LIFE

OUR CENTURY IN PICTURES
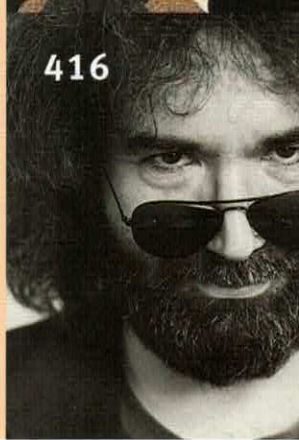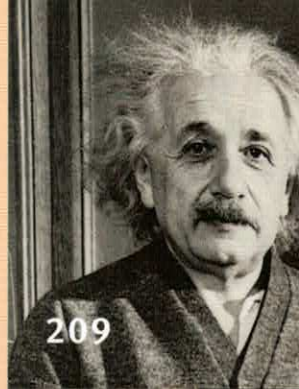
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And Now the News: Man Bytes Dogma

BY PAUL SAFFO

WELCOME TO THE decade of the dot, that tiny bit of Internet grammar whose ubiquity in E-mail addresses and Web URLs so neatly captures the giddying impact of technology on our lives at century's end.

Seven years ago, the Internet was little more than a cyberspace wilderness traversed by nerds and early adopters, while the Web was an obscure tool unknown to all but a handful of researchers. Today, the Internet is a more potent medium than television, and the Web is driving the Dow into the stratosphere as it reinvents one new industry after another.

If the dot is the Nineties' symbol, then the S-curve is its trajectory. This is the curve of Moore's law, which dictates that the number of circuits packed onto computer chips doubles every 18 months with the result that the power of the chips doubles at the same rate and their cost drops by half. It is why a Furby has several times the processing power carried on board the Apollo command module, and the latest generation of video-game players out-

performs the best graphics supercomputers of a decade ago.

The S-curve is everywhere we look in this decade. It is the curve of traffic on the Internet, of transactions on the World Wide Web, of cellular phone sales and, at moments, of unread E-mail lurking in our in boxes. It is the curve of new scientific discoveries and also is the curve of our collective surprise and uncertainty as we struggle to understand the revolutions swirling around us. Thus, the ubiquitous dot is not merely a mark in cyberspace but also the anchor in the exclamation points and question marks punctuating our astonishment at all that is afoot.

Technology empowers. It floods our lives with options and overwhelms us with choice, and it places us squarely in the middle of the revolutions it generates. But with choice comes the burden of choosing wisely. Computers and E-mail can free us from the tyranny of rush hour or lure us into working 24 hours a
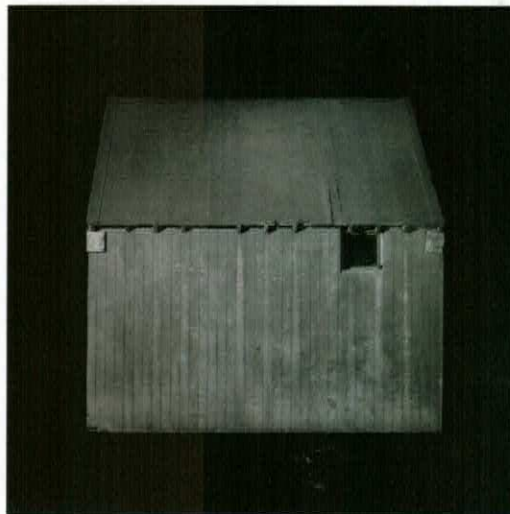
In this tiny Montana shack were built mail bombs — 16 in 17 years — that killed three, maimed 23. The Unabomber gave his technophobic rationale in a 1995 screed. His kid brother recognized the author's style. In 1998, Ted Kaczynski, 55, drew life times four.
RICHARD BARNES

day. Satellites and video can remind
us that the world is indeed a global
village or simply display a missile's
eye view of warfare in real time.
New wonder drugs can lower infant
mortality or simply allow us to grow
more hair, improve sexual perfor-
mance and have litters of designer
children.

Technology also changes our
view of reality even when it does not
touch us directly. This decade has
seen one astonishing technology-enabled discovery
after another. The Hubble telescope has reached
deep into look-back time and reminded us that even
"empty" corners of the sky are teeming with galaxies.
Robots drift through the oceans, revealing unimag-
ined geographies and discovering exotic life-forms
that would have taxed the imagination of a science
fiction writer a decade earlier. The universe keeps
getting bigger, but so does our world, as we discover
that this planet we live on is vastly more subtle and
complex than we ever imagined.

"I'm all for progress; it's change I object to."
That sentiment, expressed by Mark Twain a century
ago, is echoed in our ambivalence toward technol-
ogy and the life-changing choices it forces upon us.
We complain about E-mail and phone calls, but we
still rush out to buy the latest, smallest cell phone so
that we are never out of touch. The *Titanic* disaster
fascinates us as a tale of techno-hubris even as we are
transfixed by the submarine robots that brought im-
ages of the wreck into our living rooms. And *Star*

Wars still works its magic as a morality tale about the
battle between technologies that amplify the human
spirit (Luke Skywalker) and technologies that extin-
guish it (Darth Vader).

Without a doubt, we have become steadily more
dependent upon ever more complex and obscure
technologies. In general, the less visible a computer
is, the more important a role it plays in one's life.
Smash my laptop, and I'll pull out a pen and paper
and keep working. Crash the computer switch in the
local phone exchange, and I am isolated. But mess
with the computer running the power grid, and I'm
thrown back to an age of candles and oil lamps with
rotting food in the refrigerator.

The past two decades have been punctuated by
reminders of the complexities — and cost — of our
myriad technological choices. Techno-disasters
from Chernobyl to Bhopal, from TWA Flight 800 to
mad-cow disease, splash across the news. Technol-
ogy undoubtedly is an amplifier, not just of our
hopes, but also of our carelessness, our ignorance

and studied inadvertence. While we fret over distant risks, greater dangers lurk closer to home, from daily rush-hour auto fatalities to cancers triggered by waste products from the technologies we surround ourselves with. As Socrates observed, "Nothing vast enters life without a hidden curse."

While the majority of us fret, an addled few have been tempted to extremes trying to overcome their dependence on what they perceive to be distant and impersonal technologies. Neo-Luddite Theodore Kaczynski sought to make his antitechnology statement with lovingly crafted bombs that were themselves skillful examples of earlier technological art. Others are even more aggressive in their embrace of the technology they seek to repudiate: the Aum Shinrikyo cult built secret labs to produce the sarin they released in a Tokyo subway attack and even visited Africa in a quest for the Ebola virus.

Aum illustrates a special terror created by technology — the increasing chaos-making power it confers on ever-smaller groups and, ultimately, upon individuals. It took a bureaucracy of more than a hundred thousand people to build the first atom bomb; now a crude weapon is not beyond the reach of a few determined terrorists. Or as Aum's botched attack pointed up, why bother with nukes at all when one can confect enough ricin in a kitchen to kill half of San Francisco? What took Timothy McVeigh a vanload of fertilizer to accomplish might one day be pulled off by a crazed innovator with a briefcase full of bugs.

The Y2K bug has become the poster child for our growing technological ambivalence. Alarmists fear that it will crash our computers and paralyze society like some scene from *The Day the Earth Stood Still*. This is unlikely in the extreme, and Y2K may prove to be the biggest nonevent of the century, but no one can say for sure. If something so obviously avoidable as the Y2K flaw was built into our computers, what subtler and more serious defects lurk in the techno-logical systems we trust ever more of our lives to?

Our unease about technology can itself amplify minor problems into major tragedies. A careless software error by an amateur astronomer led in the fall of 1996 to the myth that a "Saturn-like" alien spacecraft was shadowing comet Hale-Bopp. Broadcast over talk-show radio and the Internet, the myth was seized upon by the Heaven's Gate cultists, who were then moved to mass suicide. It is told that they purchased a large amateur telescope in order to view the incoming spacecraft — and promptly returned it as defective when, upon observing the comet, they failed to spy the nonexistent craft. Y2K is this season's cometary apparition: Some fundamentalist preachers have seized upon Y2K as one more proof of a coming Armageddon. Just as Heaven's Gate was moved to suicide by an irresponsible myth, will others see religious portent in otherwise minor computer glitches and welcome the new century with acts of eschatological terrorism?

Meanwhile, the S-curve is serving up a new helping of life-changing technological wonders. Digital technology is front and center in this decade of the dot, but larger shifts are already afoot. The sweep of the century reveals an interesting pattern — about every 30 years, a new technology takes the lead in shaping our lives. Chemistry dominated the first third of the century, giving us everything from aspirin to plastic but also making the First World War the chemist's war of poison gas and novel explosives. Physics defined the second third of the century, taking us down into the structure of the atom and outward to the edges of the universe but also leaving us the dark gift of nuclear weapons used to end World War II. And today's digital marvels are but the capstone on three decades in which information technology has been at center stage.

But revolutions beget revolutions, and even though information technology still holds more than its share of surprises, we are entering the new cen-

e4 c6 2. d4 d5 3. Nc3 dxe4

Rather than his next move against IBM's Deep Blue, Gary Kasparov should have been thinking about another computer, *2001*'s HAL. The world chess champ, 34, didn't and so, in 1997, lost a six-game match. Pssst: Next time, Gary, use your opposable thumb and go for its RAM.
AFP

tury on the cusp of a vaster revolution shaped by biology. The stumbling first steps of a newborn cloned Dolly are portent to this gathering change. Look for the first human genome to be decoded soon after century's end, with reverberating consequences stacked up like hurricanes across the first half of the next century. It will be a brave new world of potent biopharmaceuticals and gene therapy, a world in which cancer and heart disease are conquered much as polio and smallpox were in this century. It will also be a world of artificial organisms, of regenerative medicine and possibly of rejuvenation. A handful of genetic visionaries think that the next generation born on this planet may live a thousand years — provided it can afford the bill.

The Nineties and its S-curve of technological wonders have delivered us to a frontier of vast and terrible freedoms. Our technologies are not all-powerful, but they are all-changing, for first we invent our technologies, and then we turn around and use our technologies to reinvent ourselves. We are gazing to the edge of the universe and probing to the heart of matter. We are building the first halting artificial companions, and we are tinkering with the very stuff of what makes us human. Our inventiveness brought us here. Now let us hope that we will also discover the wisdom to lead us through the wilderness of choices that await us in the century ahead.

Paul Saffo is director of the Institute for the Future in Palo Alto, California, which provides forecasting services to major corporations and government agencies. He holds degrees from Harvard, Cambridge and Stanford and is the author of two books and many articles.