OMNI

JUNE 1997

THE FUTURE OF MONEY: ONE WORLD—ONE ECONOMY

THE GREENING OF CORPORATIONS

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SCI-FI ART: THE EARLY DAYS

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VOL 13 NO 9 JUNE 1991

Tsuneo Sanda's startling futurescape offers much to contemplate. Do we stare through a broken glass at a world gone buggy for machines? Or have the machines themselves broken through the glass to enter, and perhaps conquer, our world? Or just to conquer the Chrysler Building? At least the insect has good taste in architecture. (Additional art and photo credits, page 84)

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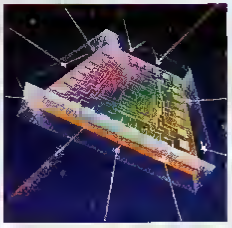


FIRST WORD

TOTAL RECALL:
Developments in supercomputing promise to change the life-style of Americans at home and at work

Justin Rattner, founder and director of technology for Intel's Supercomputer Systems Division, is the principal investigator for the Delta Touchstone project.

How do you experiment on a thunderstorm? How do you decipher a genetic code with 3 billion components? How do you test the stability of a supersonic aircraft?

The answer: You use a computer. Relying on the fastest computers on the planet, scientists can create simulations of nature and study everything from the collision of galaxies to the behavior of subatomic particles.

But while the need for superfast computers has never been greater, the conventional path to high-speed computing has reached a dead end. The systems that dominated supercomputing in the Eighties have hit the brick walls of physics and economics, making even small performance improvements very difficult and expensive.

To meet the demand for faster systems, computer designers and physical scientists have turned to microprocessors. Silicon technology has already turned 50 million of us into personal computer users and turned business computing on its ear—all in less than a decade. Now that same technology promises a similar impact on high-performance computing.

By combining the power of hundreds of microprocessors working in parallel, Intel Corporation, in cooperation with the U.S. Defense Advanced Research Projects Agency, has developed the Delta Touchstone system. Delta is the world's fastest computer, capable of processing 32 gigaflops (billion operations per second), ten times the power of the fastest traditional super-computer.

To take advantage of Delta's enormous power, 14 prominent U.S. research institutions, including NASA, the National Science Foundation, and the California Institute of Technology, have formed the Concurrent Supercomputing Consortium. Sharing the system via a nationwide network, scientists will conduct computational experiments on many of what the U.S. High Performance Computing and Communications Program has identified as the "Twenty Grand Challenges" of science. Until now, scientists have lacked the computing power to address these problems, which include such demanding scientific and computational challenges as global climate modeling.

For scientists, a computer that's ten times faster than current systems is like a telescope or microscope that's ten times more powerful—it allows them to see more. With a faster computer, scientists can build more detailed models and conduct more elaborate experiments.

While Delta's immediate users will be scientists, the system's impact will eventually reach us all. Progress in structural biology and human genome research will advance our ability to prevent and treat diseases. Global climate models will give us more complete information on the greenhouse effect. And the ability to identify objects in outer space will enrich our understanding of our own planet and the nature of the universe.

In addition to its importance for science, Delta highlights the trend that will dominate computing throughout the Nineties and beyond: using microprocessors as the building blocks for the full spectrum of computing solutions.

At all levels of computing, powerful microprocessors, working alone or in parallel, will mean faster computers offering an enriched range of features. Hand-held, pen-based computers will bring millions more of us into the computer age—serving as day planners, road atlases, cellular video phones, and general information centers rolled into one.

Desktop personal computers will continue as potent systems in their own right but will also serve as gateways to supercomputers for tasks requiring massive computational power. You might, for example, ask a supercomputer to churn through a set of "what-if" scenarios on complex financial packages so that you and your stockbroker can check out the results on your personal computer.

Delta-style systems will take us even a step further to teraflop computing (a trillion operations per second) within the next five years. What this means for the average user is that Delta-level performance could arrive on the desktop and in the home by the turn of the century. At work, your personal computer could track multiple business factors—including market conditions, demographics, buying patterns, and more. At home, you could take your family on a trip to Mars without ever leaving your living room. Today the calculations to visualize the surface of Mars require numerous hours even for a computer as powerful as the current Delta system with gigaflop computing. But with the development of teraflop computing, instead of watching a video on Saturday night, you'll be able to rent the database of Mars, pop it into your high-definition information/entertainment center, put on your virtual reality headset and pilot your family as you skim over the red planet. ∞

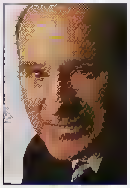
OMNIBUS

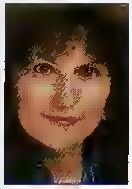
ALL THAT GLITTERS ISN'T GREEN

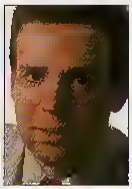
Our writers work hard for the money, even when they have prior engagements

Some save it. Some spend it. Others think of it as the true meaning of life. And we all want it. But contrary to popular song, money does not make the world go round—at least not from a scientific perspective. In fact, when you look back on its evolution and the articles used to represent it—salt, shells, shovels, knives, tobacco, and now plastic—money and how it gets that way seems arbitrary in the extreme.

Travel writer Ellen Hoffman ("One World, One Currency," page 50) has accumulated currency from 50 countries on six continents and keeps them neatly wrapped in plastic and stored in a box. "I don't collect coins," she says. "It's just one of those things that happens—I'm running to catch my flight and haven't had the time to convert whatever is in my pocket." Her most interesting souvenir: a Polish zloty note that is now worthless as capital on the world market. A former reporter for *The Washington Post* and the author of *How To Plan A Succesful Trip* (Farragut Press, 1988), Hoffman is currently a contributing editor at *Frequent Flyer* magazine.







Contributors, clockwise from bottom: Melanie Menagh, Jeff Goldberg, Pat Cadigan, Lamont Wood, and Greg Pope.

Are corporations that embrace "green" business practices just jumping on the environmental bandwagon to aid product sales? Do their motives really matter as long as they're on the road to emerald cities? "Any movement in that direction is fine," says Melanie Menagh ("The Business of Being Green," page 42). "The increasing number of companies adopting an environmental conscience shows consumer pressure is paying off."

While Lamont Wood ("A Pocket Full of Miracles," page 58) was writing his story on the electronic future of money, he was also learning how to be a new parent of twin boys. "I operated on little sleep, literally running on empty," Wood says. "When I finished the story and turned it in, I couldn't remember what I had written." Wood has written for *Byte* magazine and *The Chicago Tribune*—under less stressful circumstances, we hope.

A former economist himself, Anthony Liversidge (Interview, page 76) caught up with economist Jeffrey Sachs at the Council of Foreign Relations meeting in New York. "He's passionate about his work, and it pays off," says Liversidge, who has written for *The Economist*.

Jeff Goldberg (Mind, page 28) sniffed out his story in a so-called perfume factory where computers are storing scent memories. And the computers are doing better than Goldberg. "I don't recall what scents were prevalent when I was in the lab, but I think they were sweet," Goldberg says. Well, at least they weren't offensive. Goldberg is the author of *Anatomy of a Scientific Discovery* (Bantam).

With a new gold rush threatening wild lands, *Omni* associate editor Beth Howard (Earth, page 20) believes we must reconcile our desire for luxuries with our environmental principles, which, she admits, is easier said than done. "When my fiance gave me a gold-and-diamond engagement ring, I paused for a moment, but only briefly," says Howard. "And I kept the ring."

Perhaps the level of political sophistication has increased over time, but as the recent interpretation of Mayan petro glyphs indicates, political propaganda seems to be timeless. Greg Pope (Digs, page 26) has always had an intellectual interest in Aztec and Mayan cultures even though he's never set foot in Mexico. "If I could have been born a Mayan, I would have been a scribe," says Pope, a regular contributor to *Popular Mechanics*. "Scribes were too important to be slain in human sacrifices."

A regular *Omni* contributor, science-fiction author Pat Cadigan ("Johnny Come Home," page 70) lives in Kansas. Her most recent books are *Patterns* (Ursus Press), a collection of short stories, and *Synners* (Bantam). "The Power and the Passion" (*Omni*, March 1990) was recently nominated for a Nebula Award. ∞

HOME OFFICE:

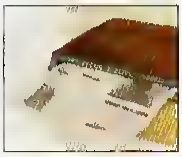
2020

Information technology, like all technologies, ultimately hits home—in more ways than one. In the months to come *Omni* will look at some of the likely results of advances in information technology as they relate to our home lives. Being at home away from the office, does not necessarily mean being away from work. As we pointed out this past April, we have entered the age of "The Constant Office," with work—and the information upon which that work rests—available to us around the clock, and around the world.

By way of looking from time to time at the nature and consequences of the office revolution currently taking place, we're launching a new series: Home Office 2020. As always with *Omni*, our concern is with the *consequences* of technology: its impact, benefits, and problems. We won't be dealing here with hands-on looks at software and hardware; our sister publication, *Compute*, does that better than anyone.

What we *are* going to look at is the nature of the world we are creating with ever smarter, ever faster, ever more capable machines. And we're going to look at it in a way different from anyone else. Home Office 2020 is intended to be an imaginative forum, a place of speculation and debate. There will be fiction here, as well as forecasts, and even the occasional polemic. An exciting place.

To inaugurate the Home Office 2020 series, we're honored to have a short story by Arno Penzias. Nobel prize winner, director of research at Bell Labs, Penzias is also the author of *Ideas and Information*, one of the key books of the information revolution. In his piece this month, titled simply "2020," Penzias reminds us that the technology we bring home to automate work will ultimately exert an effect on home education as well. Penzias's vision is a lovely and gentle one. Technology, he argues here as in his book, can be liberating. We have the tools at hand to accomplish a renewal of the art of learning, which is to say the art of asking questions and making connections. It is a pleasure to join a great scientist on just such a visionary voyage of discovery.



ILLUSTRATIONS BY ÉTIENNE DELESSERT

THE NEW LABOR MOVEMENT: THE MOVEMENT OF LABOR FROM YOUR OFFICE TO ANYWHERE

We're also interested in more close-up views of specific technologies. To that end we've asked Gregg Keizer, an *Omni* contributing editor and one of the Information Age's leading young writers, to gaze forward 30 years or so, and focus specifically on portable information technology and desktop publishing.

If you think those two arenas have seen a lot of change in the past decade, wait until you see what's ahead. What's ahead for Home Office 2020? We'll look at programs that can seek out the information you want, assemble it for you in the format you prefer, and do it all globally, while you're doing something else. Interface design will also come under our scrutiny. Is the keyboard really the best way to communicate with our smart machines? What are the challenges and opportunities offered by voice-driven computers, by handwritten interfaces, by technologies barely on today's drawing boards? We'll look as well at the sort of computer power that will be available to individuals 30 years from now. And more.

Does this mean *Omni* is becoming a computer magazine? My answer is an emphatic no. There's more to the future than computers, exciting though they may be. But computers and information technology are exerting a larger and larger effect on our world, and our world is, after all, *Omni*'s subject matter.—*KEITH FERRELL*

HOME OFFICE: 2020

2020

Arno Penzias, as one might expect from a man whose accomplishments include a Nobel prize, has interesting insights into the nature of the information revolution. Fortunately for us, he's distilled those insights into a remarkable—and remarkably readable—book called Ideas and Information. *Now available in paperback, and in editions around the world, Penzias's book provides an enticing look at the shape a new information-oriented world might assume.*

This is no starry-eyed bundle of optimism. Penzias is all too aware of the problems and challenges computers can generate, even as they are introduced by their champions as the solution to all problems. Rather, in clear and thoughtful prose, Penzias walks the reader through the very crucial difference between information, and its more important relative, idea. The distinction is not a simple one, but understanding it is critical to the successful integration of computer technology into our lives.

Better than most writers, Penzias builds his arguments carefully, buoying them with examples from his own life and work. Since his work includes being director of research at Bell Laboratories, on the very front lines of the Information Age, Penzias's perspective is well grounded in technological realities, even as his imagination soars toward the future. '2020' is worthwhile reading for anyone interested in the nature of the machines that are transforming our world.—Keith Ferrell

BY ARNO PENZIAS

CAN IT BE THAT FOR OUR INTREPID YOUNG HEROINE IN THE BIG APPLE OF 2020, LIFE MEANS MUCH MORE THAN GIRL INTERFACES ROY, GIRL LOSES ROY, GIRL INTERFACES ROY BACK AGAIN?

'What a way to celebrate my twentieth birthday!' Rachel blinked hard a couple of times to relieve her tired eyes and squeezed the trigger of her laser pistol. In response, a tiny dot of red light sparkled on the huge electric generator opposite her. A slight motion of her wrist swung the spot around a squarish opening.

"Now, replace the cover plate over that section," she told the robot.

"Okay, Rachel, you got it. I'll put the cover plate on the opening you marked with your laser beam. I'll get back to you as soon as I'm done."

They had been at this for more than four hours, and the robot's unflagging enthusiasm was beginning to grate on her nerves.

Con Edison's robotic voice response units lacked some of the amenities of newer models. No automatic mood adjustment, for one.

Rachel moved to the control console and called up the appropriate menu. The voice response selection she had made earlier popped up on the screen: 'Male, young adult, cheerful.'

Time for a change. She replaced "cheerful" with "subdued."

"How much longer will the cover replacement take?' she asked.

"Approximately three minutes."

Much better.

"Next, check all the vacuum seals, and get ready to refuel the cryogenics."

"Acknowledged, Rachel. According to my records, my present task will complete the reassembly of this generator, so I will next be able to initiate the vacuum check and refill procedures. These tasks should take a total of twenty-seven minutes. I will notify you if my estimate changes by more than ten percent, Rachel."

With the robot busily engaged, Rachel switched off the rock video she had been playing as background music and turned her attention back to dictating an account of the morning's work into the maintenance log. "January 1, 2020, 8:37 A.M." she began, glancing down at the screen to check the exact time. Fortunately, the coffee was still hot.

CONTINUED ON PAGE 63

OFFICE ON YOUR WRIST

BY GREGG KEIZER

YOU'LL BE ABLE TO TAKE IT WITH YOU IN THE FUTURE—YOUR JOB, THAT IS. WHILE WORK MAY NEVER BE A GOLD BRACELET, IT COULD WELL HAVE A SILVER LINING

You are your office. When you hear that pitch, you'll know the future has arrived.

Twenty-nine years from now you may still be working, but you won't be chained to a 10- by 12-foot office in a tower deep downtown. You'll be free to work where you want, at least part of the time, because where you are is where your work is.

An NEC, Tandy, or Matsushita wristband contains the most crucial elements of 2020's portable office. Embedded within the one-and-a-half-inch-wide band is a positional sensor by which AT&T's navigational network keeps track of you. Sensors constantly read data from the navigational satellites updating your communication and data services. After all, if they don't know where you are, they can't call you.

Your phone and phone book are on your wrist, too. Like much in your home office repertory, the cellular phone is Lilliputian and voice controlled. The latter makes possible the former, for without the need for buttons to push, the phone is simply a thin speaker in the wristband. Need a number? Tell the phone book to look it up for you: "Number, Brink, E., Cypress Street, Richardson, Texas." Your wristband dials for you, complete with the coded entry to connect to the least expensive service from your current location.

And voice mail hits your wrist first. Messages are relayed to your region, then to you, aimed by the navnet, for final storage in the nonvolatile memory that's woven into the band's fabric. "Play messages" brings forth a stream of digitized voices reminding you about a dinner date, offering information, or asking that you call back.

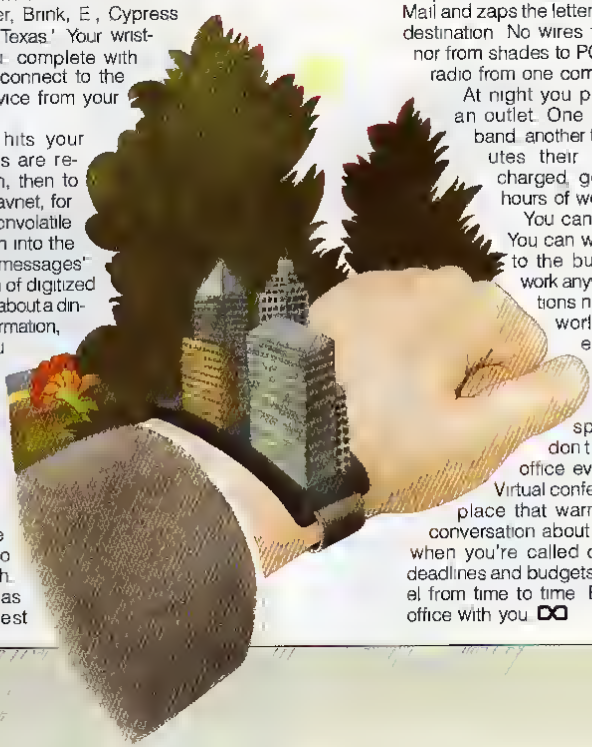
The Sony glasses don't just shade your eyes from the sun. They also project the words, figures, and pictures from the Panasonic pocket PC you've just flipped open. No keyboard, though. Your office PC has one—it's still the best way to write—but here on the patio, your work is a bit lighter.

Hardly bigger than your palm and no thicker than two credit cards, the pocket PC unfolds to reveal a black surface. Touch one of the six symbols arranged along an edge, and icons appear on the PC. Each icon represents a document, a change in format, or another software command. Press one of the document icons. Look up. You see a full-size letter as if it were hovering two feet in front of your eyes. Press another icon for voice security—it's a bit noisy here on the patio, and you don't want the pocket PC inserting stray sounds in the letter—then begin dictating. As you talk, characters form on the letter. You edit and revise the same way. Tapping icons on the PC changes the letter's appearance or stores it in memory.

When you're through, you press another icon, one that looks like an envelope (some symbols never change, even though the UPS/Postal Service delivers only parcels now) to send the letter. As you snap shut the PC, your phone dials MCI Mail and zaps the letter electronically to its destination. No wires from PC to phone, nor from shades to PC. Signals travel by radio from one component to another.

At night you plug two leads into an outlet. One goes to the wristband, another to the PC. In 60 minutes their batteries are recharged, good for another six hours of work.

You can work in any room. You can work from an airliner to the bullet train. You can work anywhere. Communications networks blanket the world; data services, electronic mail, and cellular phones connect you to your office at the speed of light. You don't work away from the office every day, of course. Virtual conferencing doesn't replace that warm handshake, that conversation about your kids, that fear when you're called on the carpet over deadlines and budgets. And you'll still travel from time to time. But you'll take your office with you. ☒



HOME OFFICE: 2020

GUTENBERG

BY GREGG REIZER

DO YOU REALLY LOVE THE SPORTS PAGE, BUT HATE THE BUSINESS SECTION? NEVER FEAR: YOU WILL SOON GET ONLY THE SECTIONS THAT YOU WANT THROUGH YOUR HOME PC

You'll be an editor, a publisher, and a printer. By 2020, you'll build newspapers and magazines in your home, and print out books written by the world's best writers.

For 30 years, prophets have divined paperless magazines, electronic newspapers, and literature disseminated without bookstores. They were right—just premature. During the next three decades, you'll find the tools that let you become printer and publisher with complete control over what you read and when you read it.

Your world of 2020 won't be entirely without paper, but it will be a place where *you* run the presses. You'll likely have a choice. Pick up the put-together paper on your doorstep, or make your own. Assembling a personal morning edition won't be hard. From your home office PC you access your favorite news E-services, including your local daily, the nearest metro service, a national wire, and one of the foreign bureaus. You choose stories and accompanying photos by telling the services to clip pieces to your specifications. You have no interest in reading about crime or schools or weather today, so you block those out. Finance and soccer sports news are all you want. The paper that comes out of your PC's printer may be small, but it's exactly what you want.

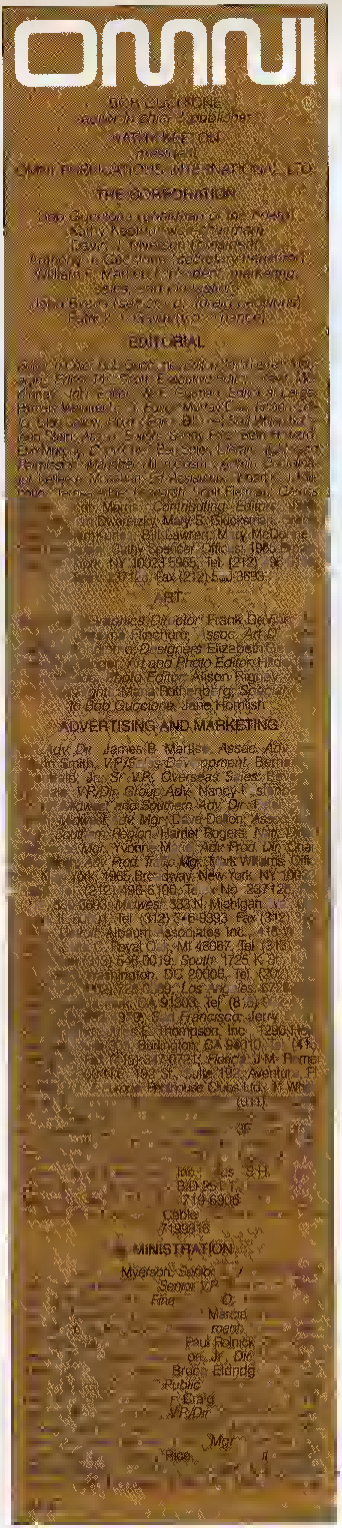
Or you can subscribe to one of the thousands of custom compilations already available on the data services. Since the Supreme Court's recognition in 2007 of an individual's right to information access, amateur newshounds have flocked to resell their papers. Want sports only, with an emphasis on local high-school football? How about a paper with extensive updates from every capital city of the world? Or a science-heavy daily that also dotes on comic strips, book reviews, and celebrity gossip?

You can make magazines in much the same way. Most publications put an electronic ghost of themselves on the data services for reading, but you can clip articles from several, then combine them under one cover. Maybe you enjoy a favorite newsmagazine, but it doesn't contain enough breaking science news for your taste. It doesn't take much to beef up its coverage.

All this comes over telephone and data lines into your home office PC. The PC captures the words and pictures, then, based on designs you've picked in the past, assembles a newspaper or magazine and prints it for you.

If you don't have a home PC, you can still get your news the high-tech way by turning on the home fax. National papers like *The New York Times*, *The Wall Street Journal*, and *USA Today* were first to adopt this delivery system, but some local dailies are active now, too. Top national, international, sports, finance, and government stories curl out of the fax machine at any time of the day. You can pull a five-page paper from the machine seconds before you leave for work, then browse through it on the trip into the city.

You can also read a book on your home PC, ask your portable PC to read it to you, or print it out. The printer can produce passable paperback-like editions on inexpensive paper, bound by a plastic cover. Everyone in the twenty-first century can claim to be a Gutenberg disciple. The turn of the millennium hasn't made you a news reporter, nor has it made you a magazine or book writer, but it has turned you into a compiler and publisher of information. Like 24-hour video news, instant home publishing lets you decide when you're going to get your facts. What's more, it lets you choose exactly what you'll get from newspapers, magazines, and books. You've got complete control over time and content. Your freedom of the press knows few bounds.



COMMUNICATIONS

READERS' WRITES:
It's not safe on Earth or the moon, so why not go to Mars for a gay ol' time

Unsuccessful Category

I hope no one else thinks like Steven Berglas [Mind, March 1991], who states that "the [success] syndrome is like AIDS." Suffering from aloneness, adventure seeking, and adultery hardly puts Donald Trump and other victims of success in the same category as people living with AIDS. And in his pitiful attempt to draw attention to his pet concern, Berglas denigrates the memory of the thousands of people who have died from AIDS-related diseases.

John Kertz
Miami

Space for Everyone

On behalf of the Gay & Lesbian Alliance Against Defamation (GLAAD), I would like to add to the portrait of Michael Collins presented in your March issue. We respect Collins as a forward thinker and as an authority in his field. However, in his recent book *Mission to Mars* he demonstrates that he does not apply his usual sound reasoning to issues involving lesbians and gays. On page 91, he writes that although there will be some "highly qualified homosexual candidates," he would not choose them for the first trip to the red planet. In the tight quarters of a spaceship, he asserts, some interpersonal problems might arise, and "introducing an element of homosexuality could only make matters worse." We have entered negotiations with Mr. Collins to redress this offensive reference. Hopefully, he will realize that discrimination based on any innate characteristic, whether it is gender, race, or sexual orientation, is a practice best left in the past—and on Earth.

Scott Sherman
New York City

Moon Lampoon

When I read "Moonstruck" [Continuum] in your March issue, I wondered if I'd picked up a copy of *National Lampoon* by mistake. What a wonderfully satirical piece. At least I hope mathematician Alexander Abian realizes that destroying the moon would cause ecological and geological disasters of unprecedented proportions. Perhaps it would be best if he remained confined to his classroom.

Kim L. Neidigh
San Antonio

Shake, Rattle, and Roll

I enjoyed your interview with seismologist Allan Lindh [March 1991]. Being a lifelong resident of the San Francisco Bay Area, I feel it is a shame that people don't act on the precautionary necessary steps to prepare for possible earthquake damage. When it does hit, most of us will fall victim to collapsing houses and scant supplies due mainly to laziness. Let's hope people wake up before it is too late.

Kerry Guadagnin
San Jose, CA

Computer Maestro?

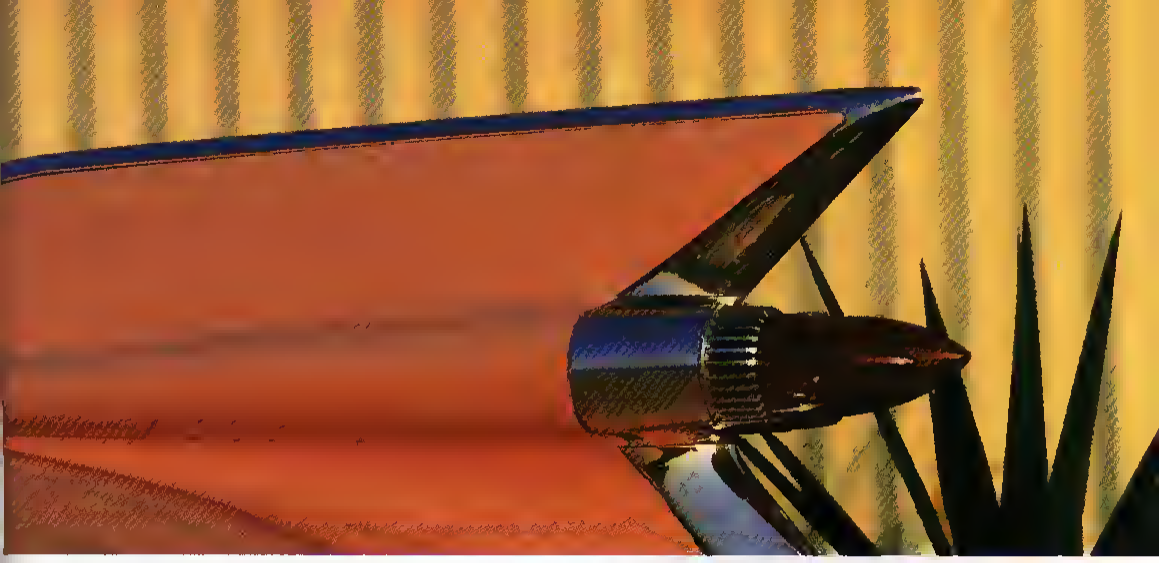
As a hyperinstrument builder I was interested in the article "Bach to the Future" [March 1991]. But you don't have to wait for virtual reality or spend $20,000 on an MIT hyperglove to play hypermusic. A number of software programs have been available for several years that can create cascading fractal, inhumanly fast ribbons of transposing arpeggios with the slightest motion of the mouse. The ones I know of are *Hyperchord*, *M*, *Music Mouse*, and *Pixound*. These are readily available for less than $200. We should expect a hypervirtuoso to soon blow us all away.

Peter McClard
New York City

Cleaning the Table

It was upsetting to read the misleading headline in your table of contents [Antimatter, February 1991] "Budd Hopkins versus mental health professionals." I am no more opposed to psychotherapy as a profession than Ralph Nader is opposed to the automobile as a means of transportation. I've brought more psychotherapists into UFO abduction research than anyone. But like Nader, I know from bitter experience that some mental health professionals are unsafe at any speed and, like certain automobiles, outrageously overpriced.

Budd Hopkins
New York City



American Classics

The '50s gave birth to a wide range of classics, from tail fins to rock & roll. One of the design triumphs of the period was the Hamilton Ventura, hailed as a work of art as well as a technological breakthrough when it was introduced in 1957 as the world's first electric watch.

Today's Ventura, an exquisitely crafted re-creation of the original, has been updated with a state-of-the-art quartz movement.

Hamilton. Designing American classics for nearly 100 years.

The Hamilton Ventura, originally introduced 1957

Hamilton

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EARTH

THE GREAT TERRAIN ROBBERY

An outdated law is wreaking havoc on the Western wilderness

A modern-day gold rush turns thousands of acres of Nevada wild land into wasteland. A 160-acre scenic plot near Keystone, Colorado purchased from the government for $400, later sells for $1 million. A family-owned sand mining company buys a 780-acre block of land within the Oregon Dunes National Recreation Area for $1,900.

In this era of new ecological awareness such acts are nevertheless perfectly legitimate, thanks to an archaic mining law originally designed to help settle the American West. Under the so-called 1872 Mining Law, virtually unchanged since it was signed by President Ulysses S. Grant, mining concerns can stake claim to, and even purchase, federal lands at prices as low as $2.50 an acre—as long as they can prove that the mineral find will be a profitable one.

Fool's gold: You've got to hand it to the government for its archaic mining policies.

With land open to exploration at dirt-cheap prices, mining companies have flocked to Western states in the last decade with a zeal reminiscent of the feverish gold diggers of a century ago. The gold mining industry has been the primary beneficiary of this environmental loophole—even as it comes up with more toxic technologies to extract the mineral. And a new process, cyanide heap leach mining, in which cyanide dissolves and removes gold from ore, allows miners to economically recover widely dispersed deposits. "With the technology and the price of gold, it is economically advantageous to go after extremely low-grade ore deposits," says David Albersworth, public lands director of the National Wildlife Federation.

Under the best of circumstances, of course, mining extracts an environmental toll along with the precious metals. In Nevada, the center of the gold frenzy, gaping holes remain where miners once churned up mammoth chunks of earth. The cyanide used in the gold mining ends up in large, open ponds, where it kills wildlife and pollutes streams.

Opponents of the 1872 Mining Law have been increasingly critical of the Bureau of Land Management (BLM), which oversees the millions of federal acres that mining companies are gobbling up. The BLM, they argue, has been lax in regulating mining. "The BLM claims it can increase environmental protection against hard rock mining, but it has never shown any willingness to do so," Albersworth says.

According to BLM spokesman Mike Ratliff, the agency has recently issued policies requiring safeguards for using cyanide and reclamation of the land.

Beyond the ecological pitfalls of the mining process itself, environmentalists lament the irrevocable loss of virgin territory. According to a recent Government Accounting Office (GAO) report, since 1978, citizens and private companies have snatched about 157,000 acres of public land—much of it prized wilderness terrain—for a nominal fee. These include 1,700 acres of New Mexico forest above the Jemez River, recently designated by Congress as "a Wild and Scenic River." The law has also led to the acquisition of public lands for vacation properties and even, in one case, a waste dump.

Spurred by national conservation groups, Congress is considering bills to reform the law. Environmentalists have asked the government to reconsider the carte blanche given to mining companies and to require restoration of abandoned mine sites.

Not surprisingly, the mining industry wants to preserve its privileges, especially the principle of self-initiation, which permits companies to simply stake a claim on a parcel of public land, instead of submitting competitive bids to acquire it.

The industry also aims to get the public on its side. "The biggest challenge is convincing people they need mining, and to educate them to what the mining industry means as far as life-styles and keeping us free from foreign dependency," says Robbin Lee of Colorado-based Atlas Precious Metals, which has several Western gold mines. "Most people say, 'I want my gold jewelry, but I don't want you mining in my backyard.'"

Indeed. In the end the people will have to decide how much of the nation's backyard they are willing to sacrifice for a gold necklace.—Beth Howard

SPACE

WE HAVE LIFTOFF:
A new modular launch system promises to make getting into orbit cheaper and safer

Perhaps someday there will be a service comparable to Federal Express or United Parcel Service that sends items not across the country but into space, reliably and at a reasonable price. Meanwhile, with space launches of all types becoming more commonplace today's space shuttles and expendable launch vehicles (ELVs) are still prohibitively expensive and have an uncomfortably high rate of failure. These shortcomings are among the chief impediments to U.S. space development.

Based on decades-old technology, the current vehicles were designed with no safety margin. They must operate at the absolute limit of performance to haul their heaviest payloads into orbit. This makes for launch costs of $4,000 to more than $10,000 per pound of payload to low Earth orbit, with failure rates of about 5 percent for ELVs and 1 to 3 percent for the post-*Challenger* shuttle. But the needs of no single segment of the space community—military, civil, or commercial—can justify the high up-front investment for a new launch system.

A few months ago, however, the necessary pieces to revamp the country's launch system began to fall into place. First the National Space Council called for combining all U.S. space launch requirements. Then the Advisory Committee on the Future of the U.S. Space Program, appointed by President Bush, urged the development of a new launch system. At the same time the Air Force and NASA began to jointly develop a vehicle both could use. Vice President Quayle and budget director Richard Darman granted approval in January to proceed further.

Actually, to meet the payload needs of its different users, the new launcher will be not just a single vehicle but a modular family, much like the European Ariane 4. Its core will probably include at least four oxygen–hydrogen rocket engines, each about 30 percent more powerful than each of the shuttle's three main engines, as well as a large propellant tank similar to the shuttle's and a variety of payload capsules. It will eventually replace the shuttle to transport human crews.

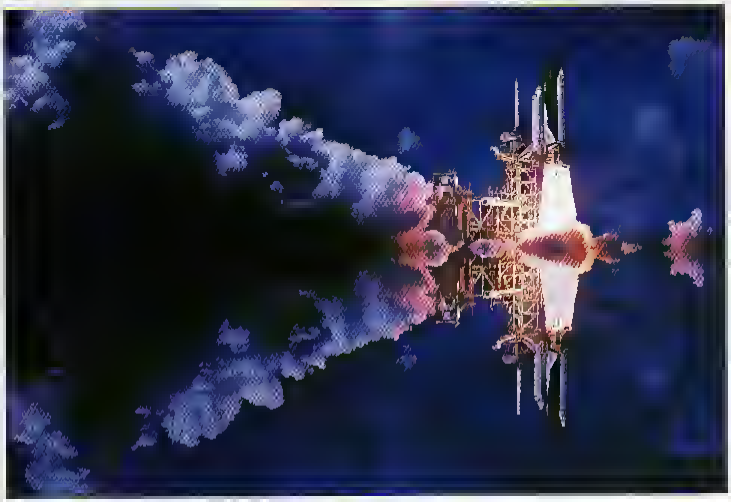
For heavy payloads, solid-propellant boosters like the shuttle's will be added to the core; these will eventually be replaced by boosters powered by the same liquid-propellant engines as the core vehicle, with tanks so similar to the core's they can be built using the same tooling. Various combinations of the core and boosters will be able to handle payloads ranging from approximately 50,000 pounds to more than 200,000 pounds.

The real key to the new vehicle program is its approach to both design and operations. The new launcher will be stronger and heavier than absolutely necessary so that its maximum payload will not stress the craft to its design limits. Its booster engines will be recovered and reused. Initially the core's engines will be expendable, but they, too, will be reused when enough flights are made to justify the recovery cost.

Also, because most rocket-powered launcher failures are propulsion related, the new vehicle will be designed so that, like a commercial airplane, it can still function if an engine fails during flight. Finally, vehicle assembly, checkout, and ground operations will be highly automated to eliminate the expensive "standing army" needed to maintain and launch the current vehicles.

The vehicle's designers are aiming for an average launch cost of $500 per pound to low orbit and a failure rate of 1 percent. If all goes well—and it should, because the technology is already available—the new century will dawn on the first large new operational U.S. launch vehicle in three decades.

—Jerry Grey



The next U.S. launch system, due at the turn of the century, will feature a core vehicle, boosters with reuseble engines for heavy payloads, end cargo capsules of various sizes.

DIGS

READ MY GLYPHS.
How true are the tales that lie behind the boasts of Maya kings?

Imagine reconstructing American history exclusively from the words on government monuments and in State of the Union addresses. "Sure, your first reaction is to dismiss it all as propaganda," says Linda Schele, a University of Texas art historian, "but looking over two hundred years you'd find the string of history."

A similar problem confronts Schele and other archaeologists who study the ancient cultures of southern Mexico and Central America. There, between 900 B.C. and A.D. 900, the Maya built monumental cities, detailed the passage of time, researched astronomy, and farmed the rain forest while Europe stumbled through its Dark Ages. Only recently have archaeologists cracked the code of the hieroglyphics that festoon Maya structures. No longer tantalizing visual poetry, the glyphs now read as prose. After nearly 1,100 years the Maya speak again.

But do the words really tell the complex political history of the Maya, as Schele and others believe? Or do they merely spin the stories that Maya kings wanted readers to believe? The debate currently divides Mayan archaeologists, but recent evidence suggests that the hieroglyphics do indeed speak the truth.

At Copán in Honduras stands the most richly inscribed Maya monument yet found—the Hieroglyphic Stairway erected by King Smoke-Shell in A.D. 756. Its 2,200 glyphs trace his pedigree back to the legendary Blue-Quetzal-Macaw, who Copán kings claimed founded the dynasty in the fifth century. But whether Blue-Quetzal-Macaw was a myth or a real person had never been conclusively established. Was Smoke-Shell trying to shore up the royal image by calling on a mythical ancestor?

As it turns out, Smoke-Shell wasn't blowing smoke. Recently Northern Illinois University archaeologist William Fash found a series of buried inscriptions dated A.D. 435, naming Blue-Quetzal-Macaw as the current ruler. "He wasn't a fairy tale," Fash asserts. "He was a viable historical figure."

Last spring in Guatemala, Vanderbilt University's Arthur Demarest uncovered yet another hieroglyphic staircase, this time in the ruins of Dos Pilas. The Dos Pilas glyphs record a spate of battles with the distant Maya power center of Tikal.

"We'd seen a few references to wars with Tikal, but this confirms it nicely," Demarest says. "It also confirms the origins of the Dos Pilas dynasty."

How much the royal wars shaped Maya life is the question that fuels the debate over the relevance of the hieroglyphics. "Were these wars just the ridiculous carryings-on of an overdressed elite," asks Demarest, "or did they have real impact on the landscape?" His opinion: Instead of altering political geography, most Maya wars simply furnished material for the winners' propaganda, which in turn bolstered a royal power base that leaned precariously on personal charisma.

And therein lies the danger of depending on hieroglyphic narratives for history, skeptics say. "Battles were fought and lost," says William Sanders, a Mayanist at Pennsylvania State University, "but political relationships between states didn't change—that's what bothers me about these stories."

While Demarest concedes that the inscriptions have the trappings of propaganda, he believes the glyphs don't lie but merely leave out embarrassing details. "Maya propaganda is so obvious," he says, "it's easy to read past its strutting, bragging nature. You get to a skeletal history, and then you can flesh out the skeleton with archaeology."

—Gregory T. Pope

Pomp and procession in ancient Mesoamerica: How much history was the carrying-on of an overdressed elite?

MIND

SOLID-STATE NOSE

A computer duplicates the wiring in the brain's olfactory cortex, where odors are processed

A computer model proved so adept at ferreting out electronic "smells," it's led to a chip giving silicon "brains" new powers of recognition

Someday if the Navy builds a radar system that sniffs the skies with the aid of a computer model capable of remembering and distinguishing friendly from unfriendly aircraft it may be thanks to neuroscientists at the University of California's Bonney Center for the Neurobiology of Learning and Memory at Irvine. According to Richard Granger the model's builder, it could provide valuable insights into how powers of mind emerge from the real brain.

The computer model of smell is based on organic brain circuits identified by Granger's collaborator Gary Lynch, a pioneer in the study of mechanisms of learning and memory. The network of 5,000 interconnecting cells is programmed to mimic neurons in the olfactory cortex that contain N-methyl-D-aspartate receptors. Lynch previously demonstrated in animals that stimulation of such neurons causes successively stronger responses a phenomenon called long-term potentiation (LTP), which neuroscientists believe is a fundamental process in memory formation.

The mathematically coded odors tested on the simulation were also derived from Lynch's studies. When he applied similar electrical patterns directly to the olfactory centers of rats' brains, the animals reared and sniffed as if they were smelling a real scent. They could even distinguish one electronic odor from another. But it was impossible to figure out what was going on inside the animals' heads until Granger constructed his computer model. "The results were unexpected," Granger says. "At first the response looked random, but the first sniff always caused the same group of cells to fire." He noticed that distinct cell-firing patterns began to accompany the second and third sniffs as the computer's recognition of odors was fine-tuned. Granger compares the process by which the circuits sort responses into hierarchical categories to a wine testing. "On the first sniff you know it's a wine, on the second sniff, French; on the third, a bordeaux."

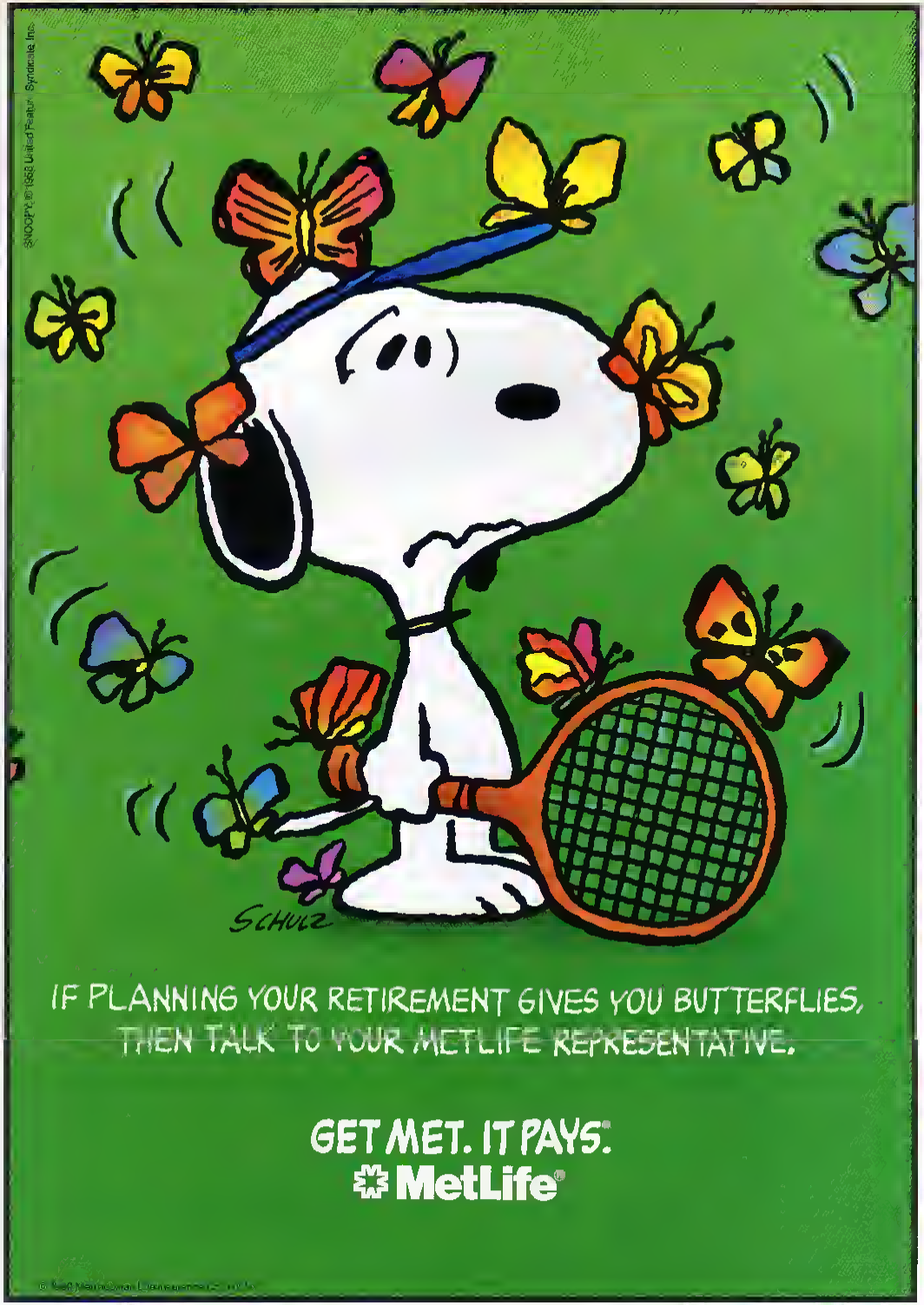
The key to the computer model's odor-distinguishing capabilities appears to be the sniff rate—five times a second. The frequency corresponds to the natural rate at which animals sniff out clues to the environment and to the pattern of brain waves called theta rhythms that accompany such behavior. Lynch and others have found that theta rhythms are also present when animals are learning tasks and seem directly associated with LTP activation in individual neurons.

The observation leads Lynch to wonder whether the patterns in the model's simulation might also apply to the neocortex, where higher forms of learning take place. "The basic design principles are repeated throughout the neocortex," Lynch says. "The olfactory cortex should serve as a Rosetta stone for understanding the neocortex."

The extraordinary talent for odor recognition displayed by rats leads Granger to think along similar lines.

"Because olfactory perception is the evolutionary precursor for the rest of the cortex, not only might we learn about other primary perception such as vision, hearing, and touch," he says, "but the progressively more fine-tuned brain cell activity in the model may underlie the rapid, long-lasting, large-capacity memory that allows a human to distinguish faces and voices. It may have to do with why we take a second glance, another perceptual sample, at all."

The Defense Advanced Research Projects Agency has invested heavily in this and similar undertakings. The Irvine scientists collaborating with engineers at Adaptive Solutions, Inc., in Beaverton, Oregon, have translated the Granger–Lynch simulation into a patented custom computer chip. Containing 50,000 cells—nearly as many as the entire rat olfactory cortex—the chip is designed to interface with conventional computers to perform difficult voice and image recognition tasks. Granger sees another possibility. Such a technology might be the basis for implantable brain pacemakers to correct malfunctioning senses. "We'll go where the circuits lead us," he says.—Jeff Goldberg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SCHULZ
IF PLANNING YOUR RETIREMENT GIVES YOU BUTTERFLIES,
THEN TALK TO YOUR METLIFE REPRESENTATIVE.
GET MET. IT PAYS.
MetLife

ARTS

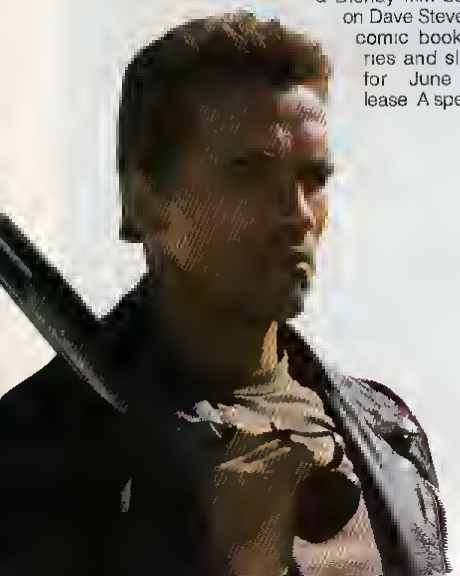
TALES FROM THE SCRIPT:
From fantasizing professors and time-traveling cyborgs, to monsters that really do live in the closet

Science fiction continues its hyperdrive pace in Hollywood, providing moviemakers with the best opportunity to show off their special effects. And two of this summer's likeliest blockbusters—*The Rocketeer* and *Terminator 2 Judgment Day*—are science fiction at its pure, unadulterated best.

Two of the season's earliest scheduled releases include *Suburban Commando* and *The Fisher King*. Starring Hulk Hogan and Christopher Lloyd, *Suburban Commando* involves an extraterrestrial mercenary seeking asylum and a "quiet vacation" on Earth. In *The Fisher King*, Robin Williams hits the screen again, this time as a former professor of history who lives in a fantasy world of his own making, one where turrets and castles form the skyline of a medieval New York City populated by damsels in distress and knights in shining armor.

Moving up in history to 1938, daring pilot Cliff Secord finds an extraordinary rocket pack that enables him to fly in *The Rocketeer*, a Disney film based on Dave Stevens's comic book series and slated for June release. A specially designed helmet not only helps Secord to navigate but also keeps his identity a secret in this good-versus-evil science-fiction adventure. *The Rocketeer* is the kind of film Uncle Walt would have commissioned himself.

In July Bill and Ted's next excellent adventure will take them to California in the year 2691. Under the tentative title *Bill and Ted Go to Hell*, our unlikely heroes are pursued by evil Bill- and Ted-like robots programmed to annihilate the human time travelers. And in *Radio Flyer* two brothers escape into the magical world of childhood, where animals can talk, monsters really do live in the closet, and a little red wagon (Radio Flyer) can fly.



Will Arnold terminate the child leader? Will Robin (Williams) rescue a fair maiden in medieval Manhattan? Do you really think we will tell you and spoil your summer screening?

July is also the month of the Terminator, with Arnold Schwarzenegger reprising his cyborg role. In the original film, the Terminator traveled back to 1984 but failed in his mission to kill the woman whose child would grow up to lead the future human resistance to robots. Directed by James Cameron (*Aliens, The Abyss*), *Terminator 2 Judgment Day* begins with Armageddon (August 29, 1997) when 3 billion people die in a nuclear holocaust. With the survivors poised for rebellion, cyborg Arnold travels back to 1991. His mission: Terminate young John Connor, the post-nuclear resistance leader.

A terminator of another sort, Chucky, the killer doll, returns in *Child's Play 3* later this summer. And Anthony Michael Hall plays *A Gnome Named Gnorm*, a fantasy involving a little person from Inner Earth who helps a detective solve crimes. To find out if anyone steals Gnorm's Lucky Charms, catch the movie in August.

Cryonics serves as the basis for the plot in September's *Late for Dinner*. Taking part in a bizarre and dangerous experiment in 1962, two friends are placed in frozen animation and wake up 29 years later feeling as if they just had a good night's sleep. Everyone else, however, has aged nearly three decades. The comedy revolves around the human guinea pigs' return home and their attempts to reestablish bonds with their families.

And don't worry, Freddy Krueger lives, at least until October and the release of *Nightmare on Elm Street VI—Freddy's Dead: The Final Nightmare*. Is this *really* the end of Freddy? Don't bet on it—but it does make a nice long title.—A.J.S. Rayl

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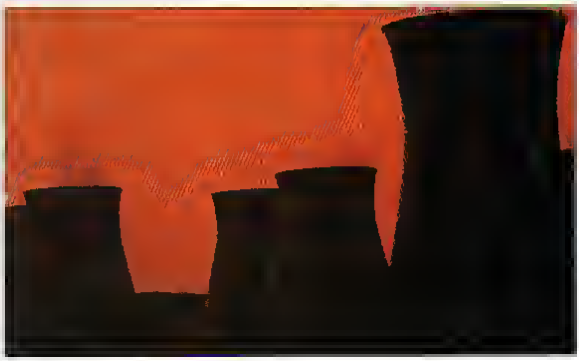
ARTIFICIAL INTELLIGENCE

MORE POWER TO THEM
Western computers will help the Soviets modernize their nuclear power industry

The Soviets hope to use the new computers to design inherently safe reactors, a promising export commodity



It's no wonder that Soviet nuclear power engineers have a credibility problem. Witness the initial response of a highly ranked Soviet physicist to the report of the Chernobyl accident in 1986. State officials wanted to know what kind of radiation might be leaking into the environment and what problems it might cause, the scientist says. He and his colleagues concluded that an explosion at the Chernobyl plant could not possibly occur. So they told officials that the report must be wrong and advised them not to worry about it.

Although some Soviet nuclear engineers pine for the old days of discreetly handled disasters, others have begun using *glasnost* to help polish their profession's tarnished reputation. The backbone of the effort is a recent $32 million purchase of American mainframe computers—six Cyber 962s manufactured by Control Data—to be devoted exclusively to improving the safety of Soviet nuclear power plants.

Although the sale far exceeds U.S. and international trade limitations on exports to the Soviet Union, it was approved last October with stipulations regarding who may operate the computers. Delivered early in the year to six Soviet nuclear power research institutes, the general-purpose mainframes will accelerate safety efforts already under way, especially at the country's 15 Chernobyl-type reactors still in operation.

Notoriously slow and unreliable Soviet computers have been a major stumbling block to designing and operating safe reactors. In the West, nuclear engineers run innumerable computer simulations to study the possible results of various situations. But simulations require a lot of computer power, and the Soviet machines have not been up to the task. As a result, Soviet engineers had little idea what to expect if reactors malfunctioned or were mismanaged. The Control Data machines will help them eliminate the sort of design flaws that led to the Chernobyl accident.

However, the speed and power of the U.S. computers, while necessary, were not their primary selling points. The Cyber machines' overriding attraction is their ability to exchange data with other Western computers, a feat the Soviet hardware cannot accomplish. Having compatible hardware will enable scientists at Electricite de France International, the World Association of Nuclear Operators, Italy's atomic energy agency, and other organizations to analyze Soviet computer data and suggest improvements. The Argonne National Laboratory near Chicago is already sifting through its library for software programs for the new computers.

In matters of plant safety, expert opinion from international organizations has proved useful in addressing the concerns of the increasingly vocal Soviet environmental movement, which has blocked the construction of new Soviet nuclear plants. The new computers will help the Soviets work with the Western organizations more effectively, which the Soviet nuclear scientists hope will reassure the Greens and help to avoid conflicts with them over the modernization of old plants and the building of new ones to meet future energy needs.

The Soviets also plan to use the Control Data machines to design and simulate so-called inherently safe reactors that automatically cool down in the event of an accident. While many countries, including the United States, are working on such reactors, none have yet been built. Soviet engineers are especially optimistic about inherently safe breeder reactors that use lead, or a lead–bismuth mixture, as a coolant. Nonbreeder reactors use water to cool the core, while conventional breeder reactors use sodium, a fairly volatile element.

Lead and lead–bismuth, however, don't explode, like sodium, or evaporate quickly, like water, making them good candidates for coolant materials in inherently safe reactors.

Unlike most other countries, the Soviet Union already uses lead or lead–bismuth in some of its conventional military reactors. Soviet scientists familiarity with lead and lead–bismuth could give them a much-needed jump on the rest of the world in developing inherently safe reactor technology, which could be a profitable export.

—Fred Guterl

CONTINUUM

READ THIS PAGE TO SOMEONE WHO CAN'T

Meet, with minimal editing, Ms. Melvyn Campbell. Plus: Coneheads that ticket polluters, and stalking the wild rayon

I came to America from Jamaica in 1969. I wish I had known about a literacy program then, because I would be a better reader today. Back then I had to have my son help me with my business, filling out forms and paying bills. Finally, he said to me, "You have to help yourself." I decided to try to make up my own bills and do my own banking. One day I was looking at TV and I saw the announcement for the literacy program at the Brooklyn Public Library, so I called the number.

They told me to come for a test, and I came in. I started by working on the computer, I moved from there to a beginning class, and finally I got a tutor. It helped me. I am not at the place where I was when I first came to the program. When I went to school as a child in Jamaica, if you had problems, the teacher helped you a little, but you had to be fast, or the other children just left you behind. It gave me the mind not to go back. You may be getting help at home, but you can't retain it because you know that you have to go back to school and face the other kids. But you can't blame it all on other people, you are the person who is holding back your own self.

When you can't read, you go someplace, like the bank, or for a job, and they say, "Make sure you read the fine lines," but that's where the tricky part is. If you can't read, you don't know to ask questions. They take you at your word, *they* aren't going to ask *you* any questions. Suppose it is your money, and you don't understand the fine print, you can have real problems. Or if you go on vacation, it can be difficult because at home you find your way, but traveling you don't know the area. If there is a sign saying, "Do not enter," and you cannot read it, that can mean trouble.

Not being able to read well holds you back in everything because you don't have confidence in yourself. It changes the way you stand and the way you sit and the way you deliver yourself. You talk less for fear of saying the wrong thing. A person that cannot read thinks right, but they don't know how to put their thoughts together into words because they doubt themselves. You may know the truth about something, and you want to tell a person about it, but just because you can't read, and the other person can, or the other person went to college, you feel that they know it all. So you don't say anything because you think that you will say the wrong thing. Since I have been coming to the literacy program, my reading and writing are better. I still have a long way to go, but it has helped me a lot. My understanding is much better. Filling out forms is easier. I can get more when I listen to the news. I understand more words, and that helps me to get more when people are talking, and to try to speak a little better myself. I personally can say that I have stepped up from where I was in reading and writing, and I have confidence that I didn't have before.

My advice for other adults who have trouble reading is to spend a little time with yourself and say, "I must help myself." Do not say, "I am too old, it's too late." While there is life there is hope. Do not give up, there is hope for the old as well as the young. It was just lucky for me that I am one of the fortunate ones to have the opportunity to find a program to help me. I truly want to read better and do a lot of things on my own. I don't want to have to depend on anyone, but just to do things to help myself.—*MELVYN CAMPBELL*

Melvyn Campbell has been a member of the Brooklyn Public Library Literacy Program for three years. Ms. Campbell works for a hotel in Midtown Manhattan and visits her grandchildren in Florida as often as she can.

CONTINUUM

Sex pistils. Lacandonia schismatica's sex organs, as compared with this "normal" flower, are inside out.

SEX, EVOLUTION, AND *LACANDONIA SCHISMATICA*

When it came to the sex life of plants, botanists thought they had seen it all. Every flowering plant, they believed, places the pistil, or female sex organ, at the center of the flower with the male pollen-producing stamens surrounding it. But a recent discovery by Esteban Martínez may necessitate a rewrite of Biology 101 textbooks.

While trekking though the jungles of southern Mexico, Martínez, a biologist with the National University of Mexico, discovered a tiny flower with a single stamen in the center surrounded by 50 or more pistils—the opposite of "normal" flowers.

Researchers say the origin and evolution of the flower, *Lacandonia schismatica*, poses interesting possibilities. It might simply be a curious mutation, or it may be the result of chromosomal rearrangements forged over thousands of years, by a small population of plants.

"The flower is certainly one of the most interesting plant discoveries of this century," says Gerrit Davidse, Missouri Botanical Garden curator who is working with Martínez to unravel the floral puzzle.

—Tom R. Kovach

SEXUAL DEVIATIONS, SUCH AS FOOT FETISHES, ARE AN ALMOST EXCLUSIVELY MALE PHENOMENON.

THE FIRST HUMAN ARTIFICIAL INSEMINATION TOOK PLACE IN 1785, RESULTING IN THE BIRTH OF A HEALTHY BABY BOY.

UP CLOSE AND MINERAL

For the first time, scientists have taken atomic-scale photos of the surface of minerals, a development Stanford University geochemist Michael Hochella calls "revolutionary." The pictures, captured by a scanning tunneling electron microscope, reveal molecules and even individual atoms. The breakthrough could lead to better ways of coping with toxic spills.

When any substance is dissolved in water and poured onto soil, it reacts with minerals in the soil. For example, when water containing dissolved gold flows over sulfide rock, each gold atom gains electrons. A thin, invisible film of metallic gold accumulates on the rock's surface. In the same way, a toxic metal in solution might bind to minerals in the soil instead of trickling down to poison groundwater. With the new technique, "we can look at the chemistry at the interface between mineral particles and groundwater," says Hochella. Eventually, geochemists may predict how toxic materials will behave in different soils.—Sandy Fritz

EGYPT'S GARDEN OF EDEN?

Test pumping 300 miles east of Owenjat in Egypt's vast Western Desert has convinced scientists at Boston University's Center for Remote Sensing that enough water lies below the arid surface to create a lush agricultural area.

The discovery was triggered by shuttle-based radar probes in 1981. "We expected to see only rocky surface," recalls Farouk El-Baz, the director of BU's Center, "but the radar penetrated the sand and reflected back the courses of rivers hidden beneath the sand." The Egyptians drilled into the dry beds to discover water hidden far beneath them.

The exact amount of water is unknown, but the pressure at 12 recently drilled wellheads has not dropped measurably since 1987, when the Egyptians began building and operating a 5,000-acre experimental farm. El-Baz thinks that there is enough water to irrigate 200,000 acres for 200 years.

—George Mobbs

Space-based radar shows ancient river channels that lie under these sand dunes.

Looking for clues. Cancer researcher Stuart Gordon

CANCER WARNING SYSTEM

Nearly 10,000 Americans die each week of cancer. But a test under development at the University of Colorado's School of Medicine may allow doctors to detect cancers before they gain a foothold in the body, dramatically improving the chances of successful treatment.

While researching abnormal blood clotting in cancer patients, biochemist Stuart Gordon detected the presence of a protein that promoted blood clotting around malignant tumors. Dubbed cancer procoagulant (CP), the protein was absent from normal cells and it wasn't present in benign tumors. It proliferated, however, in early cancer cells. Armed with this information, Gordon developed a blood test for detecting the early stages of cancer that was 100 percent accurate in its first trials.

Further studies show promise for CP as a possible cancer vaccine. When mice were immunized with CP and then injected with cancer cells, the rodents didn't develop cancer, unlike control groups that got the cancer cells but not the CP.

Gordon cautions, however, that results are only preliminary and much more needs to be learned about CP. It might, for example, interfere with wound healing or tissue regeneration. Gordon now wants to look for the presence of CP in urine. If he finds it, home cancer tests could become as common and inexpensive as home pregnancy tests. An ongoing 2,000-patient study will take a year to complete, and gaining FDA approval for his test will take at least another two years.—Peggy Noonan

"Beyond the mountains more mountains."
—Haitian proverb

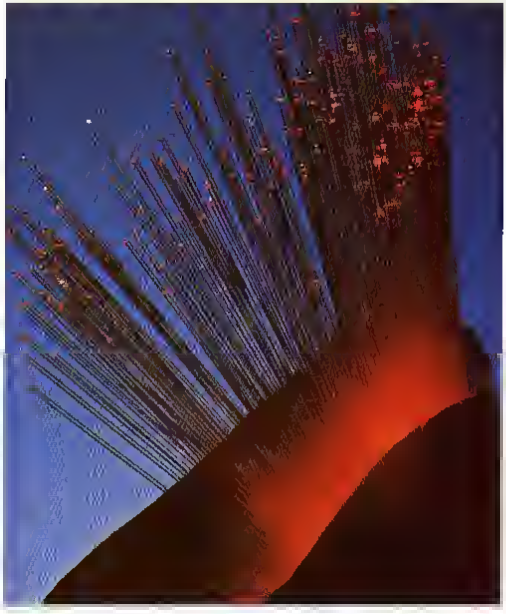
WOMEN ARE BIGGER FLIRTS THAN MEN, BEING MORE LIKELY TO USE EYE CONTACT, SMILES, FLEETING TOUCHES, AND SUGGESTIVE GROOMING (LIP LICKING, HAIR SMOOTHING) TO ATTRACT ATTENTION. MEN HUG AND KISS.

FASTEST LASER IN THE WEST

Lasers are as lasers do, and to a pair of Taiwanese researchers at AT&T's Bell Laboratories, that means speed. And in less than a year Young-Kai Chen and Ming Wu have developed the world's fastest laser, which could revolutionize long-distance fiber-optic telecommunications and microwave communications.

The colliding-pulse mode-locked (CPM) laser cranks out 350 billion light pulses a second, 100 times faster than any commercially available laser. To attain such speeds, the CPM laser's pulses must also be extremely brief—less than one trillionth of a second per pulse. Each pulse carries one bit of information, so the faster the laser, the quicker data can be transmitted. The semiconductor laser has other advantages. It runs cooler, uses less energy, and costs less to produce than light-operated models.

The AT&T physicists are optimistic that they'll remain ahead in the fast-moving laser field. "We want to get lasers as fast as one thousand billion pulses," Wu says.—Lloyd Chrein



Cheaper by the pulses. An extremely speedy laser may make fiber-optic telecommunications more energy efficient

CONTINUUM

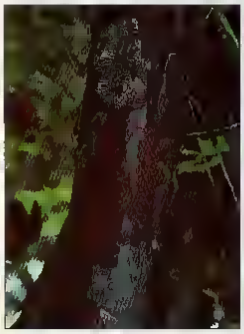
A CANCER CURE GROWS IN OREGON

The promising anti-cancer drug taxol comes from the Pacific yew, a rare and slow-growing evergreen found in Canada and a few northwestern states. Since each taxol treatment destroys up to three trees, however, nature may not supply enough taxol to meet demand. While chemists have so far been unable to synthesize the drug, an Ithaca, New York, company has recently developed a method to produce taxol without killing trees.

Taxol is produced by the Pacific yew in response to stress, such as an attack by fungi or insects. To make taxol in the lab, scientists at Phyton Catalytic place a small piece of yew bark in a nutrient-rich culture medium, causing the cells to grow and multiply. An added chemical simulates a natural stress to the tree, making "the cell think it is being attacked," says Phyton's president Rustin Howard. "It responds by producing taxol."

The technique still needs refinement to adapt to large-scale production.

—Billy Allstetter



Thank yew. Cancer patients might want to plant a Pacific yew

NINETY PERCENT OF THE SCIENTISTS IN THE HISTORY OF THE WORLD ARE STILL ALIVE.

CUBISM ILLUMINATED

Researchers at Sandia National Laboratories in New Mexico have developed a light cube that uses no electricity and lasts for 20 years. Its power source: radioactive tritium.

The self-contained light cubes, says Lee Leonard, research manager of the project, are ten times brighter than earlier tritium-powered lights and far hardier. "They're so much more robust, you could put a bullet through them and only the bullet hole itself would go dark," he says.

The Sandia lights are fashioned from transparent, spongelike glass cubes bonded with zinc sulfide phosphor and tritium. As the tritium decays, it produces radiation, exciting phosphors and producing light. While light escapes from the cubes, radiation does not.

A prototype should be ready later this year, and the light cube could be commercially available by 1992.—George Nobbe

Smile, you're on Cone Camera. Donald Stedman checks a pollution monitor hidden inside a traffic cone.

CAUGHT IN THE ACT

The next time you drive off a highway exit ramp in a cloud of exhaust fumes, don't be too sure the traffic cone you passed was just a traffic cone. It could conceal an infrared remote-sensing pollution monitor.

Connected to a video camera, the monitor records the license plate numbers of cars that emit 100 or more grams of carbon monoxide per mile, well over the limits set by the Clean Air Act. Citations are sent to violators.

Designed by University of Denver chemistry professor Donald Stedman, the remote emissions monitor has a negligible margin of error, according to road tests reported by the Journal of the Air and Waste Management Association. And it can test as many as 1,200 cars per hour, day or night, in any weather.

The monitor checks emission levels of passing cars by shooting parallel beams of infrared light through the exhaust fumes from the tailpipes of passing cars, the exhaust gases altering the beams' wavelength. Focused on a mirror on the opposite side of the roadway, the beams bounce back to the small, polygon-shaped detection unit. It requires less than a second to determine a car's emissions. Several state highways have expressed interest in Stedman's prototype. The reasons, the designer points out, are obvious. "Ten percent of our cars create more than fifty percent of the air pollution," Stedman says. "Many states require annual emission tests, but they are annoying, inconvenient, and ineffective because they're performed at idling speeds, not on the highways. Besides, they do nothing to clean the air."

—George Nobbe

CONTINUUM

Thanks to a new process for producing rayon, you'll be able to eat the kernels and wear the stalks

RAW FASHION

Chalk up another use for agricultural waste. While biomasss proponets cite sugarcane and manure as potential energy sources, corn stalks and straw, for example, could be raw material for rayon. The only difference you'll notice will be on price tags in the stores.

The production of rayon requires high-quality cellulose from, say, cotton. This, and the highly toxic processing chemicals that quickly corrode equipment, makes the manufacture of rayon expensive, with the costs, of course, passed along to the consumer.

A technique developed by Purdue University's Li Fu Chen, however, uses cellulose from any source and dissolves it in a zinc chloride solution that is less expensive and less toxic than other cellulose solvents. Spinning the cellulose-zinc chloride mixture produces rayon fibers almost immediately, unlike the current method that takes nearly 18 hours. The zinc chloride, moreover, is recyclable.

Chen hopes to have his process on the market in five years, if not sooner. "The equipment is already there," he says. "All the industry has to do is change the preparation procedure."

—Robert W. Tinsley

THIRTY-THREE PERCENT MORE BOY BABIES THAN GIRLS DIE IN THE FIRST YEAR OF LIFE.

AN ELECTRIC EEL'S CHARGE IS SO POTENT IT CAN KNOCK A HORSE UNCONSCIOUS FROM 20 FEET AWAY.

A ONE-PACK-PER-DAY CIGARETTE SMOKER CONSUMES 400 MILLIGRAMS OF NICOTINE IN A WEEK. THAT WOULD BE ENOUGH TO CAUSE INSTANT DEATH IF TAKEN IN ONE DOSE

KILLER PAINKILLERS?

Problems in Europe with the nonprescription painkiller phenacetin have raised questions about acetaminophen, a chemical derivative of phenacetin and a key pain-killing ingredient in Tylenol, Anacin-3, and Extra-Strength Excedrin.

A 20-year study of Swiss factory workers showed that women who regularly took high doses of phenacetin, banned in the United States since 1983, faced elevated risks of kidney disease and kidney-related death. When ingested, phenacetin breaks down into acetaminophen and other by-products. Whether acetaminophen is the culprit in kidney damage has yet to be determined.

"Acetaminophen may be completely safe," says Paul Stolley of the University of Pennsylvania School of Medicine. "We need long-term studies to find out for sure."

Stolley stresses that people who use acetaminophen-based medications in the recommended way—one or two tablets every six hours for a couple of days—have absolutely nothing to worry about. "I'm worried about people with chronic pain who take eight to ten pills a day for a couple of years," he says.

—Steve Nadis

Pain killer? Acetaminophen, a drug used in over the-counter pain relievers, may cause kidney damage and even death.

CONTINUUM

The lipid "supersandwich" tastes and smells well, but it's not meant to be eaten

SMELL NO EVIL, TASTE NO EVIL

The lipid-ceramic "supersandwich" developed by scientists at Cornell University may not look like a nose or a tongue, but it will be able to "smell" and "taste" as well as the real organs.

In nature, lipid membranes in the tongue and nose play a key role in differentiating smells and tastes. So, to create artificial olfactory sensors, materials scientists Emmanuel Giannelis and Wolfgang Sachse layered lipids between supporting sheets of an ultrafine ceramic material.

When specific aromatic or flavorful substances come in contact with the lipid layer of the supersandwich, the electrical characteristics of the artificial membrane change.

The researchers believe the change could be measured by a transducer. If successful, the artificial sensors could detect bitter or toxic contaminants in food and health-care products or "in any situation where it's too dangerous for humans to do the sniffing or tasting," Giannelis says.

—Kathleen McAuliffe

THE SIGNATURE OF SUICIDE

The body's natural opiates perform a host of functions, from numbing pain to producing euphoria. But they may also play a part in severe depression, helping to identify patients at risk of committing suicide.

Neurobiologists Anat Biegon of New York University's School of Medicine and Ruth Gross-Isseroff of the Weizmann Institute of Science in Israel tallied the number of opiate receptors in the brains of 12 suicide victims and those of 12 people who died from other causes. The result: Suicide victims sported up to nine times more opiate receptors than normal people, with the highest concentration found in the sensory-motor region of the brain. "This difference may relate to the common observation that depressed people are much more sensitive to pain and much less sensitive to pleasure," Biegon says.

Diagnostic equipment can already detect changes in the number of opiate receptors, so a quantitative test for identifying suicide-prone patients may not be far away. "We may also find new drugs that act on these receptors," Biegon says.

—Kathleen McAuliffe

THE CRACKING SOUND FROM A SNAPPED WHIP IS A MINI SONIC BOOM, BREAKING THE SOUND BARRIER BY ATTAINING SPEEDS OF UP TO 700 MPH

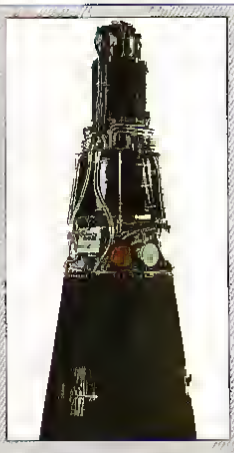
REACTIVE BUYING

In a switch from the usual direction of technology transfer, the United States recently completed a deal to buy a nuclear reactor—from the Soviet Union.

The Department of Energy, the Strategic Defense Initiative Organization, and the Air Force will pay the Soviets an as yet undetermined fee for the Topaz II Space Nuclear Power System, a reactor similar to the one that has been powering Soviet satellites for years.

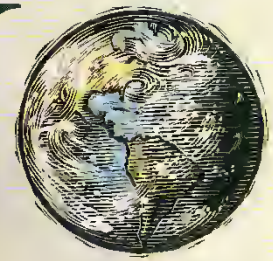
Studying the Topaz II would save the United States both time and effort in developing a similar space nuclear power system. "We can learn some things about how it is put together and operated, and apply that knowledge to the work we're doing on our program," says Tom Miller, chief of the Nuclear Propulsion Office at NASA's Lewis Research Center. According to Joe Nieberding at the Lewis Research Center, nuclear power may replace the traditional photovoltaic cells in interplanetary flight and on the moon, where the rays of the sun would be diminished or interrupted for extended periods of time.

—Robert W. Tinsley



We'll take it. The United States bought this Soviet reactor.

THE BUSINESS OF GOING GREEN



FEATURE
BY MELANIE MENAGH

Perched in a steel- and glass-clad monolith at 1 Beacon Street (yes, of Boston Brahmin fame) David Beckwith doesn't seem much submit to as take command of an interview. A paragon of Brooks Brothers sartorialism in his oxford shirt and power necktie, Beckwith's delivery is crisp, pointed, intense, bandying about brokerspeak terms like *capital mobility, long-term appreciation,* and *universe of attractive stocks.* During the discussion Beckwith persistently glances over at his VDT, presumably for up-to-the-nanosecond input from Dow Jones.

Another New England entrepreneur, holding forth from a converted warehouse hung with tie-dyed banners just outside Burlington, Vermont, Alan Newman converses supine on a couch. "Back problems," he says apologetically. This position enables his rainbow-socked Birkenstock-shod feet to cross and uncross for emphasis, as strains of Van Morrison filter in from elsewhere on-site. Newman's universe of attractive subjects includes out-of-body experience and a "kinder, softer spirit"—corporate style.

As diverse as Beckwith and Newman seem in dress and demeanor, they actually have a great deal in common. Both men are involved in businesses devoted to preserving and improving life on the planet for future generations by investing in green companies and green products. In fact, the very diversity of these men demonstrates that green business is no longer considered a black-or-white affair, but now attracts an entire spectrum of people who are convinced there are fortunes to be made in this field.

Beckwith is vice president and portfolio manager of a $56 million environmental fund at Freedom Capital Management Corporation, the one fund at Freedom devoted to investing in companies like Ionics, Inc., which specializes in water treatment, and Imco Recycling, Inc. These companies, Beckwith says, contribute to a cleaner or healthier environment.

Newman is president of Seventh Generation, Inc., a mail-order catalog business that features only environmentally friendly products, including organic products like aloe vera body lotion and Ecover nonpolluting dishwashing liquid. Applying textbook business principles to a field virtually unknown five years ago, Newman has built up a multimillion-dollar money-spinner.

Beckwith and Newman are successful entrepreneurs sincerely devoted to the proposition that investing in green companies and buying green products is not only good news for your conscience and for the environment but can also bring in big bucks. Says Beckwith: "The environmental track and the economic track are not perpendicular, they're parallel, they are common causes, more than competing causes." Newman agrees. "Environmental responsibility makes economic sense ninety-nine out of a hundred times."

Similar testimony echoes from boardrooms to showrooms, from the halls of the Environmental Protection Agency to the factory floor. There is money to be made from saving the planet. Today government officials, mutual fund managers, and green consumer advocacy groups agree that it makes sense financially to consider the environmental implications of all corporate decisions, from products and services to philosophy and management style.

And in the future, the experts contend, green companies will leave their "dirty" companions far behind. Government and the venture capital community will take eco-minded companies more seriously. Green investing will be the wave of the future. Americans purchasing dollars will have the power to change corporate policy; companies will sit up and listen to the green consumer. The prices for green products will actually come down, making them cheaper than their nongreen counterparts. We'll even develop modular appliances that can be easily customized. Instead of throwing out an old refrigerator, we'll buy one for life and update it—spelling the end of the concept of planned obsolescence.

On the practical level, green companies not only try to produce products that are not harmful to the environment, but also work to produce these products through processes that are kind to the environment. A green company might manufacture, say, natural cosmetics, not tested on animals, as opposed to polystyrene containers that are not easily recyclable, clog landfills, and whose production contributes to the depletion of the ozone layer.

Green products, from unbleached coffee filters to energy-efficient refrigerators, enable customers to choose items that will do minimum damage to the planet, without significantly sacrificing convenience or quality.

Beyond products and services, green companies espouse a certain philosophy and management style from the CEO on down. They understand that industry must take responsibility for its employees, neighboring communities, and the planet as a whole—not just now, but in the long term.

Products should be manufactured using the least amount of energy and producing the least amount of toxic by-products possible. Employees should enjoy decent wages and benefits, perhaps a profit-sharing program, and there should be a regular forum enabling them to voice their concerns, complaints, and suggestions to management. In turn, administrators should enlist the expertise of the EPA and environmental groups on how to best use their resources. And a percentage of profits might be earmarked for local or international green organizations.

"We got into Seventh Generation so we could leave the world in a better situation than we found it when we started," says Newman. It was Ronald Reagan, Newman claims, who, perhaps unwittingly, set the green business revolution in motion. "Reagan said that government was not going to fund social programs any longer," Newman says. "It took ten years for us to figure out that business had to step into the vacuum and start contributing to positive change."

Seventh Generation donates 1 percent of its revenues to nonprofit environmental organizations. It runs in-house seminars to educate employees on environmental issues. It is fanatical about recycling and using recycled products like cardboard shipping boxes.

What really differentiates the greens from the nongreens, however, is that green companies pay attention to a *double bottom line:* They place equal value on ecological and fiscal considerations.

FROM THE BOARDROOM TO THE SHOWROOM, FROM THE HALLS OF THE EPA TO THE FACTORY FLOOR, YOU HEAR THE CRY: THERE'S GOLD IN A GREENER PLANET.

IN OUR TIME: A GREEN, WELL-LIGHTED PLACE

Architecture and design for the green office follow two interconnected tracks. Materials and procedures employed should not be harmful to the ecosystem; and the interior environment should promote the health and well-being of all employees. Seem like pretty simple premises? Surprisingly, the majority of architects and designers today either eschew or are ignorant of these basic principles.

Not so Kirsten Childs, director of interior design for Croxton Collaborative, a New York City firm specializing in green architecture.

Croxton has designed space for several eco-minded organizations—notably, award-winning offices for the Natural Resources Defense Council (NRDC) and an upcoming project remodeling an entire building for the Audubon Society. The best way to win prospective clients over to the green side is to emphasize the cost savings offered by green design. "We don't go in and talk about the environment, we talk about what we can do to save them money," says Childs. "The NRDC is saving more than fifty percent of energy costs compared with a conventionally fitted office."

Perhaps the most significant savings derive from an energy-efficient approach to lighting.

"Lighting represents thirty percent of all energy used—not only for illumination but also for cooling costs," Childs says. Croxton is cutting down on lighting at Audubon and the NRDC by installing highly efficient fixtures, using smaller fluorescent lamps (bulbs) with electronic ballasts (solid-state sockets that increase lamp efficiency), including occupancy sensors (motion-sensitive switches that turn off lights when a room is vacated), and maximizing daylight by using glass transoms to permit it to flow throughout the office.

Cutting back on lighting not only saves energy, it also saves employees from headache and fatigue caused by eyestrain. Peter Flack, managing principal of Flack + Kurtz, the engineers working with Croxton at the NRDC and Audubon, says that adjusting the quality of light is as important as adjusting the quantity.

Flack advocates using warmer, more amber-white, less blue white, light. Ideally, light should be reflected (shining upward from a cabinet, for instance) rather than direct, which causes glare.

Air quality is another important aspect of the green office. "Sick building syndrome" has received a lot of press when disease-causing bacteria breeding in air-conditioning units have spread through sealed buildings, sickening workers.

Douglas Greenwood, manager of the Environmental Resource Program at the American Institute of Architects, based in Washington, DC, says that ironically, "the air you breathe on a city street is better than that in most offices." William McDonough, director of William McDonough Architects in New York City, is another preeminent green practitioner. "Presently, an architect has to trip though a minefield of toxic building materials," McDonough says. Synthetic fiber carpets and especially their adhesive glues emit (or "off-gas") toxins; particleboard used in office furniture off-gasses formaldehyde; oil-based paints give off fumes. Aggravating the problem is the lack of fresh air. Childs says that Croxton designs call for fresh air to be circulated through an office six or seven times per hour.

"You can tell the difference at the NRDC," she says. "Workers benefit, the air feels good all the time." Studies show that by using nontoxic building materials and proper ventilation, worker productivity increases.

Finally, green office design strives to preserve the global environment and its precious resources. The Audubon project includes a gas-fired heating and cooling system. Burning gas generates fewer noxious substances (like the sulfuric acid responsible for acid rain) and reduces carbon mon- and dioxide emissions (causes of global warming). Green designers also frown upon the profligate use of endangered species such as mahogany or teak. Bill McDonough says, "If you want to use hardwoods, buy from a source that's practicing sustainable forestry. And you don't panel an entire room with it, you use it sparingly, treating it like the precious commodity that it is."

WHAT CAN *YOU* DO?
There are plenty of simple things you can do to make your office a greener place. Most eco-minded products can be found everywhere. "We don't use state-of-the-art equipment; we just bring together materials available on the market," Childs says. And many green materials are also economical over the long haul.

LIGHTING:
- Decrease the number of lamps (bulbs) in fluorescent fixtures.
- Use task lighting (i.e. a small, individual light at your workstation) with a fluorescent (not incandescent) lamp.
- Change color rendition from blue-white to a warmer amber-white light.
- Replace conventional ballasts with more efficient electronic ballasts.
- Change fluorescent lamps from T-12 to T-8 (a smaller, more efficient light bulb).

AIR QUALITY
- Trace the path of the air you're breathing to the outdoors. Be sure you *are* getting fresh air. Air intake vents may be over a dumpster or a subway grating. Some landlords disconnect air intakes to save money on energy.
- Don't use air fresheners to dull the senses and mask problems.
- Try to use latex paints, tack down carpet (instead of gluing), install furniture made of solid wood (not particleboard).
- Talk to your cleaning service about any harsh chemicals it might use.
- Be sure anything that gives off fumes (a copying machine, for example) is properly vented.

CONSERVATION:
- Set up a recycling program.
- Use vinegar to wash windows.
- Avoid cleansers with solvents, try lemon oil.
- Skip disposable polystyrene cups; use ceramic mugs instead.
- Request that your food service do away with plastic plates and knives.
- No disposable pens (use a fountain pen) or pencils (use mechanical pencils).
- Carpool or take public transportation to work. **DO**

IN THE FUTURE, EXPERTS SAY, GREEN COMPANIES WILL OUTSHINE THEIR "DIRTY" BROTHERS. IT'S BUSINESSES' NEXT WAVE, SAYS SEVENTH GENERATION'S ALAN NEWMAN, BELOW.

Environmentalists and economists concur. Companies with this positive attitude toward the environment, on-site and around the world, are miles ahead of the competition when it comes to making informed management decisions, and they are going to see substantial financial rewards for their commitment to environmental ideals.

Earth's Best of Middlebury, Vermont, makes baby food using only certified organic (chemical-free) produce that's better for babies, farmers, and the ecosystem. Earth Care Paper based in Madison, Wisconsin, recycles paper products. It has a special ethics task force that, for instance, fielded a request from Exxon for office supplies by saying, We'll sell you our paper if you change your environmental policies. (Exxon declined.)

And shoppers in Santa Fe can find green products at How On Earth, with 2,300 square feet of merchandise, where everything—from the biodegradable floor tiling to the solar-powered company car—embodies the philosophy that green products pay for themselves in savings on packaging costs (concentrated laundry detergent sold in small, recyclable containers).

Naturally, the financial community wants a piece of the action. Green investing is a specialty for mutual fund managers at the Calvert Group in Washington, DC, who seek out environmentally responsible companies, asserting that this is a promising low-risk, long-term growth area. Green investors predict that the green movement is more than a passing fad, that cleaning up the environment will become increasingly big business, and that stockholders don't want to be responsible for a polluting company's cleaning up after itself.

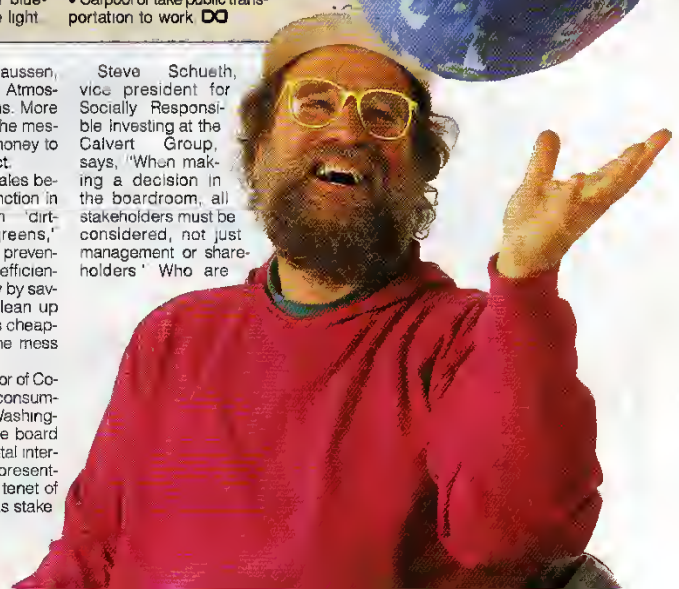
To spur America on to environmental responsibility, the EPA has developed programs like Green Lights, which encourages corporations to install energy-efficient lighting. If U.S. companies want to be serious players in the international arena, some environmentalists argue, adopting green management principles is the best way to regain our competitive edge. "The United States doesn't have to lose thirty percent of our business to lose the edge, we can lose five percent," says John Hoffman, director of the EPA's Division of Global Change. "We've got to make savings if we want to accrue capital, we'll need new money to invest if we want to be competitive in world markets. Japan and Germany use half the energy that the United States does to achieve the same productivity."

Of course, EPA officials understand that a complex array of carrots and sticks will be required to persuade industrial interests of the fiscal wisdom of eschewing their wanton ways. In addition to programs like Green Lights to encourage conservation, the EPA is authorized under the Clean Air and Clean Water acts to penalize "dirty" companies. "Industry must realize that it's bad business to be dirty," says Eileen Claussen, director of the EPA's Office of Atmospheric and Indoor Air Programs. More to the point, industry's getting the message loud and clear. There's money to be made by cleaning up its act.

"Being green will increase sales because there is a growing distinction in the public mind between 'dirties' and the true greens,' Claussen says. Pollution prevention, she says, means energy efficiency. Companies can save money by saving energy. 'It's cheaper to clean up sooner rather than later, and it's cheapest to reengineer to prevent the mess in the first place,' she says.

Alisa Gravitz, executive director of Co-op America, a nonprofit green consumer advocacy group based in Washington, DC, calls for "a seat on the board for Mother Nature." Environmental interests should be on the table, represented in business decisions. This tenet of green management is known as stakeholder management.

Steve Schueth, vice president for Socially Responsible Investing at the Calvert Group, says, "When making a decision in the boardroom, all stakeholders must be considered, not just management or shareholders." Who are



the stakeholders? Employees, the community, the planet. 'Each should be considered without preference. By doing this, management will make better, less volatile decisions.'

Some of the companies Schueth sees as appropriate for his investors at first glance may not seem typical eco-minded operations. For instance, Schueth says, Clorox is a 'strong environmental company.' Surprised? Take a closer look. Bleach is not particularly toxic,' Schueth says. "Its production, however, has a very toxic by-product, chlorine gas. But Clorox has a state-of-the-art system to treat this gas, and an emergency response system to protect employees and the community. According to Schueth, Clorox's record is good. It's consumer friendly and it supports the community and education.

Green consumers, an increasingly visible and voluble group, actively seek out goods produced by ecology-minded companies. Newman says that customers want to do business with a corporation that has a set of social values and they will choose products based on a company's track record. Arnie Koss, cofounder of Earth's Best, says that the baby food industry is a prime example of a business offering a great opportunity to tap into the sensibility of the green consumer.

We felt that if we did things right and weren't just hype, just a marketing façade, we would be appreciated.' And the company has inspired a great deal of brand loyalty among its customers. 'They see us as a company that's different, and they actually want us to succeed. What we enjoy out there in the marketplace is that most prized resource, goodwill.'

Advocacy groups such as Co-Op America are making it increasingly difficult for "dirty" companies that won't comply with green guidelines, by spurring on the public to economic activism. Consumers must realize that what they do in the supermarket does make a difference.

"People feel it's hard as an individual to do anything," says William Burns, director of environmental affairs at Earth Care Paper. "Green consumerism is a means of individual empowerment." Consumers can effect corporate change. Look at Starkist, which introduced "dolphin-free" tuna, and McDonald's, which agreed to discontinue polystyrene packaging.

"Companies are bound to sit up and listen if they want to stay competitive," says Gravitz. "When a dollar leaves your hand, it goes to companies that are either doing work you support or undoing work you support. You need to make that distinction in your mind and purchase accordingly."

Green consumerism however, does not come without its price. Many Earth-friendly products are 5, 10, up to 25 percent more expensive than their non-green counterparts. A jar of Earth's Best carrots costs 59 cents, about 25 cents more than those of nonorganic competitors. "Today many people live paycheck to paycheck, they aren't in a position to pay out a lot of extra money," says Jeffrey Wellman, manager of How On Earth.

Wellman says the store is looking at ways "to make our products more readily available to lower-income people. We're considering a deferred payment plan or setting aside one percent of our profits to assist people who otherwise wouldn't be able to shop here."

Some green products can actually be had for fewer greenbacks. Although initially these items appear to cost more, they cost less, and in some cases will even pay for themselves, over time. How On Earth sells a small box of concentrated laundry detergent. Although it costs more than the same size box at the supermarket, at only three tablespoons per load the small box will do 48 loads but costs the same as a large supermarket box that will do only 15.

While some green products offer modest savings to consumers, some can represent huge cost cuts for high-volume business customers. For instance, the EPA is trying to persuade big companies to install more efficient lighting. "They can save $21.50 per socket per year by replacing conventional bulbs with compact fluorescents," says Hoffman, who directs the EPA's Green Lights program. "For a company with several thousand employees, three or four sockets per employee, we're talking about tens of thousands of dollars saved every year."

The EPA has made believers of more than 41 companies, including heavy hitters like Bell Atlantic, Citicorp, and Nike, and it hopes to turn on Fortune 500 corporations to green lighting. "Green products equal high-value products," says Hoffman. "There might be a higher initial cost, but we're talking about value purchasing over a life cycle." The EPA hopes that corporate honchos will see the light and introduce green principles elsewhere in their companies. "It's simple," Hoffman says. "Green marketing is consistent with high-value marketing. The smart companies are no longer going to make the environment a separate issue."

Beckwith figures that cleaning up the environment is going to be increasingly big business. "The United States is spending a hundred billion dollars annually on the environment," he says. "Most experts expect that to double in the next ten years." And the major ecological problems are not going to go away anytime soon. "The companies we're investing in are resilient; their services are always in demand. Water is indispensable; garbage needs to be disposed of daily; there'll always be a need for alternative energy," he says.

Schueth argues that Calvert does not consider "dirty" industries to be attractive investments. "Our investors don't want to have to pay for a company's cleaning up its past mistakes, or for completely retooling so it doesn't make similar ones in the future," Schueth says. Delving into a company's soiled environmental past makes for a lot more work— ten times the usual man-hours researching prospective companies," Schueth says. "But obviously, there are real practical benefits from looking at both how the company is managed and its possible impact on the environment. We look at a *double bottom line*."

As to the future of green products, W. David Stephenson, a management consultant specializing in green issues, forecasts, "We're going to abandon the concept of planned obsolescence. Any consumer back out in the marketplace won't necessarily buy your product again, especially if it broke down after a year. He can choose another company's product."

Stephenson foresees the development of modular appliances, with plug-in features that can be updated and customized. Take, for instance, a refrigerator that people buy once in maybe 15 years. If that refrigerator were made of modular units—plug-in shelves that could be customized, an in-door ice-maker that could be updated every five years—companies could continue to make money off the original refrigerator. "This will develop system loyalty," Stephenson says. "And it should be an open system, sort of like computer software and camera lenses; third-party vendors will be able to use your add-ons."

Where cost is concerned, Gravitz predicts some prices will come down. Products will be made of simpler and fewer materials and have less packaging. Prices for nongreen products, however, may actually increase.

"There will be more cradle-to-grave analysis to determine the true cost of a product," she says. "If we want to be truthful to consumers, we'll have to start internalizing the presently externalized costs—the cost of cleaning up CFC pollution will be included in the price of polystyrene containers—and that will cause prices to rise." Finally, as demand increases, new technologies for recycling will be discovered, more companies will produce green products, and prices will fall.

If the experts are correct, green business will do increasingly well in the future. Gravitz says that as the population declines, "companies will be chasing after fewer customers and fewer sales. They will have to get really savvy, and the green companies will have an edge." As with prospective customers, so, too, with potential employees. "With the diminishing of the baby boom, the current employees' market will become an employees' market," she says. "Job applicants will question corporate policy, and companies will face stiff competition for the best and the brightest."

Business has to make a change because time is running out, and we'll soon be facing a point of no return. Annie Koss insists that companies must lead the way. "It is essential for business today to be responsible, not just to the bottom line—that's one-dimensional—but to the *added bottom line*, the one that considers how we can improve the environment."

Fortunately, we won't have to rely on the altruism of business. American companies are beginning to understand that green business is better business. Burns says Earth Care Paper is a "perfect example that you can make money and spread the gospel. We're a company that spends money on issues, and is doing very well." Koss's summation? "You can do the right thing—and be very successful." **DO**

ARTICLE BY ELLEN HOFFMAN

Today's money changing is slowed by multiple monetary systems Are we ready for

ONE WORLD, ONE CURRENCY?

In 1869 the British economist and journalist Walter Bagehot published a pamphlet called "The Assimilation of the English and American Monay as a Step toward a Universal Money."

"Commarca is averywhere identical," ha wrote 122 years ago. "Buying and selling, lending and borrowing, are alike all the world ovar, and all matters concerning them ought universally to be alika too.... Ultimataly the world will sea one Code da Commerce, and one money as the symbol of it."

Bagehot's "world economy" consistad primarily of America and Europe. And in Bagehot's time there were no airplanes, no telephones, no computers, and no fax machines to bridge international time zones and challenge the ability of nations to control their own aconomies. Yet his arguments for a universal currency closely rasemble those being advanced today for a single European or an even more global currency. Proponents say that such a currency would

- ancourage small businesses that lack expertise in dealing with fluctuating exchange ratas to enter international markets,
- eliminate fees paid by consumers and businesses whenever currency is converted,
- promote worldwide trade, investment, and job creation by cushioning businesses and nations against the uncertainties caused by unpredictable exchange rates.

In the last decades of the twentieth century we have seen the arrival of a global economy and such widespread acceptance of the dollar that some even call it an "intarnational currency." This has occurrad despite fundamantal changas in world currency systems, from the gold-backed dollar to the floating currancy wa have today. Major economic powers have struggled to establish systems for cushioning their aconomias against fluctuations in exchange rates. And on a global level, many nations link the value of their own currencies to the value of others, such as the French franc or the U.S. dollar. Yet most indapendent nations—except for a few that belong to currency unions—continue to issue their own currencies and use them within thair borders. Development of communications and more efficient transport have spawned not only global products that are manufactured in one country, assembled in another and sold in a third,

but also breathtakingly fast movements of money around the globe, from one country to another, one industry to another, and one currency to another.

In such a "small" world an economic or political change—a hike in oil prices, for example—can have an instant global ripple effect. Economists say that in this situation the existence of multiple currencies—especially "floating" currencies whose relative values are constantly in flux—can dampen foreign investment and trade as well as the growth of employment opportunities and consumers' choices among products and prices.

Despite the theoretical benefits it might offer, creation of a universal currency is far from commanding the attention of economists or world political leaders in the Nineties. But interest in the concept of at least reducing the number of world currencies has been heightened by the European Community's (EC) drive to establish its own currency to maximize the advantages of the "single market" scheduled to go into effect in 1992.

Imagine this: At the foreign exchange counter at Kennedy International Airport you cash in dollars for traveler's checks and a pocketful of coins and bills, both denominated in European Currency Units, or ecus. With this money you breakfast on coffee and croissants in Paris, purchase stamps and postcards in Rome, and settle your hotel bill in Amsterdam. You do not watch your travel budget being frittered away by commissions required to change your dollars into francs, your francs into lira, or lira into guilders. The ecu is not just a fantasy. It's not used in the cafes of Paris and not traded in foreign exchange markets, but a European currency called the ecu does already exist. It is used primarily for financial transactions and for keeping accounts among the EC's member countries.

The existing ecu has not replaced the traditional currencies of the 12 nations of the EC; in fact, its value is set by a formula that takes into account the relative values of the German mark, the French franc, and the currencies of the other ten EC members, making it less volatile than any individual currency.

But the approach of the 1992 deadline for a single market free of physical, technical, and financial barriers to trade and the concept that one market needs one money have intensified interest in restructuring the monetary system and creating a new European currency that would be used throughout the EC—not in addition to, but instead of the national currencies—and that would be accepted globally. (If the EC agreed on a new currency, it would not necessarily be called the ecu.)

What is the significance of the move to create a single European currency? Is a common currency necessary for free trade? Do we really need a global currency? Is it desirable? Could it happen in our lifetime? How could it happen? Who would issue the currency? Would individual nations have to give up their sovereignty?

Proponents of the single currency—which would be a feature of a unified monetary system—say it would eliminate inefficiency and the expense of exchange transactions, contribute to economic and price stability by removing uncertainties about variations in exchange rates, and increase Europe's ability to compete against the United States and Japan.

Great Britain, the only member of the EC to raise serious objections, has suggested that giving up the pound sterling would mean relinquishing its national sovereignty, and has proposed instead that the EC create a thirteenth currency that would compete with the other 12. Other questions are primarily technical, related to the search for a way to link the economies of 12 countries that have different rates of inflation, living standards, deficits, and interest rates without exacerbating, instead of

resolving economic hardships. These sorts of issues, raised by the current negotiations on European economic unity, would also arise in the event of a movement to create a global currency.

Prospects for a truly global currency seem so far-out to most economists and even to futurists that there are no well-developed plans or proposals for creating one. Even the World Federalist Association, which advocates "political and economic integration on the world level," has not focused on the currency issue because, according to field director Scott Hoffman, "it could happen only as a by-product" of a world government.

Some economists and politicians who have looked into the future, however, see the outlines not of a global currency but of a common currency for the major economic powers—the United States, Europe, and Japan—and any others that might want to tag along.

For instance, this proposal surfaced in the British magazine *The Economist* a few months after the October 1987 stock market crash: "Thirty years from now Americans, Japanese, Europeans, and people in many other rich countries and some relatively poor countries will probably be paying for their shopping with the same currency — let's say the phoenix. The phoenix will be favored by companies and shoppers because it will be more convenient than today's national currencies, which by then will seem a quaint cause of much disruption to economic life in the late twentieth century."

Admitting that their readers might have found the idea "outlandish" when it was proposed in 1988, the editors endorsed the proposal again in 1990, observing that "the new momentum towards European monetary union has put the world somewhat ahead of schedule" in moving toward a common currency for the industrial countries.

No group has put the proposal for a "phoenix zone" on a negotiating table. But the underlying concept remains alive—in fact, it garnered some attention before the article appeared in *The Economist*.

For example, Richard N. Cooper, a Harvard University economist who served as under secretary of state for economic affairs in the Carter administration, published in the early Eighties a proposal for a common currency for the industrial democracies, calling it "too radical for the near future" and suggesting that it serve as a "vision" or goal for the longer term.

One reason proponents of a more global currency are so cautious about their predictions is that creating a viable currency involves more than just minting coins or printing paper bills. According to Cooper, having a common currency implies a common monetary policy and an international mechanism to determine that policy—a central bank to produce and control the money supply. The economists interviewed for this article say that the toughest barriers to be overcome are political, not economic.

Says Gary Hufbauer, a Georgetown University economist who is an authority on European unification: "A common currency is the last stage of a lot of other integration that should take place first—freeing up trade, making migration easier, reconciling technical standards." When these preliminary steps have been taken, he says, you could get a ground swell. "At that point people will ask 'Why are we dealing with all of these different currencies?'" he says.

Because currency is produced by governments, which use it to enshrine their kings and queens and presidents and symbols of them, it is sometimes assumed that a world currency could exist only if nations gave up their sovereign rights. But Bagehot, Cooper, and the editorial board of *The Economist*, among others, all argue that although difficult, it might be possible to create a supranational monetary system and common currency and still allow nations to control their internal political, budgetary, and taxation policies.

Contemporary examples of this approach exist in Africa, where there are two monetary unions, each consisting of several independent nations whose currencies are pegged to the French franc, and in Europe, where Luxembourg accepts the Belgian franc as legal tender, although the policy is not reciprocated by all Belgians.

Cooper points out that in a monetary union of the major industrial democracies, each nation could even continue to print its own currency—with its own political symbols—as long as the value of the currency was set by the international system.

In the United States, 50 states share a currency and a monetary policy that controls the flow of money, yet currency is issued by 12 different Federal Reserve banks, and each state manages its own fiscal or internal budget policy. A similar model may be emerging in Europe, where a regional bank or other authority would issue the currency and control its supply, while each country would retain control of its fiscal policy.

Estimates of how long it will take to establish a European currency—and whether it really will happen—vary widely. During 1991, finance ministers of the EC are meeting as part of the first stage (determining how the basic charter, the Treaty of Rome, would have to be amended) of a three-stage process designed to lead to a single currency. In the second stage, the EC would create a central bank to work with the cen-

tral banks of member nations toward stage three irrevocably locked exchange rates and then, a single currency. But regardless of how long it may take, scenarios for a common currency of the industrialized democracies seem to assume that adoption of a single European currency would be a step toward, and perhaps even a prerequisite for, creating a broader currency union involving Europe, the United States or North America, and Japan.

Whether this type of union implies a leap to a global currency is another matter. The sine qua non for a common currency must be a common defense arrangement so that the countries are not going to fight each other, but are going to defend each other," says Robert Mundell, an economist at Columbia University, who suggests that a common language and culture are also important bases for monetary union.

"If the world consisted of five hundred nations of ten million people each and we didn't have a big China, a powerful United States, and a Soviet Union, we'd inevitably have to have a world currency," he says. But as long as there are supereconomies, he speculates, it's more likely that world trade will rely on several major currencies.

Even the proliferation of free trade zones, economists say, does not necessarily imply use of a common currency. In his book *Megatrends 2000*, John Naisbitt declares that there is "a big, powerful, overarching megatrend toward worldwide free trade," citing as examples accords between the United States and Canada, the pending United States–Mexico pact, the Australia–New Zealand free trade agreement reviewed in 1988, and the possibility that a Brazil–Argentina agreement could eventually form the nucleus of a South American common market.

He forecasts a "linkup of North America, Europe, and Japan to form a golden triangle of free trade" in the next century, but does not go on to predict that such trading blocs might merge their currencies, let alone forge a global currency system.

"There is no necessary connection between a free trade area and a common currency area," Cooper says. Explains Ralph C. Bryant, an economist at the Brookings Institution, "There's not an epsilon of a suggestion that the Canadian dollar or the Mexican peso should be pegged to the U.S. dollar."

Bryant, who emphasizes that he is not an active advocate of a global currency, does support closer international economic cooperation. "Rather than pulling back from financial interdependence," he says, "national governments should increase 'multilateral decision making' by paying greater attention to the effects of their economic decisions on other nations, and strengthening international organizations."

Asked to speculate about how and whether a world currency might evolve by the year 2050, Bryant said that, assuming that "integration of markets has proceeded over the decades at the same pace as it has in recent decades," preconditions for establishing the currency would include "a greatly strengthened global financial institution, a truly international legislative organization, and a level of international cooperation higher than in the Nineties."

It's difficult to know whether the creation of a global currency will take its place on the international agenda in our lifetime. The pace and surprise of economic and political developments just in the last two years—the thawing of the Cold War and the eruption of war in the Middle East—make economists and futurists wary of predicting even a decade ahead, let alone two or three or five decades.

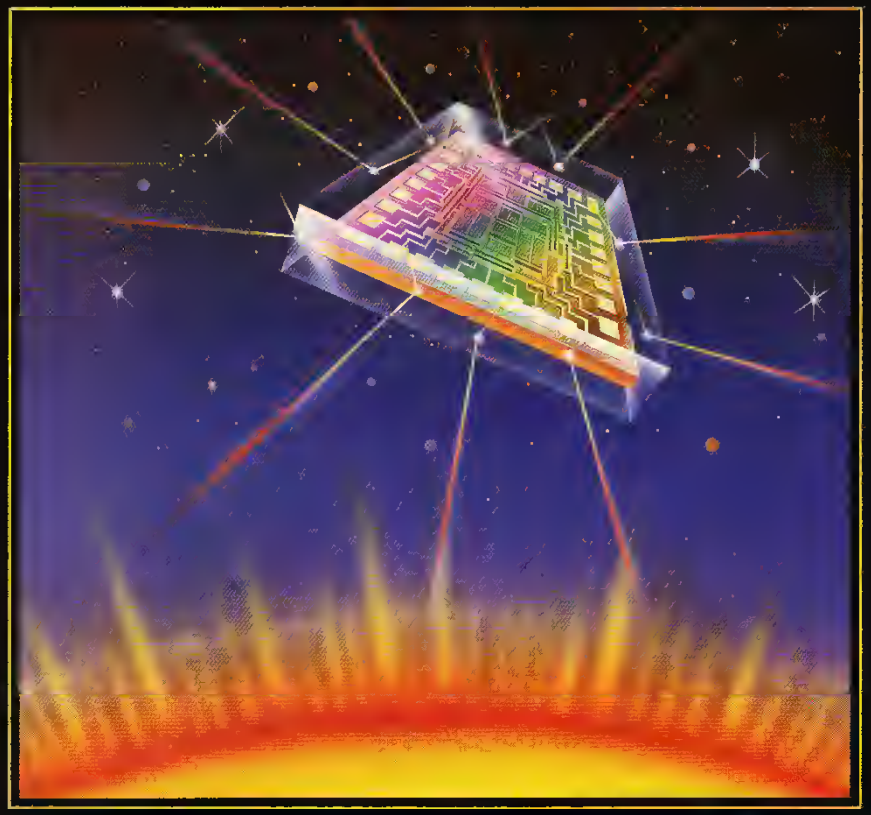
What remains clear is that powerful forces are propelling the world further down the road of economic interdependence, that political institutions increasingly need to catch up, and that any country which assumes it can insulate itself from the world economic system and still prosper faces the risk of becoming an anachronism.

Futurist Alvin Toffler has written that the rise of "global gladiators"—his term for multinational corporations and other border-crossing forces, such as the environmental movement—has generated momentum for "all sorts of new global institutions." But whether one of these should be a new international monetary structure with a world currency or whether some other alternative—such as returning to a system of fixed exchange rates—would be equally effective in promoting stability and deterring unwanted economic surprises, is still being debated.

For one thing, as Cooper points out, the communications technology that has propelled us toward global economic interpedendence has—by allowing for worldwide, instant currency transactions—made managing and manipulating the world's many money systems increasingly easier.

For the moment, given the existence of few economic superpowers and the formidable issues surrounding achievement of a world order based on more equitable power sharing, for all but the most futuristic thinkers the basic question about whether to strive for an international currency is likely to remain:

In a world where we can beat our dollars into Deutsche marks and our Deutsche marks into yen by issuing a simple command through the phone or the modem, have we already—de facto—created a global currency? ☐☐



A POCKETFUL OF MIRACLES

ARTICLE
BY LAMONT WOOD

It's a cold evening in the year 2006 as you wait at the checkout counter at a pharmacy in the wrong part of town, fingering your card, a little concerned about the cost of the pills you're buying. If only there was a card reader around ...

The man in front of you catches your attention—he flourishes one of those fancy "super smart cards" with an LCD readout and tiny keypad on one side. Probably a European—those supers are handy for currency conversion, not to mention ID and cross-border government benefits. "Borders have been replaced by cards," they say.

But you also notice that the man is being entirely too open, smiling at the clerk and making no effort to conceal the number he's punching into the verification pad by the counter.

You're disconcerted—doesn't he know what people will do for that number? True, there happens to be no one looking at the moment, but the papers are filled with accounts of "people hackers" and their "social engineering" who try to chat with you, make friends with you, mislead you, seduce you—anything to get you to blurt out your smart card's access code. Or, barring that, to learn enough about you to guess what code you would have assigned the card.

That's why you're shopping in this part of town—no one knows you. Well, that and they give you generous late-hour frequent-shopper discount points on your card. And if there are hoodlums in the parking lot, they generally ignore you if you're not wearing gold or furs. Cash can't be strong-armed anymore because nobody carries it. It's the smiling faces you have to be wary of . .

The nature of money, and the elaborate little rituals that accompany spending it, will change within our lifetime—in fact, probably within the next 15 years. While the exact nature and consequences of that change are anybody's guess, its agent is already at hand in the form of devices known as *smart cards*.

A smart card has the same profile as plastic credit or automatic teller machine (ATM) cards, and may even carry embossed lettering on its front and the familiar magnetic stripe on its back. But embedded in smart cards' slightly thicker bodies, sealed within the same resin coating that shields military satellite chips against prying, are microcomputers and digital memories. Flat metal connectors on one side of the card enable it to communicate with the world beyond your wallet.

Like ATM cards, individual smart cards will be accompanied by a personal identification number (PIN). But while an ATM's PIN simply identifies your account number, a smart card can hold the account and its history within itself, carrying money the way a postage meter carries currency.

The 15-year dawning of the age of the smart card is not a guess but rather a calculation made by Jerome Svigals of Redwood City, California, an industry consultant as well as publisher of a newsletter called *Smart Cards and Comments*. "It took fifteen years—from 1965 to 1980—for the first standard magnetic striped cards to be accepted by the major credit card companies," Svigals says. "From 1980 to 1990 about 1.1 *billion* mag striped cards went into circulation." Svigals sees a 25-year cycle: 15 years to put everything into place, followed by a decade during which a user base is built. "We're now about ten years into the initial build-up," Svigals says. "We should expect broad-scale use by 1996. By 2006 [smart cards] should be pretty much the standard way of doing business."

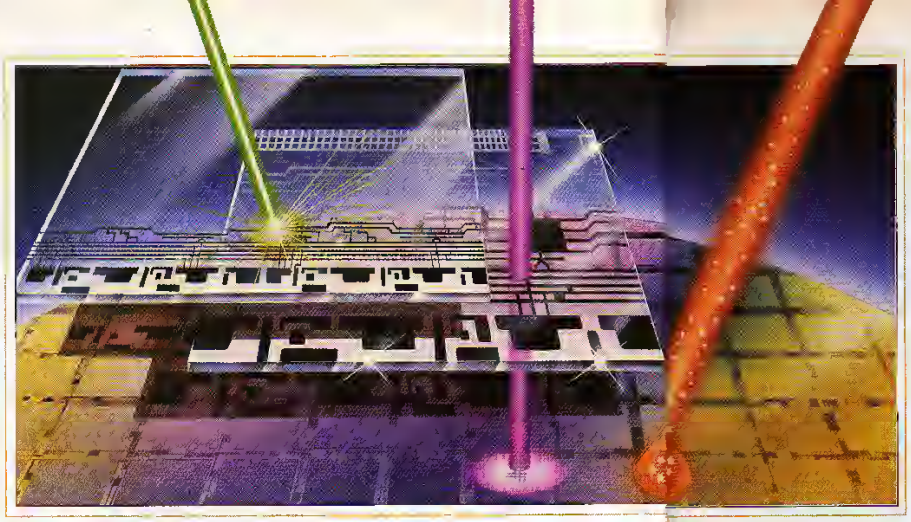
Hundreds of thousands of people, mostly in Europe and Japan, are already using smart cards. Communities like the Isle of Jersey in the English Channel have adopted the technology for local merchants, liberating foreign visitors from struggling with unfamiliar currency. Some French towns use the cards for an array of municipal services including libraries and admission to public swimming pools. In Japan, Nissan issues smart cards with new cars; the card stores both the maintenance and loan payment records. English viewers can use smart cards in pay television meters.

Where are the American smart cards? Good question. "For strange and unknown reasons, the United States is not taking up the technology," says Stephen Siedman, a consultant in Palo Alto, California, and publisher of *Smartcard Monthly*.

Actually, the technology is arriving here from different directions. Smart cards were developed in France in the late Seventies as part of a drive to modernize the government-owned telephone system. With smart

CASH AND CREDIT CARDS WILL SOON BE OBSOLETE. BUT HOW BRAINY ARE THE NEW SMART CARDS?

ILLUSTRATIONS BY ANDY ZITO



cards the French could eliminate the cost of collecting coins from pay phones. The technology has since been adopted by the telephone systems in Japan and much of the rest of Western Europe.

(In Japan, brightly decorated phone cards are commonly handed out as retail premiums. Phone cards are even given as wedding gifts, decorated with pictures of the happy couple. A collector's market has emerged, with phone cards sought as avidly as baseball cards.)

The lack of a central telephone company in the United States stymied a French attempt to export the technology here during the Eighties. Nor did the vast American credit card companies embrace the technology.

"Three years ago we decided it was too expensive to replace [existing] credit cards," says Larry Ladouceur, MasterCard International's vice president of advanced technology. Between the autumn of 1985 and the autumn of 1987, MasterCard tested about 60,000 smart cards in Palm Beach, Florida, and in Columbia, Maryland. Smart cards, says Ladouceur, were found to be a couple of orders of magnitude more reliable than ATM cards, whose magnetic stripes can be affected by magnets. No change in spending habits resulted from the introduction of the smart cards. "We are still looking at the technology very carefully," Ladouceur says. "You never know when a breakthrough is going to come."

Visa, meanwhile, is currently testing about 3,000 "Supersmart Cards" in Japan, according to Visa spokesperson David Brancoli. Supersmart Cards are essentially encryption devices with three-year batteries. A keypad on the card enables its use whether or not a merchant has a computer terminal. The user simply authorizes a transaction via the card's keypad; the card itself verifies that the amount is available, producing an authorization number that the merchant can use to receive payment, much as he would with a handwritten check.

The potential inherent in such a card calls for the addition of other services. Brancoli expects to see banks issue smart cards that do far more than handle account balances. Still, it will be a while before traditional cards are replaced. "Hundreds of millions of dollars have been invested in readers for magnetic stripes," Brancoli says, "and there is no business case for mass conversion. But we continue to support activities that would allow a gradual evolution to smart cards."

One place smart cards may catch on quickly is at the supermarket. Stores might issue "club cards" to customers, who can use them to collect electronic coupons, earn frequent-shopper points, and authorize purchases. The customers get added convenience, the stores get mailing lists and shopper preference information, something most of them have never had. Ambitious pilot projects are under way in Columbus, Ohio, and Des Moines, Iowa.

Another party looking hard at smart cards is the federal government. John Moore, co-chairman of the Federal Smartcard User Group and a computer analyst at the Financial Management Service of the U.S. Department of the Treasury, was involved in a recent survey that turned up 34 smart card programs at the federal and state levels. While many of these programs serve accounting purposes—such as tracking gas station records—about 40 percent involve electronic benefit transfers (EBTs).

A typical EBT application replaces food stamps with magnetic striped cards

THANKS FOR THE MEMORY

First cousin to the smart card, memory cards offer more power, more storage, more versatility—and may face an even longer acceptance curve before reaching consumers.

If a smart card can be thought of as a sophisticated and more capable credit card, memory cards are more akin to pocket calculators.

"Memory cards are thicker [than smart cards] and have the ability to retain memory like a hard disc or floppy disc," says Ian Irving, national sales manager of the battery products division of Maxell Corporation. "You can transfer data to the card, program the card, use it essentially as a very durable, very mobile data and software storage device."

Memory cards, says Irving, offer particular advantages over other storage media. "This is a very robust medium," he says. "A memory card can survive in an environment where a floppy disc would face problems. Extremes of weather and temperature do not affect memory cards as they do floppy discs."

Some of the applications for memory cards put even the most durable media to stringent tests. Irving cites factory environments as ideal for memory card usage. "Think about an automatic lathe installation," he suggests. "You could store the lathe's program on a memory card, then toss the card into the bin with the finished machined parts. When the bin is empty, there's the card, ready to be used in the lathe once more."

Memory cards are already beginning to find favor in the computer industry. Because a memory card has no moving parts, and eliminates the need for a bulky disc drive, the technology is playing a part in decreasing the weight of notebook computers.

Not all of the applications are so prosaic. Keith Watanabe, technical representative for memory cards at Maxell, points out that memory cards offer one of the fastest data access times in the world. That speed can come in handy in the world of auto racing, where data recorded on the track during the race can be dumped almost instantly during a pit stop, saving vital seconds for the pit crew to make necessary adjustments to the car.

While smart cards are considered in many ways to be disposable, memory cards have a longer life. A smart card, for example, might be electronically charged with a certain value, which is reduced each time the card is used. When the card's value is used up, it's simply thrown away.

Memory cards, on the other hand, are designed to last. The card's internal memory is battery-backed, with battery life determined by the card's memory capacity. "Depending on the amount of storage," says Irving, "memory cards have a battery life of two to five years." The battery is replaceable.

Because they're more sophisticated, memory cards are more expensive to produce than smart cards. "At the moment," Irving says, "cost of media is one of the things standing in the way of widespread acceptance of memory cards." Production cost is directly related to the card's capacity.

A memory card costs from $10 to $2,000 depending on the type of card memory and its capacity. The smallest memory cards offer about 10K of memory, while the largest can store eight or more megabytes of information.

"Naturally," Irving says, "the cost of memory will decrease with increased use of the technology."

The cards' high degree of storage capacity—the equivalent of hundreds of typewritten pages of data—is, Irving believes, the factor that will ultimately lead to widespread adoption of memory cards. Credit card companies, he points out, are already offering more and more services, adding more and more value to their cards. "As this trend continues," Irving says, "the credit card companies will need to access more data from each card. Memory cards should offer an effective solution."

There's another advantage to the cards. Memory cards disseminate data to individuals rather than storing it in central databanks. "For example, each customer of a video store," Irving says, "would carry his own records with him at all times. While the initial cost to the store might be higher for the cards themselves, the long-term costs could be lower because you've eliminated the need for a central computer."

—Patric Hellmaan

SOME SMART CARDS WERE BITTEN TO DEATH BY U.S. MARINES.

that require online authorization—the card reader is connected by telephone lines to a central databank. A pilot program involving "off-line" smart cards is scheduled to begin this fall in Dayton, Ohio, because the smart cards carry their information with them, the benefits transfers can be accomplished without costly long-distance telephone hookups. Organizers of the project hope smart cards will reduce the telecommunications overhead and also allow EBT use in places not reached by phone.

There's only one place in the United States where smart cards have replaced cash, the Parris Island Marine Corps Recruit Depot in South Carolina. Jennie Fleitner, comptroller of the post exchange, says the PX made the move to smart cards in 1987 to eliminate the drill instructors' nightly cash inventory for each recruit. Now there are as many as 6,500 smart cards circulating through Parris Island at one time.

According to Fleitner, no cards or PINs have been stolen since the program began. Recruits are told to give one another privacy when punching in their PINs. The biggest problem has been the marines' tendency, their hands full as they stand in line, to hold the cards in their mouths. Some cards have been bitten to death.

Pilot projects and test introductions do not a national smart card program make. That lack of national consensus and direction may come back to haunt us—in the form of several cards doing what a single one could do as well.

"The advantage of plastic cards is marketing," says Svigals, "and no one who issues one is ever going to share it. You'll be dealing with a lot of industries—banks, airlines, supermarkets—and they'll see no reason to share."

And so, rummaging through all the cards in your wallet, you get to the counter and plop down the pills your doctor prescribed after you had that incident while watching President Quayle's inaugural address. The pharmacist had routinely scanned your health insurance smart card to check the prescription against the list it contains of other drugs you've been dispensed, looking for duplications or contraindications. None came up, but the pharmacist would be liable if she didn't check.

You give a card to the clerk—and he looks quizzical. Oh—that's your high-definition VCR program smart card—it stores the settings you like and saves you from having to read the 300-page manual. You fish through your wallet for the right card. The clerk swipes it and casually eyes the digitized picture of you that the card just put up on his screen. Despite all the jokes, no one pays much attention to your smart card picture—what matters is that you have the PIN. You huddle over the keypad, not wanting to be seen, but wanting to get the number right—after three failures the card locks up and you have to take it back to the bank.

But you get it right and the cash drawer unnecessarily plops open—it's an older point-of-sale terminal and can't help itself. The clerk wanly eyes the contents before shutting it. There're some bills in there. The day is almost over and there's money in there that someone will have to do something with. The boss won't like that.

"Here—would you like some money?" he asks, awkwardly holding out some of the greenbacks. "We'll sell them to you on your card."

You find yourself eyeing the pieces of paper—you'd forgotten there'd been another President Jackson. The clerk is still waiting. But he doesn't offer any discount. "Oh, no thanks," you stammer. He looks disappointed. You get your package and trudge into the cold. But your mind is still on those greenbacks. Pieces of paper treated as if they had value simply because they had pictures and numbers printed on them, you muse.

What an odd idea. ∞

OFFICE: 2020

CONTINUED FROM PAGE 12

She took a sip and picked up the faulty sensor that had ruined her plans for New Year's Eve. Finding it in the early hours had tested her ability to stay awake as much as her analytical skills. Both came with the territory. Con Ed's program was supposed to give interns hands-on responsibility, and this experience certainly fit that category.

As Rachel dictated, she pictured Joe Scanlon's reaction to her story. The maintenance supervisor's veiled skepticism about her abilities had been proved wrong. She'd shown him! But her party dress was hanging in the closet, and here she was in jeans and sneakers with just a robot for company.

Uh-oh. She'd lost her train of thought. "Come on, Rachel, get back on the ball," she told herself. A single keystroke, and her terminal screen brought up a typed text of the material she had just been dictating. She saw where her narrative had begun to stray. Backing up the recording to that spot, she began again. No sense quitting when you're almost done.

About an hour later, Rachel emerged with briefcase in hand from the power plant into pale winter sunshine. First Avenue was unnaturally quiet, with most New Yorkers still resting from their New Year's Eve celebrations. The fresh air felt good, and she began to cheer up.

She walked two blocks north and soon reached the shelter at the nearest bus stop. "When will the next number-nineteen bus arrive?" she asked.

From long habit, she had moved close to the microphone and cupped her hand to one side. On normal days, traffic noise tended to confuse the bus stop's voice-recognition system, forcing some would-be users to repeat their questions.

"The next number-nineteen bus will arrive in approximately eleven minutes. More than fifty percent of the seats are vacant at this time."

"I'm going crosstown on Fifty-seventh Street. How long will I have to wait for a westbound bus?"

"Approximately fourteen minutes. Holiday schedules apply today."

"I want to get to Fifty-eighth Street and Ninth Avenue. Is there a faster way?"

"No faster routes are available this morning."

"Thanks," Rachel said unnecessarily. Even though talking computers had been part of her life since childhood, she couldn't help speaking to them as if they were people.

With more than ten minutes to kill before the bus arrived, she decided to check her mail. Reaching inside her coat, she retrieved the telephone she normally carried in her jacket pocket. "Home control, please," she said. Since it was too cold to retrieve her laptop from the briefcase at her feet, she elected to receive spoken summaries of her messages.

"There are eleven items in the active file, including four new ones," her home computer reported. "Two were received in facsimile form and appear to be unsolicited advertisements. One is from the Student Travel Agency, and the other contains a discount coupon on pizzas for Fordham University students."

"I don't want to see the travel flier, but save the pizza coupon. What else?"

"A seventy-nine-word E-mail message from Professor Lynch. Shall I read it to you?"

"Yes, go ahead."

"Rachel: I've just finished matching up next semester's internship preferences with the available slots and am happy to tell you that you are getting your first choice. Your contact will be ROBERTO SALAZAR. Working in a cosmetics packaging operation will be quite a change from the power plant, but

that's the idea. We want our M.B.A.'s to experience the full range of the business world. I'll be anxious to read your term paper on Con Edison. Good luck. Rachel."

"Remind me to call Salazar tomorrow afternoon, and cross-index him under 'Spring Semester.'"

"I have added the reference and will call ROBOSALAZAR to find out when Mr. Salazar will be available to speak with you."

"Fine. What else do you have?"

The final item was a short voice message from Michael. "Hi, it's one minute to midnight. Happy New Year and happy birthday. I'll call you tomorrow."

"Happy New Year to you, too," she whispered to herself, hurt that he hadn't added anything more personal. Breaking their New Year's Eve date to baby-sit that ailing superconducting generator had put a momentary crimp in their relationship. But the job had to get done.

The soft whine of the bus interrupted her thoughts as it slid to a stop in front of her.

Once on board, she selected a seat in an empty row. Firmly resolved to put Michael out of her mind, she retrieved her laptop computer from the briefcase and activated the unit's voice input by pressing the multicolored broach pinned to her collar. A Christmas present to herself. Like most of her friends, Rachel changed lapel microphones to match her clothes and mood. Next she snapped her pocket telephone into its socket on the laptop and almost immediately received a log-in prompt from the network servers. After establishing her identity via a short, spoken dialogue, she retrieved an electronic camera from her briefcase and proceeded to transfer the photos she had taken that morning into the system's image files.

The term paper was in pretty good shape. The history section reviewed the prolonged battles over the greenhouse effect that ultimately transformed the world's mix of energy sources, and how the world's industrial powers had not only been forced to cut their own energy consumption but had also financed a global program of power generation based on nuclear energy. "Not bad," she thought, but the more recent developments needed polishing. Topic by topic, she proceeded to shape the reference material she had assembled into readable paragraphs—continuing progress toward fusion energy, the competition between French and Japanese firms supplying fail-safe fission reactors for the U.S. market, and the rates at which users of fossil fuels were converting to electricity or electrically created hydrogen.

Supplementing her voice inputs with the laptop's touch screen and keyboard, she proceeded to assemble the rest of her report. A quick call to the New York Public Library produced a nice *Washington Post* photograph of the massive antinuclear rally that marked the high point of the controversy. Scaling it to size, she inserted the image at an appropriate point in the text and authorized payment of the fee for its use, but only after making sure that she would only be charged the "noncommercial" rate.

The imminent arrival of the bus at Fifty-eighth Street interrupted her progress, so she returned the laptop to its case. Instead of logging off, however, she merely used her cordless microphone to continue dictating. By the time she was seated in the crosstown bus, she had finished first drafts of all the remaining sections. She decided to defer reviewing the typed copies that the automatic dictation system had created until she could confirm that the overhauled generator was back in service. More out of habit than real interest, she reopened her laptop and scanned the TV listings. Idly, she flicked on a game show. While Rachel usually enjoyed competing against other viewers and had even won once, today's topic didn't really interest her. "If all else fails, there's always more homework," she thought as she flipped to the university's "classroom" screen and downloaded a videotape of a seminar she had missed.

> "Breaking their New Year's Eve date just to baby-sit with that ailing superconducting generator had put a momentary crimp in their relationship."

Rachel's class did not meet in traditional classroom lectures. Instead, the professor and his students met via multimedia conferencing. Since Rachel hadn't been at her workstation at the scheduled time, the conferencing system's connection had automatically defaulted to her personal "answering machine," giving her a televised recording of the proceeding.

Starting the playback, Rachel saw the familiar row of snapshot-size windows across the top of her screen. Most contained televised head-and-shoulder images of the professor and the other students. Only hers and that of another absentee remained blank. Small icons indicated that both absentees were getting real-time video recordings for later review. Each participant saw a similar screen and could converse with the others in a face-to-face manner, thanks to small video cameras mounted atop each workstation's display.

The major portion of the screen provided a space that served as a multimedia "blackboard." In order to reinforce a point about the effects of technology on productivity, the professor started by showing a film clip of a corporate file room taken in the early Nineties.

"Hard as it is to believe today," he began, "most office work depended on paper records as recently as twenty-five years ago. In the early Nineties, for example, office workers filed more than a quarter of a trillion paper documents each year in the United States alone. Placed side-by-side, one year's filing cabinet production would have spanned the entire North American continent from ocean to ocean."

"But they had facsimile and mass storage media in those days, didn't they?" one student asked.

"Yes, but it took a while to integrate the pieceparts. Imagine how it must have been, fumbling through papers by hand instead of just letting an optical character reader scan the stored images and get the meaning out. What a waste! As you know, computer manufacturers advertised paperless offices as early as the Sixties. But those systems only accommodated typed data. No wonder they didn't work."

"Bad as America's office productivity was in the last century, Japan's was even worse. As U.S. manufacturers began to match Japan's factory productivity in the Nineties, the Japanese could no longer afford to maintain their antiquated office methods, especially since Japan's industrial competitors had largely unburdened themselves of the need to maintain massive defense budgets."

The lecture continued, but Rachel's attention wandered. A blinking icon indicated an incoming call from Michael. She stopped the lecture and took the call. To her surprise, Michael's face didn't appear on her screen. Instead, she found herself looking at a half-grown German shepherd, comfortably scratching its ear.

"Hi. We've just come back from a run through Central Park," she heard Michael say as he moved into view. "We had a great time, but Ludwig is covered with mud. How about coming over and helping me give him a bath? I'd offer to make lunch, but I don't have much in the house."

"That's okay," Rachel smiled. "I'll bring along a pizza." DO

For ten years Paul was the unchallenged master. Decades later, he still inspires

A BRUSH WITH GENIUS

BY FORREST J. ACKERMAN

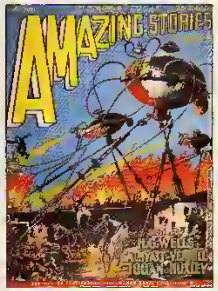
From 1926 to 1936 Frank Rudolph Paul knocked the sox off young American sci-fi fans, introducing them by his artwork to H.G. Wells, Edgar Rice Burroughs, and others. Our optics were dazzled by the brand-new worlds of the magicolored covers that first lured us inside the prescient pages of *Amazing Stories* and *Science Wonder Stories*. By Paul. Paul above all. There were other science-fiction artists of the time—but none could hold a palette to Paul.

He was guest of honor at the first World Science Fiction Convention in 1939. Among the 185 attendees honoring Paul was Ray Bradbury, and of this legendary legerdemainic artist Bradbury acknowledges:

FRANK R. PAUL

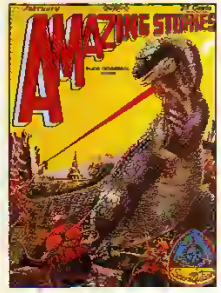
Was it he then that first drew me into science fiction and the far future, and not the authors inside the incredible copies of *Amazing Stories* and *Wonder Stories* in 1928 and 1929 and 1930? Is he responsible for my life, almost more than any other influence, because he widened my eyes and opened my soul? Did he cause me to be ready for Buck Rogers, Tarzan, and Flash Gordon, with Jules Verne and H.G. Wells to follow? Yes. It was his cities, of course, those huge and gravity-defying architectures of some impossible time beyond my own life. When I saw his magazine covers when I was eight, I wanted to run into Frank R. Paul's skyscrapers and stay as a permanent dweller. If there were other painters and illustrators of futures somewhere in the world, I did not yet know them. He was sufficient. He hyperventilated me long before that term arose in our language. Because of him, when I walked through the Chicago World's Fair in 1933 I wept on the train heading north to Waukegan at midnight, longing for that future that I left behind. Stunned with the architectures of some far year, I began to dream my own city blueprints and build papier-mâché towns in my backyard, illuminated by Christmas tree lights which promptly razed the towns with short-circuit fires. And when the cities burned, I trapped them on paper and began to write. So much for the Beauties, the architectures, of Frank R. Paul. What about his Beasts? For surely Paul created both. Not just one Beauty but many. Not just one Beast, but Beasts multifold. And the astronauts caught between? Not human at all. Dead in the moment of birth. Mere cardboard cutouts with almost Little Orphan Annie eyes, cartoons created merely to stare upon the miracles of buildings that soared halfway to the moon, and creatures exiting such buildings by the scores of thousands, proving again and again the fecundity of the Universe. The astronauts were there as stiff mannequins to gape at encounters with intelligent worms, seals, spiders, mollusks, bright pterodactyls, and even brighter upright-wandering Beasts that by their very intelligence, will, and morality (not always, but often) proved themselves more than human. For Paul, and the authors he illustrated, proved that humanity is not a

Although confined within an artificial environment, a time traveler from the future has no problem defending himself or making his laconic remarks about the state of civilization perfectly clear. From "The Machine Man of Ardathia" by Francis Flagg, in *Amazing Stories*, November 1927.

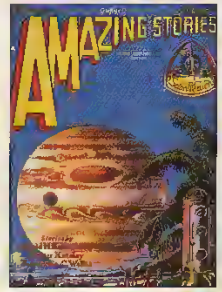


Eleven years before Orson Welles and the Mercury Theater group shocked America with their radio broadcast adaptation of H.G. Wells's *War of the Worlds*, Paul's cover illustration for the August 1927 edition of *Amazing Stories* gave readers a potent rendition of the Martians' war machines, pictured here decimating nineteenth-century England.

Nine-year-old Forrest Ackerman was inspired by this Frank R. Paul cover from the October 1926 issue of *Amazing Stories* to become an SF writer.

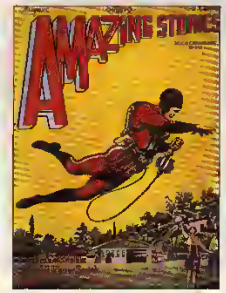


The "aliens" pictured here, firing death rays at a dinosaur, are really moon men from the past who visit Earth only to find it inhabited by thunder lizards. Paul, who trained as a draftsman, makes excellent use of the available space on the February 1932 cover of *Amazing Stories*.



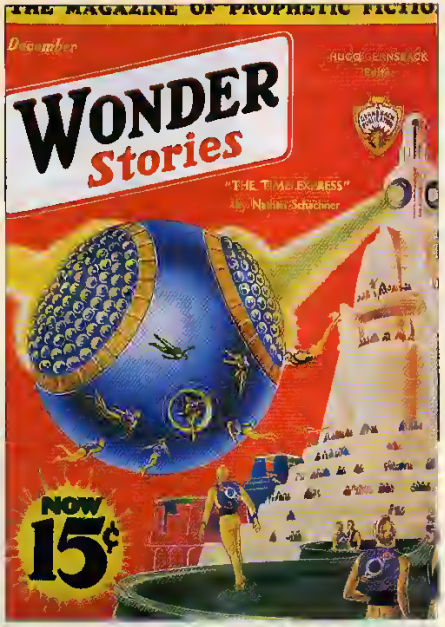
Earthmen gaze upon the luminous planet Jupiter from one of its moons. With the exception of the Great Red Spot, placed in the wrong hemisphere, note how closely Paul's representation of the giant planet matches the images sent to Earth by the Voyager probes some 50 years later.

During the 1920's, SF art was still searching for an identity. Paul's work with contrasting primary colors and action scenes helped define the genre. This cover, picturing a scene from "To the Moon by Proxy," by J. Schlossel, shows a lion expecting to make short work of an apparent human thrown into his arena. The beast gets an unpleasant surprise when it proves to be a metallic robot.



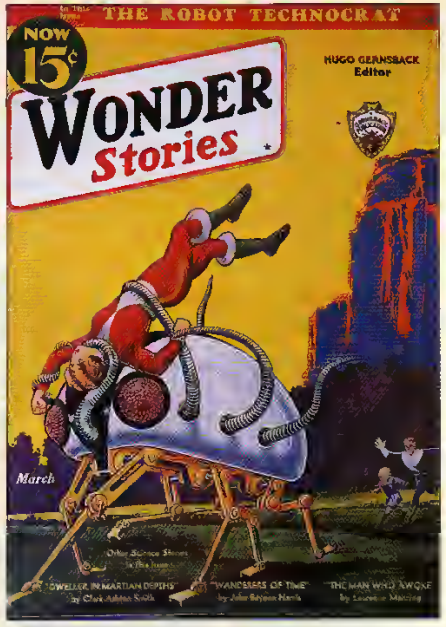
The August 1928 *Amazing Stories* introduces none other than Anthony "Buck" Rogers, although the floating man on this cover illustration pictures Richard Seaton, the trailblazing star created by Edward Elmer "Doc" Smith in "The Skylark of Space."

In "The Second Swarm," by J. Schlossel, the Earth has been invaded by creatures from another star system. The Earthlings respond by sending a gigantic, mile-long starship, capable of traveling light-years, to the nearest star system to parley with the aliens and colonize planets.



Newsstands of the Twenties and Thirties were crowded with magazines. A Paul cover almost guaranteed strong sales. In the December 1932 *Wonder Stories* Paul illustrates a scene from Nat Schacher's "Time Express" where tourists relax in the future.

Paul made sure he read the stories he was commissioned to illustrate, and he had a flare for selecting dramatic scenes that would sell a magazine. This cover illustration (above, right), from the March 1933 *Wonder Stories*, shows a time traveler locked in the grips of a gigantic machine that is operated by ants.



Opposite page, right: This 1930 edition of *Air Wonder Stories* features a war machine that effectively neuters the threat of fighter planes under development at the time—a flying buzz saw that shears aircraft in half.

Opposite page, below: The picture that generated thousands of words—the November 1929 issue of *Science Wonder Stories* featured a contest asking readers to shape a story based on the Paul-illustrated cover of a flying saucer carrying off the Woolworth Building, then the tallest in the world. The prize-winner received a $300 cash award, a king's ransom in those days.

shape, size, texture, color, or language, but a concept. He gave us inhabitants of the Light, animal concepts in word and deed, capable of behaving better than their visitors from the Third Planet. So we were engrossed, month on month from the late Twenties on up into the Thirties, by cities that promised eternal joy because they flew our souls to land on their ramparts, and by the witty animals who invited us to perambulate their alien shores and did not eat us like oysters at the end of our stroll. Beauties and Beasts. Cities and aliens. Say this. Then say. Frank R. Paul. They are one. And being one, widened our eyes, our minds, and then our souls. We promised, with love at first sight of his monthly art shows, that we would grow up but not old, and try our damndest to live forever.

—Thus spake the Martian Chronicler

Who could hope to compete with the wonderful word wizardry of Ray Bradbury? Still, I employ this opportunity to shout to the world how the October 1926 issue of *Amazing Stories*, graced by Frank R. Paul's amazing cover, levitated itself right off the shelf at my neighborhood magazine rack and wafted on wings of wonder into my waiting arms (all nine years of them). In ensuing months and years I beheld flying saucers (20 years before the first reported UFO sighting in 1949) kidnapping the Woolworth Building and the Eiffel Tower . . . an astronaut greeting a twice-his-size bulb-chested Barsoomian with feathers, telescopic eyes, and antennae . . . a Gl*ant* (sci-ants fiction!) towering in its formidable formic might over a cowering man . . . marvels both Brobdingnagian and Lilliputian, a pyrotechnic kaleidoscope, the supernel supremundane. By the master of imaginative art. The maestro of the marvelous. This modest man, born in Austria in 1884, student of art in Vienna, Paris, and New York, was discovered by the Luxembourgian immigrant Hugo Gernsback, "Father of Science Fiction," who employed him to illustrate *Electrical Experimenter* and *Science and Invention*, the *Omni*'s of their day before the birth of *Amazing Stories*. Perhaps the most astonishing fact of all is that Paul was not primarily an illustrator of science

CONTINUED ON PAGE 84

FICTION BY PAT CADIGAN

JOHNNY COME HOME

There was nothing for me to do in Moscow but drink.

Well, that and look for Johnny, and I no longer really had to do that. The Sense told me he was in the city, eventually our paths would cross and I would reel him in. But until that happened, I had to do something and drinking was it. Bars as Westerners know them were still relatively new in Moscow. Most of them little more than empty storefronts with the bare essentials; if you wanted atmosphere, you brought it with you. Or, if you were an especially wealthy tourist, you could go to one of the headjob parlors, where they gave you a happy-hood and a couple of gloves so you could enjoy your Stoli in whatever virtual environment they

PAINTING BY BILL VUKSANOVICH

So there I was, boozing and cruising in Moscow. They all envied me back home.

were running that night—provided, of course, you'd made your reservation the required six to eight months in advance.

I figured it was artificial reality either way and not being an especially wealthy tourist, I opted for the austerity plan. Besides, in Moscow it was the booze that carried importance, not the place where you drank it, and Stoli seemed to have a deeper understanding of the drinking organism. It certainly understood me. Besides being mellow and friendly, it had the salutary effect of enhancing the Sense. The bad news was that sobering up dulled me, but that was easy enough to take care of.

So there I was, boozing and cruising in Moscow. They all envied me back home—it [illegible] to fetch Johnny and I got to go to Russia to [illegible] first time I'd ever [illegible] the North American continent, too. But here's a little home truth for you (and why not home truth, seeing as how we've had the awful truth, nothing but the truth, and cheap truth, God help us each and every one): One place is pretty much like another, and once I understood what I could do in Moscow, I might have been anywhere, the language difference notwithstanding. Even now—or maybe especially now, in the last weeks before the millennium turned. Well, not a full turn—next year would be the real first year of the new millennium, but everyone in the world seemed to be stuck on the idea that 2000 was the big year. Certain ideas die hard, and others don't die at all. Like Johnny's ideas.

He could live a thousand years himself and never give up on those sweet, mad ideas: master of my fate, captain of my soul, world full of miracles, tomorrow's another day (or another millennium), anything can happen and it probably will.

Yah. Dream about it, Johnny. He'd be doing that right now, somewhere in Moscow, living in his own brand of artificial reality, dreaming hard enough to [illegible] someone wh-

I held my place at a bar that had once been some kind of counter—kitchen? grocery?—it was hard to tell in this light—in another dingy ex-storefront.

As usual, there were lots of foreigners. Some were tourists and business travelers, but a good many of them were what the government was calling "temporary long-term." No doubt plenty of those were skating along on forged papers, hoping to find some way to establish residency later. Russia had been through a lot of changes in the Nineties right along with the rest of the world, but people themselves never really change, no matter where they are. Nor do situations. That's some more home truth, and you could figure that one out even without the Sense.

So *I* maintained, anyway. The Sense is not one hundred percent infallible but the group back home believed it was a constant all-over advantage. I was of two minds, you should pardon the expression, about that myself, and it sometimes caused more friction among us than Johnny's periodic coop flying. "Loyal opposition" is not an easy concept to put over to organisms like us, but we all understood disloyal opposition. We had Johnny. Or we would when I brought him home again, tired disillusioned, and hung over from his freedom bender to play docile prodigal and rejoin. Until all those sweet, mad ideas built up enough to set him off again.

I was on my third Stoli, watching the bartender sort out orders and make change, when the front door opened wide with a blast of frigid winter air. Over the multilingual gabble, someone started calling for papers in six different languages, and the person on my left dropped like a stone.

I looked down. A pretty, heart-shaped face framed by dark blond hair looked back up at me, eyes wide.

"Pamageeteh menye," she whispered. *Help me.*

I was on the verge of telling her I wasn't Russian. Then I moved so that I was standing directly in front of her, my ankle length coat spread to hide her. She had been at the end of the bar next to the wall, so perhaps no one had seen her duck. Even if someone had, this wasn't the type of crowd that would alert the immigration officers now moving through the place and shining flashlights on documents held up for inspection.

Chatter became hushed and most movement ceased, except for the sweep of the flashlight beams standing out hard in the smoky air, like light swords in some old science-fiction movie. The bartender moved slowly down the counter, picking up empty glasses, running a rag over the chipped Formica, until he came to where I was standing. Folding his arms, he leaned against the wall and looked around in an aimless, bored way before letting his gaze rest pointedly to my left.

I showed him my passport and shrugged.

He made a fist, wincing. His thoughts were like a bellow in my skull, a mostly incoherent expression of anger, at me with my coat so obviously spread, at the woman hiding behind it, at the immigration officers, at the world in general for interfering with him. He was very young, one of the post-*glasnost* generation, with no memory of a different time, when this empty storefront would have been equally empty even with a store in it, when he might have begged the blond's blue jeans from her to sell on the black market and ended up crouching in the dark with her, hiding from KGB, not immigration.

Or perhaps he was a member of a hate group. I could get no clear indication from him. Even with plenty of warm Sense-enhancing Stoli in me, his tension was an occluder.

The bartender's gaze shifted and I turned to look at the immigration officer now standing on my right. Without moving my elbows from the bar, I showed her my open passport. In the peripheral glow from the flashlight, her face was calm, unworried: she might have been an acquaintance looking at pictures of my family.

She moved the flashlight beam to my face. I stared past it to the two pinpoints of reflected light, all I could see of her eyes now. Everything stopped.

After a while, she said, "Thank you, Maria Tell." her accent making the words musical. She held her head high as she turned around. I could feel the bartender staring hard at me as the woman made her way to the door, where the other officers were waiting. They filed out in another blast of Moscow winter wind that cleared a little of the smoke and briefly overrode the ancient space heaters. I could still Sense her aching feet, her fatigue, her discomfort in the cold, her wish that they could just give this foreigner watering hole a last once-over and leave empty-handed, through for the night, and if by chance there were refuseniks with forged papers among the crowd, then please don't let her have to find them. let it be one of the others who would have to stay up the rest of the night inputting and contacting embassy officials and whatnot. All she wanted was to go home and see what had been downloaded from the International Net.

That made me the genie who had granted her wish. No wonder she'd thanked me so politely.

The blond emerged from under my coat, swiping at her mussed hair and looking dazed, as if she had just awak-

'Contact the Census Bureau and tell them we have an update.'

CONTINUED ON PAGE 87

Suffering from runaway inflation? Foreign debt through the ceiling? Send for Dr. Economy. He's willing to make house calls, and his fast-working prescriptions could make your country boom in the twenty-first century

INTERVIEW

JEFFREY SACHS

Helmeted goons firing tracer bullets at crowds, peasants toppling statues of dictators, tanks rolling over the legs of women. These are horrific visions of politics, not science. Unless you are economist Jeffrey Sachs of Harvard. Sachs's laboratories, where he tests theories and charts prescriptions, are nation-states. The clients of this high-risk consultant are governments in crisis. Revolution and runaway inflation are his stock-in-trade.

Because the economic consequences of political upheavals have traditionally been so resistant to plan and prediction, the theorists of "economic science" have hedged their bets in these arenas and stayed in their ivory towers, where, it's said, if they were all laid end to end they still wouldn't reach a conclusion. But Sachs dares to go hands-on. At thirty-six, he is a mop-top, globe-trotting wunderkind, an intellectual gun for hire who is as often on an airplane as he is at home in Cambridge, Massachusetts.

PHOTOGRAPHS BY ROBERT ESSEL

A dozen governments in Latin America and Europe have lined up for his advice in the last six years, and no wonder: Sachs delivers. In Bolivia his strategies reduced hyperinflation from 60,000 percent to an annual rate of 12 percent.

How did Sachs end up on the world's stage with top government ministers clamoring for his wisdom at such an early age? Economist and sage John Kenneth Galbraith says Sachs "inspires a great deal of confidence." Nor is there anything astonishing about his youth to Galbraith. "I was the price czar of the United States at the same age," he says. Sachs's talent, explains his Washington partner, economist Homi Kharas, is to "translate complex theory into powerful and simple terms that persuade politicians and others to support a program."

Addicted to economics from an early age, Sachs conducted a veritable blitzkrieg on his Ph.D. at Harvard, completing the course work by the end of his first year of graduate school. And within three years of earning his Ph.D. he had become a full professor.

In 1986 Bolivia, beset by galloping inflation, sent a delegation to Harvard for help. Sachs became an adviser to Bolivia's president and by all accounts can take much credit for the inflation-puncturing policies. Fernando Romero, banker and former planning minister in Bolivia, says Sachs "made our reform plan consistent and complete and found ways to cope with the often brutal social costs of readjustment."

A key part of Sachs's success involved persuading overseas lenders to forgive half Bolivia's foreign debt. But some U.S. bankers holding the bag were less ecstatic than the Bolivians. Sachs is a "paid flack for the countries of Latin America," growled Citicorp's ex-chairman Walter Wriston. In fact, Sachs, together with two partners, consults under the aegis of the United Nations University in Helsinki and gets paid by the university and foundations.

With more nations in hyperinflation than ever before, Sachs's advice is increasingly sought after by other Latin American countries. But real superstar status arrived when he was picked as head coach for Poland in its dramatic switch to capitalism. Facing down doubters, he insisted that Poland brave a short-term leap in prices (soaring some 600 percent so far) to commit wholeheartedly to capitalism. So far, Sachs seems vindicated. Ground-level business opportunities are flourishing in Poland, although the outcome is still in the balance.

Catching Sachs is like chasing Red Adair on the way to an oil-rig fire. "I don't suffer from jet lag," laughs Sachs, "because I'm always tired!" Interviewer Anthony Liversidge first intercepted him in Manhattan, where Sachs had come to address the exclusive Council of Foreign Relations on the outlook in the Soviet Union. Arms extended, hands firmly on the lectern throughout, Sachs fielded the notoriously tough questions from the audience in this august club with supreme confidence.

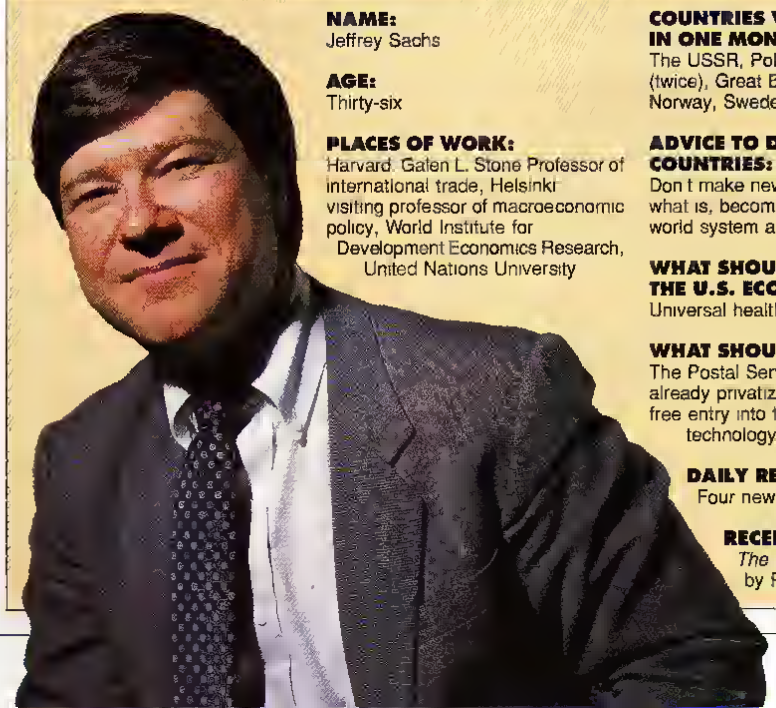
Omni: Is global capitalism the future of the world?

Sachs: The future of the world should be a movement toward an integrated world economy, based largely on private ownership. I guess that means a global capitalist system.

Omni: A bit of socialism mixed in there, perhaps?

Sachs: Capitalism today is a very complex system with a large role for the state, with some state ownership and so forth. Nineteenth-century capitalism is dead. Eastern Europe would not have broken out of the shackles of Communism to regain nineteenth-century capitalism. What it wants to gain is late-twentieth-century capitalism—a social welfare state wedded to a market economy and private ownership. This system has proved to be the most remarkable human construction—capable of producing wealth and generalized economic benefit far greater than anything previously devised in human history. In that sense, it is an attractive model for the whole world.

Omni: Is global free trade the future



NAME:
Jeffrey Sachs

AGE:
Thirty-six

PLACES OF WORK:
Harvard: Galen L. Stone Professor of international trade, Helsinki: visiting professor of macroeconomic policy, World Institute for Development Economics Research, United Nations University

COUNTRIES VISITED IN ONE MONTH:
The USSR, Poland, Yugoslavia (twice), Great Britain (twice), Norway, Sweden, and Finland

ADVICE TO DEVELOPING COUNTRIES:
Don't make new experiments, take what is, become part of the world system and evolve with it

WHAT SHOULD BE PUBLIC IN THE U.S. ECONOMY:
Universal health care

WHAT SHOULD BE PRIVATE:
The Postal Service. "We've already privatized most of it with free entry into telecommunications technology."

DAILY READING:
Four newspapers, half a book

RECENTLY READ:
The Russian Revolution by Richard Pipes

for every nation on Earth, too?

Sachs: It's the likely future of Europe; the future of the world depends on whether we go into a system of competing blocs—a European, Asian, and American bloc. That's unlikely. Competing blocs would be vastly inferior for world economic well-being than an integrated world economy. There are enough deep interests in keeping an integrated world system that it's likely to hold together despite many tensions.

Omni: In the twenty-first century, will the United States move entirely into services and ultrahigh-tech manufacturing into an information-based economy? Are we going to become a huge Switzerland?

Sachs: I'm going to give you a disappointing answer. I don't know. And no economist can tell you. Many trends in the last twenty years were unpredicted—the enormous move to a service-based economy, the extent we'd lose to Japan our lead in many important industries, even the basic trends in U.S. productivity. If you ask an economist where's a good place to invest, which industries are going to grow, where the specialization is going to occur, the track record is pretty miserable. Because that's the role of businessmen. Economists don't collect the on-the-ground information businessmen do. Every time Poland asks, Well, what are we going to be able to produce? I say I don't know.

Omni: Then you can't advise on specific products?

Sachs: It would be a horrendous thing to do. No one saw that Korea would start its export boom with wigs, that this was where the comparative advantage would be. When Chile liberalized, many envisioned an industrial boom, not an off-season-fruit boom. When Turkey liberalized, everybody thought its steel industry would collapse. But it specialized in a few products and had a terrific boom in exports.

When Poland liberalized, I heard an enormous chorus all over the world saying, Come on, Professor, how can you say they have export-led growth when they've got nothing going for them? What happened?

There was an export boom of incredible proportions. Exports to the West rose by forty-five percent in one year. Turned out they exported many things I never would have dreamed in a million years. Turned out Poland had a boom in exporting vacuum cleaners to Western Europe in 1990. Well, if you'd asked me a year before, vacuum cleaners would not have come to my mind in the first hundred and fifty items I listed! This year in Poland I've seen thousands of businessmen on the ground scurrying to do things. But just what they'll find, what the specific opportuni-

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ANTIMATTER

UFO UPDATE:
Can UFO researchers prove that aliens are tagging and tracking humans with tiny devices implanted in the body or brain?

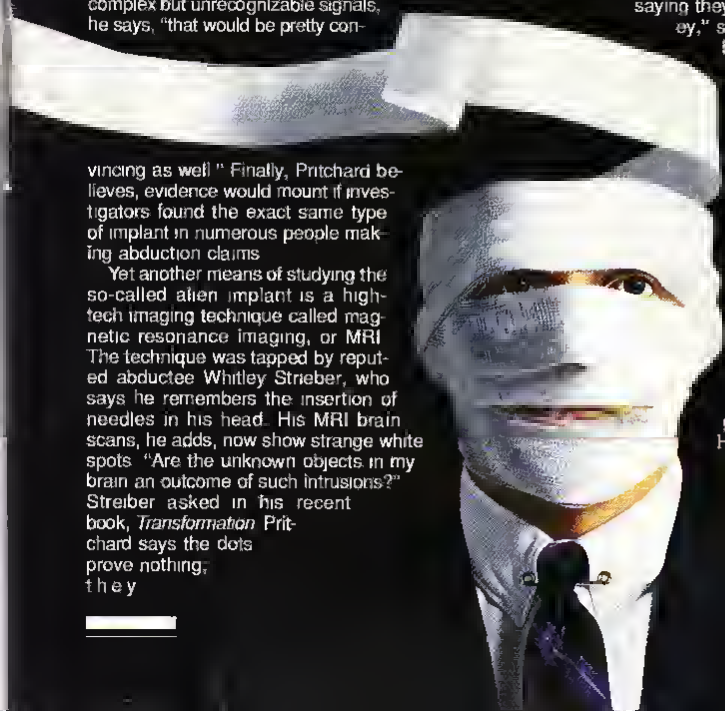
BY PAUL McCARTHY

One of the most insidious forms of alien technology ever reported by UFO buffs is the implant—a BB-like object said to be inserted in the brains or bodies of UFO abductees. According to some UFO advocates, E.T.'s use these tiny devices to tag and track human abductees just as earthbound wildlife specialists tag and track animals.

But how can anyone know whether a reputed implant is real or not? How, some UFO investigators have begun to wonder, can they authenticate an implant should a sample emerge?

One person addressing this issue is David Pritchard, a physicist at the Massachusetts Institute of Technology. According to Pritchard, no matter how strange the structure or material of an alleged implant, if it is not some "out of this world" material like "heavy metals or quark matter" it won't be possible to convince a lot of people.

But, Pritchard adds, there are other ways to skin the cat. For example, researchers could peg an insert as such if it worked like a flashlight but was a hundred times brighter than any flashlight on Earth. If the implant sent complex but unrecognizable signals, he says, "that would be pretty convincing as well." Finally, Pritchard believes, evidence would mount if investigators found the exact same type of implant in numerous people making abduction claims.



Yet another means of studying the so-called alien implant is a high-tech imaging technique called magnetic resonance imaging, or MRI. The technique was tapped by reputed abductee Whitley Strieber, who says he remembers the insertion of needles in his head. His MRI brain scans, he adds, now show strange white spots. "Are the unknown objects in my brain an outcome of such intrusions?" Strieber asked in his recent book, *Transformation*. Pritchard says the dots prove nothing; they could be air bubbles. But a statistical argument could be made he adds, if researchers can show that professed UFO abductees have significantly more dots than a random control group.

Longtime UFO skeptic Phil Klass, who doesn't believe that aliens have ever come to Earth, takes a different tack. First, he says, he would want to know "where the implant came from," and would feel more confident if it had been removed by a surgeon. Then, if it were something "that could not form naturally in the body," he would want to know if it could be made with terrestrial technology. If the answer to that is no, says Klass, "I think you have your proof."

Even more skeptical is Robert Sheaffer, author of *The UFO Verdict*, who says the whole question of UFO abductions is dubious and that the idea of alien implants is "certainly rubbish." According to Sheaffer, the UFO is a slippery phenomenon that always manages to fade away before the evidence becomes too convincing, and alien implants are an example of this. "Some people might be saying they were kidnapped by aliens for the money," says Sheaffer. "Others might be doing it because they really believe that they were abducted. But there is not a shred of evidence to substantiate this claim. Alien implants are just too good to be true."

According to UFO abduction expert Budd Hopkins, author of *Missing Time* and *Intruders*, a number of radiologists *are* privately doing MRI scans on people who claim they have been abducted by aliens—and that the aliens have inserted devices in their bodies or brains. But a neurosurgeon advised him that if, as claimed, implants exist somewhere above the upper nasal passages, then they are near the optic nerve. In that case, he says, "it would be very risky for a surgeon to try to get one out." What does Hopkins say about the prospect of actually validating these weird alien implants? "It'd have devastating societal impact," he says. "I am not looking forward to something like this."

ANTIMATTER

I DIG A PYGMY

Best bet for the title of "largest unrecognized animal in the world" is not the Loch Ness monster but Africa's legendary pygmy elephant. In the past couple of years two German zoologists have built a strong case for the existence of the six-foot-tall elephant as a separate species.

Zoologists currently accept the existence of only one species of African elephant. This species, *Loxodonta africana,* consists of two subspecies, the 11-foot savannah elephant of southern and eastern Africa and the smaller eight-foot forest elephant found in central and western Africa. The pygmy elephant, on the other hand, has been dismissed as nothing more than a *Loxodonta* juvenile.

Not so, insist Martin Eisentraut and Wolfgang Bohme of the Alexander Koenig Zoological Research Institute and Museum in Bonn. In a paper published in the *Journal of the Cologne Zoo,* they detail a number of significant skull characteristics that distinguish this controversial creature from the others. Moreover, pygmy elephants are said by native observers to be much more aggressive than the generally playful *Loxodonta* juveniles.

If pygmy elephants *are* juveniles, argue the two German zoologists, how then can you explain their fully grown tusks, the puberty of small females, and the presence of entire pygmy herds? In fact, a set of color slides taken by a former German ambassador to the Congo depicts pygmy elephants together with their own juveniles as well as some other animals, providing an objective scale. Yet zoologists remain skeptical. "I'm convinced there are small elephants running around in the forest," says elephant expert Richard Barnes of Wildlife Conservation International, "but I'm not certain yet what the explanation is. I retain an open mind."

"All we have is circumstantial evidence," Bohme admits. "What we need are some tissue or blood samples for biochemical analysis, but there's a catch. Without additional evidence, we can't get the funding to gather the data we need."—Patrick Huyghe

THE ALIEN IN YOU

You might be a superpowered space alien and not even know it, at least according to Georgette Tumas, office manager for Telstar, a Santa Fe, New Mexico, outreach program for misplaced E.T.'s.

Tumas claims that several million "benign galactics," otherwise known as aliens, volunteered to have their minds seeded into human bodies, hoping to help Earth survive a millennial evolution. Sadly, they *all* lost their memories. Then, in 1987 an interstellar emissary named Saratoga began trying to find and "activate" the lost aliens—perhaps including you. How do you know if you're an amnesiac cosmic do-gooder? In a promotional video Saratoga lists telltale signs. Are you unable to fit in? Have you ever daydreamed of being rescued by a UFO? Answer yes and you may be an E.T.

If so, Telstar urges you to pay Saratoga $250 for an "activation intensive" session (Visa and MasterCard accepted, no refunds), in which you'll sit in a room for eight hours exposed to an invisible, undetectable galactic beam. You won't feel any immediate effects, which is fortunate, according to Tumas, who likens galactic mind power to a huge cone of force. The beam, Tumas adds, will "activate" all amnesiac aliens, enabling them to go about their original mission: upgrading the civilization on Earth.

> VISA AND MASTERCARD ACCEPTED, NO REFUNDS. AN UNDETECTABLE GALACTIC BEAM WILL ACTIVATE AMNESIAC ALIENS, ENABLING THEM TO UPGRADE CIVILIZATION HERE ON EARTH

Although Telstar has received uncritical airtime on a local radio station, some Santa Fe UFO buffs question Saratoga's sincerity. And in New York, best-selling author and UFO researcher Budd Hopkins doubted the Telstar claims were real. What's more, he added, "profit making gives UFO research a bad name. Nobody should charge money for entree to the truth."—Mark Arnold

THE TRUTH ABOUT HEARING THINGS

Those who hear voices are usually considered psychotic or saintly. But a recent five-year study by Petaluma, California, psychotherapist Myrtle Heery indicates that otherwise ordinary people may sometimes hear voices, too.

In the course of her research, in fact, Heery found three types of inner voices. The first, she says, is a fragmented part of the self. One man reported that whenever he lacked courage, for instance, a voice told him what to say or do.

The second type of voice provides guidance for growth through individual dialogue. Heery gives the example of a painter "who checks things out" with her inner voice before she does them.

The third type of voice is a doorway to a higher self, Heery reports, and has a spiritual dimension. Those reporting this type of voice, generally heard by people who practice prayer or meditation, she notes, "are typically engaged in service for the larger good of humanity, without any monetary gain or ego manifestation."

Heery emphasizes that her subjects "are functioning members of the community." Some people are ultimately institutionalized because of the voices, she says, "but that's unfortunate. If the voice comes from outside the individual or if it has a harmful message, then the person needs help. But if the voices come from the inner self, they can be positive, enriching things."

—Paul McCarthy

THE NORSE GOD OF MEXICO

In the Mexican legend of Quetzalcoatl, a god brings the fruits of civilization to Mexico. He promises to return, then leaves by boat for the East.

This ancient story has captivated Mexicans for centuries. But now Gustavo Nelin, a retired, Swedish-born chemistry professor in Cuernavaca, Mexico, says that the "god"—called Quetzalcoatl by Mexicans—may have been Viking Ari Marson. According to Norse legend, says Nelin, Marson joined Eric the Red on a mission to Greenland, circa A.D. 985. According to lore, 11 of Eric's 25 ships were lost en route. And Marson, Nelin contends in his new book, *The Saga of Votan*, was on one of the lost ships. According to Nelin, Marson eventually reached the country of Mexico itself. In fact, he adds, "Mexican legend states that Quetzalcoatl came to a place called Tula. Coincidentally—or perhaps not—the old name for Scandinavia is Tule."

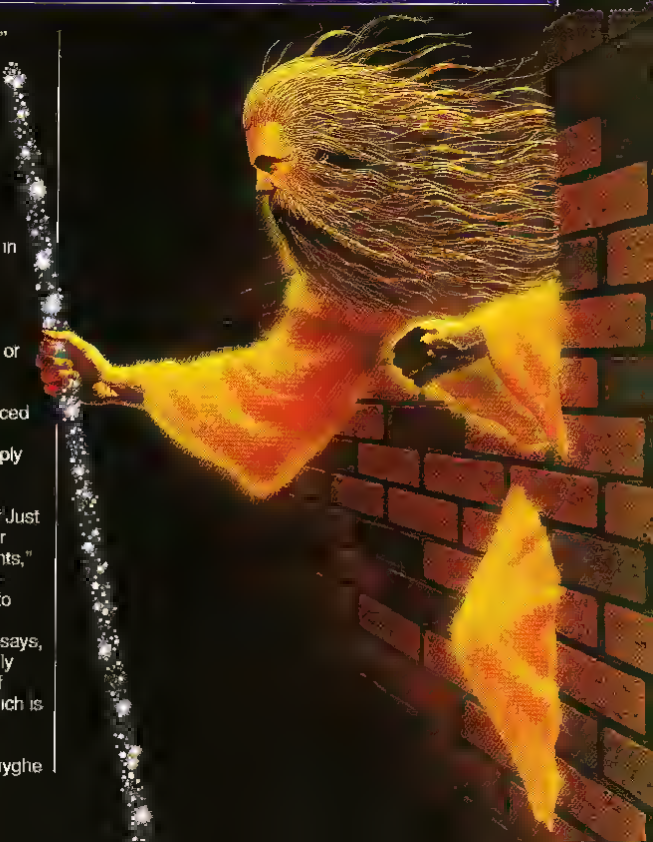
Most archaeologists find Nelin's literary evidence unconvincing. "It's possible that Ari Marson existed and was lost somewhere," says Birgitta Wallace, staff archaeologist for the Canadian Park Service in Halifax and a noted Viking expert.

"But it is equally possible that he could have been lost in Europe or Africa. Besides," Wallace adds, "the myth of Quetzalcoatl can be placed quite nicely within the culture of Mexico. It simply does not fit into Viking culture at all."

But Nelin disagrees. "Just as the Norse called their boats dragons or serpents," he says, the word *Quetzalcoatl* meant serpent to the Mexicans.

"What's more," Nelin says, "Quetzalcoatl supposedly taught the inhabitants of Mexico to use metal, which is just what a Viking might have done."

—Patrick Huyghe



A BRUSH

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fiction—it was *only a sideline*! He was primarily an illustrator of textbooks!

He died June 29, 1963. Already Paul is enjoying a renaissance in Czechoslovakia on the covers of the science-fiction periodical *Ikarie*. Taiwan wants him. Original Paul paintings, rare as pterodactyls' teeth, are owned primarily by three U.S. collectors: Sam Moskowitz, Robert Lesser, and the Ackermuseum of Hollywood. A much-sought-after Paul cover commands up to $7,500.

What are the opinions of the artist's work by several shakers and movers in the sci-fi genre?

Frank Kelly Freas, winner of innumerable Hugos (the science-fiction field's first, oldest, and highest award): "Few science-fiction artists have had any discernible influence outside the science-fiction field. Paul was an exception. His influence on the technical and architectural thought of his time is still visible today. After over 50 years of construction, demolition and reconstruction, the southern skyline of New York is *still* something straight out of a Paul illustration."

Vincent Di Fate, award-winning sci-fi artist: "Struggling with the limitations of the print medium and dealing intelligently with the challenge of needing to be conspicuous in a veritable sea of pulp images, the garish palette was Paul's equivalent of the grand gesture. There is tremendous imagination and intensity in his work. One is easily persuaded by the clarity of his art and by its immensely authoritative manner that the images he depicts are real. His work was a marvelous kind of 'brain food' for a growing new audience eager to read stories of gadgets and gears and things that go clank in the night. In his austere and economical linear style, often devoid of lighting and atmospheric effects, Paul gave special emphasis to his machines, and those machines endure as a testament to his resourcefulness in matters mechanical, and his unswerving belief in the value of science. Most of the major elements of his paintings can be found along the diagonal axes, and this, aided by the linear treatment and the use of large, flat areas of saturated color, produces a most dynamic and eye-catching effect. In my heart I know that had it not been for him there probably wouldn't be people in the world like me. Paul's presence in the formative years of the genre helped give it shape. It took Paul to give the field its unique look."

Sam Moskowitz, doyen historian of the science-fiction field: "Frank R. Paul succeeded in capturing the spirit of science fiction better than any illustrator before or after. One glance at any of his covers and you know it illustrates a work of science fiction. Additionally he was an innovator. He did not use spaceships or future cities as icons or symbolizations but invented new models or designs for every illustration. Similarly with alien creatures, he frequently visualized them more completely than the author's own description. Before Chesley Bonestell, he depicted space landscapes and otherworldly images. When national magazines or editors of coffee-table books search for science-fiction scenes, when shown the panorama of existing material they most frequently select Paul over any other."

Charles D. Hornig, boy wonder who at the age of 17 became the world's youngest professional science-fiction editor: "I first met Frank R. Paul in August of 1933 when I became managing editor of *Wonder Stories*. In the 57 years since, I have never met a finer person. Paul was always pleasant, soft-spoken and filled with good humor. We had many lunches together in the nearby Automat in New York, and I daily looked forward to spending a little time in his presence. I never once saw him disturbed or angry, and he fully cooperated with any suggestions I might have had about his illustrating.

> Perhaps the most astonishing fact of all: Paul wasn't primarily an illustrator of science fiction; it was only a sideline. He was primarily an illustrator of textbooks!

"When I could spare the time, I treasured going into his studio to watch him paint a cover for the magazine. He really liked science fiction and always wanted to read the stories on which he did the artwork. After we had both left Gernsback I still visited him in his new offices and found him at one time working on a cross section of the New York subway. He said it was for a proposed magazine to be named *Life*."

Gerry de la Ree of Saddle River, New Jersey, a longtime collector of science fiction and fantasy and a specialist in fantasy art whose home resembles a museum featuring the finest of Virgil Finlay and Hannes Bok, popular favorites who followed Paul: he recalls the profound effect Paul's artwork had on him: "When I discovered pulp magazine science fiction in the Thirties, Paul was well established as the dean of sci-fi artists, mainly for the many covers he had done for Gernsback's magazines but also for the countless black-and-white interiors. Around 1939 to 1940, Paul did a series of back cover paintings for *Amazing Stories* and *Fantastic Adventures*. I can recall cutting off these covers and putting them in twenty-cent Woolworth's frames and hanging them on my bedroom wall.

"In 1957, during my years as a sportswriter/editor for the *Bergen Evening Record* of Hackensack, New Jersey, I discovered that Paul was living only a few miles from my office in Teaneck. I spent an afternoon with him and started a friendship that ended only with his death in 1963. I did an interview with him at that time, but the lasting impression I have is not of his many fascinating drawings and covers but of a gentle, smiling white-haired man who seemed to ooze friendship from every pore. His Spartan apartment had no great Paul art hanging on the walls or piles of artwork on the floor, but for his drawing board and paints, there was no indication of the great impact he had had on the science-fiction field three decades earlier. He seemed embarrassed that I looked upon him as someone extraordinary."

But extraordinary he was, with a capital X, as his work attests. Phoenixlike, fired by the enthusiasm of admiring acolytes, he is rediscovered, reborn as we approach the twenty-first century he so vividly foreshadowed.

Frank R. Paul—a man who saw tomorrow, and with pen and ink and brush and paint time-traveled back to this century with visionary vistas of the shapes of things to come. ◘◘

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The Artist

JOHNNY

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ened with no idea how she'd come to be here. "God, I had no hope that would work. I was just desperate and crazy." She saw the bartender and her expression became wary. But instead of throwing her out, he leaned on the bar and looked directly into my face.

"Do you have a brother?" he asked in heavily accented English.

And then, of course, I knew exactly what Johnny had been doing all this time in Moscow.

"I'm in it for the same reason as anybody else," said the blond, puffing along beside me in the cold. "Artistic freedom."

I made a polite noise, or tried to. My lungs felt frozen. The blond's name was Evie Gray, and she was now my friend for life.

"The Russians *understand*," she went on. "They know what repression really *is*. They make movies here where people drink and use drugs, they can make fun of religion. They've got *Huckleberry Finn* in the libraries—it's pretty weird in Russian, but they've got it in the original English, too. And God, rock music! All kinds of stuff you can't hear in the States anymore: old rap, new rap, heavy fucking metal that tells you to kill yourself, for chrissakes. And in the happy-hood parlors, it's anything goes: hard-core, soft-core, violence, whatever you want, and no goddamn Council for the Prevention of Mind Control to come in and pull the plug on you—hell, you can even get abortions on demand here, did you know that? On *demand*. All you have to do is walk into a clinic and you don't even have to give them a reason—"

"Still can't burn the Russian flag on the steps of the Kremlin," I said. "But I guess nobody's perfect, eh?"

She didn't hear me. She ran on and on about the Constitution being fucked like the air and water and land had been fucked and how it was just going to get worse and worse. Whether she was saying all this for my benefit or her own wasn't clear even to her. Not that it mattered anymore. Her visa had run out three weeks before and she was now officially refusenik, subject to arrest and deportation.

I wondered if she was aware of the original meaning of *refusenik*, but I wasn't curious enough to use the Sense to find out. There were scads of these new refuseniks running around Moscow and elsewhere in the Soviet Union. I couldn't decide whether they were yet another premillennial nut group, the start of a real movement, or just more people living in their own brand of artificial reality. But then, I predated the Berlin Wall, and at my age, sometimes everybody looked like just another nut. Even when the Sense told me they were all quite sane, if not especially wise.

What Evie Gray was more than anything else was especially wealthy. I didn't point out to her that this was the only way she could have managed this dramatic flight to freedom. It's yet another home truth that only the richest and the poorest ever attain freedom, the richest because they can afford it, the poorest because nobody's ever looking for them.

"You don't share a brother-sister resemblance," said the woman with the long, straight hair. "More like mother and son, if you'll pardon my saying so."

I smiled at her; she didn't smile back. Russians were sparing with their smiles. Whoever had taught her English had been from Boston.

"He's adopted."

"Excuse me?" She looked puzzled.

"Nothing. Yuri at the Kropotkin hard currency bar gave me this address."

Her gaze slid to Evie Gray. "Did something happen at the Kropotkin?"

"No. Almost, but it was averted," I said.

"Good answer," Evie murmured.

"I understand," said the woman, stepping to the dark velvet curtain behind her. She sounded friendlier but she still didn't smile. "You realize that this is a very exclusive *mesto*, foreign visitors who come here must reserve many months in advance and the waiting list is already a year long."

The bundle in Evie's outthrust hand was obscenely thick. "I can pay."

The woman made it disappear almost before my new American friend realized she had taken it.

"Next time, you should be more discreet. Put it in a little sack and pass it. If others saw, you could be marked as worth robbing."

"I wouldn't let that happen," I said, "but we promise we'll be more careful in the future."

"*Harashow*. This way." She pulled the curtain aside and stepped into the headjob parlor.

I liked the simple descriptiveness of their name for it. *Mesto*—literally, *place. Someplace else* might have been more like it. The Russians had embraced virtual reality with a religious fervor. Having been through only a few days of a Russian winter and hearing it called unseasonably warm, I could understand.

But virtual reality was just as major in the States and any other country developed enough to maintain the technology. I could understand that, too. It was merely the next logical step after television and video games, really.

The *mesto* wasn't much like an American arcade. Instead of little single or double booths, there were rows of what looked like old barber chairs, about fifty altogether, all of them occupied by people wearing headpieces and action gloves. Lots of weird hand motions going on; some I could guess at and some I wouldn't have wanted to. There were no individual units—all the cables from the equipment disappeared into the floor. Centralized transmission, no variety, but it would make the *mesto*'s operating costs a lot cheaper, increasing the profit margin to something that even an old Eighties greed-is-good throwback would call more than respectable.

"How long have you been operating?" I asked the woman as I followed her to the end of the last row of chairs.

"Almost a year," she said.

At the end of the row was a vacant chair, the only one in the room with a headpiece sitting on it like an abandoned crown.

"Your companion bought you an hour's worth," the woman said, gesturing at it. "Take your pleasure."

I blew out an irritated breath. "That's not what I'm here for."

"If you want to see your *brother* you'll take the hour." She picked up the headpiece and held it out to me.

It didn't make any sense, and I was having a hard time with the Sense as well. The long, cold walk from the Kropotkin had sobered me up and I was dull. But the little flicker that I managed to get from her indicated that, somehow, she was telling the truth. Maybe Johnny wanted me all tangled up with wires and distracted with fancy pictures before he'd talk to me, figuring that would keep me from sussing him out. As if this artificial reality could come between us any better than the one he'd made for himself. Dream on, and on, and on, Johnny.

The woman helped me with the gloves and then started to put the headpiece on me. "I'd like some Stoli, please," I said.

"This is not a *valuta* bar," she said. "We don't serve anything. If you wanted drinks, you should have brought your own."

"Get her some vodka." Evie slipped a hand into her pocket. "You can get me some, too."

The woman hesitated.

"And bring a straw. You know, one of those hollow tube things you can suck liquids through?" I added, in response to her blank look. "Unless you're hiding some dispensers for the headpieces?"

"Yeah, it's the same fuck the tourists crap all over," said Evie.

"Shut up," I told her.

"Sometimes there's a bottle back in the office. A straw"—the woman shrugged—"I'll see what I can find." She took something from Evie—discreetly enough, I supposed—and slipped out a nearby door. Evie moved to help me with the headpiece.

"Hold it," I said.

She drew back a little, looking stung.

"I can't go on helping you indefinitely, you know."

"Can't?" She gave me a fast, pained grin. "You mean *won't*, right?"

"Look, I can fix it so tired cops don't see what they don't want to see. But I don't forge residency papers. And I'm not staying in Russia any longer than I have to."

"But you could make someone forge papers for me, couldn't you?"

I wanted to shake her.

"Is this place really so much better than the U.S.? You think Russia is heaven just because they've got *Huckleberry Finn* on the shelves and rap music on the radio and abortion on demand? Does the name Stalin mean anything to you? How about Pamyat? They were just another anti-Semitic hate group in the early Nineties, but now even their staunchest sympathizers are afraid of them. And they're not the only haters running around loose, all of them with their own agendas, but two things they all agree on: They hate Jews and they hate refuseniks. You think all of the missing ones are just blending in with their forged papers? Plenty of them are lying on slabs in a Moscow morgue, gutted like cattle, courtesy of *Pamyat*."

"*Pamyat* is a bad word around here. Don't use it." The woman reappeared and thrust a bottle that was a little over half full at me. "Scares away our business. Sorry, no straw. And I have no idea what you'll do with it when you're inside."

I took a couple of healthy swigs and stuck the bottle between my thighs. She shrugged and looked at Evie.

"I'll wait right here," Evie said.

"Hurry up and take your hour. There's a long line behind you." She pushed the headpiece all the way down so that my face was covered and the eye-screen lit up immediately.

I joined a standard dolphin's-eye sequence. As soon as artificial reality had become feasible for the mass market, everyone had gone for the dolphin and whale stuff. Out of guilt, maybe. Sorry we killed so many of you, so we'll be you, or pretend we are. I would have been bored except the quality was way beyond anything I'd ever seen before. The Russians must have been cranking away on hardware R&D, boosting definition and whatever else. But the headpiece hadn't looked like it was anything so extraordinary.

"This could hurt your funding, Evans."

The perspective cruised past a formation of opalescent eyeshaped bodies that turned right and then left as one lifting themselves out of my path like a curtain Near a boulder, a fleshy squid ignored me its tentacles rippling Seaweed drifted, sank away into the shadows Nothing new here, nothing in the least, but the quality—my inner ear kept flashing swimming messages to my stomach, where the disloyal Stoli had turned on me with a threat Disloyal opposition

I hung onto the arms of the chair and tried to keep part of my awareness tuned to where I knew my body was waiting for Johnny s presence to press in on the Sense

I might have been cruising the ocean for ten minutes, or almost the whole hour, my sense of time had slipped away like one more darting ocean creature But the novelty was wearing off and I felt bored impatient and slightly dizzy

The perspective made a sudden wide arc to the left and passed through a multicolored rock formation Something with nasty-looking jaws peered out of a dark hole but never moved as I passed

Just beyond the rocks was a giant clam, the ridges of the shell perfectly formed It began to open as I approached—more standard stuff—displaying the giant pearl in the giant clam was usually the climax and indicated a change to the next sequence *So much for my hour and finding Johnny* I thought watching the clamshell rise When I got out of the chair I was going to chug the rest of the Stoli and use the Sense to make the *mesto* hostess do cartwheels until she dropped

«Sadistic idea. Not like you. Maria »

The clamshell was gaping wide and it wasn t a pearl displayed there but a man, curled up in the fetal position He unfolded slowly and gracefully the way everything moves underwater, and turned to look at me

Same old sweet, mad Johnny His shoulder-length brown hair was floating around his head his hazel eyes were like stars in his lovely open face

«The Sense couldn't get a good fix on you until you jerked the cop in the *valuta* bar I used the Sense on the cops just that same way myself, till I found something better.» He smiled at me «Come for to carry me home sweet Maria? Sorry not this time This time I beat you I beat you all »

«You always say that, Johnny What is it now, a woman, or another man again? Even without the Sense you could make them fall in love with you Lots of people can do that But you can't make them *love* you That s something very different from falling in love Johnny and after the last three times I'd have thought you d have known

that. You'll end up killing this one with your needs, too. Just like the others. The group forgives your sin because we understand. But nobody else will. At the very least, they'll put you in jail and there you'll be, far from us and us far from you, all of us feeling the Lack. That's bad, Johnny. Remember how bad it is to feel the Lack? After your lover isn't falling in love with you anymore and you're without us?»

I was working the Sense on him, of course, and he was pushing back just as hard, maintaining the balance of pressure as only those endowed with the Sense could.

It was a balance he couldn't have with someone outside the group, the give-and-take of the Sense that we all needed, whether Johnny wanted to admit his own need or not.

«It's different this time, Marla. I let my lover go right after I found this.»

«Found what—artificial reality? You can get that anywhere. Come home and we'll buy you your own booth.»

«But they don't have centralized transmission back in the States. A multitude all looking at once, invisible to each other but all visible to me. And I can have them all, not just one at a time but together.» He spread his arms. «I found this lonely technician, got her to scan my likeness into the simulation. The scanning equipment here is so much better than ours, they've been working so much harder on it. And between me and my likeness—»

He didn't have to explain. Even without the Sense, I could have felt how it was. I think. Johnny's likeness might as well have been him. It had its own power within the artificial universe, blocking our little exchange from the rest of the clientele. A hundred people looking and none of them saw. I would have said a connection between a living being with the Sense and a likeness was impossible, except obviously none of us had tried it until now.

«Of course, I have to stay in ... keep the headpiece on, and the gloves. They're making a whole suit for me, it's almost finished. What I've done for business here—it was great before but now it's taken a real jump. We're going to expand. More of them for me, more and more, wanting to be in some beautiful, otherworldly place, one that *I* create. They give me their wanting and needing and I feel no Lack, none at all. I don't have to stay locked into the group anymore, Marla. I'm free now. *Free.*»

«Why, Johnny? Why do you have to have them? Why don't you just come home and get the same thing from the ones who really know you and understand you?»

He looked away from me, dreamily reaching up to run a finger along the belly of a passing shark.

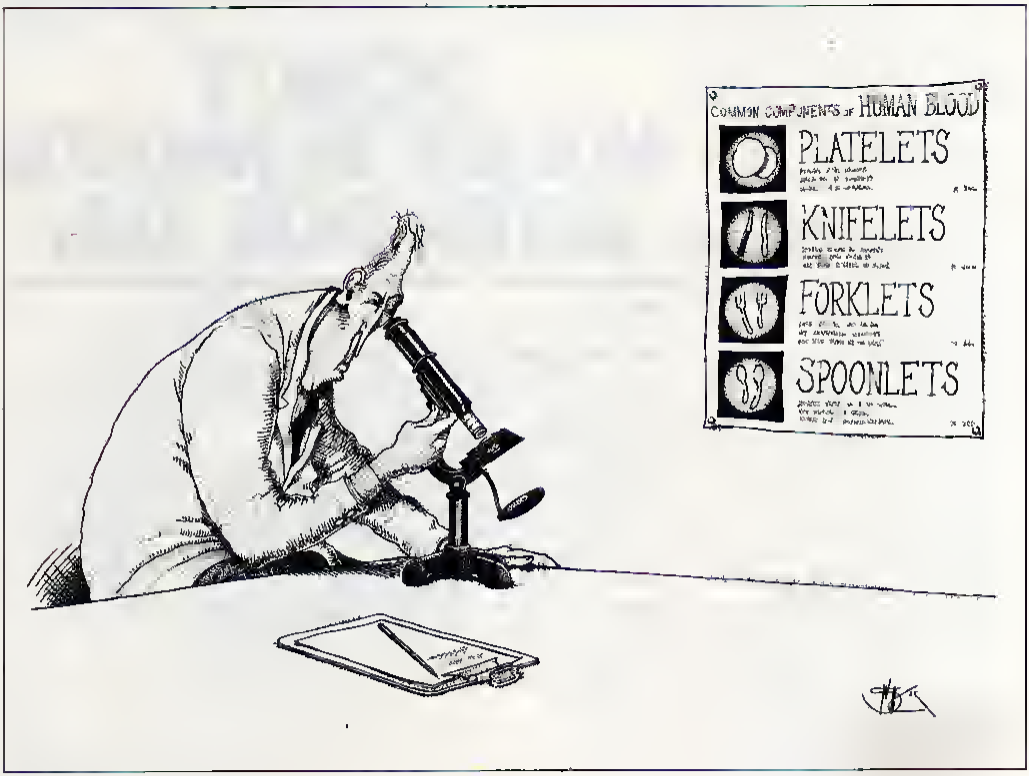
«Because it *is* always the *same*. I want *different*. I want to wake up in the morning knowing that I might see anybody, be with anybody, go anywhere. This way, I can. I don't want to be chained to the group, the way so many of them are chained to lives they never wanted. This way, anything really *is* possible. It really *is* a world full of miracles.»

«Dream about it, Johnny.» I worked the Sense harder on him. «It's still only a dream, and when you wake up, you'll still be what you've always been.»

The push came so forcefully that I would have sworn he'd found someone else with the Sense and the two of them were ganging up on me. The likeness, I realized, Johnny had invested a great deal in it as the would-be escape hatch from the prison of his life, and wherever Johnny went, the Sense went with him. I had Stoli, but Johnny had this, and it was bigger.

Still, I strained for him, trying to make him—him and his likeness?—acknowledge the connection between us and fortify its existence.

I almost had him. Perhaps I had had him—his miracle world was more wonderful, but I was more familiar.



And then rough hands tore the headpiece away and I heard the *mesto* hostess say, "Time's up."

The cold was what really brought me to, though I was already staggering along Gorky Street. Famous Gorky Street, I remembered; every few years the Russians would change the name to something else but for some reason, they'd always end up changing it back again. Evie Gray had her shoulder wedged under my armpit and my arm slung across her shoulders. She was chattering away, but my head was too bad to make sense (or Sense) of what she was saying and the traitor Stoli in my gut was like a washing machine on the heavy soil setting.

Somehow, little old Evie knew—I say it's a home truth that in times of stress, everybody's got a tiny spot of the Sense—and got me to an alley where I could throw up in peace. Good-bye, Stoli, and goodnight, Gracie. Or Evie. I was dulled out.

After a while, Evie got me moving again. She was still chattering—Christ, this woman never ran out of breath. I guess—and I caught the word *problem*.

"The real problem, Evie, old girl," I said, talking loudly over her, "the real problem here—and I think the Russians really do understand this"—I swung my free arm out to gesture at an empty storefront and almost sent us both down on the cold pavement—"the real problem is, people think life is a ladder, and it's really a wheel. That's a real home truth and we ignore it. It's there for us to see, everything is there for us to see, we've got home truth coming out of our ears, we know everything there is to know to get us through the day in one piece, and we ignore it like it doesn't exist. Hell, the *earth* is round, it *turns*, you'd think anyone could take a hint that blatant, but even someone with the Sense, who's supposed to know a little more than the average pilgrim, can still look home truth right in the kisser and say, 'No thanks, artificial reality for me, please.' I don't know what to do about that, Evie. Even with the Sense, I just don't know what to do about it."

I heard her clear her throat. "Why don't you just shut up?"

She took a real chance dumping me at Intourist. She could have just left me on the street for the authorities to pick up—probably nothing would have happened, I wasn't *refusenik*, after all—and the fact that she got me indoors before she disappeared indicated a sweet generosity of spirit within that foolish chatterbox exterior. I liked her retroactively, for all the good that would do her.

I got a plane out the next morning—all I had to do was find an Aeroflot ticket agent with a xenophobic bent and give a little push. The genie of the bottle grants your wish and leaves your country.

The layover in London was supposed to be just a few hours, but Gatwick shut down indefinitely with a bomb scare—bomb scares were coming more frequently as December 31 approached—so I took the train into London, figuring I might as well be comfortable. Besides, I'd never seen London.

Forgot my own home truth. One place is pretty much like another. There was nothing for me to do in London either but drink. But London *really* understands the drinking organism the way Moscow was trying to. The pubs were warm and mellow, Guinness was even better on the Sense than Stoli had been, and I almost didn't care when Gatwick stayed shut another day and another, and Heathrow with it.

I didn't call home. They'd all know by now anyway. I would only be telling them the details, and those could wait.

Those could wait and I could drink and like anyone in artificial reality, I lost track of the time, which was how I came to be in London on Christmas Eve, looking down a week to the (artificial) dawn of the (artificial) new millennium. Feeling the Lack and filling it with Guinness.

Travel was impossible now. There were riots every day, and not just in London. The Messiah was coming, they said: the Messiah was coming.

Then the transmission from Russia began. But I didn't bother trying to tell anyone that it wasn't really the Messiah. Just Johnny.

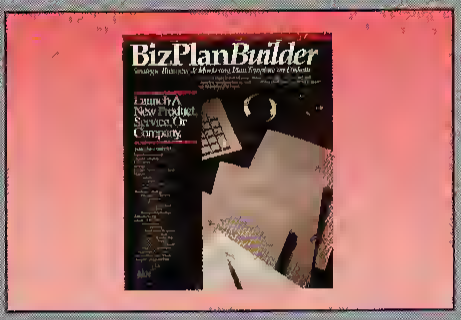
Happy-hood parlors all over London filled up, left the pubs empty (more for me, I thought, wavering at times between bitters and Guinness). Centralized transmission. No variety, but the quality . . . oh, the quality. Lost nothing bouncing off a satellite, not with Johnny on the job. Johnny on the spot, all the spots. The (artificial) dawn of the (artificial) new millennium. What everyone wanted all along, I guess.

And as to what Johnny wanted . . . not to be chained, to be free. He got both, thanks to the Sense, in any reality he chooses.

The Sense is a funny thing, and it can even be a good thing. I worked it pretty hard on him, but as I told Evie Gray, nobody's perfect. We'll get what we wanted, too, me and the rest of the group back in the States, when the transmissions to America begin, when poor, sweet, mad Johnny finally comes home. ∞

Pat Cadigan's most recent story for Omni *was "Scanman" (April 1990).*

OMNI 'DAD AND GRAD' GIFT GUIDE



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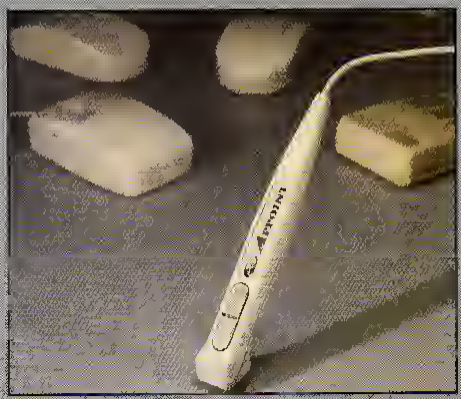

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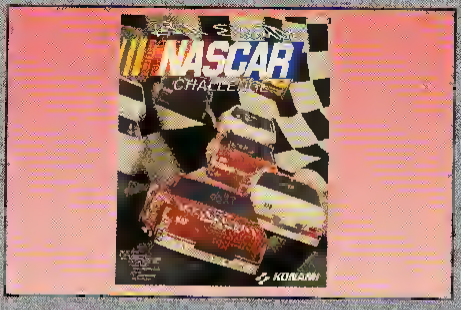

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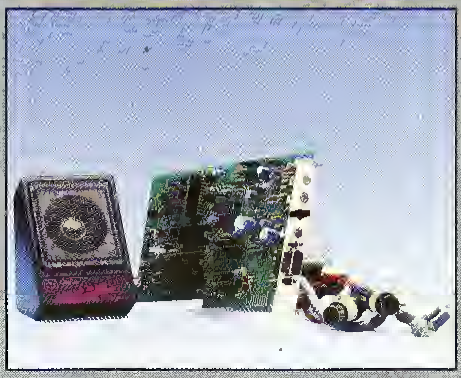

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CONTINUED FROM PAGE 79

ties are, I wouldn't predict.

Omni: Can the West rescue the Soviet Union?

Sachs: I have a sinking feeling it may be too late. No one can be sure there's a way out of what is fast becoming an extraordinarily grim situation, with a massive purge of liberals who took power in the last few years. But I disagree with those that say the Soviet Union is too vast to allow meaningful assistance from the West. My gut instinct is that even a modest contribution could be decisive in turning back the recent swing to the right.

In Poland, financial support had a galvanizing effect. When it was supported by a billion-dollar stabilization fund from the West, Poland moved overnight to make the zloty convertible [to dollars on the open market]. I was shocked at how unbelievably hard it was to raise that billion dollars for the first post-Communist government in the world offering to make radical market reforms. The day they got this one billion I came back to my hotel room in Warsaw and watched CNN report that an LBO [leveraged buyout] had just raised three billion dollars. Yet getting one billion was an awesome task! At one point Washington had called saying it was in trouble. One key Polish policymaker just folded up his bag and walked out, saying it's hopeless. They wouldn't have gone ahead without the money.

And yet Poland ended up never using a penny of it. They accumulated a four-billion-dollar surplus, not a billion-dollar deficit. But the money still gave a lot of confidence.

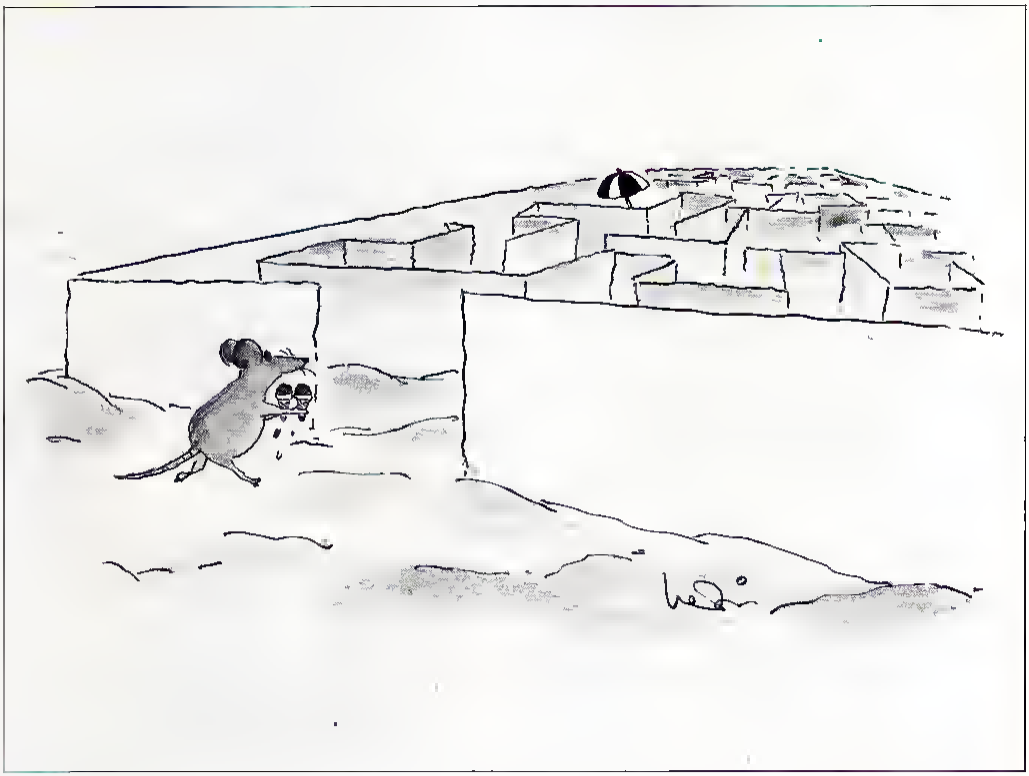
Omni: Didn't Gorbachev ask for aid?

Sachs: Last year Gorbachev was about to allow private property and introduce a program of radical reform. He appealed to Chancellor Kohl and President Mitterrand for financial assistance. Kohl brought the appeal to the Houston summit last summer. But as far as I know the United States never analyzed the proposal properly. There was a profound misunderstanding about what was going on in the Soviet Union; people couldn't hear the debate going on. A brilliant Soviet economist came to Washington to explain that the train was leaving the station, that the reformers might be left behind. He found no resonance, no understanding, not even a pledge of moral support. The United States was asleep at the switch. It was mind-boggling to both of us.

He went home and within days Gorbachev abandoned the radical program of reforms. By underestimating the foreboding in the Soviet Union about what the future held, and the intensity of the search for a way out, we missed an historic opportunity. Now the Soviet Union is collapsing economically at a remarkable rate. They are in a profound balance of payments crisis, and industrial production is plummeting. Unrest is almost certain, despite the crackdown under way. There is no way they can hold the pieces together. But I am an optimist. As the collapse ensues, another chance for the West to steer events in a way beneficial for the USSR and the States may arise. And I hope we'll be ready this time with help. The money can be conditional. It will not be to preserve a decrepit regime but large-scale financing for a coherent program of reform, based on introducing private property rights.

Omni: How much is needed?

Sachs: Perhaps thirty billion a year from the entire industrial world for four to five years, with six billion from the United States. Compared with our annual NATO expenditure of one hundred and sixty billion dollars, it's well justified. For this we can hope to achieve radical reform, the end of Communist centralization, and a peaceful transition to a democratic market system.



Omni: What is the future of Poland then?

Sachs: If you are in the middle of Europe and you do things even approximately right and your borders are open to trade people, ideas and capital goods then you will live like the rest of the Europeans. Poland was cut off from Europe for forty-five years. The idea is not simply to change the system but to rejoin the mainstream like Spain after Franco. In the short term, there are huge problems. Coming out of Communism is not easy. In the end Poland will become firmly part of the European economic space. Things are on track.

Omni: Aren't Poles lacking in vital skills and education?

Sachs: They don't have the formal training in how to operate a market economy. There's a shortage of bankers, finance specialists, stockbrokers, accountants. But those people who are an important part of the infrastructure are flooding in because of opportunities to make money right now. Investment bankers and business schools are both opening up in Poland.

Polish workers make about ninety cents per hour. Ironically that's one reason for optimism. In a few years they'll be making three dollars an hour. With Berlin just fifty miles from the border, you're in the very heart of Europe. Poland is more centrally located than Spain, and Spain's been booming right along. What Poland lacks is the legal infrastructure, a good telephone or road system, and some local talent and political stability to put the pieces together. But everything can be found.

Omni: Would change be easier under a dictatorial system?

Sachs: Democracy helps economic reform. In crisis, democratic governments can mobilize public support. The legitimacy of winning an election lets you go to the people, ask for patience and understanding, and carry out policies that otherwise would have to be done down the gun barrel, and not done effectively as a consequence.

Omni: So Gorbachev's new repression will result in harder economic times than ever in Russia?

Sachs: It's a disaster. The essence of market reform is to free up the human spirit and economic initiative. The arbitrariness of state power is dead wrong. There's a good chance the Soviet Union will spiral out of control.

Omni: Have they asked you for your opinion?

Sachs: Recently I was a guest of the Russian parliament, and I told them in no uncertain terms that socialism was a dead end and that half steps toward a market economy with a socialist orientation were an impossibility that could never produce a stable outcome. They had to go fully into a market economy with private ownership. I think the arguments made sense to them. They are, after all, living in this chaos.

Omni: Why do you believe in speed?

Sachs: Because you are moving from one internally consistent system to another in moving from Communism to capitalism. Gradualism doesn't make sense. It's as if the British decided to shift from driving on the left to the right side of the road, and the more cautious said, Why don't we do it gradually? Let's move the trucks to the other side first! The socialist system is internally consistent. That's why it worked for a long time. It is so inferior to the capitalist world in what it can produce. But if you make it inconsistent, it stops working altogether. Every time you try to mix the two, it leads to an explosion. Market socialism is a deeply destabilized system. You're free to operate with the state's property, but you have no real responsibility for it.

The few remaining British state enterprises all have a board of directors supposed to operate the firm on a market basis. In Eastern Europe, when the party was taken away, no one governed the enterprise. Either the manager was left on his own, and in many cases just stole the property in clever or crude ways, or the so-called workers' council was the governing body and voted in the manager.

Do you think he ran for election on the platform of cutting employment to two thirds to make it an efficient enterprise? On the contrary, every time state coercive power was removed, wages started running out of sight.

The budget went into huge deficit. Spiraling monetary instability resulted, creating the present shortages and inflationary crisis in the Soviet Union. Similar crises occurred in Poland, Yugoslavia, and Hungary.

Omni: Capitalism without capitalists!

Sachs: Exactly. In a normal Western firm there's a capitalist who negotiates with workers.

In Russia there's no capitalist; no one watches the capital. If property is owned by everybody, it is owned by nobody. Once managers were left on their own, they quickly figured out, Hey, I can open a private business, I can lease my little business at a very low price, I'll take all the state enterprise profits out through this dummy corporation of mine, and the state enterprise will remain a loss-making shell that will fall to the budget.

The only logical method of reform in Eastern Europe and the USSR is to try to integrate these economies into an existing system as rapidly as possible. For Poland that means emulating the capitalism existing in the EEC [European Economic Community]. The EEC has sev-

en thousand codes—industrial and legal standards and so forth. Poland is in a systematic process of adopting all these codes in every area of economic life. They are not trying to invent a new system.

It is not a Utopian revolution. Poland's is a revolution of no experiments. They are saying, We are done with experiments. That is pragmatic and unimaginative, but moral. It is not asking society to be guinea pigs for another generation.

Omni: Is weakness in education undermining America's future?

Sachs: Much recent research documents that education, or 'investment in human capital' as it's called, is fundamental to economic growth. It has not been accumulating as fast as it could in the United States. Economists have a mathematical model of why some countries are growing faster than others. And the level of education shows up as an enormously strong variable in predicting performance.

Omni: Okay. How else might the United States be able to improve its economic performance?

Sachs: The basic fact of United States economic development in the last twenty years is that it was not future oriented enough. In physical capital formation we have been overtaken by Japan, a country with half our population.

They're investing more than we are. Their saving rates are far higher. Their preuniversity education systems are far more rigorous and have higher attainment. So I'm quite sympathetic to the argument that this binge of the last ten years should end.

Omni: What happened?

Sachs: U.S. growth slowed, and rather than save more to spur further growth we saved less to keep up our living standards. This was enormously shortsighted. Our savings have been so low that whatever investing we've done has been to a significant extent financed from abroad. So we have the increasing foreign ownership of American enterprise.

Omni: If these guys are nice enough to lend us money to run our businesses and send us cheap VCRs, why shouldn't we be happy?

Sachs: If they give us money, they also take back the profits. Generally, if you borrow money, you have to repay it at some point. So we've built up a debt that is enormous in absolute terms. But it's still not enormous relative to the size of our economy. We're not over the edge yet. We're not a Brazil or a Mexico. We're not insolvent as is Argentina.

We haven't gone bankrupt by borrowing from abroad, but we've borrowed a lot. The number is estimated at half a trillion dollars in net debt to the rest of the world. And growing.

Omni. That's a twelfth of the national income. Is that a problem?

Sachs. A problem, but not yet a catastrophe. That the government has borrowed a lot has weakened our capacity to adjust and thereby compromised our future performance. We have been lazy. We have neglected important investments. Anyone who drives over a bridge or on the highways knows we have not kept up our basic material infrastructure, much less research and development.

Is it the cataclysm that some have claimed? By no means. It does mean we will live less well in the future than we might have had we timed this better. We enjoyed this past decade consumed more than we responsibly should have. So the capital we leave for this and the next generation is less. Our children are less prepared for the task of the future. The scientific community has not been as well supported as we could have afforded. It all comes down to the same thing: If you don't save for the future, you get caught out in the future.

Omni. How will we get our comeuppance?

Sachs. We'll have to squeeze our living standards to pay back the foreigners. The larger the debt grows, the more we'll have to raise taxes to service that debt. Or tax the public in a hidden way through increased inflation, as happens when governments run up debts so large they cannot be covered by taxation. Taxes distort all sorts of behavior. People don't work as hard if they have to pay higher taxes, or they reallocate resources from things they ought to be doing to other things because the first activity has a tax cost. Taxes discourage economic activities of all sorts.

Omni. It's like a consumer borrowing a lot on credit cards and thinking it's great and then suddenly realizing it's eating away at his life month by month.

Sachs. Exactly. We will bear the costs from having overconsumed in the past.

Omni. Will the debt lead to hyperinflation in the U.S.?

Sachs. It could, but I doubt that it will. Hyperinflation occurs when the debt burden is beyond the taxing authority of the government to cover. That's what happened in Bolivia. By the time a country is in hyperinflation, many terrible things have happened to its tax and spending systems.

To end it, you need many changes, but the essence is to get the fiscal system back under control so that the government pays its bills without printing money. You have to cut spending, raise tax revenues, and generally renegotiate the terms of this accumulated debt to try to get it reduced to a level that's sustainable.

Omni. Won't cutting the debt burden of the poor countries, as you advise, ruin the U.S. banks and whoever else lent them money?

Sachs. In general these debts aren't collectable. I say it's better to recognize it legally and make the settlement, rather than pretend it isn't true and keep it on the books.

Omni. Walter Wriston's reaction was to brand you a "paid flack for the underdeveloped countries." Why does something totally realistic incense him so?

Sachs. As chairman of Citibank, Wriston took a lot of his shareholders' money and put it into Latin America. And he ended up losing a great deal of it. He took one of the world's leading banks, but as a result of his lending policies it is now a greatly weakened institution. He called me a flack for pointing out that these were very bad decisions that now have to show up in the books. I have often pointed out to Mr. Wriston that I don't take money from these countries; I am an adviser paid by the UN. I am only saying that if you have so much debt it can't be serviced, there are enormous advantages in making that legally plain through a debt write-off. Domestically, that's why we have bankruptcy laws. But internationally, we

lack the institutions that could bring about this kind of debt reduction. So I was appealing to the IMF and major governments to play the role of bankruptcy judge and make formal settlements of debts to reduce them to manageable levels.

Omni: Would these countries ever get a loan again?

Sachs: Certainly not as long as the old debt is still sitting on the books. When you have an overhang of bad debt, no creditor will lend you money, because he knows it'll just be used to pay the other guys. So debt cancellation should raise the chance of getting new loans.

Omni: Don't the poor suffer under such management from the IMF?

Sachs: Actually, a lot of what happens in hyperinflation is really a ripoff by the rich. Who really benefits from the chaos? The powerful make extraordinary gains, totally unrecognized, at the expense of the poor. Letting the chaos go on to avoid being cruel to the poor is a cynical view pushed by the elites who are stuffing their pockets. There has to be a social safety net.

Omni: Why do you feel so passionately about what you do?

Sachs: Helping countries get out of crisis is not only a technical and intellectual challenge, but a moral one. I have confidence in the basic wisdom of the approach I've pursued—a mix of standard economic remedies, plus advocacy of debt relief. It's an extremely important moment for Latin America and Eastern Europe. The crises are grave and the opportunities very high.

Omni: How does your approach differ from other economists'?

Sachs: I try to be astride research and practical policy involvement, because each reinforces the other. I must be versed in history, political and social analysis, as well as technical economic analysis. I don't begrudge others their intensive work within the discipline, because I'm a consumer of the output of the pure theorists. But to be effective one needs to view economics as an encompassing social science, rather than a subdiscipline with social science.

Omni: Do you think economics has predictive powers, if not upset by politics?

Sachs: I'd be the first to say that economics rarely lives up to its mathematical pretensions.

Obviously it doesn't have anything of the predictive powers of many natural sciences. But a proper study of economics gives a very satisfactory and organized way of thinking about pressing issues. Economics is typically not well understood outside of the profession. Yet what is known is enormously useful. That gives one a vast advantage over non-economists.

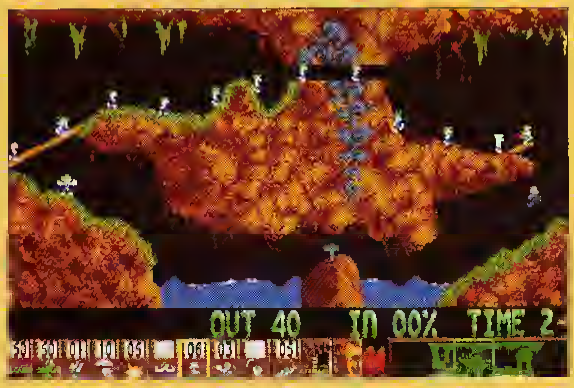
In other words, there is a reason for it. ⊠

VIDEO GAMES

GOOSED BY MOTHER

Grab a mouse to save a lemming, and learn from the old lady who lived in a shoe

No matter what appears in the next six months, one video game will rank as the most original entertainment concept of 1991. The setup: You dictate the moves of an ambitious group of hyperactive conformists who look alike and act alike and will blindly follow one another to their mutual destruction. No, this isn't *Wall Street Yuppies: The Simulation*. It's *Lemmings* (Amiga, Atari ST and IBM-PC compatibles).



Lemmings are among nature's most neurotic creations. When faced with the stress of overpopulation, these extraordinary creatures commit mass suicide by chasing one another into the sea. In *Lemmings*, however, the aim is to save the rodents from themselves by turning individual lemmings into diggers and bridge builders and parachutists in order to traverse obstacles from the entrance to the exit of 120 different puzzle screens. Diggers, for example, will open caves that keep lemmings from plunging over cliffs. Builders will construct bridges that lift lemmings out of unscalable pits.

Don't mistake *Lemmings* for a casual afternoon at the petting zoo. These fuzzballs swarm the landscape like New Yorkers at rush hour. It takes a brisk mind to rapidly carry out a solution and a sober face to resist laughing at the cartoonish activity of these animated crowds.

It's the visual charm, as well as the head-thumping challenge, that makes *Lemmings* so appealing. Kibitzing sadists may enjoy *Lemmings* as a bizarre electronic Ant Farm. They'll sit on the sidelines with hands-off glee and watch while these fuzzy little devils goose-step to their doom. With save-the-rodent compassion, however, responsible, hands-on players will grab a mouse (the computer kind) and discover the combination of lemming skills that will get these manic-depressive rodents to safety.

Lemmings ranks as a time sensitive puzzle game that pours on the action without requiring split-second joystick skills. Although the game is intellectually paced for adults, it has enough visual sizzle to wriggle into favor with young players.

KID STUFF

The cartoonish charm of *Lemmings* raises a question asked by all well-meaning parents in the age of interactive entertainment: How do you find a computer game for the youngsters that isn't like enrolling them in Saddam Hussein training camp? Guns, bombs, knives, fists, destruction, waste and war are the stuff of most computer games. It takes only 20 minutes of game time combined with a postplay candy bar to turn an overstimulated kid into a one-child Republican Guard platoon.

If you want to feel good about placing your child in front of the computer, try Sierra On-Line's heartwarming *Mixed-Up Mother Goose* (Atari ST, Apple II, Apple IIgs, Amiga, and IBM-PC compatibles). Using familiar childhood rhymes, this adventure game for children helps develop early problem-solving and reading skills. Delightful music and exquisite 256-color VGA graphics maintain the child's interest in an innocent, nonaggressive manner. A parents' guide helps Mom and Dad introduce the child to *Mixed-Up Mother Goose* and the ability to save games for as many as 12 children makes the game ideal for classroom or family use.

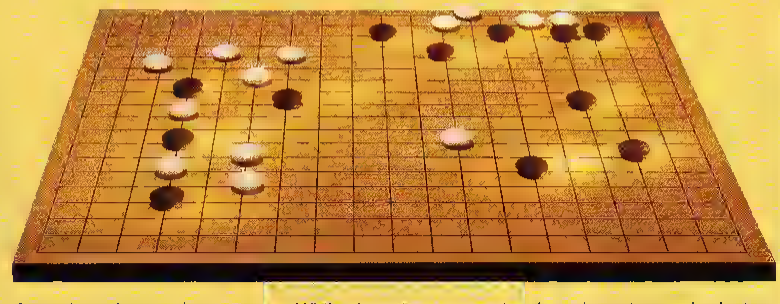
MAY THE FORGE BE WITH YOU

Although Sir-Tech's *Wizardry: Bane of the Cosmic Forge* (Amiga, IBM-PC compatibles) lacks the wry humor of its predecessors, the *Wizardry* "magic" is still there. *Bane of the Cosmic Forge* brings one of the longest computer role-playing series up to date with 3-D point-of-view graphics, digitized sound effects, nonlinear storylines, and elaborate multilevel mazes. The wealth of role-playing options makes it a rich experience even for traditionalists who swear by conventional role-playing and swear at computer role-playing games. Four times as large as any previous *Wizardry*, it also boasts an ingeniously detailed skill-based character development system and draws upon six different spell books for its magic. —Bob Lindstrom

GAMES

CHECKMATE

It took ten years before a computer outwitted our chess champ, but it may be longer before one passes Go



A number of prizes have been offered to any computer chess program that can beat the reigning world chess champion. In 1979 *Omni* and chess master David Levy offered $5,000 to any computer opponent that could win against Levy. Ten years later he finally admitted defeat. Now the largest outstanding cash prize, the Fredkin Foundation's $100,000, may also be close to being claimed. So far, however, computers can't come close to outsmarting the master-level players of Go, leading one computer company to confidently offer a $1 *million* prize to any program that can win against a human Go master.

After a series of attempts, a computer opponent finally beat Levy and claimed the $5,000 *Omni*–Levy prize in December 1989. Levy lost four games out of four to a computer program dubbed Deep Thought by its designers, a team of five Carnegie Mellon graduate students. Deep Thought's Murray Campbell expects an improved version of the program will be strong enough to win the Fredkin Foundation prize as early as next year.

While chess is an ancient, complex game, Go is even older, invented in China about 4,000 years ago and popular today throughout most of Asia, especially in Japan. The game is played with black and white stones on a grid of 19 horizontal lines by 19 vertical lines. The basic rules are simple: Place your white or black stones on the intersections, trying to connect stones of the same color along the horizontal or vertical lines. The goal: Surround as many clusters of vacant intersections as possible.

Go is also more challenging than chess, one reason being the enormity of possible plays. Unlike chess, which has only 20 possible opening moves, Go has a possible 361. And chess may offer an enormous 10^{120} possible board configurations, but Go outdoes it with 10^{761}. In chess programs computers look at every possible chess move and calculate the advantages of each, the same approach with Go gets bogged down by sheer numbers. The best programs try to merely mirror the way humans play, assessing the entire board situation and selecting a strategy. It's not easy to determine the best move. It's no help looking ahead ten moves into the game if you can't tell who's ahead at the end of those ten moves. A short-term victory may lead to long-term loss.

Curiously, a traditonal Go set also possesses subtle optical illusions. Although it's a 19-by-19 grid, the board isn't square: officially, it's 42.42 centimeters by 45.45 centimeters. The assymetry compensates for a perspective illusion. Viewed from an oblique angle, a true square looks longer left-to-right than top-to-bottom. So the Go board was designed to *look* square.

The stones also compensate for illusion. Black objects always look smaller than white ones. So Go's black stones are 2.18 centimeters in diameter, while the white ones are only 2.12 centimeters in diameter.

Aesthetically pleasing, Go uses simple elements: wood and stone, circle and line, black and white—and a game board that becomes an evolving, often strikingly beautiful mosaic. A well-played move has a visual rightness to it. A novice, in fact, often makes a powerful move with no deeper planning than mentally picturing the way it looks. In Japan teachers introduce Go to children in elementary school, and the military uses it to teach strategic thinking. In a speech telling American businessmen how to compete with the Japanese, Nikko Hotels President Yasuyuki Miura recommended the Americans learn to play Go. "While chess is a game of war, Go is a game of market share," he said. "It involves not immediate profitability but long-term influence."

According to Bruce Wilcox, one of the West's top Go players, "Americans tend to reveal a basic character flaw when they play Go. Typically, once they take over territories, they don't want to then give them up. The Japanese, however, will give up territories in exchange for something else. American are locked into personal possessions."

Wilcox's Go computer program *Nemesis* (Macintosh, IBM-PC compatibles) is available from Toyogo, Box 25460, Honolulu, HI 96825. Fidelity Electronics also offers a hand-held version of *Nemesis*, for information call (800) 634-4692. For more information on the $1 million Go prize contact Michael McGuire, Acer America, 401 Charcot, San Jose, CA 95131. Ishi Press publishes books on Go, and a variety of Go boards. Contact: Ishi Press International, 75 Bonaventura Drive, San Jose, CA 95134. —Scot Morris

LAST WORD

PENNIES FROM HELL:
Money can't buy happiness, but it can make a large down payment for treatment of "moolah madness"

Jerry Benson is vice president of NEC Technologies and buys lottery tickets for all his enemies.

Studying the impact of money on the human psyche, psychonomists have been working hard to test several age-old assumptions. Some of the more notable and controversial findings reveal that a fool and his money are actually parted rather slowly, and that a penny saved is usually about $300 earned by Sears when it wrecks the washing machine.

A recent edition of *The Psychonomy Journal* contains excerpts from a report titled "Winning the Lottery Is the Worst Thing That Can Ever Happen to You." The report provides compelling evidence that money not only can't buy happiness, but in large enough infusions can cause severe mental impairment and even death. Not because of shifts in the winner's values, but because a monetary overdose can produce symptoms similar to those exhibited by an autistic savant: a diminished sense of reality and total lack of comprehension regarding such basic concepts as money.

Scientists at the Center for Psychiatric and Economic Fusion in Palo Alto, California, have blended their research findings with a landmark case study. It's the tale of Bud Fishman, whose large windfall propelled him to an untimely demise.

At forty-one years old, Bud was a quiet, unassuming computer technician earning $45,000 a year in 1985—the year he won $2 million in the "Golden Cracker" Georgia State Lottery.

After telling the local media that he wouldn't change his lifestyle "one micron," he proceeded to buy a new Cape Cod style house, a fire-red Corvette, and a ten-screen multimedia computer entertainment system. Within two weeks he received 23 pre-approved credit card applications (a total credit limit of $210,000 at 21 percent interest), all of which he signed and returned.

Over the Christmas holidays Bud went into a spending frenzy, acquiring such items as the King Tut–size waterbed at H_2O Beds "R" Us. The crowning glory of his money mania was a whale-shaped, in-ground swimming pool, which he purchased by going to the limit on nine of his new credit cards.

He even bought 12 rounds for the house at Ken Kato's High Tech Tavern on New Year's Eve. Bud was then suffering from what the Palo Alto scientists have dubbed Post Cash Syndrome (PCS), which is also known as "moolah madness."

He hadn't recognized how differently he was behaving until he returned to work the following Monday to find his personal effects neatly boxed in a corner of his office. From the hallway his boss barked, "Apparently you don't need us anymore, Bud. Certainly not after what you said at Ken Kato's High Tech Tavern on New Year's Eve."

After a bout of what the Center for Psychiatric and Economic Fusion scientists call "pecuniary panic," Bud swallowed his pride and took a job at the Burger Buffet as the evening fry cook. Bud's unvaried diet of fries caused his cholesterol level to skyrocket. One day his heart just gave out, and he injured his spine falling across the buffet table. Bud was admitted to St. Bernard Hospital for angina pectoris, a fractured vertebra, and unsightly acne.

Returning home, he found his first lottery check. He ripped open the envelope and extracted a check for $70,000. Roughly calculating his new cash flow situation, Bud suffered a severe anxiety attack.

In the ambulance on his way to St. Bernard, it finally sunk in. His $2 million would be delivered in 20 annual payments, less incredible taxes. He went into what psychonomists call "fiscal funk."

In the summer of 1987 Bud ignored the warnings of his cardiologist (he had developed a stress-induced heart condition from the constant drone of creditors calling around the clock), and began looking for work again in the computer field. Everywhere he went the reaction was the same: "Look, Bud, you haven't worked in more than two years, you have a heart condition, and you have a lot of nerve coming to me for a job after what you said to me at Ken Kato's High Tech Tavern on New Year's Eve."

Three years of therapy, antidepressant drugs, and the decreasing value of his lottery checks against 1985 dollars provoked Bud to make his final move. After dragging himself to the top of his Cape Cod house, he vaulted into the blowhole of his empty whale-shaped pool and died. His remaining checks are being used to pay off all of the credit card companies and St. Bernard Hospital (which has almost completed its psychonometric wing).

What can be learned from all this? Psychonomists say that it is a rare person who can survive winning big money. They are now lobbying to add a warning to lottery tickets that reads ACCEPTING THE PROCEEDS FROM THIS WAGER CAN BE HARMFUL OR FATAL. ☒