own personal Lifebrowser. At first, it just looks like a regular calendar, with months stretching back years. But when he zooms in on October 2004, I can see that Lifebrowser has carefully picked only a few items to display on each day: A meeting at DARPA, the military-research agency. Pictures of Horvitz's family visit to Whidbey Island. An email announcing a surprise visit from his old college friend.

"I would never have thought about this stuff myself," Horvitz says, scanning the calendar. "But as soon as I see it, I'm like, 'Oh, right—that *was* important!'" Lifebrowser, in essence, shapes the seemingly random flow of our lives and reminds us of what we ought to be focusing on.

For me, though, the real holy grail would be a system that doesn't merely remind me of what I already know—or once knew, even. It would be one that actually conceives of new ideas.

Few computer scientists are claiming to have figured that one out. But a hint of what may be coming has already arrived from Devon Technologies, a company that has created a tool called DEVONthink. It works like this: As you work on a project, you feed DEVONthink copies of any emails, memos, documents, PDF files, or Web pages you find interesting. The software performs a complex analysis of all that information, trying to find documents that are statistically similar to one another in meaning. This is much more sophisticated than a simple word search, though: DEVONthink can learn that the words "automobile repair" and "car fixing" are synonymous, for example, even though they use completely different terms. This allows the software to spot some astonishingly subtle connections.

Steven Johnson, a writer in New York, discovered that DEVONthink's smarts could literally inspire him to come up

with profitable new ideas. He had been using the software for several years, putting all his research into it. While writing his latest book last year on the London cholera outbreak of 1854, he'd plug paragraphs of his draft into DEVONthink to see if anything else on his hard drive was related. One day, he inserted a passage on the London sewer system that used the word "sewage" a lot. DEVONthink unexpectedly unearthed a quote that discussed how vertebrates originally evolved their bones—by reusing the calcium waste generated by their metabolism.

It was a weird connection: comparing the waste systems of a city to those of an animal. But a lightbulb went off in Johnson's head, and he began dreaming up a new chapter for his book, contrasting the ways that cities and the human body find productive uses for their by-products.

"Now, strictly speaking, who is responsible for that initial idea?" he wondered, when he described the experience in an article. "Was it me or the software?" The idea, he argues, was a synthesis of two minds—his real brain and his virtual one. "Two very different kinds of intelligence playing off each other," he says, "one carbon-based, the other silicon."

In spring 2004, Gemmell lost a chunk of his memory. The Microsoft senior researcher had built his own personal MyLifeBits database, filling it, like Bell, with oodles of his email, Web surfing, and pictures. But one day, Gemmell's hard drive crashed, and he hadn't backed up in four months. When he got his MyLifeBits back up and running, the hole that had been punched in his memories was palpable, even painful. He'd be working at a project and vaguely remember some Web site or document that was important, then begin drilling down to find it—only to discover that it was part of the missing period.

"It was like having my memories stolen," he says. He was amazed to realize his backup brain was no longer some novelty but a regular part of his psychological landscape. "I realized I count on this now. It's like I expect to drive cars and have flush toilets."

Machine memory is obviously giving us astonishing abilities, but can we deal with the change it'll wreak in our lives and work? We might become so reliant on artificial memory that we lose the habit of noticing things. "What is going to happen to us if we bypass something and we ought to have noticed it?" wonders Frank Nack, the lifelogging skeptic. Is it possible to forget how to remember? Perhaps so: Most of us have lost a cell phone only to realize that we can no longer recall the phone numbers of even our closest friends because the machine remembered them for us.

Whatever it all means, Bell will likely be the first person on the planet to find out. As I leave him at his San Francisco office, he offers me a parting gift, and fittingly enough, it's a memory device: one of the notebooks he buys at a nearby stationery store. It's beautiful, oddly old-fashioned. Yes, the man who swore off paper knows it would be much easier for MyLifeBits if he did all his writing electronically, on a digital tablet or whatnot. "But I can't help it," he says, "I just love these gorgeous Japanese-made notebooks." He did, after all, spend decades as a young engineer recording every idea on pads of his own. Some habits die hard. FC

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