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OMNI

NOVEMBER 1991

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STATE-SUPPORTED EXECUTIONS OF CHILDREN

OMNI IN SPACE:
REPORT FROM OMNI'S FIRST ORBITAL EXPERIMENT

CRUISING THE ECLIPSE:
FREDERIK POHL

STRANDED IN SPACE:
WHY A RUSSIAN COSMONAUT CAN'T GO HOME

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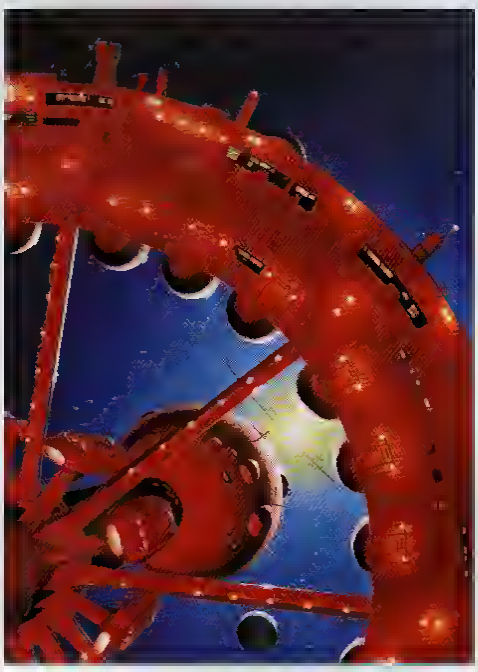
VOL 14 NO 2 NOVEMBER 1991



The need to explore pushes man into uncharted territory, seeking answers and new questions, as the cover by Chris Moore (Artbank/London) reminds us. The Soviet Union led the world into space, but August's failed coup may ground its space program. (Additional art and photo credits, page 67)

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OMNI

FIRST WORD

ORDER IN THE COURT
"And nation shall not lift up sword against nation"

By Martin Sheen

Mother Teresa was largely responsible for my returning to the Catholic faith, and now perhaps this was an opportunity to thank her personally

Monday, February 25, 6:00 PM, JFK International Airport. Flight 111 for Geneva departs at 7:30, giving me ample time to reexamine what I am doing and reconsider going on a "peace pilgrimage" with Joe Cosgrove, a brilliant and dedicated public defender.

Joe's plan was simple. We would go to Rome, meet Mother Teresa and ask her to present his legal brief to the Pope, who, in turn, would approach the World Court and demand an immediate cease-fire in the Gulf. Wishful thinking? Pure nonsense? Perhaps an equal measure of both.

6:45 PM. I am now firmly resolved to tell Joe of my intention to withdraw from the sophomoric misadventure. After listening patiently to me, he asks, "How can we determine what's in store for us before we even take the first step?" I have to agree. More often than not, it was the unplanned journey that proved more fruitful and more rewarding. I have been moved by the Spirit to join this peace pilgrimage, and I decide to trust that Spirit. We are pilgrims—not diplomats—and we must surrender to what lies in store for us and stop trying to determine the work of grace.

Tuesday, February 26, 5:00 PM (Rome time). Joe and I made our way up the Piazza San Gregorio to the residence of the Missionaries of Charity and rang the bell. No sooner had we begun to settle in than a tiny sister appeared smiling in the doorway. It was Mother Teresa of Calcutta! I was astonished at her size. Not taller than five feet, she could not have weighed more than 90 pounds, yet I had never in my life experienced a more powerful presence. She was simply overwhelming and overwhelmingly simple, which made her completely disarming. As we rose to greet her, she took our hands in hers and gave us each a blessing.

"Now, what can I do for you?" she asked. Joe said that he had been moved by the Spirit to draw up a legal petition for the World Court in The Hague to sue for a cease-fire in the Gulf that he needed to present this brief on behalf of a state, since the World Court does not acknowledge individuals as litigants. "I never heard of a World Court," Mother Teresa said. Explaining that it had been founded when the UN charter had been ratified, Joe gave the brief to Mother in an envelope addressed to Pope John Paul II.

After a reflective pause, Mother Teresa said, "You know both Saddam Hussein and Mr. Bush have ignored the Holy Father's plea to end the war. I also wrote to both of them, but neither one of them responded." She told us she had considered going to Baghdad to see Saddam. "What good could I do?" she asked. *What good?* I thought, recalling how she had caused an immediate cease-fire during the civil war in Lebanon simply by her presence in Beirut. Mother Teresa finally said, "I'm going to see the Holy Father tomorrow, and I will give it to him then." Relieved and gratified, we talked to each other for another forty-five minutes—like three old friends.

Wednesday, February 27. After meeting with Mother Teresa, the Pontiff, as part of his regular midweek general audience, issued a strong statement against the horrors of the war in the Gulf.

Thursday, February 28, 6:00 AM, Missionaries of Charity Chapel. On Mother Teresa's invitation, we returned for a Mass of celebration. Earlier that morning the news of a cease-fire in the Gulf had reached us in Rome.

Was there any meaning in our journey? Did it have any impact on the course of the war and the beginning of peace? Who can say? In his traditional Urbi et Orbi speech given on Easter Sunday, Pope John Paul II was vehement in his criticism of the Gulf War. He repeated the moral chastisement that he had used since the war's beginning, but in an unusual moment, the Pope also called the war a "violation of international law." To place a secular label on this terrible event was a dramatic move by the Holy Father. Was it coincidence that the brief Mother had given to the Pope on our behalf outlined the illegality of the war based on international law? Perhaps. A letter, dated three days after Mother Teresa's meeting with the Holy Father and written by the Vatican secretary of state, thanked Joe on behalf of the Pontiff for the information given to him. In its final paragraph, the letter bestowed the Pope's apostolic blessing on us. A fair reward for our humble effort, reminding us once again what Daniel Berrigan has always taught. Our work for essential human needs seeks not results but instead has its remuneration in the goodness, the rightness of the work itself. And that is a blessing of apostolic proportion. ☐

OMNIBUS

WRITES OF PASSAGE

Our writers leave the comfort of home to see the world through prose-colored glasses

Much of our learning is a secondhand story, remotely controlled and ready-made. Press a button and circle the globe in 30 minutes—without leaving your favorite chair. But where does all the information come from? Who collects it? A breed of intensely curious people: the activists of knowledge, the doers and diggers, are driven out exploring by a need to see the world firsthand. In this month's *Omni* our writers chase the sun and moon, burrow the ocean floor, and send ideas into orbit, shifting standpoints to offer new views of the earth—and make waves in the growing knowledge pool.

Clockwise from bottom: Beth Howard, Robert Killheffer, James Oberg, and John Stein.

Frederik Pohl ("Cruising the Eclipse," page 40) calls it science chasing. "I've taken four big trips this year: Africa, France, China, and most recently, Hawaii," Pohl says. "Science is my favorite spectator sport and I don't always need to go far to find it. The best spots are within thirty miles of my home." Author of *Gateway* and *The Space Merchants*, Pohl hits bookstores again this month, collaborating with Isaac Asimov on the environment in *Our Angry Earth* (Tor Books).

With statues tumbling and states altered daily in the former Soviet Union, what is the future of the space program? *Omni* contributor **James Oberg** (Space, page 22) flew twice to Baikonur, the Soviet "space city," which resulted in the PBS *Nova* special "Russian Right Stuff" and an *Omni* feature article (October 1990). "To actually see what I had been studying for thirty years seemed an unending series of delights," Oberg says. In addition to his day job at NASA Mission Control in Houston, he writes and lectures frequently when he's not back at the ranch in rural Galveston County, Texas.

More down to Earth—tragically—"Suffer the Children" (page 81) is the result of *Omni* president **Kathy Keeton**'s longstanding interest in and concern for the future of our children, on both a global and a local level. To further explore this troubling subject, international editor **W. E. Gutman** embarked on an eye-widening trip to Guatemala. Reflecting on his seven-day, 24-hour vigil with the country's street children, Gutman says, "These issues affect the future in human rather than technological ways and will do so indefinitely unless we make changes now." For more than three months prior to his trek, he pored over horrifying statistics compiled on the street children. "But nothing could prepare you for what you see in Guatemala."

Deciding to delve full fathom into the ocean to hunt for buried treasure, *Omni* called **John Stein** ("Interview," page 70). An international banker by day, he was thrilled at the opportunity to return to an old fascination: the sea. "I haven't had the time for scuba diving recently, but I've been following the work of George Bass for years," Stein says. As the father of underwater archaeology, "a bar of gold doesn't excite Bass," Stein says. "The wealth of his excavation lies in its power to change history."

While exploration's rewards are obvious, it requires persistence. This is what most impressed associate editor **Beth Howard** in her dealings with Duke University professor Franklin H. Cocks ("The Light Stuff," page 70). "This had been in the works for many years," Howard says of the *Omni* Get Away Special. "It was so exciting for Cocks to have his invention actually go into space, but he had to endure many roadblocks. There were innumerable delays—three in the last month alone."

Editorial assistant **Robert Killheffer** (Books, page 18), chose to review Norman Spinrad's novel *Russian Spring* (Bantam) because it so closely—and uncannily—mirrored the reality of recent events in the Soviet Union. "Spinrad traveled all over Europe and into Russia to research this book. His experience lends an immediacy to the novel that it wouldn't otherwise have had," says Killheffer. A writer for *Publishers Weekly* as well as the managing editor of *The New York Review of Science Fiction*, he is also a piggish collector of porcine chatchkas. ☒


STAR TREK
ENTERPRISE
THE UNDISCOVERED COUNTRY
STARDATE
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COMMUNICATIONS

THE WORD ACCORDING TO OUR READERS

Taking issue with statistics and beliefs, getting to the heart of the matter, and finding the original Omega

Rash Belief

Father Andrew Greeley [First Word, August 1991] may be correct that people's religious beliefs have not changed much in the last 60 years. But his opinion that journalists and academics "have drifted away from their religious origins" is a rash statement at best. Perhaps because they have traditionally been our foremost advocates of freedom of thought, action, and belief, they find those ideals more divinely inspired than chauvinism, self-righteousness, intolerance, and dogmatism.

Audrey N. Glickman
Pittsburgh

I Am the Keymaster

According to "The Mind of God" [August], neuroscientist Michael Persinger "doesn't believe the answers [in the search for God] lie in the cosmos but in the human brain." Actually, God did first try hiding the key to his existence in the cosmos. In fact, he tried one spot after another, but no matter where in the universe he tried, human beings somehow managed to find it. Finally he came up with the perfect spot and hid the key in the human heart because he knew that was the one place no one would look.

David Siskin
New York City

Faith No More

I agree with Murray Cox [Forum, August] but object to Andrew Greeley's opinions [First Word]. From my own personal experience, coupled with the historical reality of such events as the Inquisition and the Holocaust, I cannot place faith in some benign and all-powerful force that could possibly allow atrocities committed against beings supposedly created in his own image. Must we meekly accept the existence of God because statistics indicate nine out of ten people pray in a week or because 95 out of 100 individuals believe in God? I don't think so.

Katherine Ann Nelson
American Humanist Association
Amherst, MA

Born-again Candidate

Your August issue is an enlightened masterpiece. I would only suggest that perhaps the spirit of God will flow among us more readily if we minimize preconceptions. Thus Murray Cox's statement "All religions presuppose the existence of God" [Forum] assumes there is no institutionalized open-ended religious search for truth and meaning. Unitarian Universalism, however, is such an enterprise for which he is a likely candidate. I also would assume that not everyone who reads the Morris Berman interview will "hear the protestation." All I hear are bells.

Carol Benson Holst
Director of Religious Education
Unitarian Universalist Society
Verdugo Hills, CA

Growing Pains

Until reading the August Interview with Morris Berman, I thought the tendency to move to a horizontal axis was part of growing up. I now understand that it is, in part, an act of spiritual desperation. While I don't have any answers either, I appreciate the questions and agree it is better to know than not know.

Eleanor Roberts
Owensboro, KY

Point Taken

"The Mind of God" reminded me of a book titled *The Phenomenon of Man* (Harper and Row 1959), in which author Teilhard de Chardin developed a thesis similar to Frank Tipler's. He even called it "The Omega Point." I suggest that Tipler's theory actually originated with De Chardin.

Shaun Q. McMahon
Westwood, KS

Frank Tipler replies: Teilhard had the right idea about the Omega Point but lacked the calculations to solve the problems. We were both struggling with the same questions concerning future human evolution, but I have the advantage of 30 years of new science and theory. My theory is his theory done right. ∞

BOOKS

TO RUSSIA WITH LOVE
A science-fiction writer inadvertently turns soothsayer

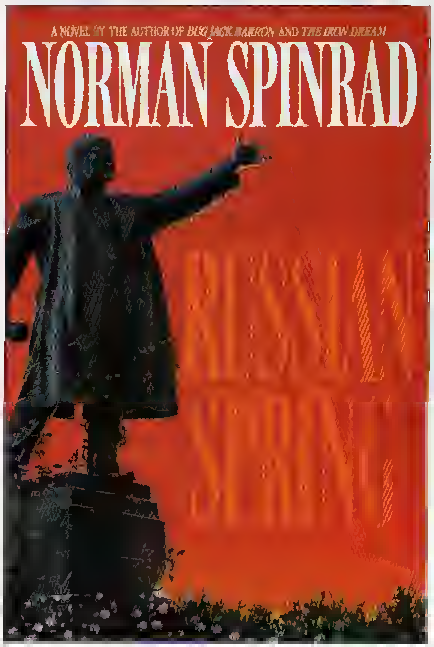
By Robert K. J. Killheffer

It sounds like something out of recent headlines. A moderate Soviet president struggles to hold his country together as the republics declare independence and militant old guard hard-liners grumble, tanks roll through Moscow streets, and a coup led by Soviet Army commanders places the president under arrest, declaring martial law . . . But this is not a front-page *New York Times* story. It's a pivotal scene from Norman Spinrad's latest novel, *Russian Spring* (Bantam, $22.50), published in September and written long before the abortive August coup against Mikhail Gorbachev.

Spinrad began writing *Russian Spring* in 1988, and as the novel progressed he found his fictional prophecies fulfilled again and again, forcing him to redraft his book. "This novel went through many drafts," Spinrad recalls, "because when I started writing it, events such as the German unification seemed far in the future, but as I wrote, most of the things I had been thinking of started to come true."

Science-fiction writers sometimes try to predict the future, at least in general terms, as they extrapolate from current events and perceived trends to create a possible future world. But rarely does science fiction parallel real events as closely as Spinrad's plot mirrors reality. Still, recent events don't mitigate the novel's impact. "If I had another draft to do, I would have written the coup attempt in," says Spinrad. "In the final draft I do refer to a 'Time of Troubles,' vaguely. I think events validate the book."

Spinrad's novel foretells the breakup of the Soviet Union and offers hope for the future.



But there is much more to *Russian Spring* than an eerie forecasting of current events. The novel centers on Jerry Reed, an expatriate American living in Paris, who fled an increasingly reactionary, repressive, and militaristic United States to work with the European Space Agency in the semi-unified Common Europe. Through Reed's story, Spinrad blasts America's failure to pursue its early success in space and criticizes the ongoing militarization of our space program.

Alongside Reed's story is the tale of his two children, illuminating the larger issues of world politics. Bobby Reed inherits a vision of an idealistic, enlightened America from his father and he ventures into the benighted United States in an attempt to find and rekindle that spirit. Jerry's wife, Sonya, is a career Soviet bureaucrat, and their daughter, Franja, absorbs her mother's love of and faith in the newly expansive Soviet system, enrolling in the Soviet space program. Following the Reed children's opposite but converging paths, Spinrad examines the forces shaping both America and Russia today, pointing out the good and bad of each and hinting at ways for the world to tap the best of both systems.

In the end, *Russian Spring* is about living for a dream. For Reed, it is the hope of space travel, for himself and for humanity at large; for Bobby, it is the vision of an America restored to its place as a champion of freedom and progressive values; for Franja, it is the chance for Russia to emerge from centuries of backwardness as a leader of equal standing in the advancement of human culture. Spinrad's vision strikes to the heart of our world's current morass. His desire to slip the shackles of history, abandon our inherited biases, grudges, pettiness, and most of all, *inertia*, and start anew to build a world in which our best qualities are accented is exactly what we need now. Spinrad gives his readers a worthy goal toward which to work.

As we confront the changing face of our relationship with the Russians, making vital decisions about aid, alliance, trust, and treaties, Spinrad's positive outlook might make all the difference. Some readers who know Spinrad from his previous science fiction books may feel that *Russian Spring* is not a science-fiction novel at all because of its clear roots in contemporary events. But *Russian Spring*, using the techniques of future extrapolation to comment so movingly on our current world situation, does what science fiction and only science fiction can do: it shows us where we might be headed and offers thoughts on how we can make the best possible real future with the tools we have. ∞

WHEELS

A SHOCK TO THE SYSTEM
GM's electric car will soon be on the streets

By Mark Fischetti

You've got to run to the mall, so you pull the plug from the electric outlet in your garage, yank the cord so it retracts into the back of your car, get behind the wheel, and put the vehicle in gear. You turn out of your driveway and zoom up the street, your electric car making about as much noise as an electric razor.

Such a scenario moved a giant step closer to reality when General Motors recently announced it would be the first major auto manufacturer to mass-produce an electric car. Production will begin in several years at a plant capable of turning out 25,000 vehicles a year. GM will market the vehicle as a second family car, based on a 2,200-pound, two-seater prototype called the Impact.

Clean-air legislation, not rising gas prices, has provided the stimulus to produce electric cars after similar efforts failed in the Seventies. New California legislation requires that, by 1998, vehicles without tail pipe emissions constitute 2 percent of each automaker's fleet sold within the state. By 2003 that figure must rise to 10 percent or more than 200,000 cars annually. Massachusetts and New York recently adopted similar rules.

The electric car that is GM's response to the new laws will have a maximum range of 120 miles and a top speed of 75 miles per hour. But the vehicle is no souped-up golf cart. It will roar from 0 to 60 mph in a startling eight seconds. Made from strong, lightweight aluminum and plastic, it sports a sleek shape that makes it 33 percent more resistant than any standard car to the dragging effect created by air passing over the car body at high speeds. Also, its specially designed tires roll twice as easily as those made of conventional rubber and weigh only 12.5 pounds each.

All these improvements will come at a price. While GM won't comment on what the production model might cost, auto analysts estimate the price at between $20,000 and $30,000. "We can't build some glory car that's too expensive for anyone to buy," says spokeswoman Toni Simonetti. "But the car has got to perform like a regular car or consumers won't buy it."

Despite the hefty initial expense, electric cars have many long-range benefits, both economic and environmental. Because they don't use fossil fuels, the cars themselves create no air pollution. They will produce some indirect emissions, however, as power plants generate the additional electricity needed to recharge the cars. Taking these increased power-plant emissions into account, some studies show that electric cars will still produce, per mile, 98 percent less carbon monoxide and nitrous oxides, 25 percent less carbon dioxide, and about the same amount of sulfur as conventional cars.

Electric cars don't cost much to maintain because there's no need for oil changes or tune-ups, no radiators to fill, and no filters or spark plugs to replace. Recharging the battery pack takes from two hours to eight hours and costs about half as much as a comparable amount of gasoline. Over 100,000 miles, an electric car winds up costing at least $5,000 less than a gas guzzler, including the cost of replacing the $1,500 battery pack every 20,000 miles.

Those batteries present electric cars' only serious environmental problem. Replacing the GM prototype's 32 ten-volt lead–acid batteries, similar to a typical car battery, every couple of years will create a huge increase in toxic lead waste. Each year, car owners already dump some 20 million dead batteries, each containing roughly 18 pounds of lead. To help remedy the problem, lead-recycling legislation has been introduced before Congress. With tougher pollution laws and increasing environmental awareness spurring the refinement and production of electric cars, the historic New Year's Eve of 2000 could very well find celebrators driving to parties in whirring cars with wall-socket plugs.

Waiting for Detroit: Small firms have beaten General Motors to the streets with their own electric cars, like Florida-based Sebring Auto-Cycle's Zzipper, which sells for $9,000.

SPACE

THE POSTCOUP BLUES
The future of the Soviet space program looks more uncertain than ever

By James Oberg

The ultimate nightmare of space travel is being stranded in space due to a mechanical, medical or orbital dynamics problem. But when the first spaceman actually became "stranded" this year, the cause was entirely terrestrial. His country had run out of money.

Sergey Krikalev is the flight engineer aboard the *Mir* space station. When he kissed his new wife good-bye last May before blasting off for *Mir*, he expected to see her again in October, when he and his mission commander would be relieved by the next crew.

Each relief launch is subsidized by a foreign guest cosmonaut, who pays dearly in hard currency to spend a few days at *Mir*. Even so, Soviet space planners realized by midsummer that they couldn't pay for a planned November flight, which would carry a guest from the Kazakh republic—the home of the Baikonur space center—to appease independence-minded officials there.

So the two launches were combined into one carrying a cosmonaut to relieve Krikalev's commander, an Austrian, and a Kazakh guest. Thus the seat intended for Krikalev's replacement was occupied, and he was asked to stay in space until March, when the next relief mission arrives.

The cosmonaut's predicament resulted directly from the ongoing political and economic crisis in the former USSR. With the collapse of the Soviet economy, luxury items such as space exploration have become prime targets for cutbacks. The public mood has swung solidly against space extravaganzas at a time when basic consumer goods such as razors, soap, even medicine and food, are scarce.

While still a maverick populist, Boris Yeltsin campaigned for election on a reformist platform that included major cutbacks in space exploration. Once elected president of the Russian republic, he favored only space projects with clear-cut earthside applications.

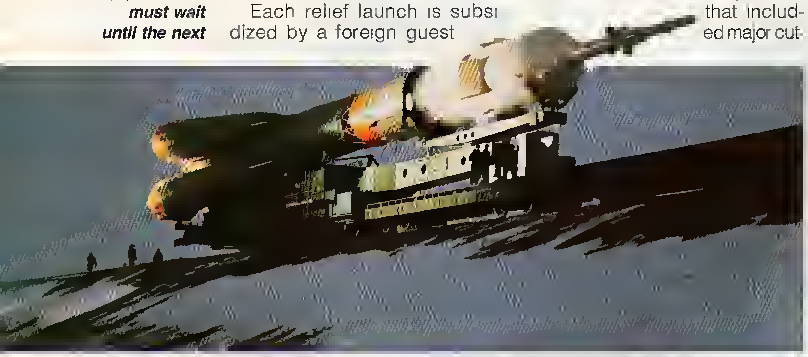
Similarly, Soviet president Mikhail Gorbachev, as early as 1987, ordered space officials to cut back on exploration and research. He also cut the space budget 10 percent per year for three years in a row.

The political upheavals in August enhanced the power of many of the Yeltsin antispace officials. Furthermore, several coup leaders, such as Oleg D. Baklanov and Vitaly K. Doguzhiyev, held influential positions in the rocket industry. The housecleaning that followed the failed coup attempt saw the resignation of other officials in the space and missile industry, such as Oleg Shishkin, head of the aerospace ministry, who had toured NASA space facilities only a month before. Space officials feared the worst, perhaps even the cancellation of the *Buran* shuttle and the shutdown of *Mir*.

However, the defeat of the military plotters also indicates that the worst may be over. Massive cuts may now at last be possible in the armaments industry, whose hard-line officials had resisted earlier budget-trimming attempts. With those officials gone, their pet projects are falling under the budget ax. Space funding, especially for applications programs, could be spared further reductions due to the sudden vulnerability of the much juicier military budget.

Meanwhile, cosmonaut Krikalev remains in orbit, stranded by the collapse of the program that launched him. The *Mir*, Earth's first multimodular space station, remains unfinished, its oldest sections already wearing out before the final sections can be launched. Housekeeping and repair chores occupy nearly all of the crew's time.

Yet the cosmonauts grimly hold on. Abandoning *Mir* now, even temporarily, could bring about the end of the cosmonaut program for years. The Soviets once billed *Mir* as a beachhead into the universe, a "highway to the cosmos." But for Sergey Krikalev and his colleagues, it has become a last-ditch stand, their one remaining chance to preserve a space presence until—somehow, someday—their society can once again commit to reaching toward space.



No room on the rocket. ***Cosmonaut Sergey Krikalev must wait until the next Soyuz rocket arrives in March to end his ten-month stay at the Mir space station.***

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TOOLS

FOR THE TWENTY-FIRST CENTURY
Manipulating consumers, new sounds, past lives, and sweetening your home

By Sandy Fritz

THE POPCORN REPORT.

Faith Popcorn. Doubleday Currency. 1991. $22.50
PLUSES: Good ideas
MINUSES: Arrogant
THE VERDICT: Mesmerizing

The Nostradamus of Marketing' (one assessment of Ms. Popcorn) uses elementary psychology, anthropology, and sociology to gaze into the future of American culture. Then she advises Big Companies how to position their products to make profits.

The ten future consumer trends defined by Popcorn are persuasively argued but marred by the imperative voice. Despite the book's silky delivery and probing inquiry, it's clear that Popcorn and her customers will spare no effort to promote and sell their products. This is science in the service of marketing.

DAT: THE COMPLETE GUIDE TO DIGITAL AUDIO TAPE.

Delton T. Horn. Tab Books, 1991. $12.95
PLUSES: Illuminating
MINUSES: A little too bright at times
THE VERDICT: Technical

"Scat," said America's music industry to DAT. Why? A single DAT can be copied without degrading the sound quality, opening the doors some say for large-scale pirating operations.

Last July a royalty agreement was reached between DAT manufacturers and music companies, so equipment and tapes should appear soon. This book covers every aspect of human perception of sound and technical advances in equipment and explains how the new technology works.

SAFER HOME TEST KIT.

DSK. 325 North Oakhurst Drive, Suite 404. Beverly Hills, CA 90210. $59.95
PLUSES: You can finally take control
MINUSES: ...but try hard not to overreact
THE VERDICT: Utilitarian

The microwave oven test in this kit revealed slight leaks from the microwave here at *Omni*. Now staffers can be seen darting out of the room when they microwave their potatoes.

Our water is lead-free, and since most of us sit in windowless cubicles, the ultraviolet ray alert system was unnecessary. These tests, and two others for radon concentration and carbon monoxide, are extremely simple to use, but, unfortunately, we are unable to verify their accuracy; the guide also provides easy-to-follow tips for taking care of the problems. ☒

THE PHOENIX CARDS.

Susan Sheppard. Reincarnation cards. Destiny Books, One Park Street, Rochester, VT 05767. 1991. $25.95
PLUSES: Unconventional
MINUSES: A questionable premise.
THE VERDICT: Clean fun

A card-and-book combo that claims to "read and interpret your past-life influences" may raise some eyebrows, but it's really good clean fun. You select from a deck of 28 faceup cards seven images that appeal to you. Then you consult the accompanying guide for interpretation.

According to Sheppard, the images you select hint at past lives. We suggest taking some time to bone up on your past lives because they may become in the Nineties what astrology was in the Seventies: reincarnating "What's your sign?" as "What's your times?"

ARTIFICIAL INTELLIGENCE

GORILLA MY DREAMS

Designing an ape's computer poses unexpected challenges

By Joan Griffiths

For her recent birthday Koko the lowland gorilla asked for a voice. Because Koko is no ordinary gorilla, her wish will soon be granted, though fulfilling it took much more time, effort, and ingenuity than expected.

Koko signs at least 600 words in American Sign Language (ASL) and understands more than 1,000 spoken words. Everyone around her talks all the time, and her inability to make human sounds frustrates her.

Fortunately, Koko sits on the advisory board of Apple Computer's Vivarium Program, an ambitious effort to understand the nature of intelligence. Several Apple scientists agreed to design a special Macintosh, complete with voice, for Koko.

A daunting task lay before them: designing a computer that is safe *for* a gorilla as well as safe *from* a gorilla. During her excited moments, 260-pound Koko careers about her room at 20 miles an hour and exerts about 2,000 pounds of concentrated force, the equivalent of a ten-pound shot traveling at 100 miles an hour.

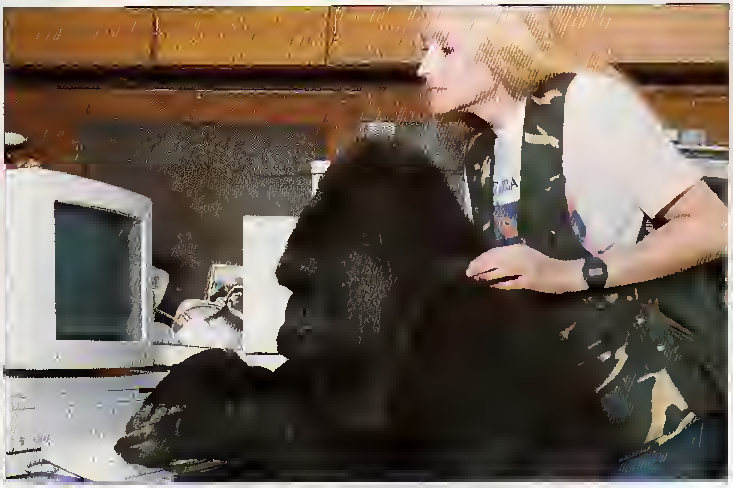
Before beginning work, the Apple computer scientists met with Koko to tell her about the project and to help her pick out a voice. As might be expected when talking with a gorilla who not only understands human speech but also continues the conversation, a few misunderstandings occurred. For example, software engineer Larry Yaeger told Koko he and his associates were from Apple. Because the fruit is her favorite treat, she enthusiastically examined each person's briefcase or bag, looking for apples.

Earlier, four women had recorded three sentences, which were then digitized into a *HyperCard* stack. One of the voices belonged to a woman Koko knew, leading her to sign, "Me girl know." Asked several times in different ways about an unfamiliar voice, she declared, "Rotten." She made no negative comments upon listening to her final choice and several times signed self-referentially, "Gorilla myself good."

Designing a computer to house Koko's new voice proved more difficult. To absorb the gorilla's strength, hardware engineer Tom Ferrara used solid aluminum for the inner structure and a polycarbonate sheet for the cover. The unit sits just 29 inches above the floor (to which it's bolted), a comfortable height for a gorilla who hunkers on the ground. The designers placed the ventilation slots in the rear to direct foreign materials that Koko might deposit, such as bananas or toys, away from the CPU, which has eight megabytes of memory and a 40-megabyte hard disk.

After testing *HyperCard* and *SuperCard*, Yaeger set out to write a special interface, called *Lingo*, for Koko. Seventy uniformly shaped and spaced buttons, each with a full-color picture adapted from an ASL gesture, cover the screen. Touching an icon activates the corresponding word stored in memory. As Koko chooses words, they accumulate in a large bar at the top of the screen, and when she touches it, the whole sentence plays. If she wishes, however, the words can be heard immediately.

The touch screen remains a stumbling block to the Apple designers. Working with MicroTouch Systems' mechanical engineer Mike Clark produced several optically bonded capacitive screens, but Koko inadvertently scratched them all. Gorillas walk on their knuckles, grinding grit deeply into their skin. When she touches the screen, "It's like grinding the bottom of your shoe across the screen," says Ron Cohn of the Gorilla Foundation in Woodside, California, one of Koko's teachers. MicroTouch has developed a new optical guard coating that should do the trick. DC



Koko may be smarter than your average gorilla, but she still needs help from caretaker Francine Patterson to learn to use her specially designed Apple Macintosh.

POLITICAL SCIENCE

THE ABD'S OF PUBLIC EDUCATION

Private schools might not be better and may well be worse

By Tom Dworetzky

Januen wun 2000
Deer Mista Bussh—
I gradiated frum wun ov yur privat skools u made with yur Amerika 2000 plan bak in 1991. Boy wuz it fun and did I lurn a lot. Thanx fur ledin ma foks uze tha vauchurz ta pik a gud skool fur me.
Luv
Ronny

Welcome the future American high-school graduate, courtesy of the education president's America 2000 school reform proposal. Devolutionary SF fantasy or fact?

The skinny on Bush's scheme: Private schools are better than public ones, so let's privatize. The cornerstone of this allegedly free-market approach is to deregulate the educational system by giving parents vouchers that pay for their kids to attend whatever schools they want. The aim is to make all schools, public or private, slug it out on the "level" playing field of the marketplace. Hey, why not? Everyone knows that private schools are great and public ones stink, right?

Wrong. Turns out that public schools do just about as well—or badly—as private institutions. Albert Shanker, president of the American Federation of Teachers, has been hammering this point home, armed with a new study showing a key flaw present in virtually all previous research suggesting private schools do a better job: twisted statistics. They don't compare similar kids. The most important factor turns out to be the parents' education levels. Control for that by comparing kids whose parents have the same schooling, and you find no significant differences on National Assessment of Educational Progress test scores in math between students in public and private schools.

Let's assume the administration knows this by now. Why, then, push for choice vouchers—and the subsequent gutting of the public school system? Consider a few possible explanations.

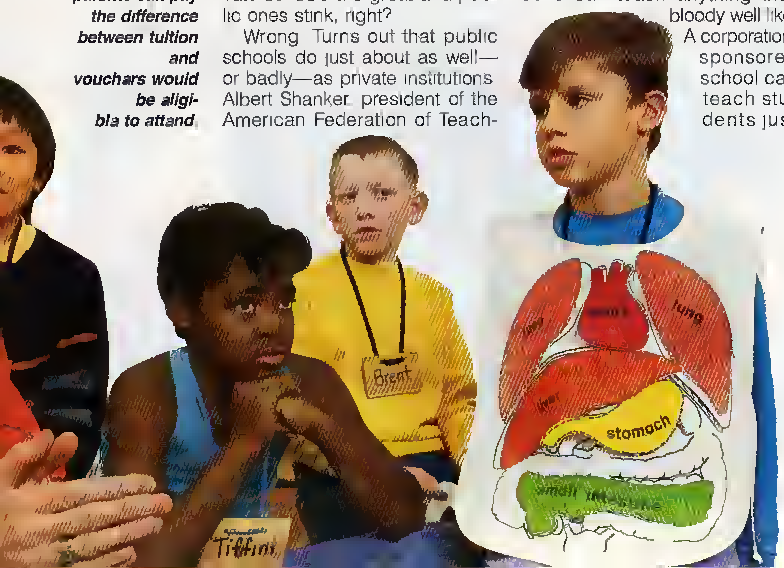
1. Public schools must by law teach a curriculum that contains politically unpopular subjects in these cynical and divisive times—topics such as desegregation, evolution, and safe sex. Private institutions can teach anything they bloody well like. A corporation-sponsored school can teach students just enough to make them good little workers and nothing about the rights and duties of citizenship—like speaking out against abuses of power, S & L ripoffs, and acts of corporate malfeasance. Private schools can promote bogus separatist theories. They can also be ripoffs, like so many vocational schools and diploma mills that advertise on matchbooks.

2. Disadvantaged, difficult students can be dumped by corporate bottom-line bean counters. Think the companies will show a little heart? Know anyone laid off by a big company lately? This short-term thinking will make education cost more, not less. Instead of paying about $4,500 a year to educate a kid, we the taxpayers can look forward to assuming the hidden cost of a gutted public system—the $25,000 a year per kid for incarceration. Jail, after all, is the graduate program for school dropouts.

3. Privatizing schools is part of an administration shell game to reduce taxes temporarily. The short-term benefit: Get reelected. We will end up with thousands of mediocre schools lacking any quality assurance. The really good schools will be oversubscribed.

Vouchers and privatization will effectively deregulate schools, exposing once again the fallacy in the argument that free market policies are always better. Remember how wonderfully laissez-faire worked for our banking system? Rewarding public schools that show improved results is the better way. Vouchers and privatization aren't the answers; they're the final nail in education's coffin. If the President thinks this plan will work so well for education, why doesn't he let us use vouchers and choice for the whole federal budget? In that case I could choose to use my vouchers for education, not H-bombs. ☒

In privatized schools only kids who pass an entrance exam and whose parents can pay the difference between tuition and vouchers would be eligible to attend.



TRANSPORTATION

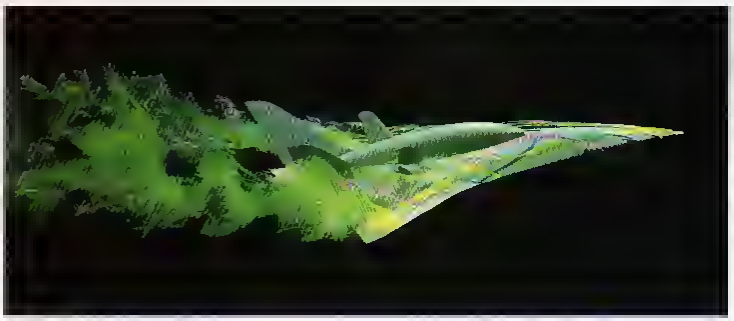
WHAT KILLED THE DYNA-SOAR?

This experimental spaceship was in the right place at the wrong time

By Martin Caidin

June 12, 1967. Searchlights play silently against a swept-winged batlike machine resting atop a huge three-barreled Titan III booster. A computer rushes through its final seconds of countdown. The giant spouts flame against steel and a dazzling sun rises into the night sky. Dyna-Soar accelerates away from Earth riding atop a rocket slingshot that will hurl it into orbit at five miles a second.

Well, *almost*. The spaceplane was officially called the X-20, nicknamed the Dyna-Soar. Dyna-Soar promised stunning ability in just about every facet of spaceflight: a unique amalgamation of aircraft, missile, *and* spaceship technology all embodied in a single powerful bird. But a combination of budget cuts and the stellar success of NASA's Mercury space program killed the Dyna-Soar, putting on the back burner a machine that this country needed desperately 30 years ago and still needs today.



It's déjà vu all over again: Dyna-Soars may be resurrected as the HL-20 personnel launch system.

When the program got under way in 1957, spirits soared at Air Force Systems Command. Studies promised the ability of Dyna-Soar not only to orbit above Earth but also to "dive-glide" as low as 20 miles for bombing runs and then "skip" or soar off the atmosphere like a flat stone skipped across water, back into orbit. As the program began building steam, Dyna-Soar begat Dyna-Soar II, Dyna-Soar III, and then Dyna-Mows. The latter was a highly advanced Dyna-Soar III to be used as a *M*anned *O*rbital *W*eapon *S*ystem. As data poured into Systems Command, everyone wanted in on the project. Astronauts began training, launch sites were designated, and the Air Force shifted its programming to leap far ahead of anything the Soviet Union might produce. In fiscal years 1961 through 1963, the program received $273 million for accelerated development.

Then, in 1964, under "pressure from the top," the Department of Defense (DOD) canceled the whole ball of wax. From a brilliant concept well into development, Dyna-Soar became as defunct as its predecessor, the dinosaur.

Well, the X-20 died. But it just wouldn't *stay* dead. No sooner had DOD buried Dyna-Soar than the Air Force, with NASA cooperation, rushed to develop a huge aerospaceplane that would lift from the ground in piggyback fashion. The main booster would be flown back home and the upper winged stage, which anyone with even myopic vision could see bore uncanny resemblance to Dyna-Soar, would race into space. Some people even called it a "space shuttle." Prophecy?

But Air Force funds for the project dried up again, so NASA rushed ahead with its own winged piggyback designs. (That, too, died, eventually to resurface as the delta-winged shuttle, approved by Nixon in 1972.)

Now it's 1991 and the ghost of Dyna-Soar has been resurrected in multiple forms. Seems the initial idea was so good that France is developing its Hermes winged spaceplane, the spitting image of the old X-20A. Japan is hammering out its HOPE unmanned and manned shuttle, another winged spaceplane. Meanwhile the Germans are planning their Sanger winged spaceplane project, and the United Kingdom looks fondly on its own HOTOL program.

Every one of these designs echoes the Boeing X-20 Dyna-Soar, the spaceplane that refuses to stay dead.

And now, nearly 30 years after DOD dropped the guillotine on Dyna-Soar, NASA (tied in with the Air Force) is rushing development of the HL-20 personnel launch system. It will boost above a Titan IV rocket (Dyna-Soar's booster was the Titan III). It has a length of 30 feet (Dyna-Soar's was 35 feet), a wingspan of 23.5 feet (Dyna-Soar's was 20.4 feet), and will weigh 22,000 pounds (Dyna-Soar weighed 11,390 pounds). Oh yes, the HL-20 will be tested with airdrops from a B-52. The Dyna-Soar test program called for airdrops from the same plane.

So it seems that we blew several hundred million dollars, dumped more than 30 years down the toilet—and with a new name and a slightly different shape, Dyna-Soar is very much alive and kicking. A rose by any other name is ☒

ANIMALS

POACH BUSTERS:
Who you gonna call? A Scotland Yard detective agency for animals

By Jessica Speart

Even as the herd of elk grazed peacefully on public lands in New Mexico, poachers were plotting a crime, finally closing in on the beasts and nabbing more than 100 of them. Loading the elk onto trucks, they headed for Canada but were stopped by federal agents just beyond the state line in Antonito, Colorado.

Until now, law enforcement officials would have been hard-pressed to prove that the elk—their antlers earmarked for the Asian black market—were not privately owned ranch animals as claimed. This time, however, the officials shone ultraviolet lights on the elk's urine. To the poachers' chagrin, the urine glowed, the result of a harmless powder concocted by the National Fish and Wildlife Forensics Laboratory. Park officials had dispersed the powder in hay on state wildlands. Only elk baited off these lands, the agents reasoned, could have eaten the treated hay.

America's wild elk are safe once more, thanks to a special forensics lab.

Resulting in 20 indictments, the so-called Pee Glow case is one of the first success stories of the forensics lab, which is quickly earning a reputation as the Scotland Yard for animals. Run by Ken Goddard, former director of the Huntington Beach Crime Lab, the $4.5 million laboratory in Ashland, Oregon, is doing what 350 U.S. forensics labs do every day: link suspect, victim, and crime with physical evidence. But while most labs solve crimes involving one species—man—this one handles the rest of the animal kingdom. "It's like landing on a brand-new planet," Goddard says.

The effort comes none too soon. The United States is contributing more than ever to the estimated $2 billion illegal world wildlife market. Most often the slaughtered animals make their way to Asia, where their parts are used as aphrodisiacs and as antidotes to ailments including cancer and hemorrhoids. A fresh gallbladder, for example, sells for around $500. Dried and ground, it will bring in $1,200 an ounce. Elk antlers, believed to be most potent when they're "in velvet," engorged with blood, fetch up to $400 an ounce.

Indeed, the lab itself attests to the grisly carnage. A mutilated tiger's head, severed bear paws, and bags of crushed tiger bone and ivory shavings are just a few of the specimens in this little shop of beastly horrors.

Armed with the latest technology, the lab has taken on the poachers with a passion, using a multidisciplinary approach. The scientists start with morphology, making identifications by comparing features like fur, hides, feathers, or claws of confiscated animals with herd samples.

When a species can't be identified this way, muscle, blood, tissue, and soft organs go to the serology lab, where researchers perform electrophoresis, or protein separation. Inserted in a gel and subjected to a 200-volt electric shock, proteins bend in patterns that can be compared with samples to determine the species.

A new technique called a polymerase chain reaction also allows scientists to read the genetic code in DNA samples. If deer meat, for example, is found in a freezer in Miami, DNA fingerprinting can link the meat to a herd in Yellowstone. The smallest sample of blood or tissue, even if found on a hunter's shirt, will provide a positive identification. And unlike cruder techniques, DNA evidence is indisputable in court.

The area of criminalization, however, has presented the lab with its primary challenges—and breakthroughs. A $250,000 scanning electron microscope and a 25¢ protractor helped to break the back of the illegal ivory trade when forensic scientists Ed Espinoza and Mary-Jacque Mann used them to differentiate between mammoth ivory, which can be bought and sold legally, and elephant ivory, which cannot be traded. Both ivories have what are called Schreger lines that differ according to the species. And the research team is close to being able to determine the ivories' age through protein degradation.

Meanwhile researchers have high hopes for another high-tech tool: the gas chromatograph mass spectrometer used at the Olympics to detect drug use in athletes. The machine will make it possible to determine the chemicals and toxins used on animals.

With such an arsenal of resources, the lab is poised to halt the grisly business of poaching. "There's a growing sense among poachers that the easy life is going to come to an end," Goddard says. ☐

CONTINUUM

FAIRWAY TO HEAVEN:

Pebble Beach is yours for the putting, thanks to virtual reality. Also, nuclear mudslinging and the bonny tides of Scotland

Let it be known: Virtual reality golf is here, and it is good.

It's good because golf takes tons of time. Hours for a tee time, hours to play a round, in sunshine if you're lucky, in hail and brimstone if you're not. Add lost balls, torn-up greens, and the threat of lightning and Lyme disease, and you know why 20 million American duffers at one time or another consider beating their clubs into plowshares.

Enter virtual reality golf.

Instead of spending the night trying fitfully to get some sleep in your car (in the hope of getting a tee time at your public links), you enter a private room, press a button, and voilà, you're at majestic surfside Pebble Beach, or stately tree-lined Pinehurst II, or the European Championship Links of Quinta do Lago, Portugal (all through a large screen on the wall and the miracle of software behind it). Drop a ball on the plastic turf, dial up wind velocity—nae wind, nae golf, say golf's sadistic originators, the Scots—pinch yourself to see if you're dreaming, and let it rip.

Now if you live in the city, worse, New York City, where 7 million souls are shoehorned into a few unescapable square miles, you've really got something, don't you think?

The two different systems I played, InGolf and Par T, use infrared beams, photo-optical detectors, and computers to track the ball's velocity, spin, and direction. Whack your drive against the screen, the computer computes, and a blurred facsimile hooks or slices down the fairway. Then instead of having to search for the ball, or even schlepp through the grass to get there, the screen instantly changes, and without flexing a muscle you're peering at the flagstick or at the trunk of a tree.

Select your next club (after spotting the digitized yardage) and hack away again. Finally, hopefully upon reaching the green, the plastic grass at your feet metamorphoses into a putting surface. Drop your ball on a prearranged spot, knock in your putt, dial in your score, and it's on to the next championship hole.

Raise your hand and a real waiter arrives, opening a frosty bottle of beer. Ooops, that's not virtual reality.

In Manhattan I played Par T at Midtown Golf and the World Trade Country Club, and InGolf at the Eastern Athletic Club in Brooklyn Heights (there are Par T and InGolf courses around the nation). Both systems cost their owners more than $30,000, about the price of a membership in a fancy country club. It'll cost you about $25 an hour, and both use real balls, though InGolf's ball contains an inserted mirror to be positioned precisely on a tee. Both promise extreme accuracy (Par T says to within a yard). My feeling is that the two systems tend to come up short on the drives and long on the slices—but then again, I usually come up short on my drives and long on my slices.

Par T uses thousands of photos of real courses blown up onto the screen, whereas InGolf paints its fairways and greens like a giant video game. InGolf's advantage: In a pixeled re-creation the ball melds in better with its surroundings, for example, it has a shadow, splashes with the appropriate *glub* in water, ricochets with a rifle crack off tree limbs. Disadvantage: You're always wondering whether Donkey Kong will appear to stomp you into a divot.

A tree in your way? Par T conveniently ignores the fact. (Midtown Golf swears they're going to fix that.) The simulated ball on the screen looks more like a whizzing alien than a golf shot. InGolf's trees are identical: like a cartoon—it *is* a cartoon—and golf's joys are, for us hackers at least, largely aesthetic.

Of course, standing in the sun with the wind in your hair and, after taking a whack, watching your golf ball waft into a cloudless sky can never be simulated. Neither can shivering in the rain, waiting forever to hit a shot, or losing half a dozen balls on your first hole after staying up all night to get a tee time. Hey, you can't have everything.

—BOB BERGER

CONTINUUM

I can see clearly now. Embedding the intrastromal corneal ring in the eye corrects nearsightedness, farsightedness, and astigmatism

THE VISION RING

People with minor vision problems may soon be able to throw away their glasses or contact lenses. A California company has devised a tiny, transparent plastic ring, which, when implanted in the eye, reshapes the eye to correct the patient's vision. The ring flattens the eye's curvature to correct nearsightedness, steepens it to correct farsightedness, or makes it more uniform to combat astigmatism.

Known as the intrastromal corneal ring, the device, just three tenths of a millimeter long, worked perfectly with three eye patients at the Escola Paulista de Medicina Hospital in São Paulo, Brazil, last March. In an outpatient procedure there, surgeons needed only half an hour to embed the ring in the connective tissue of the eye, anchoring it in a channel 7.5 millimeters in diameter.

The Brazilian surgeons reported that the two-millimeter incisions healed in three days, says Thomas Loarie, president of Kera-Vision, which devised the polymethyl methacrylate ring. In addition, the patients felt no pain and couldn't even feel the implant. Loarie expects the procedure's cost to be competitive with that of such other types of corrective eye surgery as radial keratotomy and laser sculpting, which can cost more than $1,500 per eye.

Three-phase clinical trials of the procedure will be conducted with 600 patients at locations including the Bethesda Eye Institute in St. Louis and should be completed in the mid-Nineties.

—George Nobbe

"Live so that you wouldn't be ashamed to sell the family parrot to the town gossip."

—Will Rogers

CLEANING UP WITH MUD

Mud. Politicians sling it, pigs wallow in it. Now mud has a chance to clean up its image as well as uranium-contaminated waterways and nuclear waste sites.

Led by Derek R. Lovley, scientists at the U.S. Geological Survey in Reston, Virginia, have found that a strain of bacteria common to mud transforms uranium, a highly soluble radioactive metal, into a solid that can be easily isolated in wastewater and filtered out.

The bacterium, a rod-shaped microbe known as GS-15, usually gets its energy from a similar reaction involving the transformation of iron. But laboratory experiments show that it derives twice as much energy from metabolizing uranium.

The findings not only "help to explain the presence of uranium ore in certain sediments, but more important, they provide a possible mechanism for cleaning up environments contaminated with soluble uranium at a very rapid rate," says John Stolz, an assistant professor of biology at Duquesne University in Pittsburgh.

Wastewater from uranium mining and nuclear power plants could be pumped through bioreactors seeded with the microbe, which can be cultured fairly rapidly, Lovley says. The dissolved uranium would then be transformed into metal solids that could be easily removed, leaving purified water to be returned to the environment.

—Khephra Burns

"We should all be concerned about the future because we will have to spend the rest of our lives there."

—Henry Longfellow

THE FIRST SUCCESSFUL CORNEA TRANSPLANT ON RECORD TOOK PLACE IN 1835. A BRITISH ARMY SURGEON IN INDIA REMOVED THE CORNEA FROM A FRESHLY KILLED ANTELOPE AND GRAFTED IT ONTO THE EYE OF HIS PET ANTELOPE.

RARE BREED

Nearly a century ago ranchers attempted to start a cattle ranch on New Zealand's remote subantarctic Enderby Island. When the venture failed, the ranchers abandoned the cattle to fend for themselves. Remarkably, the animals survived to the present day.

New Zealand scientists have begun collecting semen from the cattle, an early shorthorn type now extinct elsewhere, in an attempt to broaden the world's bovine gene pool.

Because the Enderby Island cattle have never been exposed to antibiotics, microbiologists have taken a keen interest in studying the bacteria in their digestive systems.

Doctor of animal science Hugh Blair of New Zealand's Massey University, who is organizing the semen collection, believes that the cattle could provide a much-needed alternative to "specialized, high-performance animals."

Ironically, the move to preserve the cattle's genetic material was prompted by plans to exterminate the animals as part of a program to turn Enderby Island into a wildlife preserve.

—H. J. Cording

SURF POWER

Civil engineers at Queen's University in Belfast have found a way to use the waves crashing onto Scotland's island of Islay to power the island town of Port na Haven.

The prototype facility relies not on the rise and fall of tides, but on columns of water from incoming waves that rush into a 120-cubic-meter concrete chamber atop a rock gully at the shoreline. The water compresses the air at the top of the chamber, driving a turbine, according to engineers Alaister Thompson and Trevor Whitaker. When the waves recede, they leave a vacuum in the enclosure that sucks air back in, continuing to power the turbine. At 1,500 revolutions per minute, the normal speed of a standard electrical generator, the demonstration plant can produce 40 kilowatts of electricity, enough to keep all the lights aglow in Port na Haven (population 200).

Atlantic waves travel very long distances without dissipating energy, Thompson says.

The demonstration plant will run off and on for the next two years of tests, financed by England's Department of Energy. Thompson and Whitaker plan further study of the chamber's design, but they are confident that wave power can eventually meet electricity needs along the west coast of Britain as cheaply as coal and with less damage to the environment.

—George Nobbe

Hang ten—kilowatts, that is. Civil engineers at Belfast's Queen's University have turned the power of waves into electricity.

YOU CAN'T FLY HOME AGAIN

On June 8, 1991, the Kenai Peninsula Racing Pigeon Club released 58 experienced racing pigeons from King Salmon, Alaska. Two weeks later only five pigeons had made their way home to Kenai, 230 miles to the east. "That's an extremely low rate of return," says Bill Kluge, president elect of the club. "It's normally about a six-hour trip." Puzzled, Kluge contacted experts at the University of Alaska in Fairbanks, who told him the pigeons had likely fallen victim to violent solar flares.

To guide themselves, the birds rely on the earth's magnetic field, which was disturbed by frequent solar flares in June according to geophysics and electrical engineering professor Robert Hunsucker. The flares and resulting magnetic storms disoriented the pigeons. "The higher the latitude, the more disoriented they get," he says.

What about the wayward fliers? "If we were going to have stragglers, odds are they would have come in by now," Kluge says. "These birds probably kept flying and flying, believing they were headed in the right direction. Some might have gone a thousand miles before stopping to rest."

—Steve Nadis

Solar flares make racing pigeons lose their way.

CONTINUUM

FARMING THE SEA BREEZES

Picturesque windmills dot the landscape in Denmark and other northern European countries. Now windmills have begun rising from the icy sea off the southern coast of Sweden as part of a plan to harness the winds to power the entire country.

Last fall the world's first ocean-based windmill began operating in a corner of Sweden's Hanö Bay. With a diameter of 75 feet and anchored by three concrete legs, the rotor rises 123 feet above the Baltic Sea. Sydkraft, one of the country's two major utilities, operates it as well as Sweden's largest land-based windmill.

Sydkraft put the new windmill out at sea because breezes are stronger and more consistent offshore than inland. Competition for real estate has also cut the amount of land available for siting hundreds of windmills. On the downside, offshore wind generators cost more to build and operate. "We're hoping that the increased wind energy will compensate for the higher cost," says Olof Sandberg of the National Energy Administration in Stockholm.

During a five-year test, energy officials will monitor the Hanö Bay turbine's performance and its effect on local fishing and shipping. If all goes well, Sydkraft plans to build an oceanic wind energy "farm" of 98 windmills. It's estimated that 60 of these farms would be needed to replace Sweden's nuclear power plants, which are scheduled to be phased out by the year 2010.

—Steve Nadis

One of Sweden's major electric companies built a windmill in the Baltic Sea to capture the robust ocean breezes

Currently added to ice cream as a thickening agent, Zooglan may soon be used to isolate heavy metals in wastewater

EAT IT, WEAR IT, OR DUMP IT

A Seventies *Saturday Night Live* sketch touted the wonders of Shimmer, both a dessert topping and a floor wax. Zooglan has even more diverse uses. It's a thickening and lubricating agent in food and cosmetics and it's just about ideal for cleaning up wastewater.

Produced by a bacterium called *Zoogloea ramigeria*, Zooglan basically consists of polysaccharides, long strings of sugar molecules according to Donald D. Easson, a biochemical engineer who conducted much of his research at the Massachusetts Institute of Technology. Exactly what *Zoogloea ramigeria* uses Zooglan for remains something of a mystery. "It could be an energy storage source that the bacteria need to survive," Easson theorizes. *Zoogloea ramigeria* gets by in its watery environment by absorbing such nutrients as iron, he says.

The bacteria also carry a negative electrical charge that causes them to bind with heavy metals of the sort found in wastewater, making them clump together and settle into a residue easily separated from the water. Easson and his colleagues think that, using genetic engineering, they can design a process to produce enough Zooglan for cleaning up wastewater on a large scale. Easson envisions growing the bacteria in tanks, isolating and harvesting the strings of molecules.

—George Nobbe

"Nothing wears clothes, but Man; nothing doth need but he to wear them."
—George Herbert

CONTINUUM

Mmm rats for dinner! Africans consider nkumbi, or giant rodents, good eating, but the wild creatures are tough to catch

RAT RANCHING

How do you feed the hungry poor in Africa? Let them eat rats

Like the Gambian and cane cutter rats, or *nkumbi*, found in nearly a third of Africa Considered a delicacy there the cat-sized rodents are tough to catch, so a team at the University of Wisconsin (UW) has begun domesticating them for backyard rat ranching

Such "microlivestock' have many advantages, according to Jane Homan, veterinarian and associate scientist in the university's international programs office The critters eat local plants, require no special feeds, have little impact on the environment, and can be raised in backyard pens much as Westerners might keep chickens Any extra meat can easily be sold at the local market

Mbakulirahi Malekani, a professor at Zaire's University of Kinshasa came up with the idea of domesticating the giant rats He contacted Tom Yuill, associate dean of UW's School of Medicine, having noticed Yuill's work with the National Research Council's Board on Science, Technology, and International Development on tapping underutilized resources around the world

BY AGE 35, WHEN THE HUMAN SKELETON HAS REACHED ITS PEAK MASS, BONES CAN BEAR 24,000 POUNDS OF PRESSURE PER SQUARE INCH WITHOUT BREAKING

Yuill and Homan subsequently began collaborating on the rat project, and they have since received a grant to perfect rodent ranching and started a colony of Gambian rats in Zaire Domesticating the rats "is really a case of trying to develop appropriate management techniques," like the control of parasites and disease, Homan says

For all of giant rats good points, don t look for rat meat at your supermarket. The researchers have no plans for major commercial production or even the importation of rat meat from Africa Even though muskrats and other "bush" animals are eaten in various parts of the United States, Homan says, Westerners draw the line at eating rats —Peggy Noonan

"When you say you agree on a thing in principle, you mean you have not the slightest intention of carrying it out in practice."
—Otto von Bismark

ROBBING FISH OF CHILDHOOD

In an attempt to reproduce before landing in a fisherman's net, codfish in the North Sea now mature earlier than they did a century ago, says Cathy Rowell, a doctoral biology student at England's University of York.

A female cod can live up to 20 years, reproducing every year from the age of 3 or 4 But now Rowell says, there is a 60 percent chance each year that a cod will be caught in the heavily trawled North Sea once it reaches the legally harvestable age Only 15 percent of the fish currently survive to breed at the age of 3 and only 5 percent reach the age of 4.

Checking historical records, Rowell found that in 1893 half the female cod population became mature once they reached 75 centimeters long Nearly 100 years later, half the females are becoming fertile at 50 centimeters.

"I looked at other indicators, like temperature," Rowell says, "but the pattern of change provides dramatic evidence that it is human activity that is forcing the cod to change so rapidly This is one of the few known cases of evolution occurring as a direct result of human behavior rather than as a gradual response to changes in the environment."
—Ivor Smullen

Heavy commercial fishing has forced codfish in the North Sea to grow up fast so they can reproduce before getting caught.

LAST JULY *OMNI* JOINED A FLOTILLA OF SUN WORSHIPPERS ON A VOYAGE INTO THE TWILIGHT ZONE.

CRUISING THE ECLIPSE

7 27 AM, July 7, 1991. We're ninety-six hours from the eclipse, but some of the dedicated eclipse fans are already out on the starboard railings of the *S.S. Independence,* squinting anxiously at the sun. It's good and bright right this minute. That's pretty much the way you'd expect the sun to be here in these sunny Hawaiian waters, and the good news is that if the moon were going to slide in front of it today instead of four days from now you'd surely say that it was being eclipsed, all right. The bad news is that you wouldn't be able to make out some of the fainter outer corona because there's a thin, high fan of cirrus that starts at the horizon and spreads out over the eastern sky. It won't keep you from getting a sunburn, but it's just enough to fuzz out the fainter patches of coronal light. Maybe our luck will be better on July 11.

Maybe it won't, too. Pacific skies are cloudy. I've flown over this ocean twice in the last few weeks, fourteen and a half hours from San Francisco to Hong Kong, and there was never a minute when I could look out my window and see no clouds in the sky at all. This morning there are fluffy little clumps of cumulus all over the eastern horizon. Twenty minutes later, while we're eating our breakfast papaya and omelets on the fantail, a couple of clumps slide right over the sun, and that's the kind of thing that can really spoil an eclipse for you.

ARTICLE BY FREDERIK POHL

THE SUN AND MOON DON'T CONSULT HUMAN WISHES WHEN THEY MEET, TYPICALLY IN THE MIDDLE OF AN OCEAN, JUNGLE, OR SIBERIAN WASTELAND

Of course, on the *Independence* we'll be a moving target. We should be able to dodge a few cumulus shadows. We'd better do it, too. There are 800 passengers who have booked passage on the *Independence* for the sole and simple reason that they want to see the sun go out. If they don't see it with their own eyes some of them are going to be thirsting for blood.

Eight hundred on the *Independence*, 800 more on its sister ship, the *Constitution*... heaven knows how many others aiming to be out at sea somewhere in Hawaiian waters, on anything from a kayak to a catamaran, so they can get a good look at the Nineties' best eclipse.

The great thing about the July 11, 1991, eclipse isn't just that it's a good long one (more than four minutes of totality right here, some other eclipses give you only *seconds*) but that its path sweeps right over a lot of places where people like to go anyway. Once it leaves the Big Island its next stop on land is the tourist havens along the Mexican coast, so Baja California is standing room only, too. Other eclipses have been in far less desirable (or, for that matter, accessible) places. The sun and moon don't consult human wishes when they meet. The moon's shadow can strike the earth anywhere on its sunlit (or, of course, temporarily *non*sunlit) face from the North Pole to Antarctica, and it has a distressing habit of doing so in the middle of an ocean, jungle, or Siberian wasteland: when scientists wanted to check out Albert Einstein's relativity predictions by observing the May 29, 1919, eclipse they had to go to an island in Africa's Gulf of Guinea to do it.

Still, some of our shipmates on the *Independence* might do the same thing. Some of them have seen three, five, as many as a dozen total eclipses in one part of the world or another, anywhere from New York's Central Park (that was way back in 1925, I saw most of that one myself) to the China Sea, and they all want more. They come in all shapes and sizes, our shipmates do. Over the week we're at sea I meet an Army chaplain, an advertising executive, a bundle of teachers at all levels, retired senior citizens from assorted walks of life, and—unusual for a cruise ship, but not really unexpected for this one—a great many working scientists: astronomers, physicists, mathematicians, biologists, chemists, computer people, and one or two who don't exactly say what it is they're working on, but whose home base is one or another research facility of the Department of Defense.

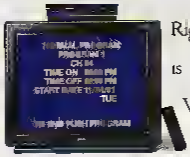
Then there are the kids. There are dozens of them. We happen to have lunch one day with a bright, well-mannered seven-year-old named Michael, traveling with his grandparents and doing his best to be good company, but clearly yearning to get it over with so he can get back to his Nintendo. The adults have other entertainment: movies, hula lessons, cards, contests, cabaret shows, and "us"—astronaut Michael Collins, photographer George Keene, meteorologist Joe Rao, and generalist (which is to say, science-fiction writer) me. This will be Keene's eleventh eclipse, and he has spectacular photographs of the last five to prove it. Joe Rao is the weatherman who will try to pick out the clearest piece of ocean for us on the morning of the eleventh, besides which he has seen and photographed several eclipses himself; while Mike Collins, on his way around the moon on Apollo 11 in 1969, saw all the personal eclipses a person might want. I am low man on this particular totem pole. All I have is the memory of that ancient 1925 event—and now Joe Rao breaks the news to me that I was several miles too far south and east at the time to see real totality, so that all I actually got was about a 99.99 percent partial. I never knew that. I was five years old. All I knew was that the sun went out.

We sail after sunset. When it's full dark and we're well away from the light pollution of Honolulu and Waikiki, Joe Rao takes a bunch of us out on deck to look at the constellations. Captain L. Richard Haugh has turned off all the lights: the rules of the sea will allow, and the seeing is good.

This is a good place to see the southern constellations, and these are good ships for the purpose. Especially if you want to take pictures. They were originally built as Atlantic liners, with glamorous histories, until the Hawaiian-American Line rebuilt them to cruise the islands. They're steady photographic platforms because their propulsion is gentle steam rather than the sometimes jittery diesel motors.

7:28 A.M., July 8. We're tied up at the port of Nawiliwili, Kauai, and if the eclipse were this morning we'd be in pretty

Finally, a VCR everybody and his dog can program.



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good shape. The high cirrus veil is gone, and although there are some hefty cumuli around, we shouldn't have much trouble dodging them.

There's one unwelcome development. The trade winds blow steadily from the east at these latitudes, but for the last few days they've been taking some time off. Now, in the absence of the trades, dust from the erupting volcano in the Philippines has backtracked to our air. Besides burying Clark Field, Mount Pinatubo is making a faint, almost invisible, silvery sheen over the sky. Its dust has made some gorgeous sunsets, but sunsets we can get almost any day, and it's for the best possible view of the total eclipse that we've collectively traveled all these miles.

Mauna Loa isn't the Big Island's only towering mountain. The other is Mauna Kea, just a trifle taller and crowned with astronomical observatories.

That's one of the other graces of this July 1991 eclipse. Its path of totality goes smack over one of the world's largest aggregations of big telescopes on the peak of Mauna Kea. The reason so many institutions have put their biggest instruments there isn't because the astronomers like sunbathing on the beaches—actually, much of the programming for the telescopes is done by remote control from as far away as the Greenwich Observatory in England—but because the seeing is so good. At two and a half miles up, the mirrors are placed well above much of the earth's air and most of its obscuring water vapor—most of the time.

Still, I know from personal experience that even up there the seeing sometimes goes sour. I'm an observatories fan—everything from the Big Eye on Mount Palomar to the Bigger Dish of the radio telescope at Arecibo, Puerto Rico—and once when I was staying in Hilo I couldn't resist the temptation to take a look. Against advice I rented a four-wheel-drive vehicle and made the climb. The advice had been good. It wasn't a fun drive: narrow road snaking up the mountain, high winds that made the Jeeps I'd slither back and forth on the loose gravel, with 500-foot drops and no guardrails, and a freezing, sleety tempest at the top. There wasn't going to be any seeing that day. Not even sight-seeing; I turned right around and headed back down—and was lucky, I guess, because the next day the road washed out in the storm and a party of astronomers was stuck on the mountain for three days.

And they're not doing much better now. The peak of Mauna Kea has been socked in for three days, and the solar astronomers are biting their nails. They really want to get this one in. It's not their only chance, quite. Sooner or later there will be another total eclipse passing over their heads, but, on average, they come back to the same place only once every 350 years.

The Mauna Kea astronomers don't really need a total eclipse to study, for instance, the sun's corona. They do it all year round. They make their own eclipses, when they want them, by sliding a sun-sized opaque disc into the optics of their telescopes, and with the bright solar disc hidden the corona pops right out. But then sunglow lights the air around the image, and besides, the chance of comparing the natural eclipse with the coronagraph studies lets them check their simulation, and anyway they certainly *want* to see it. They've been setting up for this once-in-several-lifetimes photo opportunity on Mauna Kea for a long time, and the clouds that are now hovering around the top of the mountain have never been more unwelcome.

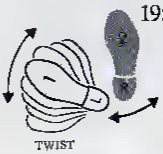
On deck a passenger asks me if we're going to see Baily's Beads. I couldn't be more pleased, because I happen to know the answer to that one. "No."

Baily's Beads are the little necklace of bright points of light that you sometimes see around the eclipsed sun at totality. They come from the mountains on the rim of the moon, at an exact matchup the valleys between them let light from the sun's rim through.

But we won't see them this trip, because on this eclipse the moon is a tad too large; it will overlap the disc of the sun and thus cut off not only Baily's Beads but a little of the inner corona, and the reasons for *that* are that the moon happens to be about as close to us (at 222,380 miles) as it ever gets, and also simply that it's July.

The season of the year matters. The earth's orbit around the sun isn't a perfect circle, it's stretched out a little to become an ellipse, and the sun isn't exactly at the center of it. What makes things nice for the Northern Hemisphere is that when it's our winter we're at the part of the orbit that's closer to the sun, and now in July we're the farthest from it—94,552,000 miles or so instead of the average distance of around 93,000,000. This makes our Northern seasons a little milder than those south of the equator, but it also makes the sun relatively a little smaller for this summer eclipse. Thus there will be the moon's overlap—and no beads.

Carried away with this success, I go on to demonstrate some eclipse-view-



You always come back to the basics.

ing techniques. The ship's owners have passed out cards containing patches of totally exposed photographic film to look through, which is one first-rate way to do it. The patches are about as nearly totally opaque as you can get—if you hold them over a light bulb, the bulb is invisible—but through them the sun is nicely visible, looking like a tiny orange hanging in space.

There are other ways of seeing the sun without risking your optic nerve, too, and I demonstrate some of them to my rapidly growing audience, which sometimes gets up to as many as four. I show them how to make a pinhole in a stiff sheet of paper and hold it over a white surface, the pinhole becomes a lens and the image on the surface is a perfect tiny replica of the sun. A larger image can be made by using binoculars or a small telescope—not looking through it, of course, because that's a rapid way to achieve blindness, but letting the light from the eyepiece fall on a surface. Or you can simply use a mirror to reflect an image on a wall.

It's worth looking at even before the eclipse, because this is an active period for the sun just now—many flares, many sunspots. With the naked eye I can't see any sunspots on any of our images, but through a 30-power telescope I find two big ones close together and a speckling of tinier ones, like grains of black pepper on a melon. With all this activity there should be some fine flares to see at totality.

At night George Keene gives a slide talk on the planets of the solar system and some of the more glamorous other telescopic objects. The cruise director has scheduled the talk for the ship's 125-seat theater, yet there are 200 or 300 other passengers milling around who want to get in and can't.

The thing is, the people on the *Independence* are not your usual passengers. Some of them are normal enough to just want the usual sea, sun, and shopping, and for them the eclipse is just a nice little added attraction, but the overwhelming majority are a different breed. They are among those lucky few who have discovered what a grand spectator sport science is. I understand them well, for I am of their blood. Like them, I try to chase science wherever I go, from marveling at fossils captured in the polished marble lobby of a Manhattan skyscraper to 2,200-year-old irrigation projects in China. I have found people like these among the geysers of Iceland and in Africa's Rift Valley. *Certainly* they're going to want to attend the lectures. Even if it means missing the ukulele lessons.

7:28 A.M., July 9. We steamed all night, and this morning we're anchored off the Kona coast of the Big Island. If the eclipse were right now we might squeak by—the sun's there, all right, but it isn't perfect. It's dimmed by some clouds over the mountain.

Of course, on the eleventh we won't be this close to any mountains. We'll be anything up to 50 miles offshore, but when I look off to where we'll be on the western horizon what I see is a pretty discouragingly thick cloud bank. Forty-eight hours from now that one will be long gone . . . but what will take its place? We're not that far from the Intertropical Convergence Zone—the latitudes that sailing ship masters used to call the doldrums—which is the place where the light and fickle winds go in all directions and can pop up a disturbance on short notice. So weather forecasting in these latitudes is tricky, and the captain pores over the meteorological reports with Joe Rao.

In their talks Keene and Rao are covering the skies and the weather, so when I do my first lecture I talk about the geology of the Hawaiian islands. They're definitely volcanic, but they're also situated a long way from the "ring of fire" around the Pacific Ocean, where colliding tectonic plates produce Mexico's Paricutin and Washington State's Mount St. Helens and all the others, up through Alaska and down through Kamchatka and Japan. Hawaii sits right in the middle of the biggest tectonic plate of all, where you don't expect volcanoes to be. Yet the islands are nothing *but* a long string of volcanoes, the newest one, the Big Island, to the south and east of the island arc, the others growing older as they stretch off to the north and west, past Kauai, as far as the eroded surface atolls and underwater seamounts that end the chain.

What made them? A "hot spot," a place under the solid Pacific plate where the magma was a little hotter and more buoyant than the stuff around it, and so it pushed its way up through the rock to make a volcano. As that volcano grew, it became an island. But then the Pacific plate, slowly moving northeast, pulled that first volcano away from the hot spot, and another began in its place. And so on while the older ones, their renewing lava flows having dried up, began to be slowly eroded by the wind, rain, and waves.

The *Independence* is going to spend most of the day in the port of Hilo on the Big Island of Hawaii. The newest island, it still has the active volcanoes of Mauna Loa and Kilauea. I urge all the science chasers in the audience to take the 40-minute drive up to spectacular Volcanoes National Park so they can see the craters.

The other lecturers have been talking about the exploration of space—particularly Mike Collins, who has been there. Curiously, there's a connection between the lava tubes of Hawaii and the prospects for lunar colonization—maybe. A lava tube is formed when the lava spilling out of an overflowing crater or vent rolls down a hill; the lava moves in the form of fingers, like chocolate syrup dripping down the sides of a sundae, and the outer surface of each finger begins to cool almost at once. After a while the outer surface hardens, forming a sort of pipe that contains the molten rock pouring through its interior. When the source pool of lava dries up, the lava inside spills out. The hollow tube remains, though it is covered by later flows.

The moon once had volcanoes, too, and they probably produced their own lava tubes. If so, they're probably still there and reasonably intact—there's not much erosion on the surface of the moon to break them up as it would on Earth—and because of the light lunar gravity they're probably much bigger than Kilauea's, as much as 1,000 feet in diameter and miles long.

So there's a bit of good luck for any future lunar colonists. They probably would be looking for a safe place to live underground, away from the danger of radiation from solar flares. If they could find a convenient lava tube they could save a lot of excavation: dig down to the tube, slap a coat of sealant on the walls, fill it with air (probably imported from Earth).

All that, of course, contains several maybes—of which the biggest is that, maybe, we will sooner or later go back to the moon, this time to stay.

Around midnight we all get an unadvertised bonus, namely a chance to see some serious volcanism in action.

We don't have to chase this science very far. All we have to do is look over the rail, because the *Independence* is rounding the southern shores of the Big Island, and that's where Madam Pele

has been spilling her lava into the sea for the last few years. Villages have been buried, tropical forests set afire, and still the flow oozes down.

From the ship the first thing we see is a spattering of ruddy lights along the slope of the mountain. At a distance they look like the campfires. They aren't. They're what volcanologists call "skylights." As the lava tubes cocoon their red-hot contents on their way downhill, the tubes sometimes crack and bright sludge peeps out. And then, when they reach the beaches and the surf, the streams explode into clouds of steam, brightly lit from the fiery lava, shooting off rockets of red-hot rock in all directions. You can see this fountaining firework display 20 miles away. There are three of these steam infernos working now, and as we get closer we can hear them, too: hissing and spattering, occasionally a distant gunshot sound. In a lifetime that has given me chances of close-up inspections of a number of volcanoes, I have never seen anything like it.

That's not quite all. There's another marvel nearby, though we can't actually see it.

That one is the next Hawaiian island, already growing under the surface of the sea, it is nine miles offshore, or just about under our keel at one point, and no more than 5,000 feet away—but unfortunately those 5,000 feet are all water, straight down. Its name is Loihi. It will be a while before this young volcano's lava flows lift it above the surface, but then Loihi will be another island, and Hawaiians of that date will have to add a ninth bar to their state flag—about a million years from now.

7:28 A.M., July 10. Sun up, sun glorious; if the eclipse were today instead of tomorrow we'd have it in the bank.

Half an hour later, though, it's not so glorious. The clouds move in, a drizzle starts, before long it's pelting rain and if there's a sun in the sky there is no way for anyone on this ship to find it. But hey, what did you expect? We're docked in the harbor of Hilo.

Hilo is sited on the wet eastern side of the Hawaiian mountains, where the trade winds get lifted up and cooled off, causing them to drop out all their accumulated burden of moisture before going on to the (usually) dry Kona coast on the west. What that moisture does is fall as rain on the umbrellas of the people of Hilo—200 inches of it in an average year. It makes for wondrously lush tropical forests and gardens—but don't forget that umbrella.

At midnight we're under weigh to the offshore point where we hope to see the sun go out and Joe Rao is pacing the deck. We're already a long way from Hilo, but the clouds have followed us. The best he can count is three stars, and those only for minutes at a time. It's worry time on the *Independence*. He spent an hour at the weather station at Lyman Field in Hilo, and the best the maps and the forecasters could offer was a fingers-crossed "maybe."

But there's nothing to be done about it now, and we all go to bed—for five or six hours' max.

7:28 A.M., July 11. *This is it* . . . and we lucked out! It's gorgeous, it's happening, and it's clearly in sight!

We're at latitude 19° 30' 42" North and longitude 156° 32' 54" West, 33 and a bit miles off the Kona coast. Clouds are all around us. The Intertropical Convergence Zone has done its number around us, and high cirrus and cirrostratus, mixed with Philippine volcano dust, are coming at us from one direction, while low, thick island clouds are heading toward us from another. But we're in the clear! There's a doughnut of clouds above, but the captain has put us in the hole of the doughnut, and we can clearly see the sun

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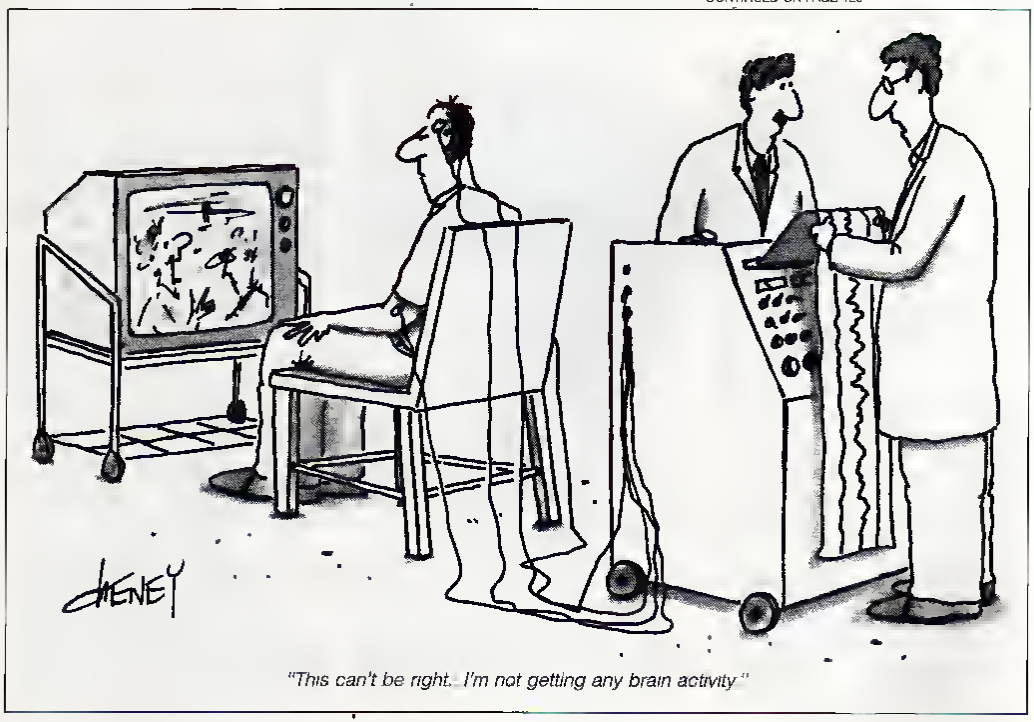

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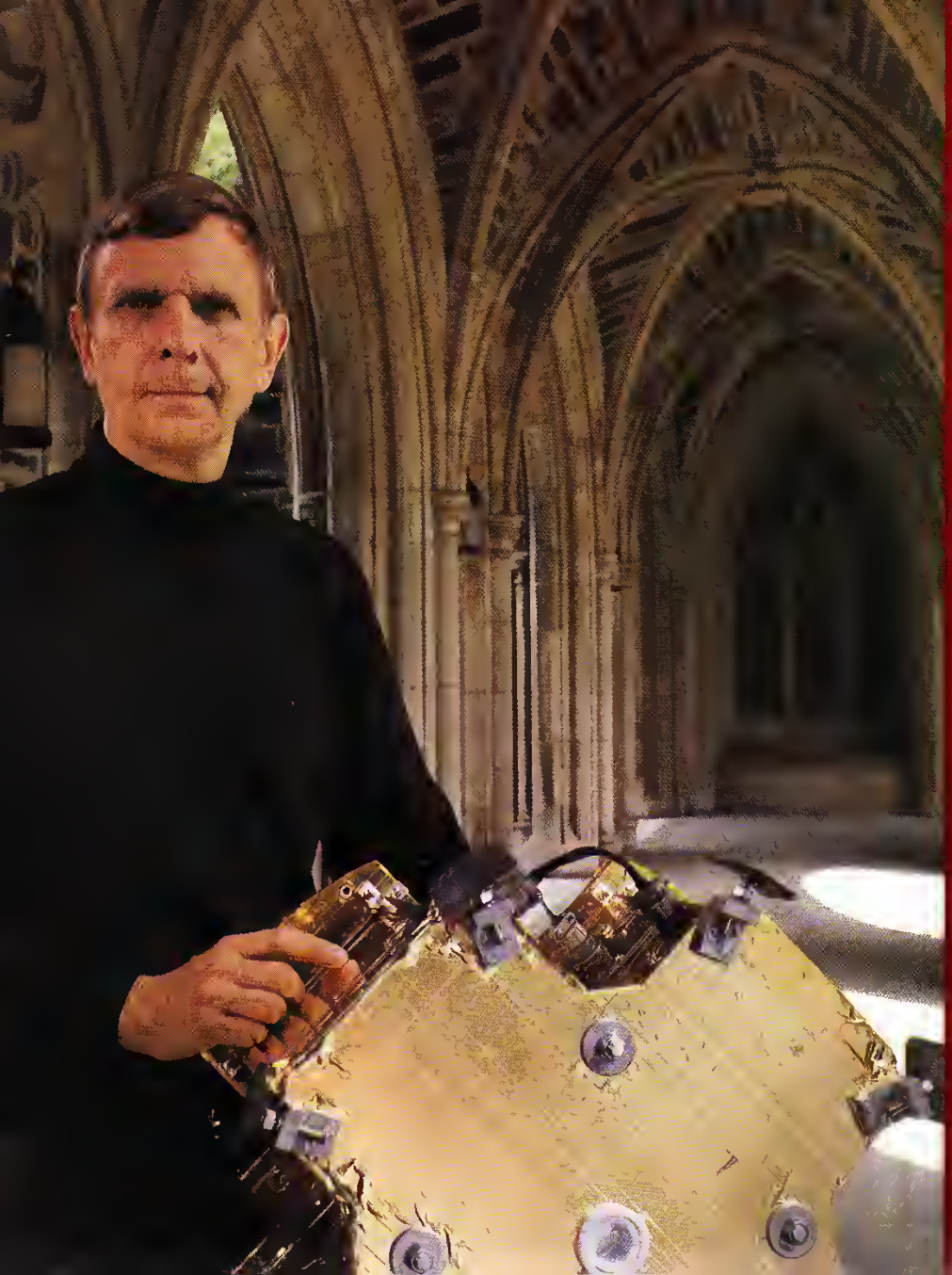


Omni goes into Earth orbit on a mission to test a promising new space material

THE LIGHT STUFF

ARTICLE BY BETH HOWARD

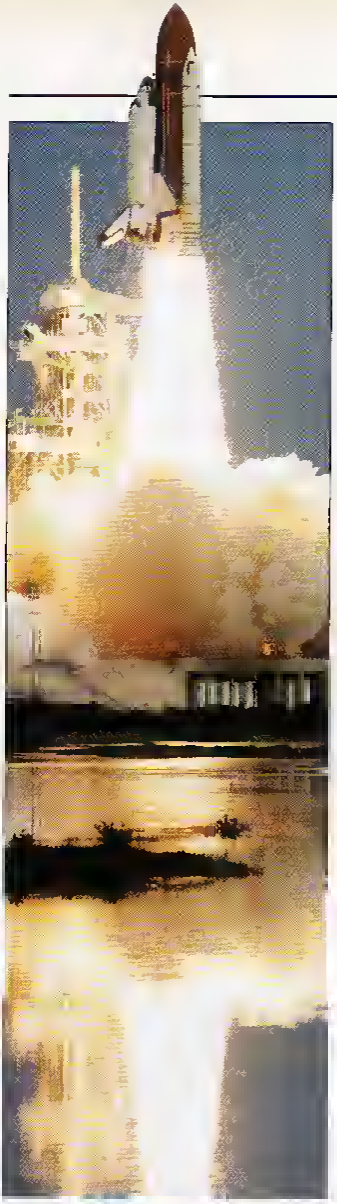
The spaceship *Columbia* zoomed silently through space. Deep in its cargo bay, among rows of identical aluminum containers, sat Payload GAS. With a flick of a switch, battery power turned the vacuum chamber inside red hot—at 500°C, hot enough to melt the unlikely mix of metals it contained and to produce a foaming gas. The resulting metal foam then expanded into an I-shaped nozzle, like meringue forced through a pastry bag. As it cooled, it formed a foamed metal I beam.

Now only a small step in a shuttle mission dedicated to space medicine, the zero-gravity metal foam experiment may eventually represent a giant leap for riveteads in space. Someday construction workers may use this technology and the alloys it produces to fashion high-strength, lightweight structures, such as the controversial space station, in zero g or to form shields to protect massive solar-powered satellites.

While the experiment took only 24 hours during *Columbia*'s nine-day journey last June, the moment of truth for Duke University engineering professor Franklin H. Cocks was nine years in the making. His own journey began with *Omni*'s Get Away Special Contest of 1982. The NASA Get Away Special program makes use of leftover space in the shuttle's cargo bay for civilian experiments. *Omni* offered to pick up the $3,000 Get Away tab as well as all of the construction expenses.

A few hundred readers responded, propos-

PHOTOGRAPH BY MALCOLM KIRK



ing experiments testing everything from the embryonic growth of sea urchins to psychic spoon bending in space. *Omni*'s judges, including physicist Robert W. Bussard, inventor of the interstellar ramjet, narrowed their choices to one: Cocks's novel scheme to create ultralight metal compounds of magnesium, aluminum, and lithium in zero gravity. The judges deemed his concept the likeliest to advance the cause of space development.

If such structures as an elaborate space station are ever to get off the ground, they will have special requirements. Primarily they must be strong but weigh little, since all building materials must be shipped from Earth.

Alloys of those ultralight metallic elements, Cocks theorized, just might fit the bill. Such metals are rarely used on Earth because they react with the atmosphere, corroding when exposed to oxygen and humidity.

In previous research, Cocks, a 1963 MIT graduate and professor of materials science at Duke University's School of Engineering, had noticed a fortuitous relationship between metal density and reactivity. It appears to be a natural law that the density of materials goes down as their chemical reactivity increases.

'What this means is if you want to have extreme lightness in metals, then those metals will turn out to be chemically reactive,' Cocks says.

For example, metals like platinum and lead are dense but not reactive. Iron is less dense and more reactive. Lithium is lighter still and extremely reactive. (Reactivity is not an issue in space, which is free from the earth's corroding atmosphere.)

If light metals could satisfy the weight requirement of space construction, what about the prescription for strength? Cocks believed the answer lay in foam. Some 30 years ago Wernher von Braun suggested that lightweight, rigid structural materials could be created in space by injecting bubbles into molten metal. "A beam made of foamed metal is much stiffer than a solid beam of the same weight," Cocks says, "because the bubbles expand the material to a much greater cross-sectional area, away from the natural bending axis."

Foaming the metal in a microgravity environment prevents the bubbles from escaping from the heavier metal. Foaming should also save precious space on shuttle missions. "For building small satellites, it's not worth the trouble," Cocks says. "But if you build something that has many thousands of tons of material and you can lower the tonnage by a factor of two, saving maybe twenty shuttle flights, then it becomes worth it."

The favorable strength-to-weight ratio could lend other space ventures a hand. Cocks envisions using the foamed metals as a resilient satellite armor, the need for which will grow along with the burgeoning volume of space debris. "We're talking about the chance of satellites being hit at velocities unachievable on Earth—thirty-five thousand miles per hour," he says. "When you consider the prospect of manned satellites, the need for shielding becomes obvious."

The ultralight metals also boast one intriguing environmental benefit. If a satellite equipped with these reactive materials reentered the atmosphere, it would burn up quickly rather than hazardously scatter its debris on Earth, as *Skylab* did in 1979.

Developing such promising concepts was one thing. It was still a long way from dreaming up an experiment to actually having one in the can. Cocks put to work a group of eager young undergraduate engineering students who'd signed up for a new course, space engineering. Unlike in the standard collegiate fare, the class would actually see a tangible outcome: hardware that would fly in space. The group's universe consisted of an aluminum canister, less than 20 inches across and 15

COCKS AND HIS STUDENTS FACED DAUNTING CRITERIA: THE EXPERIMENT COULDN'T RELY ON THE SHUTTLE'S POWER SUPPLY OR THE ASTRONAUTS.

inches high that could withstand sound levels as high as 145 decibels and temperatures ranging from 110°F to -296°F. It would weigh no more than 60 pounds, about tha same as a fully loaded backpack.

The class faced a daunting set of testing criteria. Get Away rules mandated that the experiment could not rely on the ship's power supply or personnel, the astronauts aboard the shuttle would only activate the battery-operatad experiment and turn it off again with a single switch.

In the firsf year or so the student teams filled up as many as four labs in the engineering school building. "We were under pressure a couple of times because there were launch opportunities we could have taken but in fact we missed," Cocks says. "I felt if we rushed we'd fail the safety checks."

Extraordinary checks at that: NASA required that Cocks identify the source and the use of every experimant component. A safety data package that covared all safety aspects of the experiment had to be submitted in three phases, each phase more detailed than the last one.

Finally a satisfactory design emerged. In quartz vials, a mixture of the various light metals—magnesium, lithium, and aluminum—and titanium hydride would sit inside a chamber capped with an "extrusion channel" in the shape of an I beam. It would work like this: Beyond the inexorable pull of the planet, battery power would melt the alloy and release hydrogen gas from the hydride. The gas would bubble through the molten alloy, foaming it and forcing it through the channel, thus molding a miniature I beam.

With the hardware now approved, the *Omni*–Duke payload was assigned to a flight onboard the shuttle *Discovery*. Unfortunately, timing was everything. The flight was to follow the ill-fated *Challenger* mission of January 1986, which killed all of the seven astronauts aboard.

Get Away Special experimenters now faced new roadblocks. "After *Challenger* all the rules changed," Cocks says. "No combustible materials of any type whatever would be allowed on. We had to do the whole thing over again." Cocks's student crew was forced to replace 147 pieces of a combustible heat shrink tubing with Teflon tubing. They also threw out the hydrogen foaming agent, substituting a magnesium substanca. This in turn meant remixing the various metal alloys to allow for temperature differences.

Other safety standards proved even more vexing. The foaming chambers of Cocks's experiment hardware had to be vacuum sealed. Yet in order to pass inspection at the time of launch, Cocks was forced to prepare twice the number of chambers necessary for the payload, the idea being that three chambers, selected at random by NASA safety engineers, would be opened to test the vacuum seals prior to liftoff, if the seals held, the three remaining chambers would fly.

Then Cocks left the six chambers under an active vacuum pump system he'd installed in a Duke basement lab. "That was the only way I could guarantee that over a period of years the possibility of their slowly leaking would not lead to the experiment being bumped off the flight," Cocks says. "The only way I knew to do that was to maintain them under vacuum—which I did continuously for six years."

In the spring of 1990 *Omni* finally got the thumbs-up from NASA to fly the payload on a mission scheduled to lift off the following August. Cocks was understandably nervous about those vacuum seals. Yet each of the three test chambers passed the final safety check.

> One of the unsung benefits of the space program is encouraging students to go into science and engineering. Our experience clearly bears that out.

Further delays eventually pushed the launch back another nine months, to May of 1991. Finally, with a sigh of relief, Cocks gave over the canister and saw it lifted into the cargo bay of the shuttle *Columbia*.

The next time he saw it, several anxious weeks after the ship's return to Earth, he was looking at threa small I beams made of tha reactive alloys and yearning to get them back into the lab to test them for their resiliency and strength. The miniature I beams were each composed of different metal combinations: magnesium–aluminum, magnesium–lithium, and aluminum–magnesium–zinc.

NASA has also offered to evaluate the material's ability to withstand high-velocity impacts. Then Cocks will have some idea of how well his funny foamed metal will fare against those particles whipping about in space.

The Duke University team joins an elite group—the small percentage of Gat Away Special experimenters whosa projects actually work after they've met the program's extraordinary requirements. "For the first time we have foamed light reactive metals under zero gravity," says Cocks. "That has never been done before."

He is the first to applaud the students whose efforts and enthusiasm over the years kept the project alive. "One of the unsung benefits of the space program is encouraging students to go into science and engineering," he says. "Our experience certainly bears that out." Several of the course's students, he says, have gone on to pursue careers in the space industry.

NASA has encouraged Cocks fo retest his light stuff on a future shuttle mission, possible if Cocks is able to secure another Get Away slot. Yet the professor may first take a brief break from space to catch his breath. "NASA's system does work," he admits, "but it works slowly."

Still, shuttle launches have a way of making up for a lot of grief. Early in the morning on June 5 it was raining hard at Kennedy Space Center, and the prospects for launching looked pretty grim.

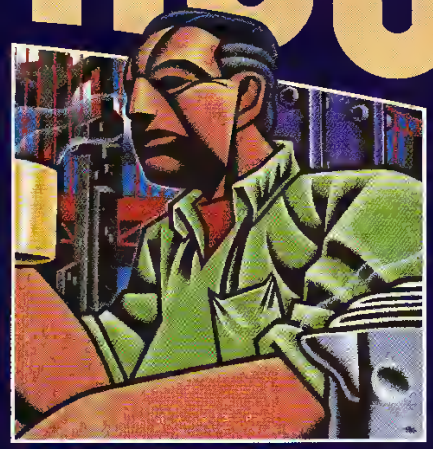
In all, the engineering professor had made three trips to Kennady during the shuttle's final preparation. The first was that tense critical check of the vacuums. The second time was a scheduled launch when engineers discovered a flaw in the hardware responsible for guiding the spacecraft back into the atmosphere and delayed liftoff for four days. That time they came within 40 minutes of launching. Cocks had had no choice but to pack up his car and his wife and twin sixteen-year-old sons and drive the 12 hours back to North Carolina, only to return three days later.

Now Cocks stood with his family and 200 or so other visitors on the viewing stand peering anxiously out at the launch site and at the nearby monitors. NASA will not launch in rain or through more than 4,500 feet of cloud cover, and there was plenty of that.

'But there was this large patch of blue sky," Cocks recalls, "and it was drifting our way. Then, my gosh, the blue patch drifted right over and they launched through it."

A collective whoop went through the small crowd as the sound wave from *Columbia*'s mighty engines rolled over them. *Fate*, Cocks remembers thinking, "in spite of all that technology, we still depended on that tiny patch of blue sky drifting over us." OO

SKINNER'S ROOM



FICTION BY WILLIAM GIBSON

PAINTING BY DOUGLAS FRASER

Halloween, she finds her way up into some old hotel above Geary: Tenderloin's cannibal fringe down one side, the gray shells of big stores off the other. Pressing her cheek to cold glass to spy the bridge's nearest tower—Skinner's room is there—all lit tonight with torches and carnival bulbs.

Too far away but still it reassures her, in here with these foreigners who've done too much of something and one of them's making noises in the bathroom—when someone touches her, cold finger on bare skin above the waistband of her jeans, sliding it in under her sweater and the hem of Skinner's jacket. not the touch that makes her jump so much as the abrupt awareness of how hot she is, a greenhouse sweat, zipped up behind the unbreathing horsehide of the ancient jacket, its seams and elbows sueded pale with wear, a jingle of hardware as she swings around—D-rings, zip-pulls, five-pointed stars—her thumb tip against the hole in the knife's blade, opening it, locked, ready. The blade's no longer than her little finger, shaped something like the head of a bird, its eye the hole that gives the thumb purchase. Blade and handle are brushed stainless, like the heavy clip, with its three precise machine screws, that secures it firmly to boottop, belt, or wristband. Edge of serrated razor.

The man—boy, really—blinks at her. He hasn't seen the blade but he's felt its meaning, her deep bodyverb, and his hand withdraws. He steps back unsteadily, grinning wetly and dunking the sodden end of a small cigar in a stemmed glass of some pharmaceutically clear liquid. "I am celebrating," he says, and draws on the cigar.

"Halloween?"

Not a noun he remembers at the moment. He just looks at her like she isn't there, then blows a blue stream of smoke up at the suite's high ceiling. Lowers the cigar. Licks his lips.

"I am living now," he says, "in this hotel, one hundred fifty days." His jacket is leather, too, but not like Skinner's. Some thin-skinned animal whose hide drapes like heavy silk, the color of tobacco. She remembers the smell of the yellow-spined magazines in Skinner's room, some so old the pictures are only shades of gray, the way the city looks sometimes from the bridge. Could she find that animal, there?

"This is a fine hotel." He dips the wet green end of the cigar into the glass again.

She thumbs the blade release and closes the knife against her thigh. He blinks at the click. He's having trouble focusing. "One hundred Fifty days."

Behind him, she sees that the others have tumbled together on the huge bed. Leather, lace, white skin, bright henna. Sounds from the bathroom are getting worse but nobody seems to hear. In the jungle heat of Skinner's jacket she slips the knife back up, under her belt. She's come up here for whatever she can find, really, but what she's found is a hard desperation, a lameness of spirit, that twists her up inside, so maybe that's why she's sweating so, steaming . .

Saw them all come laughing, drunk, out of two Mercedes taxis; she fell into step on impulse, her dusty black horsehide fading into the glossier blacks of silk hose, leather skirts, boots with jingling spurs like jewelry, furs. Sweeping past the doormen's braided coats, their gas masks, into the tall marble lobby with its carpet and mirrors and waxed furniture, its bronze-doored elevators and urns of sand.

"One hundred fifty days," he says, mouth slack and moist. "In this hotel."

The bridge maintains the integrity of its span within a riot of secondary construction, a coral growth facilitated in large part by carbon-fiber compounds. Some sections of the original structure, badly rusted, have been coated with a transparent material whose tensile strength far exceeds that of the original steel, some are splinted with the black and impervious carbon-fiber, others are laced with makeshift ligatures of taut and rusting wire.

Secondary construction has occurred piecemeal, to no set plan, employing every imaginable technique and material; the result is amorphous and startlingly organic in appearance.

At night, illuminated by Christmas bulbs, by recycled neon, by torchlight, the bridge is a magnet for the restless, the disaffected. By day, viewed from the towers of the city, it recalls the ruin of Brighton Pier in the closing decade of the previous century—seen through some cracked kaleidoscope of vernacular style.

Lately Skinner's hip can't manage the first twenty feet of ladder, so he hasn't been down to try the elevator the African welded to the rivet-studded steel of the tower. He peers at it through the hatch in the floor. It looks like the yellow plastic basket of a lineman's cherry picker, cogging its way up and down a greasy-toothed steel track like a miniature funicular railway. He admires people who add to the structure. He admires whoever it was built this room, this caulked box of ten-ply fir, perched and humming in the wind. The room's floor is a double layer of pressure-treated two-by-fours laid on edge, broken by an achingly graceful form he no longer really sees: the curve of the big cable drawn up over its saddle of steel, 17,464 pencil-thick wires.

The little pop up television on the blanket across his chest continues its dumb show. The girl

THE RUSTING SPAN OF SAN FRANCISCO'S BAY BRIDGE BECOMES THE FUTURE SITE OF A CITY OF THE HOMELESS

SKINNER'S ROOM IS A CRAMPED, CAULKED BOX OF OLD TEN-PLY BOARD, PERCHED AND HUMMING IN THE WIND

brought it for him. Stolen, probably. He never turns the sound on. The constant play of images on the liquid crystal screen is obscurely comforting, like the half-sensed movements in an aquarium. Life is there. He can't remember when he ceased to be able to distinguish commercials from programming.

His room measures fifteen by fifteen feet, the plywood walls softened by perhaps a dozen coats of white latex paint. Higher reflective index than aluminum foil, he thinks, 17,464 strands per cable. Facts. Often, now, he feels himself a void through which facts tumble, facts and faces, making no connection.

His clothes hang from mismatched iron coat hooks screwed at precise intervals along one wall. The girl wears his jacket. Lewis Leathers, Great Portland Street. She asks where that is. Jacket older than she is. Looks at the pictures in *National Geographic*, crouched there with her bare white feet on the carpet he took from the broken office block.

Memory flickers like liquid crystal. She brings him food, pumps the Coleman's chipped red tank. Remember to open the window a crack. Japanese cans, heat up when you pull a tab. Questions she asks him. Who built the bridge? Everyone. No, she says, the old part, the bridge. San Francisco, he tells her. Bone of iron, grace of cable, hangs us here. How long you live here? Years. Spoons him his meal from a mess kit stamped 1952.

This is his room. His bed. Foam, topped with a sheepskin, bottom sheet over that. Blankets. Catalytic heater. The window is circular, leaded, each segment stained a different color. You can see the city through the bull's-eye of clear yellow glass at its center.

Sometimes he remembers building the room.

The bridge's bones, its stranded tendons, are lost within an accretion of dreams: tattoo parlors, shooting galleries, pinball arcades, dimly lit stalls stacked with damp-stained years of men's magazines, chili joints, premises of unlicensed denturists, fireworks stalls, cut bait sellers, betting shops, sushi counters, pawnbrokers, wonton counters, love hotels, hot dog stands, a tortilla factory, Chinese greengrocers, liquor stores, herbalists, chiropractors, barbers, tackle shops, and bars.

These are dreams of commerce, their locations generally corresponding with the decks originally intended for vehicular traffic. Above them, toward the peaks of the cable towers, lift intricate barrios, zones of more private fantasy, sheltering an unnumbered population, of uncertain means and obscure occupation.

Three months before, she'd first come upon the bridge in fog and had seen the sellers of fruits and vegetables with their goods spread out on blankets, lit by carbide lamps and guttering smudge pots. Farm people from up the coast. She'd come from that direction herself, down past the stunted pines of Little River and Mendocino, Ukiah's twisted oak hills.

She stared back into the cavern mouth, trying to make sense of what she saw. Steam rising from the pots of soup vendors'

carts. Neon scavenged from the ruins of Oakland. How it ran together, blurred, melting in the fog. Surfaces of plywood, marble, corrugated plastic, polished brass, sequins, Styrofoam, tropical hardwoods, mirror, etched Victorian glass, chrome gone dull in the sea air—all the mad richness of it, its randomness—a tunnel roofed by a precarious shack town mountainside climbing toward the first of the cable towers.

She stood a long time, looking, then walked straight in, past a boy selling coverless yellowed paperbacks and a café where a blind parrot was chained on a metal perch, picking at a chicken's freshly severed foot.

Skinner surfaces from a dream of a bicycle covered with barnacles and sees that the girl is back. She's hung his leather jacket on its proper hook and squats now on her pallet of raw-edged black foam.

Bicycle. Barnacles.

Memory. A man called Fass snagged his tackle, hauled the bicycle up, trailing streamers of kelp. People laughed. Fass carried the bicycle away. Later he built a place to eat, a three-stool shanty leached far out over the void with Super Glue and shackles. Sold cold cooked mussels and Mexican beer. The bicycle slung above the little bar. The walls inside were shingled with picture postcards. Nights, he slept curled behind the bar. One morning the place was gone, Fass with it, just a broken shackle swinging in the wind and a few splinters of timber still adhering to the galvanized iron wall of a barber shop. People came, stood at the edge, looked down at the water between the toes of their shoes.

The girl asks him if he's hungry. He says no. Asks him if he's eaten. He says no. She opens the tin foot chest and sorts through cans. He watches her pump the Coleman.

He says open the window a crack. The circular window pivots in its oak frame. Gotta eat, she says.

She'd like to tell him about going to the hotel but she doesn't have words for how it made her feel. She feeds him soup, a spoonful at a time. Helps him to the tankless old china toilet behind the faded roses of the chintz curtain. When he's done she draws water from the roof-tank line and pours it in. Gravity does the rest. Thousands of flexible transparent lines are looped and bundled down through the structure, pouring raw sewage into the bay.

"Europe," she tries to begin.

He looks up at her, mouth full of soup.

She guesses his hair must've been blond once. He swallows the soup. "Europe what?" Sometimes he'll snap right into focus like this, if she asks him a question, but now she's not sure what the question is.

"Paris," he says, and his eyes tell her he's lost again. "I went there. London, too. Great Portland Street." He nods, satisfied somehow. "Before the devaluation." Wind sighs past the window. She thinks about climbing out on the roof. The rungs up to the hatch there are carved out of sections of two-by-four, painted the same white as the walls. He uses one for a towel rack. Undo the bolt. You raise the hatch with your head. Your eyes are level with gull shit. Nothing there, really. Flat tarpaper roof, a couple of two-by-four uprights. One flies a tattered Confederate flag, the other a faded orange windsock.

When he's asleep again, she closes the Coleman, scrubs out the pot, washes the spoon, pours the soupy water down the toilet, wipes pot and spoon, puts them away. Pulls on her hightop sneakers, laces them up. She puts on his jacket and checks that the knife's still clipped behind her belt.

"I think this would be a good time to end our session."

She lifts the hatch in the floor and climbs through, finding the first rungs of the ladder with her feet. She lowers the hatch closed, careful not to wake him. She climbs down past the riveted face of the tower, to the waiting yellow basket of the elevator. Looking up, she sees the vast cable there, where it swoops out of the bottom of Skinner's room, vanishing through a taut and glowing wall of milky plastic film, a greenhouse. Halogen bulbs throw spiky plant shadows on the plastic.

The elevator whines, creeping down the face of the tower, beside the ladder she doesn't use anymore, past a patchwork of plastic, plywood, sections of enameled steel stitched together from the skins of dead refrigerators. At the bottom of the fat-toothed track, she climbs out. She sees the man Skinner calls the African coming toward her along the catwalk, bearlike shoulders hunched in a ragged tweed overcoat. He carries a meter of some kind, a black box, dangling red and black wires tipped with alligator clips. The broken plastic frames of his glasses have been mended with silver duct tape. He smiles shyly as he eases past her, muttering something about brushes.

She rides another elevator, a bare steel cage, down to the first deck. She walks in the direction of Oakland, past racks of old clothes and blankets spread with the negotiable detritus of the city.

She finds Maria Paz in a coffee shop with windows on the bay's gray dawn. The room has the texture of an old ferry, dark dented varnish over plain heavy wood. As though someone's sawn it from a tired public vessel, lashing to the outermost edge of the structure. (Nearer Oakland, the wingless corpse of a 747 houses the kitchens of nine Thai restaurants.)

Maria Paz has eyes like slate and a tattoo of a blue swallow on the inside of her left ankle. Maria Paz smokes Kools, one after another, lighting them with a brushed chrome Zippo she takes from her purse. Each time she flicks it open, a sharp whiff of benzene cuts across the warm smells of coffee and scrambled eggs.

She sits with Maria Paz, drinks coffee, watches her smoke Kools. She tells Maria Paz about Skinner.

"How old is he?" she asks.

"Old.... I don't know."

"And he lives over the cable saddle on the first tower?"

"Yes."

"The tops of the towers.... you know about that?"

"No."

"From the days when the people came, out from the cities, to live here."

"Why did they?"

Maria Paz looks at her over the Zippo. "Nowhere to live. Bridge closed to traffic three years...."

"Traffic?"

Maria Paz laughs. "Too many cars. Dug them tunnels under the bay. For cars, for maglevs.... bridge too old. Closed it before the devaluations. No money. One night the people came. No plan, no signal. Just came. Climbed the chain link. Chain link fell. Threw the concrete in the bay. Climbed the towers. Dawn came, they were here, on the bridge, singing, and the cities saw the world was watching. Japanese airlift, food and medical. National embarrassment. Forget the water cannons, sorry." Maria Paz smiles.

"Skinner? You think he came then?"

"Maybe, he's old as you think. How long you been on the bridge?"

"Three months?"

"I was born here," says Maria Paz.

The cities had their own pressing difficulties. Not an easy century, America quite clearly in decline and the very concept of nation-states called increasing-

"A day without being put on 'hold' please."

ly into question. The squatters were allowed to remain. Among their numbers were entrepreneurs, natural politicians, artists, men and women of untapped energy and talent. The world watched as they began to build. Shipments of advanced adhesives arrived from Japan. A Belgian manufacturer donated a boatload of carbon-fiber beams. Teams of scavengers rolled through the cities on broken flatbeds, returning to the bridge piled high with discarded building materials.

The bridge and its inhabitants became a tourist attraction.

She walks back in the early light that filters through windows, through sheets of wind-shivered plastic. The bridge never sleeps, but this is a quiet time. A man is arranging fish on a bed of shaved ice in a wooden cart. The pavement beneath her feet is covered with gum wrappers and the flattened filters of cigarettes. A drunk is singing somewhere, overhead. Maria Paz left with a man, someone she'd been waiting for.

She thinks about the story and tries to imagine Skinner there, the night they took the bridge, young then, his leather jacket new and glossy.

She thinks about the Europeans in the hotel on Geary.

She reaches the first elevator, the cage, and leans back against its bars as it rises up its patched tunnel, where the private lives of her neighbors are walled away in tiny handmade spaces. Stepping from the cage, she sees the African squatting in his tweed overcoat in the light cast by a caged bulb on a long yellow extension cord, the motor of his elevator spread out around him on fresh sheets of newsprint. He looks up at her apologetically.

"Adjusting the brushes," he says.

"I'll climb." She goes up the ladder. Always keep one hand and one foot on the ladder, Skinner told her, don't think about where you are and don't look down, it's a long climb, up toward the smooth sweep of cable. Skinner must've done it thousands of times, uncounted, unthinking. She reaches the top of this ladder, makes a careful transfer to the second, the short one, that leads to his room.

He's there, of course, asleep, when she scrambles up through the hatch. She tries to move as quietly as she can, but the jingle of the jacket's chrome hardware disturbs him, or reaches him in his dream, because he calls something out, voice thick with sleep. It might be a woman's name, she thinks. It certainly isn't hers.

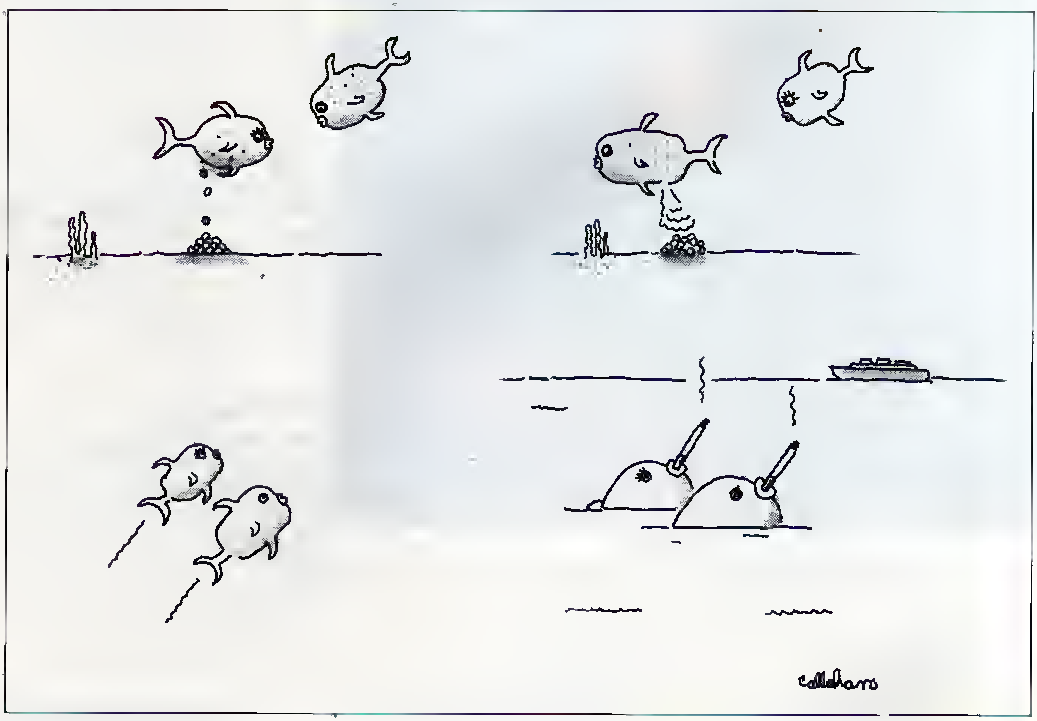
In Skinner's dream now they all run forward, and the police are hesitating, falling back. Overhead the steady drum of the network helicopters with their lights and cameras. Thin rain falls as Skinner locks his cold fingers in the chain link and starts to climb. Behind him a roar goes up, drowning the bullhorns of the police and the National Guard, and Skinner's climbing, kicking the narrow toes of his boots into chain link as though he's gone suddenly weightless—floating up, really, rising on the crowd's roar, the ragged cheer torn from all their lungs. He's there, at the top, for one interminable instant. He jumps. He's the first. He's on the bridge, running, running toward Oakland, as the chain link crashes behind him, his cheeks wet with rain.

And somewhere off in the night, on the Oakland side, another fence falls, and they meet, these two lost armies, and flow together as one, and huddle there, at the bridge's center, their arms around one another, singing ragged wordless hymns.

At dawn, the first climbers begin to scale the towers.

Skinner is with them.

She's brewing coffee on the Coleman when she sees him open his eyes.



"I thought you'd gone," he says.

"I took a walk. I'm not going anywhere. There's coffee."

He smiled, eyes sliding out of focus. "I was dreaming . . ."

"Dreaming what?"

"I don't remember . . . we were singing. In the rain . . ."

She brings him coffee in the heavy china cup he likes, holds it, helps him drink. "Skinner, were you here when they came from the cities? When they took the bridge?"

He looks up at her with a strange expression. His eyes widen. He coughs on the coffee, wipes his mouth with the back of his hand. "Yes," he says, "yes. In the rain. We were singing. I remember that."

"Did you build this place, Skinner? This room? Do you remember?"

"No," he says, "no . . . sometimes I don't remember . . . we climbed. Up. We climbed up past the helicopters. We waved at them . . . some people fell . . . at the top. We got to the top . . ."

"What happened then?"

He smiles. "The sun came out. We saw the city." ∞

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One of the world's great explorers and the father of underwater archaeology raises treasures from a Bronze Age shipwreck—the oldest one ever found—and celebrates some other raptures of the deep

INTERVIEW

GEORGE BASS

Late summer is not kind to College Station, Texas. But you'd never know it in this office, where cold air pumps, as in a deep-sea bathysphere, giving the room the cool sweet taste of compressed air from a scuba tank. Volumes line the walls, great books of the ancient world that whisper of lost secrets and hidden treasures. There is something at once mystical and scientific here, not unlike exploring the depths of the ocean floor. It's no accident.

A few months a year this home office is haven to the father of underwater archaeology. For 30 years George Bass has lived with the challenge of uncovering the most precious sunken treasure of all: knowledge—historical knowledge of Bronze Age mariners, Babylonian and Byzantine merchants, Egyptian pharaohs. Finding the oldest book on record is just one of his accomplishments. Indiana Jones got nothin' on him.

Most of the time Bass works in the field. That could

PHOTOGRAPHS BY HENNER PREFI

be on or beneath any large body of water. But much of his research is in the seas off the coast of Turkey, where numerous ancient shipwrecks have yet to exhaust their mysteries.

Bass is not the ancient mariner but a fit and youthful fifty-eight. When he was ten, he and his brother tried to make a diving helmet, which he never tried out in the water. Even as a graduate student at the American School of Classical Studies in Athens, Bass admits he never got around to actual diving, even though "I probably had more books on diving than archaeology on my desk." In fact, he strapped a scuba tank on his back only once before his first major excavation in 1960.

Yet he was "fated" for the work. With a master's degree in Near Eastern archaeology from Johns Hopkins, a Ph.D. in archaeology with a specialty in the Bronze Age between 3000 and 1000 B.C., and a desire to dive, he was the right man in the right place. In 1959 photojournalist Peter Throckmorton approached the University of Pennsylvania, where Bass was a graduate student, with news he'd found a Bronze Age shipwreck. "We didn't know at the time," says Bass, "that it was going to change ideas about the entire relationship between the Mycenaeans, Bronze Age Greeks, and Phoenicians. If I hadn't had a background in Near Eastern and preclassical archaeology, I might not have realized the significance embodied in this wreck."

In 1973 Bass founded the Institute of Nautical Archaeology, which later joined forces with Texas A&M University. "That's how an ocean explorer came to live in a Texas prairie town." Its elite graduate level program includes only around ten students a year, about a third of whom come from outside the United States. Bass remains an active and enthusiastic teacher, evaluated by students as one of the best. That honor, he says, ranks right up there with receiving the National Geographic Society Centennial Award, which recognizes him as one of the century's great explorers.

He is currently excavating a fourteenth-century B.C. shipwreck at Ulu Burun, Turkey. The oldest known wreck in the world, it may represent a royal ship carrying copper, tin, gold, silver, ebony, glass, amber, and resins from one king to another. The vessel's loss in antiquity, Bass thinks, must have been devastating.

—John Stein

NAME:
George Fletcher Bass

AGE:
Fifty-eight

POSITION:
Founder and director, Institute of Nautical Archaeology

CURRENT EXCAVATION:
Oldest known shipwreck, producing oldest known tin and glass ingots, writing materials, and first gold scarab of Nefertiti

TIMES DIVED:
More than 50,000 decompression dives

TECHNOLOGY INVENTED:
Two-person submarine, submersible decompression chamber, underwater telephone booth, stereophotogrammetry for underwater mapping

MOST RECENT BOOK WRITTEN (OF SIX):
Ships and Shipwrecks of the Americas (Thames and Hudson)

ON TREASURE HUNTING:
It's incompatible with archaeology; it destroys information

Omni: You really didn't learn scuba until a few weeks before your first trip to Turkey in 1960?

Bass: The excavation of that shipwreck off Cape Gelidonya led to my learning how to dive, and I thought it would be a one-summer lark. But there were two things that challenged me at the time. One was the site's historical significance. And now we're going back there where we thought we'd excavated everything thirty years ago, and finding evidence we couldn't with more primitive equipment. The second thing was I figured out how we had to adapt normal land techniques to the underwater world. Throughout the Sixties I spent much more time thinking about diving technology than about archaeology. Now I think almost nothing about the technology.

Omni: You've wrestled with finding a name for your field of study. You go from "underwater" to "nautical" archaeology. Why?

Bass: "Nautical" comes from the Greek word *naos*, meaning ship. And we specialize in studying ships, whether they're underwater, under land, or in rivers. We now have specialists in hulls or rigging, whereas I deal mainly with the cargoes and possessions of crew and passengers. In the early Sixties, in *Archaeology Under Water*, I said we don't call people jungle, or mountain or desert, archaeologists. The same should hold true for us, except for those who specialize in ships per se. I'm an "underwater" archaeologist only in the sense that what I do is underwater. All of us who pioneered this field worked first in terrestrial archaeology, to which I return from time to time.

Omni: You are more interested, then, in ships than harbors, inland lakes, or the wells at Chichén Itzá?

Bass: Yes. Our institute is excavating the sunken city of Port Royal, Jamaica, which went down in 1692 in an earthquake, but it's sort of an anomaly. It's shallow, and therefore good training ground for our teams. We hope to continue there, but it's not nautical archaeology.

Omni: Has the emotional strain of working underwater lessened over the years?

Bass: It's not so adventurous as when we started out working from small fishing and sponge boats, or an old wooden barge that leaked badly. Now we have a steel-hulled fifty-five-foot vessel with a decompression chamber onboard. In the last several years we haven't missed a single dive, because on-site we have a full-time mechanic, captain, and physician. I find it more pleasant working on an underwater site than on land. Mealtime conversations are more interesting because you have mechanics, physicians, and photographers and not just archaeologists who think archaeology all day.

Bass: Do you find more valuable information underwater than on land?

Bass: In some respects, yes. The wreck we're excavating now at Ulu Burun shows how often things have dis-

appeared on land because they've been destroyed by humans. We have the earliest examples of tin and glass ingots found, and the first examples of ebony logs. We have six tons of copper ingots. All this raw material, and more, would have been manufactured into finished products or goods when it arrived in port and simply disappeared without a trace. A century of excavation in the Near East and throughout the Aegean yielded not a tin or glass ingot. We have dozens of them on this one wreck—plus the only gold scarab ever found of Nefertiti. Had that remained on land, it probably would have been melted down eventually and made into something else.

The Greeks regarded their bronze statues as their highest works of art. Virtually all we have came from the sea, mostly pulled up in fishermen's nets or found by sponge divers rather than by archaeologists. Twenty-three years ago in Turkey with side-scan sonar in our little two-person submarine, *Asherah*, we found a three-hundred-foot-deep wreck that had yielded three bronze statues to fishermen's nets. Our photographs suggest there are more bronze statues under the sand on this wreck. We hope to get back to it soon with deep diving, which requires mixed gases, like heliox, rather than just compressed air.

Omni: Some of your colleagues have gotten the bends. Have you?

Bass: In 1985 I had a very minor case, a bit of nagging pain in my elbow that disappeared in our decompression chamber. The same year we had the second serious case we've had in thirty years when our expedition physician was paralyzed from the waist down. He was treated and almost completely cured in the chamber. The one thing we had in common is that we were both in our fifties. When I began in 1960, I was the youngest member of the excavation, suddenly I realized I was the oldest. That's when I decided I'd been diving enough.

The wreck at Ulu Burun is one hundred forty-five to one-eighty feet deep. I'm directing the project, but the fieldwork is directed by a graduate student. If we do another wreck, say, one hundred feet down, I'll work at that depth. For about a week every year, we return to the site at Cape Gelidonya where I started. Other than that, I'm not diving anymore.

Omni: Have you ever had panic set in at a site because of equipment failure?

Bass: In twenty-five years of very active diving, I was really only frightened once, and when I say frightened, I mean I thought the end was near. Because I'd done a land dig, I hadn't dived in three years. This was only the second or third dive and I hadn't planned it carefully. I was about one hundred fifty feet deep when I ran out of air. My reserve didn't work. Those were the years before we had see-through gauges where you always know how much air you have. My partner and I had split up. I would have drowned had he not noticed me and come to my assistance for buddy breathing when he saw me struggling toward the surface.

We're a bit superstitious about our safety record, so we don't like to brag about it. We've had around ten thousand dives on just this most recent wreck. That's a lot of deep decompression dives at one-forty- to one-eighty-feet depth.

Omni: What is your most thrilling moment underwater?

> "Our aim is to excavate one merchant ship from every century of antiquity. Then we'd move to warships, ferry and fishing boats. We'd tell the entire story of seafaring."

Bass: I know you won't believe this, but—never. The hair-stands-up-on-the-back-of-my-neck excitement comes in the library at, say, three A.M. When I first went down at Ulu Burun I was thinking, Where are we going to put the airlift? How are we going to map it? With only twenty minutes, you don't have time to be overly romantic. I enjoy the feeling of being underwater, the freedom. But diving is not where the excitement comes. We don't understand the significance of something when we find it. Even a gold medallion from the Bronze Age—it's pretty, everybody wants to see it, but just finding it hasn't got that tingling excitement of suddenly realizing it means something important.

Omni: How did your academic background help on your first excavation?

Bass: A Near Eastern archaeologist might have thought everything onboard was Near Eastern, a preclassical archaeologist might have thought everything was Bronze Age Greek. With a background in both, I saw the influence of Phoenician culture on Greek civilization in a completely new light. It changed ideas about trade, it even had an impact on our interpretation and dating of Homer. And we discovered the oldest "book" ever found, a wooden writing tablet in a vase of pomegranates about five feet tall. We found not only seeds but parts of pomegranate skins. The book was probably sitting on the lid and someone hid it inside to keep it safe from the elements.

Omni: Why at one point did you think about changing fields?

Bass: I left underwater archaeology in 1969, when I spent time in a decompression chamber with a dead sponge diver who died while we were trying to treat him. And I thought, I don't want to stick around until I pull a dead friend from the water. So I didn't work in underwater archaeology for four years. I started a dry land dig in southern Italy but as I worked there, I missed the excitement of finding whole objects rather than bits and pieces. We were trying to find out about the introduction of certain types of pottery and domestic animals into the region. I thought, If they came across the Adriatic from present-day Yugoslavia, there must be one shipwreck out there that's going to tell us as much as digging here year after year.

I missed the sea. There's something special about working on the sea. And I especially missed the comradeship of the mixture of people who go into underwater archaeology. Another thing that made me go back to it was Eric Ryan, a dear friend who suffered an air embolism and never did regain full sensation down one part of his body. He told me I should go back to it, that it had all been worth it, that of course you can be safe if you just sit in your house all day, but there are things other than that.

Another reason I'd given it up was because I was told by the chief of United States Navy salvage that I was running the largest diving operation in the world in 1969. No one, he said, had up to thirty divers going down one hundred thirty feet twice a day, six days a week for three months a year. I was doing this while teaching and publishing—without even a secretary. Well, what I did was form the Institute of Nautical Archaeology. Now I don't have to personally buy all the equipment each year, end up with a hammer and nails packing it in crates, carry it on dollies to a rented truck, drive it to the ship, ship it to Turkey, and get it through customs all by myself.

Now the equipment is ordered by our mechanic in Turkey. Our boat is kept up by our captain, who is also a diver

CONTINUED ON PAGE 108

HYPERFICTION BY
W. E. GUTMAN

The Vampire State

In the Year of Our Lord 2091, open season on street children has been declared, and Lady Justice wears an ugly face

22:10—A rank sulfurous halo hangs low over Manhattan. Driven by icy gusts, tentaclelike fingers of swirling amber gases swoop toward the slime-slick pavement, probing deep behind yawning doorways, arcades and atria, seeking out the specters that lurk within their drafty expanses.

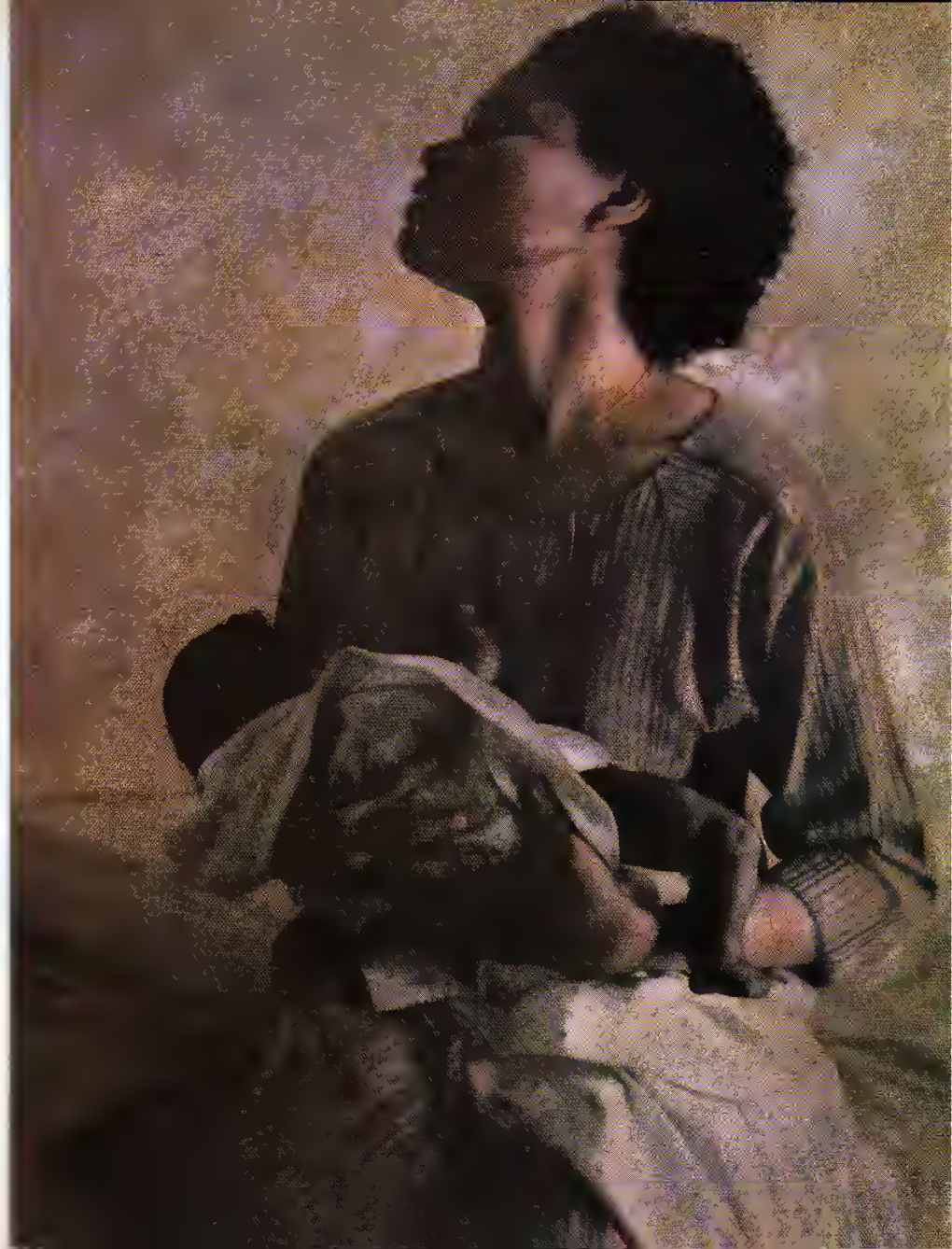
It's Christmas Eve in the Big Apple. Chiming in the distance in pious unison, ethereal and uninvolved, church-bells summon the faithful. Chiming? No: *tolling*—a wistful knell for a moribund metropolis, for the thousand and one night creatures that stalk its streets, for the near living I will ferret out and kill. Fifteen years is a long time. I must speak out.

It all came together a century ago with a salvo of statements and counterstatements tailored to help save political face while giving the citizenry the impression that justice was served. In time, words got sharper, less conciliatory, and violence, sporadic and extemporaneous, grew bolder and deadlier with each secret municipal emergency meeting.

No one protested. Not a single voice was heard. It was too late. Justice—like truth—the stronger of two conflicting arguments, justice, the paradox suspended on the point of a sword, had put on its ugliest face. The Lady had taken off her blindfold and was winking lasciviously at the oligarchy. And the carnage began.

'Tis now open season, and the blood of children, thinner than water, coalesces with putrid rivulets of swill and excrement that hug

ILLUSTRATION
BY JOANIE SCHWARZ



the curb and cascade down the sewers

Torn by civil strife, political corruption, and poverty America's big cities have fallen like gangrenous limbs An orgy of bloodletting has turned rivers red and transformed parks and playgrounds into open graves Severe economic downturns spreading unemployment, homelessness, merciless slashes in social services, all have contributed to a catastrophic increase in the number of people living below the poverty line Of the 2,000 children who wake up poor, more than 400 die of neglect or abuse There are more people in jail in the United States than in all other nations combined The number of one-parent families keeps soaring, each producing its quota of juvenile offenders More than 400 000 are in custody for nonviolent offenses such as truancy, drug use, prostitution, and petty theft Most share a cell with hardened criminals There is no more room

As the gap between the rich and poor widens, larger numbers of affluent urban dwellers move out to escape the squalor, skyrocketing taxes, crime, and a decaying infrastructure, all of which have turned cities into pockets of depravity poverty crime, disease, and social unrest

Sparked by a growing need for slave labor, mass immigration from Third World Nations—where families are notoriously large and prolific—continues to add to the ranks of the poor, the uneducated, and the culturally disconnected elements of U S society many of whom start out as street children and, if allowed to grow up, soon graduate to adult crime

What little food the kids can scrape to keep the heart pumping proves to be less than enough for the brain Out of the nearly 5 million minors subsisting on the streets and in the cavernous catacombs beneath subway and railroad tunnels and in the fetid sewers of America, more than 700,000 suffer from irreversible brain damage Drug-induced dementia and a form of Parkinsonism attributed to exposure to carbon monoxide afflict half that many Everyone is armed Looting sprees that had swelled during the long hot summer have abated Thousands of children have perished at the hands of vigilantes, sexual psychopaths, and agents of the state, all plying their own brand of justice I don t mind the competition There are simply too many kids out there Inexplicably, in one last gasp of puritanical fervor bolstered by an apostate Supreme Court and a Church obsessively committed to saving the unborn rather than the living, "pro-lifers" have succeeded in reversing *Roe* vs *Wade* and in making abortion a federal crime I get paid to pluck the fruits of this incestuous union

23:40—Tonight will be Jimmy's turn Only fourteen, he is resourceful and clever I've hunted him down day and night for a month, clambering up and down the byways and alleys he and his six cohorts patrol in search of easy prey—old folk or stragglers stranded in the night

24:10—Off of Eighth Avenue, behind the Port Authority Terminal s mazelike network of ramps and underpasses, a band of nine- and ten-year-olds take turns scrounging through trash bins and peeking into dingy motels where couples come to risk procreation for the shallow rewards of a brief grunt of ecstasy A block away, a known pedophile barters with a twelve-year-old Envious and resentful, four urchins encircle and pounce on the boy

02:54—I've found Jimmy Alone, propped against a pile of cardboard boxes by the wharf near the old Fulton Fish Market, he is hallucinating Could be glue or crack or the new rage in town, stalactites, a deadly mixture of acetone-soaked cannabis, rubber cement and denatured alcohol He could be dangerous

02:55—Jimmy sees me but doesn't move I unsheathe my revolver and point it at him, slowly deliberately, with the grace and ease and serenity granted those whose conscience has been expediently stilled by convention or apathy Jimmy slowly spreads his arms, Christlike, and rests his head against his shoulder Defiance, fatalism, relief, all are etched in that life-hardened baby face, in those glassy eyes where shimmer the eerie scintillations of night I shoot, repeatedly, remorselessly, satisfied that another street child, alone and undernourished since birth, mistreated by his peers, another boy nobody smiles to, nobody cuddles, nobody protects, nobody comforts, nobody loves will never again have a chance to sully the society that begat him

It's a living The cost of Christmas keeps going up

(From the secret diaries of Lt. Joe Krolik, Juvenile Squad, NYPD, December 24–25, in the Year of Our Lord 2091.)

Could this happen here? On these pages you've seen one scenario depicting a dark American future in which homeless children become targets of state violence

It does not have to go that far Already the numbers of children on our streets, and the streets of cities around the world are growing Every time we turn away from this problem, every day we do nothing, the problem grows

Omni is the first magazine of the future, yet children are the future's first resource The future, we have said often in these pages, belongs to all of us What share of the future do homeless children hold? What price will we have to pay tomorrow for ignoring today? The problem grows

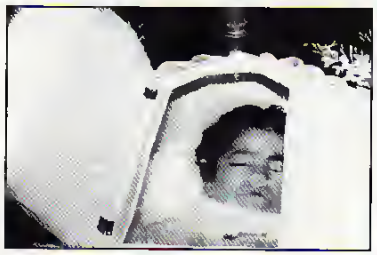
If individuals do nothing, if religious organizations do nothing—or less than nothing by encouraging unfettered reproduction—the problem will grow until it is out of control Except by institutionalized violence Except by state-sanctioned murder

The problem grows
—Keith Ferrell

"THE DEPRAVED CONDITIONS OF GUATEMALA'S STREET CHILDREN ARE, UNFORTUNATELY, TOO SIMILAR TO SITUATIONS IN MANY

THE REVEREND BILLY GRAHAM "IS TOO BUSY TO COMMENT ON THIS ISSUE." —THE BILLY GRAHAM EVANGELISTIC ASSOC.

OTHER PARTS OF THE WORLD." —THOMAS F. STROOCK, U.S. AMBASSADOR TO GUATEMALA



CHILDREN SLEEP IN DOORWAYS AND ON SIDEWALKS THROUGHOUT THE CAPITAL.

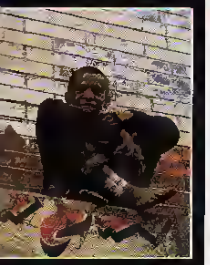
TEXT BY W. E. GUTMAN Dawn rises on Guatemala City's sixteenth-century cathedral, flushing the nave with shafts of spectral radiance and suffusing the marble altar and colonnades, crystal chandeliers, richly carved gilt pulpit, and solid mahogany pews with a celebration of light over the forces of darkness.

For Jorge, sunrise heralds the start of another perilous journey. He has just spent the night in a fetid culvert girding the cathedral's northern flank, drowsing into a thin, turbulent sleep, one eye trained against the creeping shadows, a keen ear attentive to any sound louder than his heartbeat. Normally, Jorge beds down with his friends Pedro and Felipe under a pile of filthy rags, sharing scraps of food pilfered at an outdoor stall or recovered from the garbage pit. Normally, they huddle like newborn pups, seeking warmth, sharing a bag or two of cobbler's glue until the noxious fumes yank them from the grips of hunger, cold, and fear. But these are not normal times. Beatings, torture, sexual abuse, rape, and extrajudicial executions have been on the rise in Guatemala, and Jorge, Pedro, and Felipe have decided to split for a while, to disperse, to find safety not in numbers but in solitude and stealth like hunted animals.

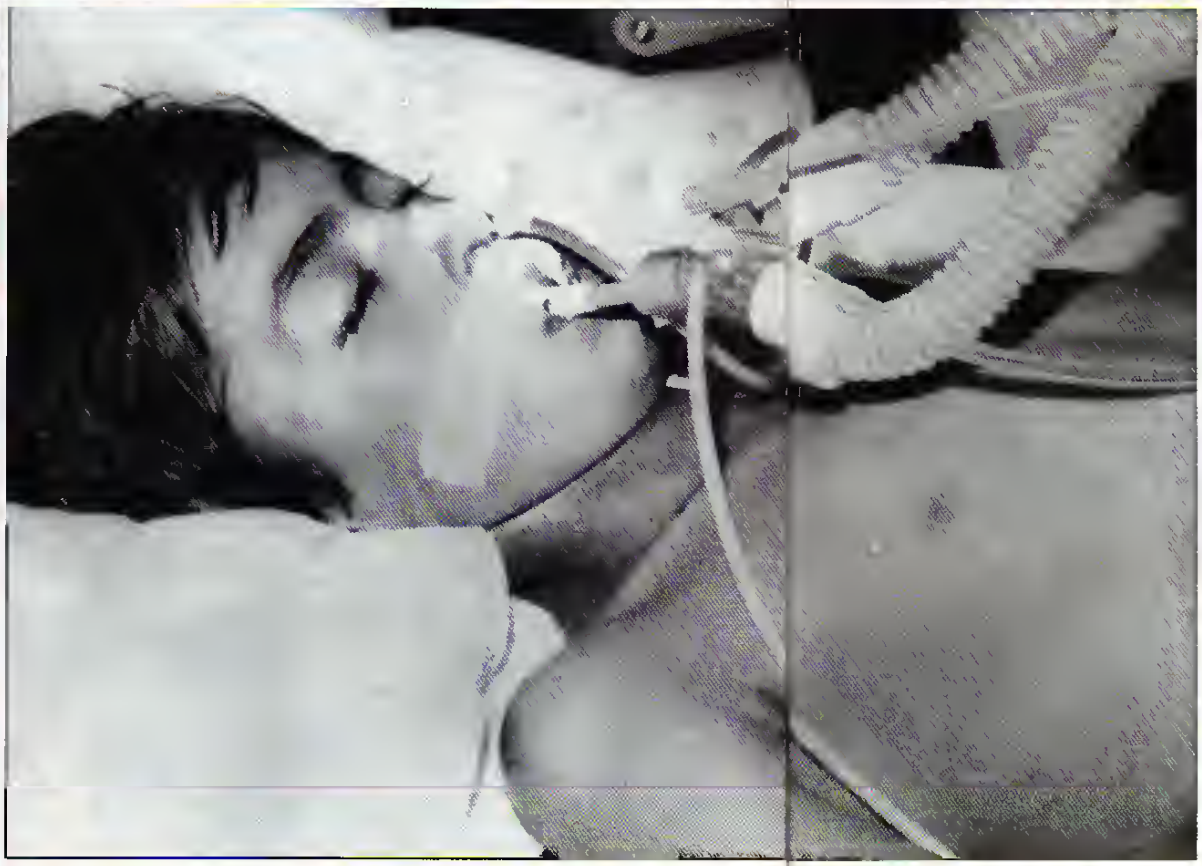
Jorge's eyes are red, the pupils dilated, the eyelids puffy and moist. A yellowed cigarette butt dangles from a blistered lower lip. He reeks of sweat and urine and glue. "*Un quetzal, Señor, dáme un quetzal por favor* [please give me a *quetzal*]," he ventures, conspicuously embarrassed. I stop, dig into my pockets, averting his eyes. He does not fit the part but he has that look that mendicants and tramps have that is best unheeded, unacknowledged, a liquid gaze in which float the cadavers of hope, will, and purpose. I surrender all my change. It isn't much. I mumble an apology in broken Spanish and walk away. Jorge follows me, ambling along sideways like a crab, tugging gently at my sleeve. He wants to shake my hand. He needs to touch and be touched, with love not lechery, with reassurance not rancor. I pat a grimy cheek, drawing a nit-infested head toward my bosom. Jorge puts his arms around my waist and begins to weep. "*Porque tu lloras?* [Why do you weep?]" I ask. "*Porque estoy en el infierno* [Because I am in hell]," he tells me. Jorge dries a sea of bitter tears, blows into a small plastic bag lined with a sticky amber substance—cobbler's glue—then avidly breathes in the caustic fumes. A flood of words gushes forth. I don't understand them all but his expression speaks volumes of the pain, the hopelessness, the cruel absurdity of life.

Jorge is eleven. Pedro and Felipe are twelve and nine, respectively. They all look half their age. Life is cheap. They may never grow up. Or old.

EVERY ENCOUNTER WITH AN ADULT CARRIES THE RISK OF ABUSE AND VIOLENCE. "THE DARK



DAYS OF GUATEMALA'S DEATH SQUADS AND MASSACRES ARE NOT YET OVER." —NEW YORK CONGRESSMAN TED WEISS



A MESSAGE CARVED IN THE LANGUAGE OF TORTURE: THOU SHALT NOT 'SING' —OR ELSE.

"HIS EMINENCE HAS NO TIME TO COMMENT ON THIS ARTICLE." —FATHER WHALEN, SPOKESMAN FOR JOHN CARDINAL O'CONNOR

Eyewitnesses now in protective custody in North America, and graphic photography obtained by *Omni*, confirm that Guatemala's *niños de la calle*—children of the street—are being subjected to a spree of tortures matched only by the Holy Inquisition. Many children were abducted, beaten, burned with cigarettes, subjected to mock executions, and sexually assaulted. Some had their ears torn off (they had heard too much), their tongues ripped out (they had spoken out), and their eyes gouged (they had seen compromising deeds) before the merciful coup de grace was applied, generally a blow to the head or a bullet to the base of the neck. Others were pushed into the countless ravines that gird Guatemala City's shantytowns, stinking chasms littered with garbage and human waste, and patrolled by feral dogs and cats. It will not surprise the reader, therefore, that I set out for Guatemala—and carried out the better part of this assignment—strapped in a lightweight bulletproof vest obligingly supplied by Point Blank Armor and aimed at protecting me not against crime lords or common felons but soldiers and cops.

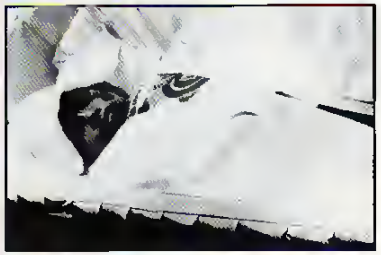
While the Nineties have witnessed dramatic political changes that culminated in victories for human rights, violations continue to defile a world already crippled by war and disfigured by famine and disease. "We've seen human rights take a backseat to trade or diplomatic concerns," said Amnesty International in releasing its 1991 report, "and become the casualty of political expediency."

In Latin America, a region historically traumatized by social and political turmoil, branded by wild swings from dictatorship to anarchy and back, human rights violations are legion. And in Guatemala, a country kneaded by volcanic and seismic upheaval, where lush mountains and precipices and neatly cultivated escarpments join to form a lush landscape of extraordinary beauty, crimes against humanity often eclipse the excesses recorded in other parts of the world.

Embarrassment, if not outrage, at Guatemala's apathy, at its unwillingness to address what has begun to draw sharp public and press attention, at long last prompted the United States—Guatemala's military and economic godfather—to suspend weapons deliveries last December. Expressing grave concern over what he termed "an escalating spree of violence, disappearances, and extrajudicial executions," Representative Jim McDermott (D., WA), one of a two-member congressional fact-finding team that toured Guatemala, told *Omni* at a press briefing that U.S. foreign policy in Central America has been "an unending disaster. We've had a history of picking the wrong sides, of aiding and abetting despotic regimes." Reminded that the United States is the only Western nation that refuses to sign and ratify the 1989 UN Children's Rights Convention, Congressman McDermott, express-

"HOW IS ONE TO EXPLAIN SO MUCH SUFFERING? HOW NUMB HAS OUR SOCIETY BECOME?

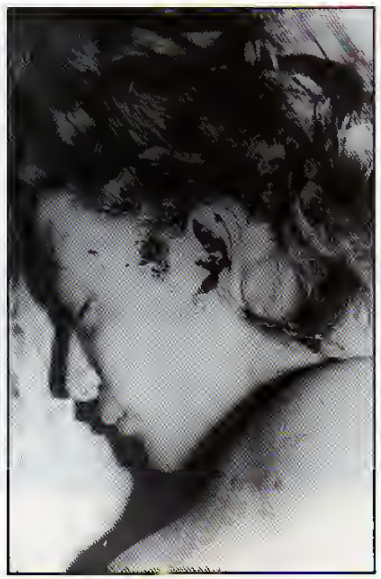
IT IS THE CHILDREN WHO PAY THE PRICE. THIS TRAGEDY MUST STOP." —ELIE WIESEL, NOBEL PEACE LAUREATE

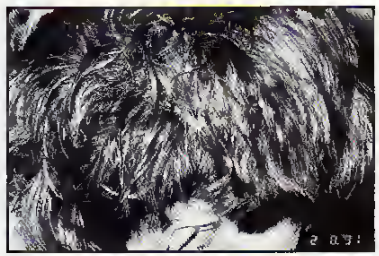


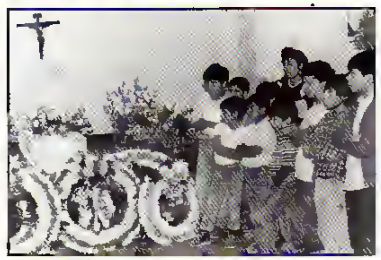
ing dismay, held out little hope for an imminent change of heart.

Those at greatest risk are the children inhabiting the streets of Guatemala City. According to Bruce Harris, the tireless executive regional director of Casa Alianza, a charitable agency that works with street children, offering them shelter, food, clothing, counseling, medical attention, and legal support, "There are at least five thousand such kids, perhaps as many as twice that number—we may never know for sure,' aged five to eighteen, doomed to the sidewalks and rank alleyways of the capital. Many have been orphaned by the so-called 30-year old counterinsurgency operation in the altiplano—the highlands—much of it funded and orchestrated by the United States. Some were abandoned by parents no longer able to feed a growing number of hungry mouths. Countless others have fled a home life punctuated by deprivation, brutality, and sexual abuse. "For the hordes of kids that end up on the street," says Harris, "life turns into a sordid blend of boredom, reckless improvisation, and ever-present danger. Every encounter with an adult—sometimes even with their peers—carries the risk of exploitation, ebuse, and violence. All are undernourished. All are in precarious health."

Precocious and opportunistic, at once ubiquitous and invisible, *los niños de la calle* scour open garbage dumps for food, sleep under parked cars, in doorways, and on sidewalks. Most survive by







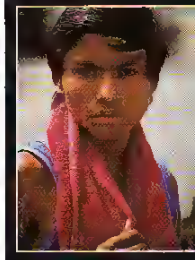
stealing, begging, and engaging in both homosexual and heterosexual prostitution.

In recent months, Amnesty International has recorded an escalating number of complaints of human rights violations against Guatemala's street children, including harassment, threats, beatings, torture, "disappearances," and extrajudicial executions reportedly carried out by the police, who frequently patrol the streets in plainclothes or pocket their badges to avoid identification, and agents of private security firms acting under license from the National Police and the Ministry of the Interior.

An Amnesty International USA spokesperson told *Omni* that "the policemen involved in these abuses,' officers moonlighting as executioners on behalf of local municipalities and private businesses, 'are seldom brought to justice, even more rarely tried, convicted, and imprisoned. We [Amnesty International] are very concerned at the delays, irregularities, and blatant reversals connected with official inquiries. Children's rights have taken a backseat to trade or diplomatic concerns."

Street children do commit petty crimes. They also sniff glue. Most are severely malnourished, and the sensations induced by the glue help overcome hunger pangs and numb them against the chill of night. Over time, the fumes destroy brain cells and can cause death. They also produce hallucinations and the reckless courage to steal.

STREET CHILDREN ARE ABDUCTED, BEATEN, MAIMED, SUBJECTED TO MOCK EXECUTIONS, AND



RAPED. BY IMMOLATING ITS CHILDREN, GUATEMALA MAY VERY WELL BE DEPRIVING ITSELF OF A FUTURE.

THE ATLAS OF SHAME: CHILDREN'S RIGHTS VIOLATIONS WORLDWIDE

There are more than 100 million street children around the world who live in fear every day of their lives. According to Amnesty International, many of these children "disappear," are beaten, illegally detained and confined, sexually exploited, tortured, and systematically killed by agents of the state.

1 **ALBANIA:** Beatings, torture, and confinement.

2 **ARGENTINA:** More than 200 children have "disappeared" since the late Seventies.

3 **BOLIVIA:** Illegal internment and torture.

4 **BRAZIL:** Nearly 460 children and adolescents were killed by death squads last year.

5 **CHAD:** Illegal imprisonment and torture of children related to "politically subversive" adults.

6 **CHINA:** Selling of child brides*. Children were among the more than 1,000 people killed in Beijing during the Tiananmen Square massacre.

7 **EL SALVADOR:** Disappearances, illegal detention, and extrajudicial executions carried out by both the military and the police.

8 **GUATEMALA:** See story.

9 **IRAQ:** More than 400 children have been detained by the police and the military without trial, tortured, and judicially or extrajudicially executed.

10 **ISRAEL/OCCUPIED TERRITORIES:** Excessive force and beatings of young Palestinians.

11 **MAURITANIA:** Beatings and executions.

12 **MYANMAR (formerly Burma):** Beatings, torture, and extrajudicial executions.

13 **NIGERIA:** Executions of minors.

14 **PERU:** Caught in the crossfire of war, hundreds of Peruvian children, some as young as ten, have been killed by the army.

15 **PHILIPPINES:** Sexual exploitation and extrajudicial executions.

16 **ROMANIA*:** Nazi-like forced increase in population during the Ceauşescu regime resulted, following the revolution, in thousands of orphaned and abandoned children, most of whom continue to live in squalid conditions.

17 **SOUTH AFRICA:** Harassment, illegal detention, beatings, torture, and extrajudicial executions.

18 **SRI LANKA:** Sexual exploitation*, abductions, "disappearances," and illegal imprisonment.

19 **TAIWAN:** Sexual exploitation.*

20 **THAILAND:** Sexual exploitation.*

21 **TURKEY:** Beatings, illegal detention, and torture.

22 **USA:** Police brutality. The United States Supreme Court has ruled that execution of juvenile offenders as young as sixteen is not specifically prohibited in the Constitution. Twenty-four states currently permit executions of juveniles, 14 states currently have such prisoners on death row.

Sources: Amnesty International, *Author's sources

"Every year forty-two thousand children die of preventable or curable diseases in Guatemala. But nobody cares. Corruption and inertia prevail," says Dr. Carlos Cossich Márquez, shaking a white head of close-cropped hair. Chief of pediatrics at Guatemala's General Hospital, Cossich sees lots of children in the course of a day. Many come from the streets. Some go directly to the morgue.

"Diarrhea, dehydration, parasitic and contagious diseases, severe upper and lower respiratory infections—we get them all," says Dr. Cossich. "We're also beginning to see infants with congenitally contracted AIDS. Gonorrhea is spreading at an alarming rate."

Dr. Cossich extends the fingers of his left hand and enumerates other startling statistics. There is only one doctor for every 1,400 inhabitants and only 36 hospitals in a country of 8.2 million people. 52.5 percent are under the age of seventeen. Guatemala is the only country on the American continents lacking a pediatric hospital. Guatemala suffers a 56.3 percent infant mortality rate. Eighty percent die because of inadequate pediatric services. Out of every 3,500 children who are treated for burns, only 700 survive. Of those, 70 percent are deformed or permanently handicapped. Dr. Cossich has run out of fingers. "... and when cholera crosses into Guatemala, as it soon will, the children—street children in particular—are doomed."

Cossich also tends to the growing number of children caught in the web of violence that stretches across Guatemala. "In addition to bullet wounds, punctures, and slashings sustained in the streets in the course of a day, we see an increasing number of battered children, children with severe burns, lacerations, dislocations, and fractures sustained at the hands of their parents and other adults."

"Malnutrition"—85 percent of Guatemala's children are chronically malnourished, according to Cossich—"in addition to illiteracy, abject poverty, and unsanitary conditions, can all be directly traced to a government that has abdicated one of its most fundamental responsibilities, education. We have a long way to go," sighs Cossich.

At the foot of the majestic Agua volcano rests a small cemetery with whitewashed mausoleums and tired wooden crosses bent by age and neglect. At the Casa Alianza plot, where the broken vestiges of youth and innocence are laid to rest, a simple marble tombstone for Nahamán Carmona Lopez says infinitely more about his death than about his brief existence, laconically recording his final words: "I only wanted to be a child; they wouldn't let me."

The thirteen-year-old Nahamán—he barely looked ten—died last March after four policemen found him and nine other street children, aged six to fourteen, sniffing glue. The officers, witnesses said, seized the glue and began pouring it over the children's heads. Nahaman resisted. The commanding officer yanked him to his feet by his ears, threw him back to the ground, and kicked him viciously in the stomach, rupturing his liver and breaking six ribs. A friend of Nahaman's who had narrowly escaped the onslaught said that his screams of pain could be heard three blocks away. Screams, laughter, and howls are hard to tell apart in the darkened, slop-splattered alleyways of Guatemala City. The police then abandoned the children, leaving Nahaman for dead curled up on the ground.

When the children returned about 30 minutes later, Nahamán had managed to move a few feet. He had lost bowel and bladder control. He was unconscious. Someone had covered him with paper flowers and a piece of white crepe, as is customary in Guate-

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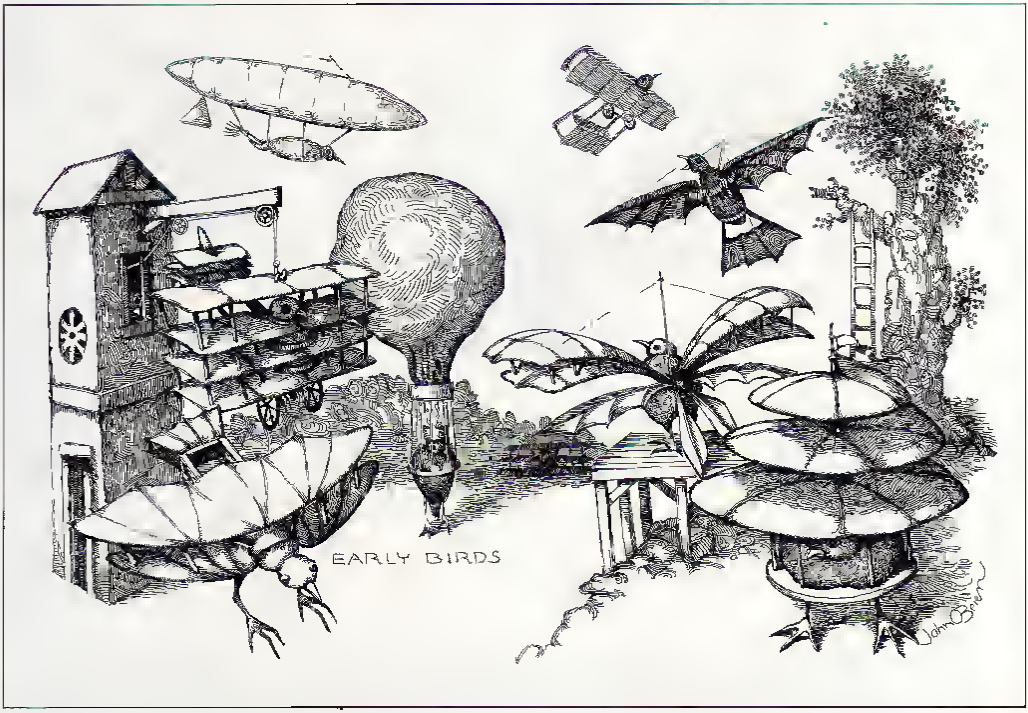


QUIET ON THE SET: INTERACTION!

BY KEITH FERRELL

Over the past decade we have seen interactive electronic entertainment evolve from simple black-and-white video games to full-color, stereo sound, nearly full-motion participatory "movies." More than ever before, the player becomes a part of the game she or he plays.

And more than ever, "interactive" becomes an accurate description of the process rather than an item of marketing jargon.

How far can "electronic games" go? In a series of "snapshots from the future," *Omni* looks at emerging technologies, the potential offered by increasingly ambitious game designs, the future of interactive electronic entertainment.

It's a bright future. A case can be made for entertainment designers and programmers being the most talented of all software artists. Certainly in the best games, there's an ease of use, a simplicity and elegance of design, that our word processing and spreadsheet designers would do well to emulate.

More than that, there's a gathering sense in the entertainment software industry of whole new horizons being opened for development, electronic frontiers being readied for exploration. The great success enjoyed by both personal computer and video game console manufacturers has served to liberate the software industry.

Software is what sells computers and video games; software is what appeals to consumers.

The hardware manufacturers understand this, and each new generation of equipment makes possible more convincing illusions, more satisfying entertainments, more fulfilling diversions. And software designers love nothing better than pushing the edges of a technology. Depth of play—a game design's ability to continue delivering entertainment after the initial excitement subsides—is a hot area among designers.

How do we enhance the illusion? How much can we do? How far can we go? Answers are beginning to emerge. Long-perceived limitations are tumbling. The walls between television and computers, movies and software, fiction on paper and electronic storytelling are coming down.

And if it can't be done today, it will tomorrow. As the hardware side of the business focuses on the development of true multimedia products that merge television, high-quality audio, and sophisticated computer technologies into a seamless whole, the boundaries of what constitutes an entertainment 'reality' will virtually disappear. Participatory entertainments will emerge on a level unimaginable a decade ago. Individuals will be able to choose their own preferred realities, their own electronic worlds of entertainment.

You will be able to visit these worlds on your own, playing solo, or you can travel in groups.

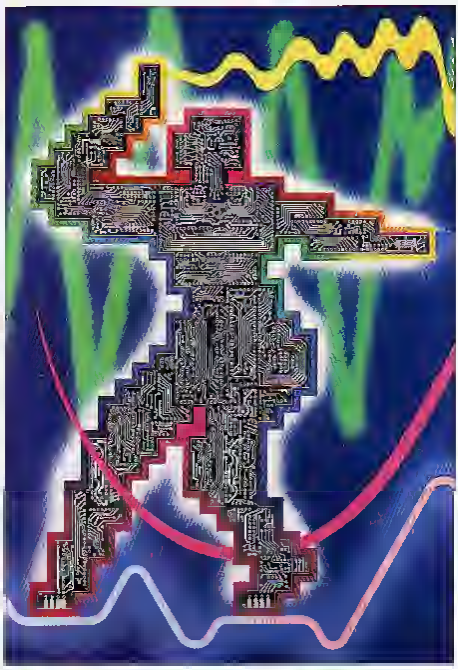
Those groups may be as small as two people vying against each other over a video game deck. Or as large as many thousands of on-line gamers playing through a telecommunications net. "Have it your way" will take on whole new levels of meaning.

Information itself will become a vital aspect of game design. We will see a blurring of the lines between entertainment and education. You'll be able to learn while you play, and play while you learn. There will be no "royal road" to learning, but the electronic road to education may be a little less steep.

What does all of this mean? Where are our interactive playthings taking us?

That's what this special section of *Omni* is all about. Call it a look ahead, a glance at what might be possible just a few years from now.

Welcome to the World of Electronic Games.



OMNI LOOKS AT EMERGING TECHNOLOGIES, THE POTENTIAL OFFERED BY INCREASINGLY AMBITIOUS GAME DESIGNS, AND THE FUTURE OF INTERACTIVE ELECTRONIC ENTERTAINMENT

GRAND ILLUSIONS

HAVE WE DISCOVERED HOW TO MAKE INTERACTIVE FICTION INTO INTERACTIVE WORKS OF ART?

We are a bit more than a decade into the interactive entertainment revolution. Has it become an art form yet? Let's quibble and say, yes and no.

Yes, emphatically so, in that we're seeing increasing numbers of games that represent a specific point of view, that encapsulate a vision of the world particular to an individual creator.

To achieve a true interactive art requires the creation of new tools, new grammars, new approaches to entertainment aesthetics. Interface design—the search for 'transparency' for a breaking down of the barriers between electronic worlds and flesh-and-blood players—is the focus of constant research, refinement and innovation. When we forget we have a joystick, mouse or keyboard at hand, we are closer to entering a work of art than playing a video game.

The best contemporary interactive game designers are seeking to enhance their illusions by deepening the relationship between player and game. On a simple level, this involves options such as the ability to select gender and appearance for interactive characters. More sophisticated interactive dramas give players the opportunity to create whole detailed biographies for themselves and their point-of-view character. Those biographies in turn affect the interactive character's relationship with other characters, and with the electronic world of the story. The dilemma in this approach lies in the fact that when we read a traditional novel or watch a play or movie, we are able to step outside ourselves, to see and learn from the example and responses of others. Interactive fiction reflects, of necessity, our own choices, our own responses. We play out our electronic dramas before an interactive mirror.

Resolving this dilemma is perhaps the most significant challenge facing our electronic artists and storytellers. We will soon begin seeing some different types of interactive storytelling.

Is it art yet? The answer is no, ambiguously so.

Some of the ambiguity is technological. Graphics, sound, motion. All must come together to create a believable illusion. The goal, some feel, is interactive fiction as striking in image and sound as motion pictures. Achievement of that level of technology, at prices mass audiences can afford, lies no more than a decade in the future.

But ambiguity flows from the creators as well. Too often game designers undermine their accomplishment by inserting unnecessary and distracting asides into their work, 'winking' at the audience and reminding them that, after all, it's only an electronic game. Imagine Scarlett O'Hara saying "After all, tomorrow is another fictional day" and you get an idea of the dimensions of the problem.

Even more grotesque, we encounter too many games in which the player is teased—or insulted—for making the wrong decision, for losing the game. If that's the payoff, then the stakes are cheapened in retrospect. Respect for audience is another essential aspect of art that more game designers could acquire.

What's needed above all is an infusion of aesthetic inspiration from more traditional art forms: the painting, the novel, the opera, the play, the motion picture. Too many of our games betray the fact that their creators are schooled primarily in other games. There are still more programmers than storytellers making interactive fiction. Most characters are blips on the screen rather than fully realized beings. Until that changes, we're unlikely to see interactive stories as memorable as their non-interactive predecessors. This is not to say that interactive art should mimic traditional forms. Far from it. What we're looking for is a *new* art form, one that learns from the past while inventing its own future. Motion pictures, still in their first century, have become the dominant art form of our age. Perhaps interactive art can go as far. Perhaps, coupling the rapidly increasing power of the computer with the insights and abilities of the artist, it can go farther.

Even if interactivity doesn't become our dominant art form, it can become a full member of the artistic community. To do so, though, we must have interactive entertainments that can be judged by the very same standards as other forms of entertainment. Not the same criteria necessarily—times, not to mention art forms and aesthetic expectations, do change.

Plot, character, insight, story, *art*. These are the real worlds for our interactive creators to explore. These are the aspects of artistic creation that will finally propel interactive entertainment out of its infancy and into adulthood.—Keith Ferrell

Rule the Desert Skies

Like some sleek, metallic bird of prey, it slices through the thin air of the desert night. Below, the enemy's radar frantically scans, searching for a sign. But the only warning is the deafening roar of ordnance demolishing its target. Before fighters can scramble, this airborne apparition vanishes, like a ghostly dream.

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VIDEO JUNKET JUNKIES

INTERACTIVE PLOT LINES ALLOW YOU TO WATCH TALES ON TV THAT YOU CAN CHANGE TO SUIT YOURSELF

You whisper *"Don't go in there"* under your breath as the movie's main character peers around a corner into a dark, and utterly dangerous place. *"Don't be so stupid,"* you add as insurance as if she could hear you from the couch and through the VCR.

We're stuck with what filmmakers give us. There's no way to change the action, force the players to strike out in new directions, or alter the ending to make it more realistic and palatable, or even more maudlin. Linear plot lines take us from start to finish; if the director, actors, and cinematographer are good we may forget about the real world for a couple of hours. If they're not, we can't do much about it but walk out.

Home entertainment of the late Nineties may change all that and motion picture storytelling in the process. Courtesy of the enormous storage capacity possible by the end of the decade, we'll watch tales on the television that we can change to suit ourselves.

The key doesn't lie in silicon but in crystal. New methods to store immense amounts of digital information are now working their way through research labs, heading for commercial and even consumer applications by the turn of the century. By shining laser light through a photoreactive crystal, these memory makers can record data in three-dimensional patterns of light and darkness. Such holographic storage crystals may hold as many as a trillion bytes, enough to fill a stack of computer discs four miles high, enough to store a feature film in HDTV format.

Stuck in a cartridge no bigger than the video game cartridges that you now slide into a game deck, holographic memory crystals are also blazing fast, retrieving data in huge chunks fast enough for full-motion video and film. With that much elbowroom, innovative directors could create the first interactive films with multiple—and certainly intertwining—threads of plot. Like their role-playing and adventure computer game forebears, interactive videos will let you pick and choose the direction, if not the outcome, of the story. At crucial plot junctions—you never know where they are, but part of the fun is in finding them—you can turn your character from one plot direction and into another, or even change points of view. Shoot now or run away. Say farewell or stay. Switch to the villain's role, or is he a villain after all? When you think there's a diversion ahead, press the controller. Up pops a list of choices, or a narrator's voice gives you the options.

This style of moviemaking demands a revolutionary change in storytelling. Simple plots will mark the first efforts, if only because the footage needed for the alternative tracks eats up space that might ordinarily go to complicating the tale. Taking their cue from interactive game designers, directors and screenwriters will build adventures that make viewers eager to assume a primary role. Stories of suspense, mystery, crime, and fantasy will likely lead off. Pornography won't be far behind.

Interactive videos may still have a single ending—most computer role-playing games do now, after all—but the route you take to that ending may differ wildly from your neighbor's.

Even such peripheral issues as video rentals would be affected. Since it might take half a dozen rentals to puzzle out the entire story, you might simply buy the thing instead. That makes sense in economic terms, too, since such films are strictly for the home. No one will sit in a theater and put up with someone else's choices when he can head home and watch his own movie.

In some ways, the digitization of America will let all of us become film directors, ordering story changes and altering actors' movements. Not all movies will be in such form—few will at first—but enough to give us a taste of the power that people like John Huston, Orson Welles, and Steven Spielberg have enjoyed.

Once we've sampled that wine, it may be a long time before we sit passively in a darkened theater again.

—Gregg Keizer

A NEW WIZARDRY

Ten years ago, Wizardry set the standards in FRP. Now, after two million copies have been sold and 25 international awards have been won, Bane of the Cosmic Forge raises and redefines those standards. This new Wizardry, the truest simulation ever of Fantasy Role Playing, will push your computer, your mind and your sense of adventure to their very limits.

True FRP Simulation!

Like a true game master, Bane of the Cosmic Forge rolls the dice, consults its charts and applies the rules. From the ADD items of armor and weaponry researched for authenticity – right down to their weights – to the realistic combat structure – incorporating Primary and Secondary attack – everything, absolutely everything, is calculated.

Full-Color, Animated Graphics!

You'll see swords swinging before your eyes; creatures of all shapes and forms will move before you, spells coming from your magician will swirl through the air. You'll walk under gargoyle-laden arches and watch candles flicker in their sconces. Your PC's internal speaker will play all of these digitized sounds without any add-on hardware . . . swords swinging, monsters venting their anger and spells letting fly.

Uncompromising Variety!

- 11 Races
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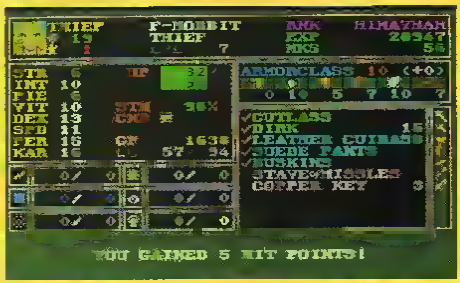
- Ranged, Primary and Secondary Weapons
- Six spellbooks, 462 spell combinations
- Multiple Armor Classes

Artificial Intelligence!

Find the ancient and cryptic dwellers who can aid you in your quest. Talk to them as you would your friends – in sentences. Only through the power of the latest in programming technology could the full dimensions of conversation this real be possible.



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WORLD OF ELECTRONIC GAMES

The cocoon is nearly complete. Add another component or two to the rack, and your home entertainment center will provide fantastic worlds where all rules are off, where you decide how the story turns, where music and sound and pictures combine to amuse you in millions of new ways. All in the comfort and safety of your family room. No lines, no long drive, no dark corners.

The missing element? A computer in disguise. By the middle of the decade, no home rec room will be finished without a black box that's part computer, part video game machine, part compact disc player, and part telephone. Set among a stereo receiver, high-definition television, speakers, and VCR, this box is the brains behind home electronics.

Nearly a third of American homes already have its ancestor cabled to their television sets. Nintendo, Sega, NEC, and SNK are the names on boxes today. Tomorrow those names may be joined by Sony, Tandy, Philips, Zenith, Matsushita, IBM, Commodore, and Apple. What seems sophisticated today—hundreds of colors, fast-moving images, and cartridges jammed with silicon chips—will look primordial in four years.

RACK 'EM UP IN YOUR REC ROOM

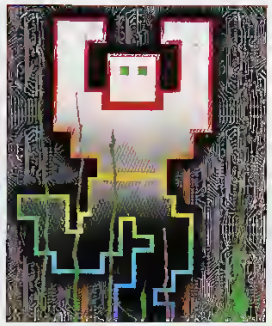
BASH HEADS, BOP THROUGH MAZES, AND BARREL DOWN RACETRACKS WITH YOUR REMOTE CONTROL

The core of tomorrow's home theater and arcade is a multimedia personal computer that looks nothing like a PC. It's a pizza-sized box two inches thick, with no keyboard in sight. Though it may have cut the technological edge four years earlier, now it's simply inexpensive. Equipped with stereo sound and 256-color graphics, this *faux* PC not only plays your high-end simulation-style games but manages the entire center at the same time. It also doubles as your home PC, linking small terminals throughout the house for office work, personal finance, and the kids' schoolwork.

Touch a switch and a CD drawer slides out. No albums in here, though, but video games on compact discs instead. Full-length sagas that set you role-playing through dungeons or on alien planets. Murder mysteries where you're the star detective, with unknown actors in supporting roles. Or time travel to Custer's Little Bighorn, Nero's Rome, and Henry's Agincourt. All feature video snippets nearly as smooth as a motion picture. You change the story at critical junctures by pressing a few buttons on a pad that looks like a television remote control.

By the late Nineties, a few daring filmmakers have ventured into interactive cinema for the home, producing brief video CDs that can be played half a dozen times before alternatives are exhausted. Their works sell briskly, if only because game publishers still haven't discovered the story subtleties that movies have honed for half a century. Your center plays these films, too, and lets you switch viewpoints and shunt the story toward a new ending.

Arcade games play in the home, too. Specialized video game machines connect to the system's central brain to play the descendants of today's driving, shooting, and jumping games. Shove the slender credit card-sized cartridges in the video machine, grab the same controller that you use to play CD games, and you're bashing heads, bopping



through mazes, and barreling down racetracks. Nearly all are retreads of popular standup arcade games. In fact, you can take the flat cartridge to the mall, play a few rounds, save your game, and then finish at home.

But you don't have to play against just the computer. Your home arcade dials up opponents by telephone. Several electronic game networks sport thousands of subscribers who visit waiting areas and challenge others to one-on-one or multi-player bouts. In a matter of moments you can assemble enough on-line players to outfit a flight of jets or link up with a friend down the block or across town for some two-player football. In some cities you can even dial an arcade and play head-to-head against almost any machine. Your opponent may be dropping in dollars, but you're only paying for the call.

The home amusement cocoon of 1995 can compete against most outside entertainment, whether movies or music, because nothing stacks up against the make-believe universe you can create with computer and video games. The fastest-growing art form of the decade—one that attracts emigrants from film, animation, and fiction—games are ready to take on the twenty-first century. Are you?—Gregg Keizer

THE ELECTRIC BODY POLITIC

YOU AND YOUR TELEVISION BECOME STRANGE BEDFELLOWS IN THE DIPLOMATIC GAMES PEOPLE PLAY

If politics makes strange bedfellows, then computers are drawing up the sheets. Already used by pundits and pollsters, politicians and their parties, computers tell us who's on first, point out the crucial issues, and call elections long before the last vote is cast. Why not put them to some good use and have them turn politics into a *real* entertainment form?

Re-creating politics on your home amusement system won't be easy. Distilling political science to a set of computer algorithms is notoriously difficult, especially if you expect everyone to agree with your assumptions. But game designers have probed the body politic with works that reduced détente to a dangerous two-step and shrank banana republic machinations to a three-way toss-up between left, moderate, and right. By the middle of the decade, political simulations will be more sophisticated, if no less opinionated.

Few things match the feeding frenzy of American presidential elections for comedy, drama, and deceit. Putting that on your home television screen—with you able to decide the next step or plan the next campaign—may reduce our politics to a simplified version of reality, but then, isn't that what television does already? By the 1996 election, you'll be able to play along at home, courtesy of some smart game designer. You'll get the basics, from fund-raising to buying TV time, but you'll also have the freedom to make it up as you go along. Want to smear the opposition with a timely leak about an extramarital affair? Want to hit back with allegations of draft dodging? Go ahead. It's just a game. A great role-playing game.

Or you can fry larger fish and take on the New World Order electronic construction set. The Soviet Union may have dissolved like so much Wicked Witch, but you've still got foreign aid to hand out, Third World wars to fight, and natural resources to retain. Before you set your home entertainment center's CD spinning, you pull down the latest game stats and formulas from the publisher's computer so that you start playing from *today*, not yesterday. You can even save the game, post your positions and predictions for all to see, and hope the real news matches yours in a month or two. Imagine—millions of political experts prognosticating about future turns of events. We might discover that we know as much as the talking heads on CNN.

We may even turn into a country of peacemakers. Tranquility in the Middle East may have eluded nine presidents, but maybe you can do a better job. Using advanced artificial intelligence, a computer game could put you in the shoes of the secretary-general of the United Nations, bargaining and negotiating with the computerized rulers of Israel, Syria, Egypt, Iraq, Iran, and every other player in the world's worst flash point. Threaten sanctions and Saddam's evil electronic twin may laugh in your face. Offer land for peace at the right price and the computer Israelis may give you the nod.

Coups and revolutions can come home, too. Video and computer games will re-create the dissolution of the USSR and its eventual reconstruction as the Soviet Republic. Everything from the 1991 coup and economic rebirth to possible civil war and anarchy will chart a course on your TV screen. It may not be history, but it'll be grand entertainment.

Future politics would work just as well. What if the United States fractures along Balkanized lines? Does the federal government go to war a second time to hold the Union together? In a computer re-creation you can find out without harming a soul. Space civics can be just as enlightening. In a solar system where Mars and the moon have been colonized and Jupiter's satellites explored and exploited, what will be the burning political issues? At your home entertainment center, you can dabble in treaties, boycotts, and blockades on an interplanetary scale. But why stop there? Most science-fiction games are simple excuses for arcade shoot-'em-ups. Why not make real aliens with cultures so...so alien...that just communicating is a chore? Add conflict and you've got the perfect mix for stellar diplomacy.

Games like these have the potential for entertainment as well as education. If we find it hard to win in a computer or video political game, we may develop sympathy for the real politicos. Or pay a bit more attention to what they're really doing.

It may be the best thing that ever happened to politics.—Gregg Keizer

THE 1991 DEMO Powerpak

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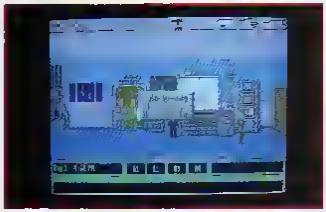
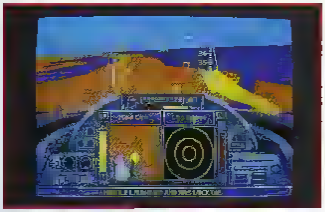
The 1991 Demo Powerpak Includes playable previews of:



MISSION: IMPOSSIBLE*

Enter the world of spies and intrigue in this new adventure offering from Konami Software. Create your own agents, set up wiretaps, and don disguises, as you try to stop an underworld plot to topple the government!



DANGER ZONE-NEAD TO NEAD AGAINST TOP GUN'S BEST*

A new flight simulation experience from Konami. Learn jet fighter tactics from three veteran war aces, thrill to multiple target views including "missile cam," and fly missions solo or in simultaneous, two-player split screen!

MARTIAN MEMORANDUM

Private eye Tex Murphy is back In a hilarious new interactive movie adventure from Access Software. For the first time, players will be able to interact with full motion video characters on a disk- based product, as they help Tex face murder, romance, deception, and prophecy from present day San Francisco to the yeor 2039

WORDTRIS

A new challenge from the TETRIS people at Spectrum HoloByte. The fast action, falling blocks now have letters on them, which players try to form into words. Time is of the essence as you try to maneuver letter tiles to spell words, as they fall from the top of the screen into the well. If you like TETRIS, you'll love WORDTRIS

FACES...TRIS III

You'll meet some pretty strange characters playing this addicting Soviet mind-teaser from Spectrum Holobyte. Falling block pieces of famous and not-so-famous faces must be stacked in the proper order (mouth to chin, eyes to nose) to form complete faces. Remember there are no points for "double chins" in this game!

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WORLDS OF WONDER

SPEND THE DAY SAILING WITH COLUMBUS, FROLICKING WITH A TYRANNOSAUR, OR CHASING AMERICA'S MOST WANTED

You're never too old to play pretend. Everyone likes to lose himself, and a few hours in the imagination of a moviemaker or writer. Pretend play lets us step outside the mundane and practical into the exciting and impossible. No little surprise, then, that one of the most popular ways to play with a computer is through worlds of make-believe.

Simulations, as these re-creations are often called, already reproduce the intricate workings of an ant colony, a city, even the entire planet. But as computer and video game machines power up in the next few years, expect simulations to follow suit, bringing even more impressive realities to your television screen.

Historical replicas, long a mainstay of computer simulations, will take on new dimensions. Though military simulations will continue to draw an audience, those with more direct learning connections will find a place on more home entertainment systems. You and your kids will be able to retrace the steps of the most famous explorers. Retouched video returns the scenery to its pristine state, while period maps and professional narrators provide color and commentary. The experience—whether you're alongside Lewis and Clark, Sir Richard Burton, Columbus, or Cortés—puts you in charge. It lets you make the decisions from start to finish, and makes you live with the consequences. Can you take Magellan's place and still circumnavigate the globe? What would it take for you, as Robert Scott, to beat Amundsen to the South Pole?

Nature, too, can be confined to the safety of the home arcade of the mid-Nineties. First to appear will be sophisticated weather models. Just as current simulations let you mess around with cities, these programs will let you play with the climate. Create cold fronts and send them barreling out of Canada. Mix air masses over the Mississippi and watch tornadoes form over the Plains. Hurricanes, too, are just a key press away. Form them from tropical depressions, and by adding just a touch more heat to the ocean waters, turn them into raging monsters that eat up the Atlantic seaboard.

Astrophysics is beyond most of us, but we'd love to build black holes, make stars go nova, or put two galaxies on a collision course. Super space simulations make it possible. Simulating science fiction may seem like a contradiction—after all, SF isn't even *real*—but it'll draw players, too. Imagine an in-depth treatment of planetary exploration, with extras from sensor scan interpretations and orbital observations to landfall and the inevitable search for life. Each new planet or system in the series would be released on a new compact disc or cartridge for a never-ending simulation.

Why stop at alien worlds? Why not mimic life with your computerized amusement park? Some programs will take the broad approach and let you guide life as it develops from single-cell creatures to intelligence. Others put you in the shoes—or paws or claws—of specific creatures to see if you can survive the laws of the jungle. Try out a tyrannosaur for size, for instance, to see what it took to keep the tyrant lizard on his feet.

More simulations—all as much fun as educational—will follow. Medicine won't be as mysterious once you have piloted a white blood cell through the bloodstream. Enhanced by actual footage from fiberoptic probes through arteries, veins, and the heart, your home arcade will add monstrous microscopic invaders, herds of corpuscles, and enough current to really toss you around the body.

Criminology is within the grasp of even the rankest detective when the computer or video machine lends a hand. Crimes—some based on real-life cases—are up for grabs. Using the homicide squad's tools of fiber matching, fingerprinting, DNA examination, witness reports, and the like, you have a chance to crack the case. It's even possible to put unsolved crimes on disc to turn millions into amateur investigators.

Scores of other worlds may turn up on your home entertainment system. Almost anything can be condensed to the size of a compact disc or cartridge, though lots may get lost in the translation. Nuclear power plant management, empire building from Caesar to Victoria, and even archaeology can be distilled to the small screen. Add a bit of drama and render the re-creation in near-photographic fashion with lots of sound effects, voice-overs, and period music, and you have an interactive experience that's impossible to really live through.

But you'll want to try.—Gregg Keizer

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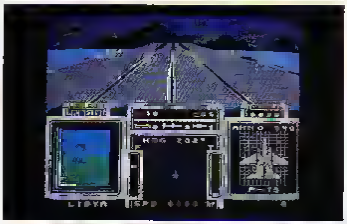

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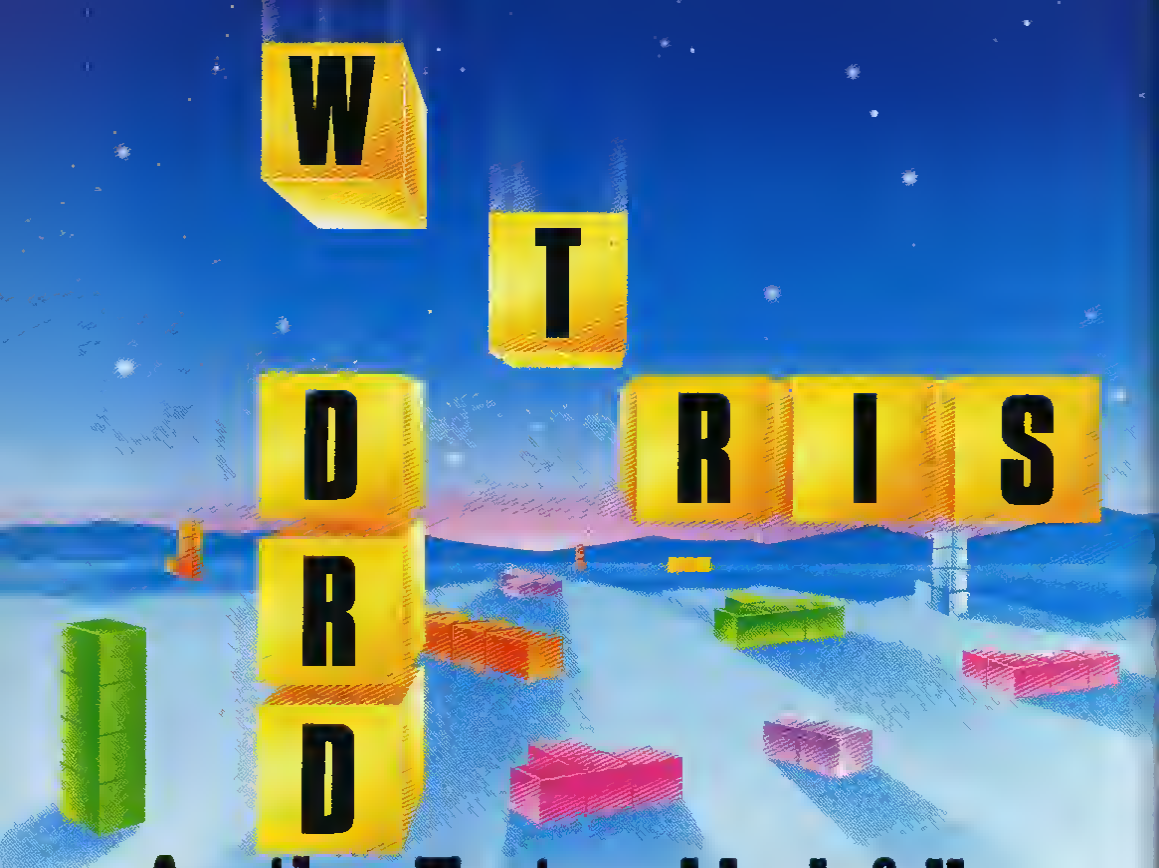
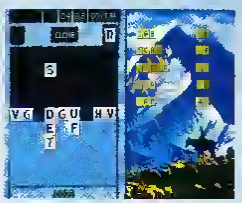


Another Eastern block falls.

There's a new TRIS on the block. Its name is WORDTRIS. And if you love TETRIS, this latest fast action, falling block, Soviet game will boggle your mind.

This time the falling pieces are letter blocks. Form them into words and score points. As each block falls, it pushes down the blocks below, producing an ever changing kaleidoscope of letters where scoring opportunities appear - and vanish at the blink of an eye.



Go for XYLOPHONE if you dare.

Create words horizontally or vertically, but don't put all your E's in one BASKET. Because every time a word lines up, *poof!* those letters disappear, and the blocks below pop up to fill the spaces. So whenever you earn points you stir up the alphabet soup. And suddenly that falling M has no HOME to go to.

WORDTRIS keeps raining vowels and consonants until you've collected enough words to move to the next level, or the well fills up. Of course, each successive round ups the ante as the blocks fall ever faster. But you can choose your difficulty level to match your skills, and select from single player, cooperative, competitive, head to head or tournament modes. The built-in 30,000 word dictionary verifies even the most obscure word.

Set the difficulty level at 10 and you'll find WORDTRIS harder to keep up with than the changes in Eastern Europe.

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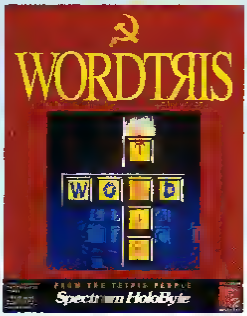

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ANTIMATTER

UFO UPDATE:
UFO researchers say their work involves endless stress and deprives their families of time, energy, and love

To the typical UFO buff, the daily life of the UFO researcher seems romantic indeed. According to the common perception, this lucky individual spends days tracking down spectacular sightings and nights hypnotically probing the psyches of alleged UFO abductees. When the researcher comes up for air, moreover, he tweaks the nose of established science and jousts with the government for classified proof of UFOs. What a life!

But the UFOlogists themselves say their profession is costly and stressful, exacting an enormous toll on earning capacity and family life. The pain and pressure of the work, they say, is rarely mentioned on the talk show circuit or in UFO magazines. Stressful career problems, for instance, have plagued investigator Richard Hall, who worked with the National Investigations Committee on Aerial Phenomena during the Sixties and Seventies and is now on the board of the Fund for UFO Research. Says Hall, "UFOs on my résumé interfered with me getting straight jobs for years."

UFOlogist David Jacobs, meanwhile, says his work takes so much time it seems "like a bottomless pit." As an abduction expert and a historian at Temple University in Philadelphia, he can't find enough hours in the day for either activity. When push came to shove, Jacobs says, he chose to study abductions. But a senior member of his department at Temple informed him that he would have to go back to regular historical scholarship if he "hoped to advance in his career." His abduction work has also strained his family life, though he feels guilty when he takes a break.

Toronto psychotherapist David Gotlib reports similar strains. Gotlib spends hours providing therapy for abductees and also produces a newsletter for abduction researchers. Between the newsletter and UFO conferences, Gotlib says, he is "out thousands of dollars worth of time." He deals with the pressure by reassessing his commitment to UFOlogy every six months. "I'll close down the newsletter," Gotlib says, "when I get a relationship or get married."

Larry Bryant, head of the Washington, DC, office of Citizens Against UFO Secrecy, says he has literally given up on a social life for the sake of UFOs. Bryant, a Pentagon employee by day, comes home to a world of unanswered phone messages and UFO correspondence. "It's a full-time part-time job," he says. Bryant says he recently received a poor job rating at the Pentagon because of his UFO work. The rating was improved only after he paid a lawyer thousands of dollars and filed a lawsuit.

Finally, artist and abduction expert Budd Hopkins claims the research has deprived his family of "time, energy, and love." But even more disturbing, he says, is a frightening feeling he calls "terminal impotence." This oppressive sensation sets in, he notes, "because there is no way to stop the abductions or ultimately help the abductees."

Given these drawbacks, why do the researchers persist? David Jacobs explains. The work, he insists, is critical because "the abduction phenomenon is the most important thing that has ever occurred."

—PAUL McCARTHY

ANTIMATTER

POETIC JUSTICE

Posterity has not been kind to the British poet Elizabeth Barrett Browning. For years dominated by her possessive father, Browning pined away on the sofa in her stuffy London bedroom on Wimpole Street. Finally, at age forty, she eloped with poet Robert Browning. The pair traveled widely, leading a relatively adventurous life, and had a child to boot. Browning's radical switch has led biographers to attribute her earlier invalidism to hypochondria, mental illness, and even opium addiction. In 1938 her own niece, Arabella Moulton-Barrett, attributed the poet's way of life to a spinal injury suffered during childhood while riding a pony. Years of deliberate malingering followed, Moulton-Barrett charged—long after the injury had healed.

But now British biochemist David Young has stepped forward to vindicate Elizabeth. After examining her doctor's letters, he says, he is convinced Elizabeth had bronchitis and that at age fifteen she contracted polio. The polio, in turn, led to curvature of the spine and a lowered left shoulder obvious from a famous portrait. She generally camouflaged this defect with her hair, Young says, which she kept unstylishly long about her face. He also suggests that her loose, unfashionable clothes hid a hip deformity.

SWORDID FEATS

Are sword swallowers fakers? The best person to answer that question must surely be a throat surgeon. So here comes William Lund, a consultant in the otolaryngology department of the Radcliffe Infirmary, Oxford, England, who has made a special investigation of the practice. For a long time, he admits, people thought the trick was faked with a blade folding up into a sword handle, like a toy dagger. This is not the case, he reports, and he now tells how the swallowers operate.

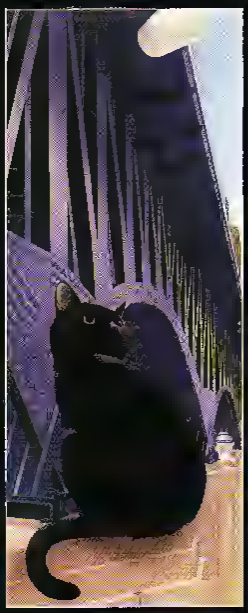
"The technique," he says, "is exactly that of passing a rigid esophagoscope [an instrument for inspecting the gullet], and the problem is to overcome the gag reflex. Most artists train by swallowing a crude ball of wadding around a lead pill attached to a length of cotton."

How long a sword can a fully trained expert swallow? That depends, Lund says, on the distance from his lips to the pit of his stomach.—Ivor Smullen

DAN MANNIX CAN SWALLOW A SABER WITH A 26-INCH BLADE BECAUSE HE'S ESPECIALLY TALL. BUT HE LOST ONE COMPETITION TO A SHORTER SWORD SWALLOWER WHO WEIGHTED HIS STOMACH DOWN WITH A HEAVY MEAL

"One of Elizabeth's doctors," says Young, "reported on her painful paroxysms and muscle twitching. This eventually led to the appearance of a spinal injury. But to me it suggests polio, which resulted in paralytic scoliosis. The time spent in her bedroom," he adds, "protected her from the cold, damp, and polluted air. As time passed her condition gradually improved, and after Robert Browning took her to the warmth of Italy, her bronchitis did not trouble her for some years."

—Ivor Smullen



CLASSIFIED QUAKES

Four days before a 7.1 magnitude quake struck California, geologist James Berkland predicted it would occur. What's more, his prediction was actually published in the *Gilroy Dispatch*.

Nonetheless, shortly after the quake, Berkland nearly lost his job as geologist for Santa Clara County. The reason: his unorthodox method. While most geologists try to predict earthquakes by such means as ground tilt measurements or magnetic field changes, the maverick Berkland uses high high tides and low low tides to tell *when* an earthquake will occur, and the lost-pet classified ads in local newspapers to determine just *how big* the quake will be and *where* it will hit.

The Chinese have long studied animal behavior and tides to psych out earthquakes, and Berkland thinks they're right on. Indeed, just before the World Series quake, "the number of missing cats in the classifieds reached twenty-seven, when normally there are only three or four," says Berkland, "and the number of missing dogs shot up to fifty-eight." The message from the animals could not have been more obvious. Two weeks before the quake two infant whales beached themselves on Ocean Beach in San Francisco and a rare pygmy whale washed up at Santa Cruz. Pigeon fanciers, noting their birds were flying the coop, had even canceled their races beginning the first of October.

Despite Berkland's success at predicting the World Series quake and others in the past, the U.S. Geological Survey does not think much of his work. "We've taken a look at it," says Roger Hunger, e geophysicist at the USGS in Golden, Colorado, "and we find that his results are not significant." Several years ago Hunger directed a full-time project evaluating earthquake predictions, and, says Hunger, "it died out from lack of success."

But Berkland is determined to go on. With the assistance of a Menlo Park entrepreneur, he has recently set up a monthly newsletter called *Syzygy* (14927 East Hills Drive, San Jose, CA 95127) and a telephone information line (1-900-226-JOLT) to give out his predictions each month. "I don't want to commercialize myself," says Berkland, "but I do want to advance science, protect the public, and get the information out. Animals have a sense of the forces at work in nature," Berkland adds. "They can feel when change occurs, and that feeling confuses them. When that happens, they react instinctively—they run and don't stop running until their senses tell them to."—Patrick Huyghe

GIANT RAT

Scared of mice? Be thankful you weren't in Abbeville, France, recently. A ratlike albino animal the size of a dog supposedly appeared in that community, terrifying residents and outmaneuvering would-be rodent hunters.

According to witnesses, the creature was nearly three and a half feet long and weighed close to 16 pounds. Veterinarian Gérard Delabie, who finally killed the animal with a lethal injection, at first believed the critter was a rat.

But University of Georgia wildlife specialist Jeff Jackson points out that rodents commonly called rats—Norway rats, house mice, and roof rats—never reach the size of the creature allegedly spotted in France. "Beavers, on the other hand, can sometimes weigh close to a hundred pounds," Jackson says there's no way to know just what kind of animal caused so much commotion, but he's skeptical that it was a rat species.—Sherry Baker

INTERVIEW

CONTINUED FROM PAGE 76

and has a degree in business administration. The vessel simply arrives on the site with all the compressors, generators, fresh-water makers, chambers, galleys full of food. We have conservators working full-time in Turkey mending pottery. We even have full-time illustrators drawing the material, and photographers doing beautiful underwater photographs and the detail photography in museums.

Omni: Do you ever have trouble with marine life at the site?

Bass: Until three years ago, we'd never seen a shark. But recently at Ulu Burun a shark goes by maybe one hundred meters away. Our greatest fear is that the site seems almost a breeding ground for a kind of scorpion fish. So we keep a spear lying at the site. Twice people have gotten scorpion fish spines into their fingers on land and almost gone into shock from the pain. If a diver put his knee on one at one-sixty feet and suddenly panicked, he'd be in serious trouble. I don't know why there are so many here, but every year we have to kill about half a dozen.

Omni: When you come across a wreck, what are your first thoughts?

Bass: Its date. Judging the forms of antiquities—Bronze Age, classical Greek, Roman, Byzantine, medieval or later—is fairly easy. Then we raise a few diagnostic artifacts to pin down the date to a century. During the last decade we've found seventy-five to eighty ancient wrecks along a small part of the Turkish coast.

Our ultimate aim is to excavate one merchant ship from every century of antiquity. Then we'd have told the entire story of hulls and pottery, weights and coins and everything. Then we'd perhaps focus on types of merchant ships, then move to warships, ferryboats, fishing boats, and so on. Essentially, we'd like to tell the story of seafaring with firsthand evidence. A set of tools from a ship of every period of antiquity would tell the history of tools better than it's been exhibited on land.

Omni: What's so important about the Bronze Age shipwreck you're excavating now?

Bass: It has an impact on the history of maritime trade, on international relations, and even Egyptology. The scarab of Nefertiti suggests to some Egyptologists that she was coruler of Egypt with her husband, Akhenaton. It has an impact on the study of literacy. This wooden tablet with its wax writing surfaces is something mentioned by Homer, but previously people didn't think these existed in the Bronze Age [3000 to 1000 B.C.] when the Trojan War took place. They did. With materials from eight cultures on this vessel, we have a broad spectrum of how they worked together. Our discoveries bring to life contemporary correspondence between various kings describing the trading and types of goods that were on the ships. We can't work without reading these ancient documents. And now people studying documents have to pay attention to what we're finding.

Colleagues working with me on a wreck only one thousand years old at Limani, Turkey, think that's even more important. The curator of Islamic art at the Metropolitan Museum of Art in New York said that had we not found all these types of glazed bowls, which we date to about A.D. 1025, art historians would have dated some of them to the ninth and perhaps twelfth century. With its three tons of medieval glass onboard, this wreck contains more Islamic glass than all the collections in all the glass museums in the world—then you multiply it by ten or a hundred and still don't come up with a reasonable figure. Not being an expert in medieval or Byzantine art, I decided to farm out most of the work to those specializing in categories of the find. But Fred Van Doorninck, who started with me in 1961, said, "George, you've got to get emotionally and intellectually involved in the wreck. You've got to publish part of it yourself."

So I took the dregs, the little miscellaneous finds that would be passed over in one or two sentences in the average archaeological report. "And we found eight bone spindle whorls" or "We found fragments of three combs," they'd say, and leave it at that. I took the spindle whorls. It was fairly easy to find out they were carved somewhere along the Syro-Palestinian coast. But why were they on this ship? Everything is carried for a reason.

By plotting their position on our plan of the site, I found they were not scattered randomly but in specific clusters in areas where fishermen were repairing their nets. It dawned on me that maybe fishermen were spinning threads to mend their nets. Then I stumbled onto something written by an Arab a century before the ship sank saying that spinning goat hair was a manly thing, unlike spinning flax, which only women did. We analyzed a few fibers of thread still surviving in a lead net sinker. It was goat hair. Then I talked to an eighty-three-year-old fisherman who

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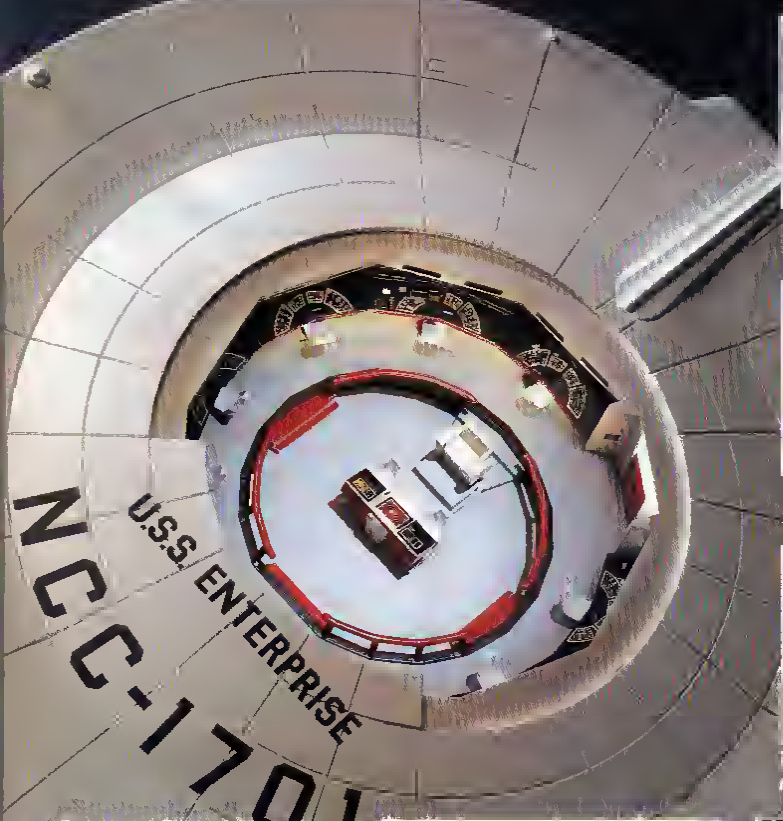
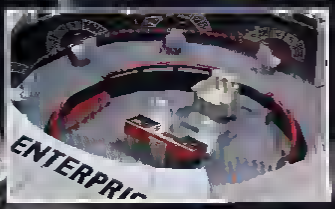
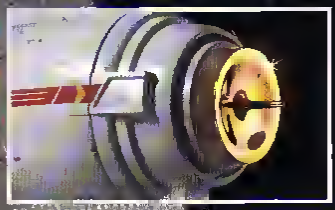




The removable dome permits access to the bridge.



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The Artist

said goat hair was the best thread for his nets. It doesn't absorb water like wool. An Ottoman net turned out to have goat hair as well. Finally I ran into a reference from the Thirties about modern Danes mending their nets with spindles and whorls. "That clinches it," I thought. "That's what they were doing."

Then a history professor wrote me, saying that one spindle whorl found at the Viking site in Newfoundland led them to reason that a woman must have been present. But if, in fact, these were not used just by women, this might not be a more permanent colony but just a fishing station. Rethinking what a single spindle whorl means could change our ideas about the discovery and colonization of early America by the Vikings.

Omni: Did the Minotaur or Labyrinth actually exist?

Bass: I believe the story is a mythological representation of the downfall of King Minos of Crete, where we know the bull was worshipped. In his excavations at the Minoan capital and at Knossos, Sir Arthur Evans found many depictions of double axes, and the word for that in antiquity is *labrys*. If you look at this mazelike palace today, you'll see the bottom floor is in corridors. That fact could easily have led to the idea of Theseus being lost inside and finding his way out only with the aid of a thread laid out by Minos's daughter Ariadne. Theseus, king of Greece, killing the Minotaur could represent the Mycenaean Greek dominance of Crete by overcoming the Minoans.

Atlantis, too, may have a basis in fact. Some people would say Plato simply made up the story to make a point. But it's not impossible that the destruction of the island of Thera by volcanic eruption led to the story of a civilization sinking beneath the waves. I don't think Atlantis is out in the middle of the Atlantic somewhere.

Omni: Have any of your findings verified mythological stories?

Bass: Everything we've found on our wrecks has tended to corroborate what Homer, who presumably lived in the late Iron Age [after 1000 B.C.], wrote about the Bronze Age. We found brushwood dunnage, a protective liner underneath cargo, on the Cape Gelidonya and Ulu Burun ships. Homer has Odysseus putting brushwood dunnage in the boat he built to leave Calypso's island. Homer often wrote about Phoenician metalworkers and sailors. People said, "Well, it's anachronistic." But our wrecks have shown the Bronze Age Phoenicians were active seafarers and metalsmiths or at least seemed to be carrying a lot of metal around the East-

ern Mediterranean. Iron Age Phoenicians became tremendous explorers and seafarers, sailing out into the Atlantic. There's reason to believe a Phoenician sailor circumnavigated Africa.

Omni: What's the significance of the glass ingots you found at Kaş?

Bass: In 1972 Leo Oppenheim, a Near Eastern linguist, speculated that a brief passage in cuneiform on a fourteenth-century clay tablet suggested the king of Tyre was shipping raw glass to the Pharaoh in Egypt. Now we've found on a ship from that period, probably sailing from the Levantine coast where the king of Tyre lived, dozens of cobalt-blue glass ingots unique in the world. They are chemically identical to Egyptian and Mycenaean blue glass. So all the blue glass in the eastern Mediterranean was probably being shipped from one area where someone had a secret recipe for making it.

Omni: What's so important about trade patterns?

Bass: They're not! [laughter] Okay, they tell how ideas spread. If my ideas about Phoenician seafarers in the Aegean are correct, some theories about Near Eastern influences on classical Greek civilization may be more accurate than some scholars admit. I like to think that archaeologists' findings that increase understanding of the past could help us make better judgments. How can we really make decisions on politics, religion, or morals if we don't know how these things actually came about?

Omni: Aside from carbon 14, what's the most accurate dating of age?

Bass. A large number of coins. One 1926 quarter in your pocket doesn't mean much. But if we find sixty coins all from about the same date, never later than a certain year, we can assume the ship sank about the time the coins stopped. After coins, pottery. You can tell by sight whether a car was made in the Thirties or Fifties. Like cars or clothing, the styles of pottery changed. I can look up a piece of pottery in the library and date it to within a century, sometimes even to a few decades.

The greatest breakthrough for the study of ancient ships will be when we have a complete dendrochronology [dating of wood age] going back to the Bronze Age. Peter Kuniholm at Cornell is devoting his life to building up such a sequence of tree rings from the present day in the Aegean and eastern Mediterranean. He's taken drillings from very old cedars in Lebanon and in Byzantine churches. If we have a piece of keel or brushwood, dendrochronology will tell us exactly when that wood was cut. It will indicate the year the ship sank much more precisely than carbon 14, thermoluminescence, or pottery.

Omni: Might some of the pottery be a lot older than the wreck itself?

Bass: Ah, yes. If you were to have dinner with me, you'd have a cup that belonged to my great-grandmother or a plate of my wife's great-grandmother. We tend to keep pottery, porcelain, or china for generations. I didn't think it would happen on ships, where things get broken by the rolling and pitching. We first dated the Ulu Burun shipwreck in the first half of the fourteenth century based on a Bronze Age Greek cup and pitcher. But the Nefertiti scarab indicates that date is at least half a century too early. That pottery was simply old and still being used.

Fred Van Doorninck has proved some amphorae on later ships were in use for more than a century. It's incredible that something as fragile as pottery could have been used in cargoes, put in holds, and taken out scores of times over a century without being broken. He's even shown where the handles have broken off and their stubs have been filed down. They'd put a new slip or wash of clay on the pot, carve new graffiti, and use it again and again. Dating is always an educated guess, unless you find an inscription saying, "I, Captain So-and-so in the year of So-and-so's reign," and of course that's a dream. But we'll find it one day.

> "I planned a roving wheeled habitat in which for months you'd travel along the seabed and find unlimited numbers of wrecks. You'd carry oxygen; your batteries would be ballast."

Omni: How do you pinpoint specific wreck sites?

Bass: In the Mediterranean, sighting remains one hundred percent the eyes of sponge divers. But the sponge industry is dying, so there's not many more years of that. In the Caribbean, documents in Spanish archives describe where a wreck is. Then you can go look for it with a magnetometer. There is little or no iron on these ships in the Mediterranean, whereas I've gone out on a reef in the Caribbean and found four wrecks in one morning because of all the cannons and anchors of iron. We've used sonar in the Mediterranean with success. I believe ours was the first group to find an ancient shipwreck with side-scan sonar back in 1967.

Omni: And that's strictly finding a protuberance underwater?

Bass: Right. Once we did a three-month random survey down the Turkish coast. Half the time we used side-scan sonar and underwater television. We found one wreck. Then we went with sponge divers and found a dozen wrecks in the next few weeks. They would go to a spot and tell us precisely where to dive and there would be the wreck right there.

Omni: What are the inherent difficulties of underwater mapping?

Bass. Only the limitation of time. If we went to saturation diving, where the diver could work seven hours a day, we'd beat that problem. Now each diver gets twenty minutes at a time, twice a day. I spent a large part of the Sixties developing new methods of mapping underwater, first with various grids, then with photography and eventually stereophotogrammetry, three-D mapping with stereophotographs as is done by airplane. We developed a system that uses a submarine—that's now standard on all small research submarines throughout the world. But on this Bronze Age shipwreck, we've gone back to meter-tapes and triangulation. It's very accurate, and there's nothing to break down.

Omni: Can you tell if pollution has affected the wrecks?

Bass: So far, they seem to be insulated. I've heard horror stories about the sludge being a half meter thick off the coast of well-populated areas of Italy and France. But I don't think it's gotten under the sand and hurt anything yet. I can certainly see the difference in Mediterranean pollution. When we used to dive it was so clear you'd go three months without seeing anything. Now at times when I'm decompressing I seem to be swimming in a sea of plastic bags. Millions of bits of plastic, it's like a ticker-tape parade. This is in an isolated part of Turkey.

Omni: Do you think underwater colonies are practical?

Bass: Not at the moment, except perhaps as research stations. And remote vehicles and submersibles are doing a lot of that work. In the late Sixties I planned to design a roving wheeled habitat in which for months you could travel along the seabed and find unlimited numbers of wrecks. Your batteries would essentially be your ballast and you could send these to the surface or have them recharged with cables

You'd carry oxygen CO_2 scrubbers and so on and just live for a month doing what sponge divers do to find so many wrecks: move slowly along the seabed. Well, I stopped that kind of designing. No one took me seriously because I was an archaeologist. I couldn't get government support for the fresh ideas we were way ahead of the engineers on. The Navy finally gave us a grant to develop our stereophotograph technique, which is now standard practice for mapping the seabed from small submersibles.

Omni: In 1989 you got the Navy to declassify some detailed maps of the ocean floor that they'd withheld because of concern over Soviet submarine activity.

Bass: You didn't get that from me! And I don't know whether it helped much. What I'd like to get declassified are aerial surveys. You can spot ballast piles in shallow water. With water-penetrating film we might be able to go deeper. When I approached the United States government about satellite or aerial pictures, they told me to go to the Turkish government. When the Turkish military heard about that, they got so exercised it almost stopped our work in Turkey forever.

There's good reason for countries to be nervous about archaeologists as spies. Every archaeology professor I ever had was in the OSS in World War II. Who else knew the countryside, languages, mountain paths as well? There was a saying: the Greek mountains were white with the parachutes of British archaeologists being sent in. My uncle, an archaeologist, was in the OSS and was dressed like a French peasant.

Omni: Was the real reason the *Titanic* got explored because the government saw an opportunity to use equipment that might have military applications?

Bass: That's what I heard, and I wouldn't be surprised if it's so. We ourselves found this deep statue-bearing shipwreck in Turkey because of our contract to evaluate three new types of side-scan sonar. I said at the time to Captain Snyder, who later became oceanographer of the Navy, "Why in the world is the Navy paying a bunch of archaeologists to test sonar?" He said we could do it much more cheaply. We had our own submersible, the Navy had all the regulations and red tape. We could just go out and do it. They weren't interested in what we found, they just wanted to know which type of sonar would find it the best.

Omni: Should the *Titanic* and *Bismarck* be left as underwater monuments?

Bass: They're not archaeological; they may become archaeological. But if you go that route, you should never bulldoze any kind of building because some day everything will be archaeological. In the case of the *Titanic*, there's an argument for leaving it alone. Some structures are simply so famous, so much a part of our cultural environment, they should be left alone. The *Titanic* is a landmark and should be left alone for that reason, not for the same reasons as leaving a Bronze Age shipwreck alone.

Omni: What are your views about this whole mess of admiralty law or lack of law that seems to protect more sites on land than sea? The notion of marine salvage is in a real state of flux.

Bass: I testified before Congress to get the bill passed to protect historic shipwrecks and had no trouble whatsoever countering and beating the best lawyers of treasure hunters. I was pleased to see senators on C-Span using my word-for-word arguments. Why is it all right to tear up a historic shipwreck when you can't do it to a land monument like the Alamo or Mount Vernon? I could find an Indian burial mound, bulldoze it, and sell the pots and say it's free enterprise. People would say, "That's immoral; send him to jail." Previously in American waters you could do that; the new law stops it.

> "There's good reason for countries to be nervous about archaeologists as spies. Every professor I had was in the OSS in World War II. Who knew the languages and mountain paths better?"

The treasure hunter will take this argument: 'There are millions of shipwrecks out there; how come they're so worried if we go after these few Spanish galleons?' Unfortunately, the treasure hunter and the archaeologist will be going after the same ship because it is an important one. There are very few known ships from the early period of New World exploration, the time directly after Columbus. We know more about how Greek and Roman ships were built than those of Columbus and the explorers who immediately followed after him.

Our institute has been looking at wrecks in the Bahamas, Turks, Caicos, and elsewhere. Without exception they've all been looted. In one the hull was dynamited and broken into one week before our team got there. Between the time our crew went down and made a sketch of it and came back, a hole had been blown in the middle. Off France and Italy, most visible wrecks in sport-diving depths have been stripped clean of their amphorae. In 1976 we surveyed site after site where there had been huge piles of amphorae described, and every single one was gone.

As for what happens to wrecks in open seas in the middle of oceans, I'm not wise enough to judge. There have been Mediterranean countries that have said the material from those wrecks should return to the country of cultural origin. This is such a nutty idea. The Greeks were making bronze statues in what is now Turkey and Italy. Does that statue go to Greece, Turkey, or Italy? Imagine a jury listening to archaeologists argue for ten years on the evidence of what nationality a ship is! We don't know the nationality of the Ulu Burun ship. There's something there from Egypt, Cyprus, the Syro-Palestinian coast, and Greece. Where does it go? I'd only hope it would all stay together and go to one museum.

Omni: What do you think of Mel Fisher's handling of the *Atocha*?

Bass: The *Atocha* was not archaeologically excavated, and I'm not happy with any wreck that's excavated in that manner. We know to the centimeter where everything is found. I spend endless hours making color-coded maps of the distribution of things on our wrecks. The treasure hunter and archaeologist cannot really cooperate. The archaeologist wants to take as long as possible to do things, whereas the hunter has to move as quickly as possible to make a profit. I've just written seventy-five pages on a pair of scissors we found ten years ago. We didn't know they existed until last year. Since these were found with part of a delousing comb and a razor, it seems like a little barber's kit. That got me into the area of shipboard toiletries. These would have been overlooked by treasure hunters and sucked up the air lift.

In the end a big part of our work is just curiosity—knowing that sailors on a thousand-year-old ship had problems grooming their hair because of lice. Just a tidbit. In that sense it's like an interesting hobby. I'm not being cynical, but I don't want to exaggerate the importance of archaeology any more than any other activity humans take pleasure in. But if we only worry about growing food and making bridges, then we won't be human. ∞

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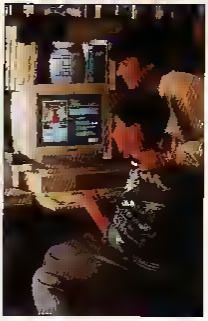

CRUISING

CONTINUED FROM PAGE 48

catch up with the moon and touch.

When the first tiny bite appears at the top of the sun there's a cheer from all concerned. The bite gets bigger . . . and bigger . . . and then, *pow!*, at 7:29:30 the bright disc of the sun is gone and the streamers of the corona leap out at us.

We have totality.

There's another cheer at that, of course. That's what this trip is all about, and it's worth everything it cost. At the top of the sun there's a spot of ruby-laser light, where one immense red prominence ten times the size of the earth has leaped out and coiled back on itself to fall back to the sun's surface. A bit later another bright prominence shows up at the bottom of the sun's disc—fortunate places for them to be, because if they'd been on the sides of the sun (that is to say, actually its north or south poles, bearing in mind our right-angle view from the earth's surface) they would have been hidden by the enlarged lunar disc and we might have seen no prominences at all.

Now we all know why we came here. Photographs don't do it. Photographs can't show the emitted light from the corona, and most of all photographs don't show the wide, dark sky surrounding the fantastic eclipsed sun. If I'd seen it without previous knowledge I'd certainly have taken it for a UFO, a Disneyland special effect, or a miracle, in fact, what it is is *wonderful*. Next to me an elderly man is weeping with joy, and most of the rest of us are close.

We have four minutes and some seconds of fine, clear, unobstructed totality, and it passes in the wink of an eye.

When we get around to remembering the rest of the world we find out that Baja did as well as we did, but almost all the thousands onshore on the island of Hawaii itself were socked in. About the only ones in the area other than ourselves who saw true totality were the handful of astronomers on top of Mauna Kea. They were above the clouds. There was a touch of ice fog at the surface, but the eclipse was clear.

And on our ship, when the show was over, Michael, the seven-year-old who had mourned his absence from his Nintendo, turned to his grandfather and said, "Now I have something to tell my grandchildren."

"What grandchildren?" his grandfather asked. "You've been telling us you were never going to get married."

"That was then," Michael said. "Now I've changed my mind."

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YXEG7

ELECTRONIC UNIVERSE

For entertaining science, fiddle with the solar system and tinker with the weather

By Gregg Keizer

Electronic entertainment is jammed with ballistic Schwarzeneggers, aliens who trade like Levantines, and robots who never heard of Asimov's laws. Sometimes even video games' frenetic pace and all go stale.

But science fact can kill silicon time just as easily as science fiction. To prove the point, switch on your PC and take a tour of the solar system with ARC Simulation Software's *Dance of the Planets* (IBM PC compatibles, to be honest, the program all but requires a fast 386 PC and really does best on a 386 equipped with a math coprocessor). It may not be a game, but it's as big a video kick as anything with a laser pistol.

Imagine your own super *Voyager*, a robotic explorer flashing through the solar system, snapping pictures from any place and any angle. Forget those stargazing programs that display tiny dots, as if the sky were a pin-pricked velvet screen. *Dance of the Planets* sets worlds spinning on your screen, animated in enough detail to let you watch Jupiter's Great Red Spot revolve, and see the seasons change on Mars. More than 60 moons, 1,300 comets, and 4,600 asteroids populate this electronic solar system, effectively offering nearly every known body and pushing even 386 PCs to their processing limit in the bargain.

Stand anywhere on Earth, on any day from 4600 B.C. to A.D. 10000, and zoom in on any planet or moon. Or see the sights from 270 astronomical units out. Magnify the view up to 32,000 times and you can watch Saturn's rings turn. Jupiter's moons flit across its surface on the screen, or even spot Pluto and Charon. For a unique perspective, look at the solar system from far above or below the ecliptic plane, a great grandstand for asteroid and comet watching.

It's easy to re-create historical comet flybys or see future close encounters with asteroids. Watch the July 11 total solar eclipse or even slip on 3-D glasses to plot Jupiter's flock of satellites. And when you've produced a majestic trip through the system, record it to disk and play it back later, like a NASA video.

This is an outstanding simulation of orbital dynamics that not only holds your attention but is as entertaining as anything that calls itself a game. For more information, contact ARC Simulation Software, Box 1974, Loveland, CO 80539, (303) 663-3223.

Tossed in space: Produced by a small company, *Dance of the Planets* will set worlds spinning, allow you to zoom in on planets and moons, and push 386 PCs to their limits.

For a down-to-earth scientific diversion, Software Toolworks' *Accu Weather Forecaster* (Mac, IBM PC and compatibles) lets you tinker with the same meteorological data that many television and radio stations use to predict tomorrow's climate. A door to a sophisticated private meteorological database, *Forecaster* may not put you on the six o'clock news, but it beats talking about how cold it gets. And you don't have to know much more about the weather than a TV meteorologist.

Select two of the more than 900 available National Weather Service reporting stations, decide how many other major stations *Forecaster* polls, and then pick the information you want. The program dials the Accu-Weather database, retrieves the data, and then builds charts, graphs, and maps—all automatically.

All this can make for information overload, but *Forecaster*'s presentation also makes it easy to understand which way the wind's blowing, or how the temperature's falling. Similar to *USA Today*'s graphs, color bar-style maps illustrate current conditions. The nearly 150 TV-quality maps range from actual satellite photos to color-enhanced radar images of storm cells sweeping across the Plains. Some of the professional-quality maps and charts are updated in real time, showing, for instance, lightning strikes as they happen.

You pay for the fun of watching the weather, though. Late-night calls to the Accu-Weather database cost 10¢ per minute, plus your long distance charges. The toll-free number costs more—19¢ per minute. Add the $9.95 monthly minimum, and you can rack up some big bills fast. Even so, getting current conditions and forecasting data takes only four or five minutes in most cases, although downloading the television-style maps takes a lot longer.

As fun as it is to play meteorologist, *Accu-Weather* can't model the weather. You can't play with temperature, humidity, barometric pressure, and tropical winds, for instance, to create a hurricane and watch it surge across the coast. Or observe the formation of a tornado. But Software Toolworks president Tom Ligon finds such possibilities intriguing.

Dance of the Clouds? What stirring scientific fun that would be! DO

GUATEMALA

CONTINUED FROM PAGE 90

mala when children die. Nahaman was taken by ambulance to San Juan de Dios, a state-run hospital. No police report was filed—he was registered as "XX" (unknown)—nor was a medical exam performed. Comatose, Nahaman was suffering convulsions and urinating blood. In addition to six fractured ribs, the boy sustained two broken fingers and open wounds to his cheeks and head. Seventy percent of his hair had to be shaved, as it was covered with glue. He also had a three-inch gash on his back. Surgery was performed in an attempt to repair Nahaman's liver and save his life. Despite recurring convulsions, no brain scan was ever done. He never regained consciousness and died ten days later.

In their brutal yet eloquent simplicity, Nahamán's last words serve as an epitaph for the 40 or more Guatemalan children who shared his fate: all killed this year in the unrelenting underground police-led campaign of extermination. In one incident, eight street children were kidnapped from a downtown neighborhood by men in a jeep. The bodies of three of the boys were soon found. All bore messages carved in the unmistakable language of torture. Their ears had been sliced off, their eyes burned out. And in a traditional warning to witnesses not to "sing," their tongues had been carved out. The other five boys were never found.

"Hopefully, they were killed first," said Bruce Harris, who brought charges against Nahamán's executioners. "But that's not the way it's usually done around here." Harris ought to know. Harassed by Guatemalan police, he and his family had to leave and now reside in Mexico.

In a larger sense, Nahamán's words also underscore the vulnerability of innocence and truth in the eternal contest with the forces of evil and injustice. The four policemen who were finally detained in connection with his death have been sentenced to prison terms of between 10 and 15 years. At this writing, however, government-led efforts are being made to release the officers. The rationale: Alleged typographical errors in court documents filed by Casa Alianza invalidate the ruling for some reason, thus prompting the authorities to conclude with characteristic sophistry that there is, therefore, no case.

Promised anonymity and baited by a $20 bribe, a Guatemala City cop told *Omni* that "the crime rate has been spiraling out of control. There are more and more gangs of street children. They've been giving us a lot of trouble. It's bad for business, bad for tourism, bad for our national image," explained the officer. "We cope as we can. We obey orders." I had heard this somewhere else. It is the same kind of crass official insolence that has time and again blocked investigations into a number of recent human rights violations, including the assassination of several prominent Guatemalan "centrist" politicians, a lawyer, scores of human rights activists, more than 50 Guatemalan and U.S. journalists, anthropologist Myrna Elizabeth Mack Chang (whose murder, it was recently confirmed, was ordered by a high-ranking member of the Guatemalan security forces), U.S. citizen Michael Devine (abducted, tortured, and murdered by a group of men that included soldiers), and children's rights advocates, including a Casa Alianza staff worker.

According to a U.S. State Department report, "Reliable evidence indicates that [Guatemalan] security forces and civil patrols committed, with al-

most total impunity, most of the major human rights abuses. These include extrajudicial killings, torture, and disappearances of, among others, human rights activists, unionists, indigenous people, and street children. Security forces are virtually never held accountable for these violations. With few exceptions, the government has failed to investigate, detain, and prosecute those perpetrators of extrajudicial and politically motivated killings who were unwilling to investigate cases aggressively if the military was thought to be involved. It is likely that military officials also shield lower-ranking personnel involved in killings. Approximately 400 policemen were discharged for a variety of abuses, including corruption.' Ex-policemen, however, are usually resettled as bodyguards or in a variety of private security assignments—and continue to carry guns.

The reign of terror that grips Guatemala has also thwarted investigations into the brutal abduction, torture, and rape by Guatemalan police of Sister Dianna Ortiz, a U.S. nun working with children. Her story was reported earlier this year by ABC's Diane Sawyer on *Prime Time Live*.

Guatemala City is a dusty, noisy metropolis that has grown and spilled over its own limits, physically and economically. Like a festering sore, far from the opulent *estancias* and chic town villas where the well-to-do live in splendid isolation, (three percent of Guatemalans own ninety-eight percent of the country's arable land) the city has spread, tentacle-like, into pestilential slums, along sunlit ridges and down the slopes of dank, garbage-strewn canyons where barefoot children, chickens, cats, and dogs share a common precarious existence. It is in one such slum, named Limon, that thirteen-year-old Angelica agreed to meet us. With a price on her head, stalked by the policeman who has repeatedly raped and threatened to kill her, Angelica now moves from hovel to hovel, hiding during the day, earning a few *quetzales* at night selling herself. We found her in a room with bare cinderblock walls, seated at the edge of a cot, her feet pitted by insect bites and skin lesions, resting on the dirt floor, under a leaking, corrugated sheetmetal roof held by waterlogged and rotting wood beams.

On the streets since she was eight, Angelica saw her mother murdered by the woman who now lives with her father. She started drinking when she was ten. A man tried to seduce her when she was eleven. She escaped and was placed in a shelter where she was homosexually molested by an older

girl. She has been sniffing glue for the past three years. Caught stealing trinkets from a variety store, she was dragged by a policeman into a cul-de-sac behind the store, where she was repeatedly raped and sodomized. The officer then shoved the barrel of his gun into her mouth and, with a smile, threatened to kill her if she talked. "Still smiling," and as if to punctuate his threat with a small sample, he kicked her in the stomach "so hard that I nearly fainted from the pain." The policeman had not bothered to remove his shield and Angelica memorized the number. She staggered into a hospital where she blurted out her story and was treated. Despite a formal complaint lodged on her behalf and forensic evidence submitted to a local magistrate, the policeman while identified three days after the incident, was never charged. "Forensic evidence' goes bad after two days and may no longer be used in a Guatemalan court of law."

In a corner of the room, under the pallid rays of a bare 40-watt bulb around which a squadron of flies keeps circling, propped on a table littered with rags and old newspapers, rests a tall, garishly painted figurine, a Madonna and child whose introspective, tortured gazes, frozen in a point in space where God is said to dwell, exude pain and disillusionment, betrayal and stupefaction. Every once in a while, almost mechanically, Angelica casts a forlorn glance at the holy icon, perhaps for reassurance. But in her large brown eyes all I see are false hopes and broken promises.

Outside, the vultures have resumed their abominable vigil, gliding overhead like black-winged angels at a witches' Sabbath, awaiting death, smelling it, tasting it almost. Surely, I reflect, even God must find Limon a very bitter fruit.

For most of Guatemala's street children, the nightmare begins at conception, an act advocated and sanctified by the Church and soon trivialized by the postpartum experience. Life thereafter has neither meaning nor value. Aloof and ethereal, Guatemala's Catholic Church has the solid backing of some mighty friends who have demonstrated greater obedience to ideology than altruism. Continuing to bow to interests stretching from the Vatican down to powerful Christian right-wingers with close ties to the murkiest segments of U.S. intelligence and paramilitary communities, Guatemala's Church has little time for street children. While the Church cannot be linked to the killings per se, it directly and indirectly bears a burden of guilt by denying women access to birth control and abortion, by censuring the teaching of safe sex, by disallowing the use of contraceptives, and by exhibiting gross indifference to the causes and consequences of overpopulation.

Contacts in Guatemala have quietly admitted that the Church has done far less than it could on behalf of the children, "partly because of a lingering antipathy by law enforcement agencies against the clergy, and partly because of its own inertia and a traditional obstructionist policy that curiously places greater emphasis on the unborn" than on the living.

While it is true that a number of activist priests and nuns have been executed in Guatemala and elsewhere in Latin America—frontline soldiers are always in the line of fire—princes of the Church rarely, if ever, face similar dangers. In the case of Guatemala, the Church's actions, or lack thereof, on behalf of its most vulnerable flock, the company it keeps, the tenacity with which it controls its dominion, the arrogance of its double standards, all speak louder than words and all too

sadly point to what can be perceived only as a depraved indifference to human life.

This inertia was dramatically illustrated during my visit to Guatemala when, not to be outdone, Guatemala's first and second ladies—both touted as staunch supporters of children's rights and both who claim pedigreed blue blood ancestry—failed to appear for a prearranged interview. No apology or explanation for their lack of interest was ever offered. "There is no justice in Guatemala," Bruce Harris commented as we parted. "Kids are abandoned by their families, persecuted by the state, rejected by society." Ironically, I noted, it is those most apt to help redress the "Sins that Cry to Heaven for Vengeance"—oppression of the poor and the orphans—whose hearts have turned to stone.

Guatemala's coat of arms consists of two crossed rifles with fixed bayonets and two crossed boarding sabers flanked by two olive branches on a field of double blue and white. A nation of contrasts, it continues to live by the rifle. Sabers keep on rattling. Both are trained on easy targets. Inexplicably, as if guided by an irresistible urge to self-destruct, Guatemala, by immolating its children, may be depriving itself of a future. Can the olive branch ever prevail? DC

POSTSCRIPT. A week after my return to New York, I received an urgent dispatch informing me that the Casa Alianza shelter in Guatemala City had been peppered with machine-gun fire. The unidentified assailants, "four heavily armed men in a blue BMW" (most likely policemen implicated in brutal crimes against street children), threatened to kill the director, the staff, and the children."

A week later, I was also informed that a seven-year-old street boy had been beaten to death by police. His head had been bashed, his eyes gouged. Positive identification could not be made. That same day, a fifteen-year-old boy was dragged by police to the outskirts of Guatemala City, where he was savagely beaten and burned over 90 percent of his body, including his genitalia.

News of the bludgeoning to death of the Financial Times *correspondent in Guatemala reached me at this writing. Sources tell me he was working on the ongoing Bank of Credit and Commerce International scandal. This brings to more than 50 the number of journalists killed in the line of duty in Guatemala since 1978. Death goes on.*

—W. E. Gutman

YOU CAN HELP

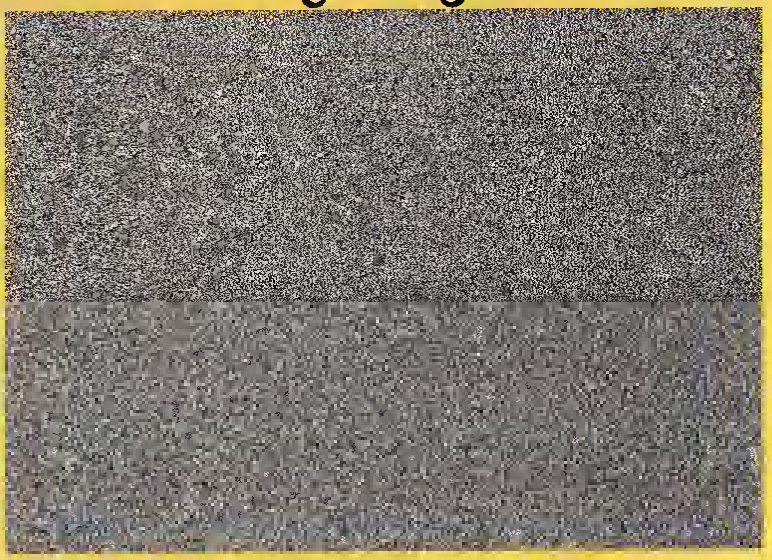
If this article has struck a chord, a letter to your elected representatives is a good start. If you desire further information or wish to help the children by making a contribution, contact the following organizations:

- AMNESTY INTERNATIONAL USA, 322 8th Ave., New York, NY 10001, (212) 807-8400. Or contact your local AI office for additional information.
- CHILDHOPE, 333 E. 38th St., New York, NY 10016, (212) 983-1422.
- CHILDREN'S RIGHTS INTERNATIONAL, 21 S. 13th St., Philadelphia, PA 19107, (215) 569-8850.
- COVENANT HOUSE, 346 W. 17th St., New York, NY 10011-5002, (800) 999-9999.
- PLAN INTERNATIONAL USA, 155 Plan Way, Box M024, Warwick, RI 02886-1099, (800) 556-7918.

GAMES

Traditional 3-D glasses won't help you find the message concealed in these random dots

By Scot Morris



The blur of random dots on this page conceals a 3-D message. Your job is to see the message and then decipher it. We'll print the solution in a later issue.

In the past, you could see three-dimensional illusions only when wearing special glasses with red and green lenses or with polarized lenses to separate "left eye" and "right eye" images. Or you could put a card between your nose and the page to separate the two printed images. Computers, however, now allow creators to make single 3-D images on paper.

Created by computer graphics whiz Dan Dyckman, our so-called single-image random dot stereogram is 980 pixels (picture elements) wide. "First I draw a strip of random dots, one hundred eighty pixels wide, down the left side of the screen, with each pixel having a fifty-fifty chance of being black or white," Dyckman says. "Then I copy the column of dots one hundred eighty pixels to the right. Each dot is printed exactly where it was before, except that within a certain contour—say, a circle—each dot will be shifted one place to the left. When the image is fused in your vision, the brain will interpret this area as a circle floating above the background."

Holding the page about one foot in front of you, look at the two circles above the image. Blur your vision and relax your eyes, as if you were looking at something several feet away. It may help to blink one eye while your vision is blurred to split the image.

Each eye should see two circles, for a total of four. Now bring your visual attention to the middle two. Make them come together and fuse into a single circle. You will see only three circles and you may perceive depth in the central circle, as if it were rising out of the page like an overturned polystyrene cup. It may also feel as if you're looking through the page.

Some people may find it easier to achieve the effect by crossing their eyes. In that case, the depth images will be reversed.

Having fused the middle circles, maintain your gaze for a few seconds and give your brain time to make sense of the visual field. Then gently let your gaze drift down the rectangle. You should now see some images in the dots.

Don't be discouraged if you can't see depth on the first try. Some people need only a few seconds before they see it, but most require as long as 20 minutes. Only a few cannot see it even after a half hour or so.

If your eyes converge the images on the page itself, you won't see any depth. You must let your eyes diverge "past" the page in order to see the image in the illusion. It's like looking out a window at the buildings beyond it but still being aware of what's on the window itself.

When you can fuse the two circles, you know your eyes are properly diverged. Keep your gaze there and the illusion will appear.

You need the proper divergence, accomplished by fusing the two middle circles. And you must hold your gaze long enough for your brain to decode the depth information.

Dyckman has also produced a Macintosh program for making your own images. For more information, send a self-addressed, stamped envelope (SASE) to Dyckman at 300 First Avenue, Suite 4-B, New York, NY 10009-1844.

N. E. Thing Enterprises also sells poster-sized random dot illusions. For information and samples send an SASE to One Kendall Square, Building 200, Cambridge, MA 02139.

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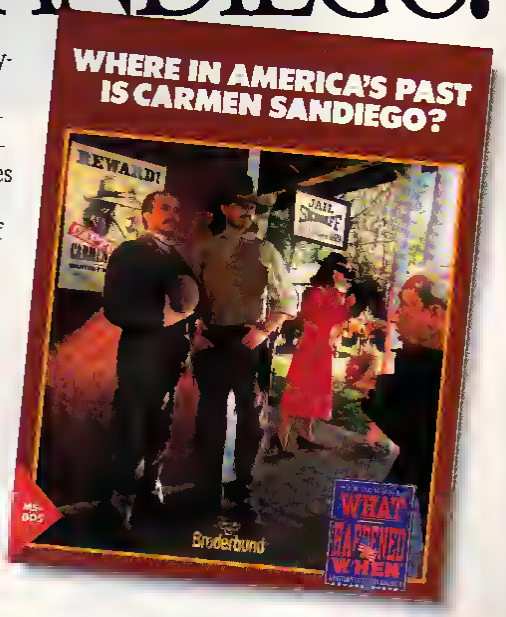

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LAST WORD

ECOLOGICIDE
Emerging environmental woes threaten Planet Earth

By Robert Bixby

Writer, editor, and ecoterrorist Robert Bixby studies ecology (or the lack thereof) from the smoggy foothills of the Smoky Mountain range.

There seems to be no end to the ecological disasters either pending or already in full swing on Space Raft Earth. We've heard the scientists' dull whine about the greenhouse effect for many years now.

And what was once the thinning of the ozone is now considered a receding ozone layer leading many scientists to recommend simply combing the ozone over from the side to cover the bare spot. "I've been doing it myself for years, and no one seems to notice that I'm almost completely bald," remarked one formerly hirsute atmospheric physicist.

Actually none of these so-called disasters will have much impact on most of us. The greenhouse effect promises to melt the poles, but unless you live in some low-lying coastal area, like Key West or Washington, DC, this just means that the beach will be a few miles closer.

The thinning of the ozone boils down to being able to maintain that deep, rich tan just by walking to the car in the morning. most of us don't spend more than a few minutes in the sun on any given day, anyway. You can put these matters out of your mind. Life will still carry on much the same.

But while all the attention has centered on mainstream ecological issues, a legion of festering problems have begun to emerge. No one talks about them, though they promise to be even more devastating than the ones that grab the headlines.

For example: automotive exhaustion. Does your car look tired? Mine does.

DEPLETION OF THE TIME ZONE

Notice how rushed you are lately? How there never seem to be enough hours in the day? Most of us attribute this to busy schedules, raising kids, and working 16 hours a day.

But in fact, the very essence of life itself is shrinking. Think back to when you were young. An hour spent in idleness could last forever. An eternity might pass as you lay on the couch, watching dust motes drift in a shaft of sunlight as you awaited *Howdy Doody* while Mom warmed up some milk in a saucepan to mix with Bosco.

Contrast the leisurely passage of time in your youth—perhaps a mere 10 or 20 years ago—with the passage of time today. By the time you remember you were going to start taping *I, Claudius* on Sunday nights, six episodes have passed. You buy a tape, fully intending to at least catch the last few, but already the series is over and you're stuck with *Upstairs, Downstairs*.

The reason for this phenomenon is time compression. As a result, time is passing faster with each moment. For example, in the time it takes you to read this sentence, you have aged six months. The universe began with a big bang and it will end with a big crunch. Soon there will be no time left. Everything will happen at once. In fact, it may be too late already.

ECONOMIC RELAPSE

It cannot have escaped your notice that everybody's broke. There isn't enough money to keep us healthy, fed, clothed, and educated.

Government agencies are hard at work figuring out ways to allow you to select the necessities you want to continue in order that the rest may be discontinued. Would you prefer police or fire protection? Food, clothing or shelter? Some have advocated turning major American cities into theme parks, complete with sewer tours to see the alligators and subway tours to see the troglodytes—anything to make or save a little money.

As an alternative to the long, successful All American Cities competition, a new contest to be named the Loathsome Bolshevik Municipality has been designed to help instill pride in the neglected residents of Newark, Boston and Detroit. The only thing standing in their way is a lack of funds. Which leads us to

THE GREENBACK EFFECT

By now you're probably in a state of aggravated anxiety, quaking in your chair, asking yourself questions like "How could it have happened?" and "What can I do to prevent it?" and "Where in the world are my nitroglycerin tablets?"

The answer to these problems is the same as the answer to any other problem: money. We need to raise lots of money. With that money, we will buy television and radio time to spread the word so even more people will be aware of the problems. And they will then send money.

So do your part. Recycle some cash today. ∞