

SPECIAL SECTION: ELECTRONIC GAMES!

OMNI

JANUARY 1991

**VIRTUAL REALITY:
LIFE IN A COMPUTER**
**BUSINESS 2001:
MANAGING THE 21ST CENTURY**
**DALAI LAMA:
NEW YEAR'S RESOLUTIONS**
CAN ANIMALS THINK?
STARSHIPS MADE OF ICE
**REGENERATE
YOUR OWN ORGANS**



\$3.50



OMNI

VOL. 13 NO. 4

JANUARY 1991

EDITOR IN CHIEF & DESIGN DIRECTOR: BOB GUCCIONE

PRESIDENT: KATHY KEETON
EDITOR: KEITH FERRELL
GRAPHICS DIRECTOR: FRANK DEVINO
MANAGING EDITOR: PHIL SCOTT
ART DIRECTOR: DWAYNE FLINCHUM

8

First Word

By Marvin Cetron
New technologies and novel ways of thinking will alter life for baby boomers. So what does that mean for 81 million Americans who began retiring in the twenty-first century?

10

Omnibus

The Who's Who of contributing authors

12

Communications

Readers' letters

14

Forum

By Keith Farnell
Knowledge is the first tool of the future, and so we enter the last decade of this century: our mission is clear

16

Explorations

By Gregg Keizer
Cybertron was a 24-hour virtual reality marathon, but was it all worthwhile? A science-fiction author reports on the state of the technology



While futurists predict the way in which we'll live in the twenty-first century, artist Stanislaw Fomardis strives to unite modern-day techniques of painting and cutting-edge avant-garde perception. His work *New Series 1980* melds evocative symbolic imagery with geometric shapes, cool, muted colors, and thought-provoking subject matter.

18

Animals

By Michael W. Fox and Pamela Weintraub
Unlike humans, animals always express their feelings. The better that we understand them, the more we'll enjoy their company

20

Space

By Steve Dileo
Galactic globes: Clusters of hydrogen ice could be the ideal fuel—and alternative construction material—for spacecraft of the twenty-first century

22

Stars

By Gregory T. Pope
Chunks of virgin rock as old as the sun bear remembrances of stars whose glory faded long before the birth of our solar system

24

The Great Omni Treasure Hunt Announcement

Find out how you could easily reap rich rewards

OMNI (ISSN 0149-6717) is published monthly in the United States and Canada by Omni Publications International Ltd., 18th Street, New York, NY 10020-9965. Second class postage paid at New York, NY, and at additional mailing offices. POSTMASTER: Send address changes to OMNI Magazine, Post Office Box 2041, Hellen, VA 57037-2041. Volume 13 Number 4. Copyright © 1991 by Omni Publications International Ltd. All rights reserved. Tel: (212) 498-6020. OMNI is a registered trademark of Omni Publications International Ltd. Printed in the USA by MeredithGarden Corp. and distributed in the USA, Canada, United States territories, possessions, and the world (except the UK) by Curtis Circulation Company, 422 Hickwood Avenue, Hightstown, NJ 08520. Distributed in the UK by GEMAC, Business Press, West Chalfont, London, G61 7DE. Copyright notice: Contents may be reproduced in whole or in part without written permission from the publisher. Any similarity between photos or persons mentioned in the fiction or nonfiction and real persons or persons living or dead is coincidental. Subscriptions: U.S. \$10.00/£4.00 per year. Canada and elsewhere—\$12.00 per year. Single copies: \$3.00 in U.S., APO, and Canada. Telephone: 1-800-225-8844. The publisher/author(s) will be responsible to return unsold/used copies. All rights in part or in their entirety remain the sole property of Omni Publications International Ltd. Letters sent to Omni or its editors become the property of the magazine.

OMNI

25

Continuum

Consumers and their mind-boggling machines, dōjō vs. the slow brain, earthquakes and the battle of Jericho, tobacco food supplements, and fickle French fungi

34

Challenge and Response

By Pamela Weintraub
What corporations will have the upper hand in the twenty-first century? John Deabold of The Deabold Group, IBM's Michael J. Quinlan, and other business leaders address future executives on new technologies, changing demographics, and human needs

40

Internal Medicine

By Sherry Baker
The organoids are coming! Neo-organ technology will replace organ transplants. And medicine will take a giant leap when our bodies are capable of total regeneration

44

Interview

By Doug Stewart
The whiz kid behind virtual reality
Jaron Lanier is the unquestioned guru of the new cult



66

Dala Lama: His Resolutions

By Keith Huxary
The Tibetan holy man's perspectives on science and technology and more at home in the twenty-first century than you'd expect from this simple monk

73

Animatter

DNA art in space, mystery bomber in the Everglades, Bigfoot and anthropology in China, moon babies in Lake Michigan

120

Arts

By Karen Wright
You can't just stand there and look at Myron Krueger's creations. His artificial realities turn art into an interactive game

122

Phenomenon

By Jane Bosveld
Silicon pelekis: A computer artist weaves complex mathematical formulas into works of fine art

124

Last Word

By Robert Euby
Rock 'n' roll musicians and computer games: The possibilities are baffling



50

Pictorial: Live Illusions

By Robert Kiheller
Mick Flay Tracy
Hollywood's newest star. But he exists only in the computer. The technology that makes the graphic performer possible will affect everything from videos and movies to political campaign messages



55

Fiction:

The Sons of Noah

By Jack Cody
The faithful live peacefully in a hidden Oregon valley until the simple harmony of their religious community is suddenly disrupted by a greedy developer's ambitious scheme

81

Special Section: The Worlds of Electronic Games

Computer and video games aren't just for kids. Game playing has evolved from boards to computers, from rolling dice to role playing. Now you can travel to real or fantastic universes, make learning fun, and enhance your game-playing systems with all the latest accessories.

FIRST WORD

RETIRING BABY BOOMERS Technological marvels will enhance life for tomorrow's aged

Marvin Cetron is president of Forecasting International and author of *American Renaissance: Our Life at the Turn of the 21st Century*.



In a very real sense, the history of the United States in the second half of the twentieth century is the history of a single generation, the baby boomers. There are no fewer than 81 million Americans between the ages of twenty-six and forty-four, about one third of the population in all socioeconomic groups. By their sheer numbers they have dominated American life since the early Sixties. When they came of age in the late Sixties and early Seventies, they changed the concerns, structure, and style of national life.

- Computers will continue to become exponentially more powerful, and their capabilities will soon include more useful forms of artificial intelligence. All the technological knowledge we work with today will represent only 1 percent of the knowledge that will be available in 2050. This is important because out of the 44 percent of the workforce who will be working with information technology at the turn of the century, half will be working out of their homes and "telecommuting" to work, thanks to advanced technology. This will save on traffic congestion, pollution, day care, and absenteeism costs.

- There will be a general shift in

societal attitudes and values from the "me ethic" to the "we ethic" to the "family ethic." Whereas the fact that conspicuous consumption is "out" and downsizing and recycling are "in," and the fact that the baby boomers now have children of their own.

- Imagine simply packing up your house and moving to a new locale. Modular plastic housing will make this possible and allow people to move more frequently and easily. English Tudor, French country, California ranch—any style of home will be manufactured by robots out of plastic, strengthened where necessary with boron or carbon, in factories just as cars are today.

And as with automobile accessories, the houses will have amenities like doors, windows, and kitchen appliances built into the wall structures. They will come with a computerized kitchen, a combined living and dining area (made practical by the shrinkage of the family), and the walls will be made up of two pieces of plastic with Styrofoam in between for insulation. What does this have to do with retiring baby boomers? To build a modular plastic house will cost only about 25 percent of what it takes to build a "stock house" today.

This means that more money will be available for disposable income and that baby boomers' children will not be priced out of the future housing market.

- Decriminalization of drugs by the year 2000, or soon after, will create a new industry with a domestic market estimated at \$40 billion per year. Approximately \$8 billion will go to cover manufacturing expenses and the costs of government regulation. We now spend \$12.8 billion each year to enforce anti-drug laws. Once we treat drug abuse as a medical rather than a legal problem, we will be able to use that money for education and treatment programs—

and as much of the \$40 billion per year in legitimate, taxable profits as society finds necessary.

- Money for retirement will come primarily from three sources: the government, business, and individuals. The military will extend to 30 years the time in service required for retirement, and all military and government workers will retire under the Social Security program, thus putting more money into the system. Companies will offer more "smorgasbord" retirement plans to their employees, working wives will select one benefit from their retirement plans to cover both spouses, while their husbands will select different benefits from their retirement plan options to cover them both. And people will be able to save more for their retirement through rentable IRAs that will be passed by Congress by the year 2000.

RETIREMENT

The baby boomers will retire to a life of comfort and prosperity far beyond that of today's seniors. Their average pre-retirement income will rise significantly, thanks to the continued "middle-classing" of America and to the benefits of immobility. That real income will stretch further than it would today, because of automation and economies of scale, which will soon reduce the cost of goods as measured by the working time required to earn them. Thus, on average, the baby boomers will leave their working years with a much larger retirement fund and far more real assets than are available even to today's affluent seniors. Their health will be better, most likely far better than we can now predict by straight-line extrapolation from today's medical practices, and the use of smorgasbord benefits will guarantee that boomers in two-income families will enjoy an unprecedentedly comfortable and secure old age. **DD**

Paramount Pictures
Presents

THE STARSHIP ENTERPRISE



**TO BOLDLY GO
WHERE NO MAN
HAS GONE BEFORE.™**

Aglow with 24 karat gold electrolite and space age with crystals, the Starship Enterprise is a true wonder that is a masterpiece of approximately 40" in length.

The first pewter re-creation ever authorized by Paramount Pictures of the most famous starship of all time.

The Starship Enterprise.™ Symbol of the eternal quest to explore new worlds.

Now, the starship that carried Kirk, Spock and Uhura to the far reaches of the galaxy can be yours. Announcing the first fully authorized pewter re-creation of the starship that has inspired millions.



Precisely reproduced with assistance from STARBUCK, creator Gene Roddenberry.

Sculptured and handcrafted in fine hand finished pewter. The main sensor and navigational deflector glow with 24 karat gold electrolite. The top propulsion units blaze with fiery red crystal electrolite.

Available only on planet Earth, and only from The Franklin Mint.
Priced at \$155

AUTHORIZED BY PARAMOUNT PICTURES

AUTHENTICATED BY GENE RODDENBERRY

The Franklin Mint
Riverside Center, Pennsylvania 18902

Yes, I want to take advantage of the unprecedented opportunity from Paramount Pictures to acquire the only authorized and fully authorized pewter replica of the Starship Enterprise.™ This reproduction is hand-cast in the original pewter, hand finished and hand polished to a brilliant finish, and accented with crystals and 24 karat gold.

I need no more money now. I will be billed for my purchase of \$155 (plus shipping and handling charges) and automatic installments of \$38.75 each (after shipment).

This is available while supplies last. For more information see

back of the Starship Enterprise or communicate by a toll-free 1-800-451-4444 with Gene Roddenberry's office.

ORDER FORM



©1991 Paramount Pictures
All Rights Reserved. STARBUCK,
Gene Roddenberry and THE STARSHIP
ENTERPRISE are trademarks of
Paramount Pictures.

Shipment of by January 31, 1991.

SIGNATURE _____

MR/MRS/MISS _____

ADDRESS _____

CITY/STATE/ZIP _____

12 1991-01

FRANKLIN MINT RETURN POLICY

If you wish to return any Franklin Mint purchase, you may do so within 30 days of your receipt of that purchase for non-faulted credit or refund.

OMNIBUS

TAKING CARE OF BUSINESS:
From the boardroom to the board game
it's how you play that counts

When we wanted to find out the future of business we turned to the SEI Center for Advanced Studies, the Wharton business school's think tank. Former *Omnis* editor Patricia Adcroft organized a roundtable discussion with leading futurists to determine the needs and direction of business in the twenty-first century. Their comments and opinions resulted in "Challenge and Response" (page 34), a series of articles assembled by *Omnis* editor at large Pamela Weintraub. "The experts not only predict the future of man-

agement," Weintraub says, "they also prescribe solutions readers can use today."

Weintraub's coeditor on *Myriad Experiences in 30 Days: The Higher Consciousness Program* (St. Martin's Press), psychologist Keith Harary ("Date Lama: His Resolutions," page 66) has studied altered states of consciousness for the last 20 years. Meeting with the Date Lama, he became enthralled by the Tibetan holy man and his philosophy. During their conversation Harary asked, "How do we balance scientific progress with the need to deal with overpopulation, pollution and racism? Which should we combat first?" To which the Date Lama simply replied, "That's a good question." After contemplating for a moment,

he answered, "There are enough people in the world to work on all those things."

The scientific director of the Humana Society, Michael Fox (*Animals*, page 38) cosponsored *You Can Save the Animals: 50 Things To Do Right Now* (St. Martin's Press), another collaborative effort with Weintraub. If people heed the advice we offer in the book, Weintraub says, "they will be protecting not only animals but also the earth."

Omnis writers also offer three different perspectives on virtual reality. Jason Lanier was difficult to pin down for the January interview (page 44), so Doug Stewart resorted to camping in front of the virtual reality guru's home to ensure that Lanier couldn't slip past.

Attending Cyberthon, a 24-hour virtual reality marathon, science-fiction author Gregg Kaezer (*Explorations*, page 16) also found it wasn't easy to get to Lanier. Lotteries were held for seats

on the bus transporting reporters from San Francisco to Lanier's headquarters. Kaezer, however, wasn't lucky enough to win passage. Asked what type of graph to world he'd prefer, Kaezer responds, "A virtual thunderstorm—where I could experience the dynamics of weather without being in physical danger." Try to dress accordingly. Gregg.

Traveling to the University of Connecticut, Karen Wright (*Arts*, page 120) expected to find fun and games during her visit with computer artist Myron Krueger. "I had no idea that working with the computer could be an aerobic exercise. Playing with Krueger's interactive-artificial realities was physically exhausting," says Wright, who has written for *Scientific American* and *Science*.

More fun and games appear in the pages of our special section "The Brave New World of Electronic Games" (page 81), edited by *Omnis* editor Keith Farnell, who embraces the combined forces of entertainment and education. Introducing himself to readers in *Forum* (page 14), Ferrell is a former senior editor at *Omnis*'s sister publication *Compute* and has written articles on software for the *World Book Encyclopedia*.

A frequent contributor to *Omnis*, Atlanta-based Sherry Baker ("Internal Medicine," page 40) often reports on ground-breaking research in the medical field. Baker is a former art critic who has specialized in science journalism for ten years.

Making his debut in *Omnis*, author Jack Cady ("The Sons of Noah," page 55) is a professor of writing at Pacific Lutheran University in Tacoma.

Kudos to *Omnifiction* editor Ellen Ostrow, who recently shared a World Fantasy award with co-editor Tom Swilling for their anthology *The Year's Best Fantasy Second Annual Collection*, published by St. Martin's Press. **DD**

Clockwise from bottom: Pamela Weintraub, Keith Harary, Sherry Baker, Doug Stewart, and Jack Cady.



FORUM

MILLENNIUM MINUS TEN AND COUNTING...

Knowledge is the future's first tool, and Omni readers approach their futures well equipped

Ten years from this month a new millennium begins. January 2001 (not January 2000, although that particular New Year's will doubtless see its share of millennial parties, not to mention its measure of millennial hangovers) looms already in our imaginations.

And not just the imagination. As we move deeper into the Nineties, we're beginning to see a dawning awareness of the calendar shift that lies ahead. Cult charismatics preach of a coming apocalypse. Space programs in disaster seek rejuvenation through long-term missions to other worlds. Scientists strive to map the human genome. Nations plan for growth or adjust to diminished expectations.

At Omni our expectations are not diminished. As we begin the

decade-long journey whose conclusion will see us enter a new millennium, and as I begin my tenure as Omni's editor, it seems appropriate to consider the role this magazine, its editors, artists, and readers play in preparing for the future.

Omni is a science magazine, and science informs and affects every moment of our lives. We look to the laboratories and research centers of the world for potential answers to questions both large and minute.

Omni is a technology magazine, mapping the ways in which advances in science are transformed into countless products and services that affect the quality of our lives.

Omni is an arts magazine. We seek to bring you visions in prose and pictorials.

Omni is a personality and lifestyle magazine, taking you behind the headlines to meet the people involved in creating the new world ahead of us.

Above all, Omni is a futurist magazine. Few periods in human history have witnessed the degree of change the past decade brought. Yet few would doubt that the coming decade, the next millennium, will see even vaster change and see the rate of change accelerate. We hope to be your doorway into the future.

Those are some of the qualities that have made Omni what it is. We endeavor to provide tools for the twenty-first century. You are the tool users, reshaping and recreating our entire world in a more human image.

It's a tall order, but one we try to keep in perspective. No magazine, not even one named Omni, can

be all things to all people. Nor would we try. Rather, each month, we assemble a mix of fact, fiction, and imagery selected to make you aware of the shapes the future assumes, the latest breakthroughs, insights, and unexpected points of view.

For more than 12 years, since Omni was created by Bob Guccione and Kathy Keeton, we've been on a mission to the future. Now, more than ever, our mission is clear. We train our eyes on the stars, but we cannot and will not neglect the challenges and opportunities that face us here.

Our species pursues answers to large questions. The questions are scientific, teachers, businesspeople, even magazine readers and editors. The fact that enormous questions are being asked, and answers seriously sought, gives us reason enough for hope.

And for more than just hope. We learn more in each decade than in all those preceding it. The pace of learning continues to accelerate, and Omni exists to help you better understand and manage the deluge of information.

Knowledge is the first tool of the future, and Omni readers approach their futures well equipped. We remain a hopeful magazine, ever aware that the price of hope is an ongoing effort.

Omni, then, is about hard work, about engagement with the real world, about the real efforts involved in making that real world a better world.

About all: Omni is your magazine. A magazine should be a dialogue, a room full of exuberant conversation on many topics. Surely you have your own opinions and insights to add to the mix. Let us hear from you.

For now, the clock is ticking toward the new millennium. Let's get on with getting on toward the future. Welcome to Omni.

—Keith Ferrel **DC**

As the clock ticks toward a new millennium, and the pace of change accelerates, Omni hopes to be your doorway into the next century.



EXPLORATIONS

REALITY CHECK:

Cyberthon 1990 gave participants a blitzkrieg peek at the future during 24 hours

The dream comes directly from science fiction. Step into a computer-generated world where anything goes and reality is warped. When the dream fades, though, what's left is a lot more down-to-earth. Black gloves detect movement, dark goggles display an electronic scene and powerful computers make it all work. Wave your hand and your virtual self moves forward in the counter-fet reality. Move your head and your electronic perspective shifts. From telepresence (the ability to direct machinery from afar) to cyberspace (shared environments that enhance electronic communications), virtual reality jumps across traditional lines of technology as easily as its computer-created objects jump from man-made universes.

The promise of virtual reality (VR) is enormous, potentially affecting everything from business and government to education and entertainment. Much as in the early days of the personal computer revolution, developers and researchers are full of optimism.

layered with naive expectations of how fast everything will ultimately come together and who will control the new technology.

All this was in evidence in early October at Cyberthon, a San Francisco-based conference-cum-VR-carnival sponsored by the POINT Foundation, the publisher of *The Whole Earth Catalog*.

Quartered in a warehouselike studio with a junkyard as a neighbor, Cyberthon gave participants a blitzkrieg peek at the future during a last 24 hours.

I was there among the crowds stumbling through the maze and found the future, well, off in the future. Virtual reality may have enough evangelists to stock Sunday morning television, but the technology is actually no more than an infant.

Sense 8, Autodesk, VPI, Research, and other firms showed off their virtual reality rigs during Cyberthon. At Autodesk's Cyberspace corner I tugged on a glove and donned a pair of light-fitting goggles, both wired and cabled to a computer. The view inside the goggles was grainy, like peering too close at a television. The computer graphics that made up Autodesk's virtual world were like children's blocks: all bright colors and sharp angles. When I tilted my head back, the computer read the movement and matched the motion in the electronic room, letting me see

the bland sky. A fish coasted by swimming in the air. Strange, but it fit the Alice in Wonderland quality of it all. When I held out my hand and pointed a finger, the sights in my goggles slowly shifted. As I groped for the fish swimming in front of me, my cartoon-like virtual hand looked like Mickey Mouse's, with broad fingers and flat edges. Finally I caught the fish and, raising my real arm, threw it. The virtual fish tumbled out of sight.

Three hours later the Autodesk rig was down for the count. The computer had been humbled by heat prostration, and VR vanished as quickly as it was created.

That's the state of VR: its childlike nature makes for interesting moments, some awkward problem solving ("Walk through that door and you'll get to another room—I think," said one Autodesk aide.) Expectations simply overwhelm reality.

Jaron Lanier, creator of the DataGlove (see interview, page 44), knows this better than anyone. "I worry that everyone will get bored waiting for virtual reality," he said at Cyberthon. With so much attention focused on VR, many proponents are counseling less ambitious dreams. "We have to lower our expectations," says Stewart Brand, author of *The Media Lab*. "It will take ten years to live up to the expectations of today."

Or 20. Or maybe only five. That's the beauty of technology. Loops of faith—and engineering—could bring VR to true reality sooner than expected. If not, well, with the Cyberthon taste fresh in my virtual mouth, the wait will be worth it.

—Gregg Kessler **DO**

Cyberspace cadets: Products such as Autodesk's Virtual Bicycle Ride will permit users to enter computer-generated worlds. But do expectations exceed the reality of current technology?



ANIMALS

PET PROJECT

Do animals feel, reason, imagine? Find out through animal sensitivity training

To be a truly effective advocate for the animals of the earth, you must be attuned to their lives. To start observe the animals you come in contact with every day. As you watch a variety of animals closely, ask yourself whether the creatures you are studying are governed by mindless instinct, or whether they seem to experience such emotions as affection and joy, anxiety and fear. Are they void of any real feeling, or do they actually seem to enjoy freedom, companionship, and other pleasures that we sometimes consider exclusively human?

As you begin to observe animals, you will see that they are more like humans than you have ever thought. Even though animals can't talk, as we do, they clearly express their emotional state, intentions, and expectations through expressive body language and sounds sometimes strikingly similar to our own. Note that both humans and dogs, for instance, may growl, whimper, scream, or pant with excitement. In fact, you will find that animals virtually always express their true feelings, while humans often ob-

scure their feelings with words.

Sit back and spend at least a half hour observing an animal you know relatively well. Note, for instance, how your dog seems to grin when greeting a loved one. See how your cat, much like you, scratches an itch and loves to eat tasty things. In fact, note how your pet communicates when it wants to be fed, played with, or taken for a walk. A dog who carries its leash as a signal that it wishes to leave is showing insight and reasoning—not just a mechanical, conditioned reflex.

Finally take some time to observe a dog or cat as it sleeps. These animals often twitch, shiver, and move their limbs—clearly suggestive of the notion that they are having dreams and therefore have imaginations.

Then spend time observing animals you don't come in contact with that often. Drive to a rural area and observe squirrels or deer, visit a local farm, or go to a local aquarium or zoo. Be alert for the profound relationship between mothers and offspring. See the animals' drive for companionship. Sense the tranquility of animals in a natural setting. Watch how an-

imals love to play and explore, investigating the world around them. Tune in to the deep anxiety, even depression, exhibited by many animals in captivity, especially those kept in inadequate houses or cages.

Finally observe some seemingly simple creatures like insects and worms. As you watch these animals, notice how they express their will to live and avoid harm and injury. It's no wonder that creatures exhibit so much angst! Scientists have recently found that when experiencing anxiety and fear all bony fish, reptiles, amphibians, birds, and mammals produce the same types of neurochemicals we do when terrified.

As you continue to observe and read more about a wide variety of animals, you will discover that some have powers far more developed than our own. Some animals can see ultraviolet or infrared light, hear ultrasound, and even navigate by sensing magnetic fields or keeping track of the sun and stars.

After you have spent sufficient time observing a variety of species, think about what you have learned. If you believe that people have souls, for instance, do you now feel that animals have souls as well? Do you feel that humans are superior to animals—an attitude those in the animal rights movement call "speciesism"—or just different?

Remember the better you understand animal behavior the more you will enjoy the company of animals, recognize when one is in need of veterinary care, intervene when you hear of cruel or indifferent treatment, and engender in your children a respect and reverence for all life. **DD**

From the forthcoming book *You Can Save the Animals: 50 Things to Do Right Now*, by Dr. Michael W. Fox and Pamela Weinraub. To be published by St. Martin's Press.

Does your pet show real emotion or simply instinct? Keeping your eyes trained on pets and other creatures promotes a deep respect for all living things.



SAIL ON ICE:

It's a spacecraft! It's a spacecraft fuel!
Hydrogen ice can even be both

Imagine tomorrow's ideal spacecraft. It will be lightweight, inexpensive, and fuel efficient. And it just might be made from clusters of huge balls of hydrogen ice serving as both the spacecraft's structure and its fuel.

Innovative space exploration missions will require unusual materials, says Jonathan V. Post, an aerospace engineer with the Space Systems Division at Rockwell International. By far the most common element in existence, hydrogen constitutes at least 75 percent of the universe's mass. In addition, hydrogen is a very lightweight structural material as a solid, although its butterlike consistency may require the addition of fiber to stiffen it. Structural hydrogen could be detached, liquefied or turned into slush, and channelled into a fusion engine as fuel. Any nonessential parts of the vessel could be consumed during the mission. Post cites such a scenario "conceptually similar to the scene in the *Mart Brothers* film *Go West* where Groucho, Harpo, and Chico feed the furnace of a steam locomotive with boxcar slats and then demolish and burn the caboose."

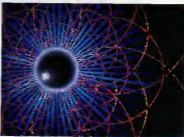
The major drawback of hydrogen iceships, which Post says are "feasible within the next thirty years" is the low temperature at which solid hydrogen melts—434°F (-259°C). To keep the hydrogen iceballs intact until they're needed for fuel, Post advocates using an onionlike structure. Thin sheets of insulating metallic material might separate spherical layers of hydrogen ice. The entire ball would be coated thickly with the same material to shield against heat and radiation. Hydrogen gas could exit through pores in the metallic material, like steam escaping from a baking apple pie.

A theoretical analysis conducted by James Selval at the University of Hawaii concluded that

such a hydrogen ice sphere measuring 12 feet in diameter (a 3.6-meter radius) would last 24 years in the relatively balmy environs of Earth orbit. For deep space missions, farther from the sun's heat, the sphere could last much longer because it would lose less hydrogen.

The idea of hydrogen iceships originated with James Stephens of NASA's Jet Propulsion Laboratory, whose 20 years of studying comets, which are made of various types of ice, inspired him to ponder alternative uses for ice. "Among the first was a simple con-

cepting that hydrogen-powered iceships assembled in orbit from iceballs launched inexpensively by small booster rockets be used for manned interstellar spaceflight. He says the cost benefits of this relatively inexpensive material (less than \$10 per pound, not including the orbiting cost) also recommend it for use in manned missions to Mars. While merely using hydrogen slush along with oxygen in conventional nonfusion engines is considered too exotic for the Mars expeditions currently being planned, Post says that applica-



cept for banking hydrogen fuel in Earth orbit without a tank," Stephens says. The ancillary benefits of frozen hydrogen include using it to cool "old-fashioned" (low-temperature) superconducting electronic systems, such as low-noise, low-power devices could make possible ultra-sensitive radio telescopes and other long-range sensors.

Stephens presented his idea to NASA in the mid-1980s, but the organization has shown no interest. Neither has the Department of Defense. Jonathan Post followed up Stephens' idea by pro-

posals for hydrogen ice have been studied at Lockheed-Guerman and Union Carbide.

Stephens admits that hydrogen iceships may be an idea whose time has not yet come, partly because the fusion reaction on which they would run has yet to be produced in a laboratory. Ion-drive engines, which could consume acidified water or lithium, are closer to being built. Still, he says, "sooner or later we will see solid hydrogen used in outer space," if for no better reason than that the Japanese are investigating it. —Steve Delos

A hydrogen ice-ship would consist of clusters of iceballs, each constructed like an onion, with layer upon layer of ice separated by thin sheets of an insulating material.

STARS

STARDUST MEMORIES.

When meteorites are compelled to talk, dead stars come to life

The telescope is astronomy's traditional tool. But in the field of meteorite investigation, the new tool of choice among astrophysicists is the ion microprobe.

Meteorites, pieces of rock left over from the birth of our solar system, say a lot about the cosmic conditions that existed 4.6 billion years ago. Nearly all modern theories about the formation of the sun and planets rely almost exclusively on the chemical analysis of meteorites. Sadly, getting a meteorite to "talk" has meant bathing it in acid until it dissolves. "You're

ing gassy cloud—the solar nebula—occupied the position now tenanted by the sun and the planets. Temperatures in this nebula reached upwards of 2,000°F hot enough, it was thought, to blend the original raw materials into a homogeneous composition. That theory prevailed until about three years ago, when microscopic diamonds were found in Meteorite Murchison. Later it yielded graphite and silicon carbide. Under scrutiny, Murchison's odd components revealed alien isotopic ratios—the number of neutrons within an atom's nucleus—that sug-

like this. A hair-thin sliver of meteorite is bombarded by an electron beam that excites the meteorite elements to give off telltale X rays. This produces X-ray "maps" highlighting unusual areas. Then, with an ion microprobe focused on the hot spots, isotopic ratios that are alien to our solar system can be located and examined. Already the technique has cracked a meteorite dubbed Cold Bokkewold into revealing its freight of alien silicon carbide. Other meteorites should divulge similar oddities.

Like many new developments, the technique raises more questions than it answers. Seen with their meteoric surroundings intact, the alien grains appear naked, lacking any protective shell that would have helped them survive the solar nebula unscathed. Thus far, no easy explanations have surfaced.

Zinner and Walker's technique promises to pump some extra coolness into what is already a fast-breaking field. Now the actual remains of ancient stars can be examined firsthand in their native context, allowing researchers to test their theories of nucleosynthesis—the process by which stars forge elements deep within their thermonuclear furnaces. By preserving the context of the grains, scientists hope to uncover more alien materials.

Astrophysicists admit that they really don't know what they'll uncover with this technique or how it will help illuminate our solar system's formation. "Right now," says Joseph Nuth, a physicist at NASA's Goddard Space Flight Center, "we're just scratching the surface." With typical scientific restraint, Walker predicts that the work being done at Washington University will change the nature of his and other researchers' jobs. "It's an exciting time to be in this field," he says.

—Gregory T. Pope

Clues extracted from chunks of interplanetary debris help



astrophysicists reconstruct the birth of our solar system

ally wonder what's in the 99.9 percent of the meteorite you're flushing down the drain," says physicist Robert M. Walker, director of Washington University's McDonnell-Peter Center for the Space Sciences in St. Louis. But pioneering work by Walker and his colleague Ernst Zinner not only coaxes new information from meteorites but allows scientists to examine the composition of a meteorite without destroying it.

For decades astrophysicists have studied meteorites, extracting the scenario from them. Before our solar system formed, a bol-

gosed it harbored elements from outside our solar system, probably says Zinner, hotsam from a long-dead star.

In spite of their importance, these revelations have been costly. Coaxing these secrets from Murchison required that much of the meteorite's bulk be dissolved away. Both Zinner and Walker disappointed with the acid bath method, sought other ways of determining the chemical components of meteorites. They turned to the electron scanning microscope and the ion microprobe to spearhead their efforts. The approach works

We will provide the clues to help you walk away as a successful big game hunter in

THE GREAT OMNI TREASURE HUNT



For more than twelve years, readers have reaped rich rewards from the pages of *Omni*, including our last live Treasure Hunt. Now prepare yourself for the sixth annual Great Omni Treasure Hunt by getting a jump start with a peek at the prizes. In next month's issue we will disclose the rules and the clues that may help you dip into our cache. We've even added a 900 number to aid your entering for those and other prizes. Grand prize: a 1991 Jeep Wrangler, valued at \$11,267. Second prize: Northgate Computer Systems software and accessories package (value: \$10,042). The third prize-winner



will take home a Casio combination TV/VCR, a rare hand-held color TV, and an Executive B.O.S.S. with electronic dictionary card, spell checker for medical and financial terms, and expansion card. Other products in the Casio package include electronic instruments as well as hi-and-here watches. Total value of the Casio prize: \$4,346. Fourth prize: a 1991 Honda Nighthawk 700 motorcycle (value: \$3,996). Fifth prize: a Mitsubishi 40-inch stereo Big Screen monitor/receiver (value: \$2,999). Pick up a copy of the February issue of *Omni* for the official rules and clues—and more prizes, too! ☐



1991 Jeep Wrangler





CONTINUUM

THE GADGET DEFICIT

Gizmos even grown-ups can use, the joys of diaper trash, iceballs from heaven, and lava in your oven

My Mazda's shift knob does more than click out transmission ratios. It panders to me. It cooals and beckons. It wears out its chrome heart to make my life easier. For—as Mazda is quick to claim—the company devotes hundreds of man-hours to testing and retesting each possible shift knob design and configuration to see which does the job best. Which shape molds most naturally into a human hand. Which covering is most pleasing. And which overall "look 'n' feel" makes your fingers go aflutter with anticipation.

This crucial pursuit, reputedly espoused by and embraced within all of today's major manufacturing firms, is called ergonomics, defined as "the degree to which the system has been developed with the human user in mind" (McGraw-Hill Encyclopedia of Science and Technology). Personally, I love the concept. I even like the sound of the word. I wish only that the results lived up to the hype.

Recently, for example, I purchased a "premium" model rowing machine for home exercise. Within minutes of unwrapping my booty, I realized the unit I was so cautiously dissecting did not in any way match the color picture on the box. The assembly instructions, in Pidgin English, hinted darkly that putting the contraption together would be only slightly less complex than building a nuclear reactor. Perseverance paid off, however. After applying equal amounts of time and luck, I was finally able to make my rower, er, row. But the only cogent ergonomic thought that went into the design of the product was the shape of the cardboard container. It was packed in that ergonomics in the real world.

Take videocassette recorders. VCRs are like snowflakes—no two are quite alike. While all are intended to do more or less the same things—play, record now, record later—the actual designs are about as consistent



and predictable as a roulette wheel. If you lose or misplace the manual, you end up with little more than a digital clock.

And then there is the ubiquitous microwave oven. What do those "low," "medium," and "high" settings really hint at? Show me a consumer sufficiently schooled in the effect of microwave transmissions on food molecules to properly—and intuitively—select the optimal setting! Only small children, bless them, seem to know how to make these

machines bend to their wills. "Put it on Hi and nuke it," says my nine-year-old niece. I do. It works.

Can anyone truly say the modern car is designed with the human user in mind? Recall the last time you plopped behind the wheel of your neighbor's new vehicle. How quickly did you find the knob that popped open the hood or the trunk? Were you able to adjust the left-side mirror without "unadjusting" the right-side mirror; activating the headlight washers or windshield wipers; or possibly lowering the convertible top? Did you know which lever to push or pull to slide the seat forward without simultaneously upsetting the angle of the seat back or expelling the pneumatically pressured lumbar sac?

As with most of today's products, the only thing we really know about car seats is that, given the correct incentive, they will move. Beyond that, you—and your ergonomically inspired intuition—are completely on your own. Could it be that companies are spending too much time on colors and shapes, gearshifts, knobs, and buttons? Perhaps ergonomics is in some strange way a depletable resource like oil or ozone. Maybe expending too much time upon one application leaves less to go around for other, more serious inventions. Maybe we're squandering too much energy and valuable resources on small gadgets and stuff while the world around us literally seems to be falling apart.—CHRISTINE WELLDON



CONTINUUM

TREES WILL BE HAPPY TO HEAR THIS

The decade's newest nuisance, diaper gulf, where-in parents recognize that the disposable diapers they change upwards of seven times a day add to the growing number (18 billion a year at least count) of disposables that wind up in U.S. landfills.

The situation has prompted Procter and Gamble, the world's biggest manufacturer of disposable diapers, to team up with the Seattle Solid Waste Utility to establish the nation's first

and separated before being processed into paper pulp, plastic, and absorbent gel. The end products range all the way from city park benches to bullet-proof vests.

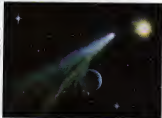
Soon Procter and Gamble and Seattle Solid Waste will begin recycling contaminated paper.

"If we can recycle diapers economically," says Tim Croll, program development director for the Seattle utility, "we might do the same for milk cartons, food wrappers, or paper plates smeared with mustard."

—Steve Nadez

A FEMALE PIGEON MUST SEE ANOTHER PIGEON TO LAY EGGS. PIGEON CHAIRS WILL NOT FUNCTION IF THE BIRD IS ALONE. IF SHE DOESN'T HAVE COMPANY, HER OWN REFLECTION WILL DO NICELY.

diaper recycling plant. One thousand babies in Seattle are contributing 7,000 diapers per day to the pilot project. The diapers, picked up at homes and day care centers, are sanitized



Hot behind the ears: Are icy comets purifying the earth's upper atmosphere with tons of water?

KIND—OR KILLER—COMETS FROM BEYOND

With the greenhouse effect and the destruction of the ozone layer, Earth's atmosphere is taking a terrible beating these days. According to meteorologist John Olivero of Pennsylvania State University, the upper atmosphere may be taking a literal beating as well—from so-called minicometes, balls of ice weighing up to 100 tons.

Olivero noticed something odd while examining data from a research program designed to measure water vapor about 50 to 65 kilometers above the earth's surface: every three days or so, there was what he calls an "enormous increase" in water vapor at that altitude.

Olivero had started the project with the intent to disprove the minicomet theory originally proposed a few

years ago by University of Iowa astronomer Louis Frank to explain the existence of mysterious "holes" in the upper atmosphere. Nonetheless he was forced to admit that if there were so many minicometes as Frank proposed—up to 10 million a day dissolving as they hit the upper atmosphere—they might explain all that extra water.

Olivero is the first to agree that the minicomet theory is highly controversial. "I'm not here to tell the world that I've proved it," he says, "but I think our data support it."

—Bill Lawren

EINSTEIN ON TRIAL

When physicist C. W. Francis Evered came to Stanford University in 1962 to head up the Gravity Probe B project, he was twenty-eight years old. He didn't realize that by the time the experiment is shot

NO QUEEN BEE HAS EVER STUNG A HUMAN BEING. QUEENS WILL USE THEIR STINGERS ONLY ON OTHER QUEEN BEES. THE QUEEN'S STINGER IS NOT BARBED AS ARE THOSE OF OTHER BEES IN THE HIVE, SO SHE IS THE ONLY BEE THAT'S ABLE TO USE HER STINGER REPEATEDLY WITHOUT DISMEMBERING HERSELF.

into space, probably in 1997, he if he in his sixties.

Why the wait? Ewert says it took years to develop the equipment needed for the experiment. Now, with everything ready, Gravity Probe B will provide the most stringent test of Einstein's theory of general relativity ever made.

Gravity Probe B will look for two specific effects predicted by general relativity. The first, called frame dragging, postulates that when the earth (or any massive body) rotates, it should "drag" nearby space with it, much the way a whirlpool drags nearby water into its vortex. Four gyroscopes onboard a satellite will search for this effect. Should the gyroscopes alter their preset orientation by as little as one hundred-thousandth of a degree per year, frame dragging will be confirmed.

Scientists expect to see an even bigger influence on the gyroscopes if Einstein's so-called geodetic effect

THE FICKLE FUNGI OF FRANCE

In the French forests of Pargand, it is almost sacrilegious to interfere with the manner in which truffles are unearthed. Undaunted, a biochemist from the University of Manchester's Institute of Science and Technology in England has developed an electronic device that may give pink slips to the hounds and hogs used to find truffles.

Kishna Penseud, who spent six years refining artificial noses and tongues assembled his truffle-hunting gadget for researchers at the University of Toulouse in southwestern France. Early trials went well. While the machines did not find all the truffles, even the French grudgingly admit that their pigs and dogs miss the mark about half the time.

Truffles grow underground among the roots of oaks and hazelwood trees and can be detected only by the unique smell they emit. Penseud's contraption, which resembles a hand-held metal detector, uses an array of 20 sensors to locate the

combination of gases that gives the fungus its singular odor; a microprocessor in the detector "sniffs" around and decides where best to dig.

"It may not be as sensitive as a dog's nose, but it's more systematic," says Penseud. Moreover, he can say with great assurance that his electronic nose won't wander off after more interesting aromas, and it never gets tired. The French unearth several tons of truffles each year at about \$600 a kilo. If they can double their output, presumably they'd be glad to pay Penseud's price and to holl with tradition.

—George Nobbe

Fetch your pink slip. Rover, a machine has taken your place.



holds true. This idea predicts that a massive body will distort the geometry of space the way an iron cannonball would distort a tightly stretched sheet of cloth if it were placed in the center.

If Gravity Probe B fails to find a discrepancy in the

predicted effects, it won't necessarily topple the whole edifice of general relativity, says Stanford physicist John Tjebkema. "But it might help refine the theory or lead to something new, something that hasn't been thought of before."

—Steve Nadis

DEJÀ VU—AGAIN

If this sounds familiar, it just might be. Déjà vu—that eerie feeling of remembering something that is happening right in front of your eyes—has been explained... again.

Dr. Willem Braud, an experimental psychologist and senior research associate at the Mind Science Foundation in San Antonio, says déjà vu may be caused by a slow relay in the brain.

Braud like many other researchers, believes that the right and left hemispheres of the brain communicate with each other through electrical impulses. Braud says that if an impulse "misfires," it causes a slight delay in communication, and confusion sets in. The brain believes it's receiving a memory instead of a current observation, causing déjà vu.

"The psychologist doesn't think his explanation rules out true precognitive experiences. There are a lot of exceptional abilities that are real and quite natural," Braud says.

—Peggy Noonan



CONTINUUM

JOSHUA AND THE EARTHQUAKE

The Israelite conquest of Jericho—featuring the notorious blocking of the Jordan River and the toppling of Jericho's walls when Joshua blew his horn—is one Bible story that most scholars label a myth. But historical analyst Bryant Wood of the Ephrata, Pennsylvania, Associates for Biblical Research is convinced the tale is true.

In the 1980s, British archaeologist Kathleen Kenyon excavated a limited area at Jericho and concluded that the city was destroyed by Egyptians in 1550 B.C.

Wood, however, notes that Kenyon based her dating on the absence of Late Bronze Age pottery and points out that British archaeologist John Garstang, who dug at

Jericho in the 1930s, found large quantities of what have now been identified as Late Bronze Age pots. In addition, a piece of charcoal found in Jericho's burned debris was radiocarbon dated to 1410 B.C., suggesting a downfall close to the time of Israel's birth.

As for the claim that the Israelites crossed the Jordan River on dry land, Wood says, "It's not so far-fetched if you study the seismic activity of the area. As late as 1927, mud slides caused by earthquakes cut off the flow of the Jordan. A slide blocked the river, so the Israelites crossed to Jericho on dry land."

Wood also thinks that an earthquake most likely hit just before the attack, bringing Jericho's famed walls tumbling down.

—Sherry Baker

FOOD THAT GOES BUMP IN THE NIGHT

Sure, food can be pretty to look at and frequently pleasing to the palate—but can it dance? Not yet, at least not in public. But two researchers from RJR Nabisco have just patented what amounts to a volcanic cookie, which spews a lava-like filling from its center when heated in a microwave oven. Not surprisingly, the Nabisco people are



SOUTH OF THE BORDER

Meteorite maven Robert Haag thought that he got a bargain when he paid \$400,000 for a 37-ton intergalactic rock, but when he tried to truck his prize out of Argentina, he was arrested.

Haag, who says he has "the best job in the solar system," found that his reputation as a meteorite buyer/buyer resulted in a less-than-typical job arrangement. "I was a celebrity prisoner," he says. "I got to go back to my hotel every night. I had a blast down there."

After posting \$20,000 bail, Haag returned to the United States to avoid the Argentinean officials eventually dropped the charges. Though he laments the loss of the 37-tonner, Haag hopes to return to an area in Argentina where 4,000 years ago a huge meteorite broke up and spread debris over a 200-mile area. "It's like the elephant graveyard of meteorites," he says. —Curt Wohlschlag

reluctant to reveal details about their volcanic cookie.

"It's food as performance art," says Pat Cusick, a group marketing research manager at Campbell Soup's Microwave Institute. "Finding ways to make food interesting—an adventure to eat and watch—it's a whole unappreciated area."

Will consumers swallow prouetting capons or singing salads? Martin Friedman, editor of *Gourmet's* *New Product News*, thinks they will. "It's been the dream in this business to come up with a food that dances, changes colors, moves around, or does something," he says. "So far, nothing out there does that." —Steve Nadis

WHEN ALBERT EINSTEIN WAS ON HIS DEATH BED, HE UTTERED SOME THING IN GERMAN. THE NURSE WHO WAS ATTENDING HIM DID NOT SPEAK GERMAN. SO NO ONE WILL EVER KNOW THE GREAT SCIENTIST'S LAST WORDS.

A MOSQUITO HAS FORTY SEVEN TEETH.

THE PENGUIN IS THE ONLY BIRD IN THE WORLD THAT CAN SWIM BUT CAN'T FLY.





CONTINUUM



From the heart: A new device lock starts faulty tokens.

THIS VEST CAN SAVE YOUR LIFE

Thousands of heart attack victims die every day thanks to cardiopulmonary resuscitation (CPR), a technique in which rhythmic pressure is applied to the chest, forcing blood to the victim's heart and brain. Less well-known are the potentially life-threatening aspects of CPR. Press too hard on the chest and the victim's ribs can crack, perhaps puncturing a lung or causing internal bleed-

ing. This danger could become a thing of the past with a new vest that performs CPR automatically.

The inflatable vest, developed by a team of medical researchers at Johns Hopkins University School of Medicine in Baltimore, fits around the victim's chest and back. A built-in computer explains researcher Joshua E. Teitel, tells the vest to deliver evenly distributed bursts of pressure hard enough to promote blood flow but gentle enough to avoid injury. In tests on seven dogs whose hearts had stopped beating, the vest restored the heartbeat and saved the dogs' lives with no injuries whatever.

Tests on humans are just beginning, Teitel says, and it will be at least two to three years before the results are in. If it goes well, the researchers think the vest could be produced in disposable form for as little as a few hundred dollars each.

—Bill Lawren

DENTAL FILLINGS OF THE DEAD

As if auto exhaust, industrial effluent, and chlorofluorocarbons weren't enough, we may now have yet another source of air pollution to worry about—dental fillings of the dead.

According to geologist Allan Mills of the University of Leicester in England, cremating corpses may release worrisome amounts of toxic mercury vapor into

the air. Mercury, Mills explains, is used to harden dental fillings made of silver and copper alloys. At body temperatures the mercury-hardened fillings are perfectly safe, but cremate someone whose mouth was full of fillings and the fillings break down, releasing mercury as vapor into the surrounding atmosphere. In fact, says Mills, a thinning crematorium could release as much as 24 pounds of the poison into the air every

DURING THE WINTER IN SIBERIA IT CAN GET SO COLD THAT THE MOISTURE IN A PERSON'S BREATH FREEZES INSTEAD OF FORMING VAPOR AND THEN AUDIBLY FALLS TO THE EARTH AS CRYSTALS

year. As little as one millionth of a gram of mercury per liter of air can damage the central nervous system, with symptoms ranging from irritability to tremors and even insanity.

The threat could be eliminated, says Mills, merely by adding filters to crematorium smokestacks to absorb the mercury vapor before it enters the atmosphere. "I'm simply drawing attention to a possible hazard," he says, "and I'm hoping the environmentalists will prove me right or wrong." —Bill Lawren

UNDERSEA COVER-UP

In the mid-Seventies, as nuclear waste began to accumulate at an alarming rate, some scientists proposed burying the dangerous stuff under the ocean

floor. The proposal was loudly opposed by environmentalists, who feared radioactive contamination of the oceans, and, in the United States at least, the idea of disposing of nuclear waste at sea was dropped.

But now a pair of British oceanographers have revived the concept. Sarah Colley and John Thomson of the Institute of Oceanographic Sciences in Godalming, England, looked at 30-meter-long, layered cores of seabed sediment, which contain natural traces of radioactive uranium, thorium, and radium. When they compared the radioactive signatures found near the older, bottom sections of the cores with the radioactive signatures at the top, they discovered that the radioactive elements had not migrated upward in any significant amount during the last 500,000 years. This suggests that radioactive waste buried deeply enough might stay put.

Will the British government, which currently stores its nuclear waste in tanks, now consider undersea disposal? Probably not, says Colley. "They [the British government] made a policy decision not to look at any other method of disposal until at least 2050," she says. "So it's still a dead issue." —Bill Lawren



Where does the waste go? Why not under the seafloor?



CONTINUUM

THE BREAST STUFF

Liposuction, the most popular cosmetic procedure in the United States, seems to have a curious side effect in women: It makes their breasts larger.

The discovery announced by Ohio State University dermatologists Dwight Scarborough and Imri Brascoia, appears counterintuitive because liposuction surgery removes unwanted fat from the stomach, hips, or thighs. Scarborough, however, reasons that when fat is removed from one part of the body it may trigger a "metabolic shift of sorts" that routes fat to "different areas of the body, including the breasts."

In that study the two researchers noted that of 18 women who had a liter (about a quart) of fat removed, 12—or 75 percent—experienced a measurable increase in breast

size within six months to a year after surgery. Five women in the group increased a full cup size. (Man who had more than a liter of fat removed did not experience breast enlargement.) Scarborough and Brascoia are currently conducting a yearlong inquiry to determine which patients will increase breast size, by how much, and whether the change is permanent. In the meantime, Scarborough says women should choose liposuction "for its primary benefits." —Peggy Noonan

SWEEP SNAKES

In our January 1990 issue we mentioned that the population explosion of brown tree snakes has triggered ecological disaster on the island of Guam. Guamanians had a chance not only to strike back but also to win cash and other prizes in an all-out snake hunt—organized by the



Eden will never be the same: With brown tree snakes swamping the island of Guam, the natives are beginning to get restless.

Guam Tribune and its editor Doug Cifers.

The two-person team that brought in the most dead snakes within the one-month free-for-all won a Nissan pickup truck. Second- and third-place teams won TV sets, with additional prizes awarded for the longest snake caught and the most

clever snake trap.

When the contest ended in July, 1,300 snakes had been caught. Cifers says the contest barely dented the population, estimated to be in the millions. But the snakes and kill-site data will be used to develop a plan for eradicating the pests.

—Paul McCarthy



Nation in a carbonogenic clothing: The new tobacco.

TOBACCO ROAD

Plant geneticist Shih Sheen of the University of Kentucky in Lexington wants the whole world to meet the tobacco plant in its newest incarnation: food supplement.

"There's no protein like it," says Sheen. He might be right. Tobacco, like all plants, contains an enzyme that helps green leaves utilize carbon dioxide.

But unlike those in other plants, the tobacco enzyme is easy to purify and crystallize, resulting in

a colorless, tasteless protein free of nicotine and other potentially toxic substances.

"You can boil it and it won't coagulate; you can even add it to soft drinks," says Sheen, who, deep in his heart, believes that "America's prejudice against tobacco prevents us from accepting it as healthy. He thinks that developing countries, with a greater need for dietary protein, will be the first to take a share to tobacco-based protein.

—Marlyn Larkus

QUEEN VICTORIA'S DOCTORS PRESCRIBED MARIJUANA TO RELIEVE HER MENSTRUAL CRAMPS

WHERE DOES THE DUST IN YOUR HOUSE COME FROM ACCORDING TO A STUDY BY LONDON'S CLINICAL RESEARCH CENTER, 70 PERCENT OF IT CONSISTS OF SHED HUMAN SKIN



Fast-as-light computers, global energy wars, and a legion of environmental activists are just some of the factors that will influence the corporate world in the year 2001. To find out what executives must be on the lookout for in the turbulent years ahead, *Omni*

CHALLENGE & RESPONSE

BUSINESS MANAGEMENT IN THE 21st CENTURY recently sponsored a roundtable with the SEI Center for Advanced Studies in Management, part of the Wharton School of the University of Pennsylvania. Our topic: management in the twenty-first century. To kick off the conference, think tank members and corporation execs delineated the world ahead. They predicted a tremendous division between the haves (those in the U.S., the European Common Mar-

BY PAMELA WEINTRAUB



ket, and East Asia) and the have-nots (including citizens of the Soviet Union and Brazil). Some nations will prosper and digital products, biotech, smart buildings and bullet trains, while others wallow in hunger and despair, lacking even the energy to heat their homes. Thanks to the tremendous mobility of the twenty-first century, however, national lines will blur as people flow easily from culture to culture. Advances in biotechnology will help the workforce grow ever older, with individuals remaining productive until the age of seventy, eighty or beyond. Not just people, machinery will require decades of education before they can fill the shoes of those who finally retire.

Admiral Bobby Ray Innan, former deputy director of the CIA, now an entrepreneur, discusses life, money, and politics in the next century. His always planning statement appears below and serves as a starting point. Other futurists who members then responded to Jim Mann (and each other), predicting the corporate future and providing solutions to a host of corporate dilemmas. Their names follow Innan's report.

STRATEGIC PLANNING REPORT MANAGEMENT 2001

The world of the twenty-first century will be racked by turmoil—by terrorism, revolution, and tribal bloodshed. Most of the world will be in a state of chaos. South America will be an economic basket case, and the poorly financed, bankrupt welfare state of the Soviet Union will remain the work ethic of Asia and the West.

In contrast to these troubled regions will be three major trading areas: zones of relative wealth—the European Community, the North American free trade zone, and the East Asian trading bloc. We should see tremendous conflicts between the haves and the have-nots.

The Americans will have problems as well. If the budget deficit does, in the U.S. falls apart, we will stumble into a very deep recession. As a result, there will be a net cost of labor in the U.S. We must create an attractive region for foreign investment.

Early in the twenty-first century, more than half of those entering the workforce in Florida, Texas, Colorado, New Mexico, and California will be non-Anglo. We will also see an extremely significant shift in the production of aircraft, maintenance, and engineers.

STRATEGIES FOR SUCCESS

Managers who follow the strategies listed below should thrive in the coming age of turbulence—the Nineties—and in the century to come.

Nurturing the research base.—The key to American success lies in our research base, especially the university sector. Due to the declining pool of talent, the best managers will be forced not to overinvest in-house research, but rather to rely on cooperative research activity among many companies, universities, and even the government.

Superstar managers will identify how to track evolving research and then invest in parallel receptor activities within their own organizations. Real success will go to those who can facilitate technology transfer from an outside source.

Advances in biotechnology will lead to a dramatically older workforce.

The need for these skilled workers will create intense pressure against retirement, even though most people find staying in the same field for 50-plus years is boring.

To help with strategic planning as well as in the twenty-first century, management must understand not just the technology or product but also the culture and religion of countries in which they work.

High-tech leadership.—More than ever, managers will need the ability to inspire, attract, and motivate talented people from a wide range of environments and demographics. Given the declining pool of talent, cash alone will not be the critical factor in attracting and retaining people. Talent must feel that management has a deep interest in career development. More than anything, the future manager will need a wide understanding of the local nationalities, the politics, and the culture of the countries in which they work. The most important biological characteristic of contemporary man is our ability to institutionalize, and the role in this will be especially visible against our biology. We must invent, cultivate, and improve a "strong network" to lead the interesting, selection of our biological make-up. I should have they responded that it is—genetics. I think you'll find them very interesting and very unusual. Notwithstanding the above, aggressive, non-conformist as a radical. I'll be very even and up with you. I should have they responded that it is—genetics. I think you'll find them very interesting and very unusual. Notwithstanding the above, aggressive, non-conformist as a radical. I'll be very even and up with you. I should have they responded that it is—genetics. I think you'll find them very interesting and very unusual. Notwithstanding the above, aggressive, non-conformist as a radical. I'll be very even and up with you.

—Admiral Bobby Ray Innan

GREEN BUSINESS

From Charles O. Barnes, Executive Director, Institute for Technology and Policy Studies

Birth of the Environment.—Global warming, depletion of the ozone layer, acid rain, and water contamination are the problems that will go away by 2025. Corporations will be forced to become good environmental citizens if they don't pay the price in the form of consumed and avoided.

Right now, even in the midst of a global energy shortage, there is no incentive to invest in energy conservation. The only way to conserve energy will be to invest in energy conservation.

What's more, there is the real danger of global warming. The real danger is that the huge infrastructure that now exists will be obsolete. In the future, energy will be much more expensive, and as a result, infrastructure will be obsolete. The real danger is that the huge infrastructure that now exists will be obsolete. In the future, energy will be much more expensive, and as a result, infrastructure will be obsolete. The real danger is that the huge infrastructure that now exists will be obsolete. In the future, energy will be much more expensive, and as a result, infrastructure will be obsolete.

Global planning. Future managers must learn about strategic planning in a global environment. As we move increasingly to multinational corporations, managers will have to cut much of the manufacturing, as well as the research and development, in the hands of local nationalities.

MONEY MATTERS

From Joseph P. Costello, President of Costello Inc.

Be Technological.—In the midst of today's corporations, there is a real danger. The real danger is that the huge infrastructure that now exists will be obsolete. In the future, energy will be much more expensive, and as a result, infrastructure will be obsolete. The real danger is that the huge infrastructure that now exists will be obsolete. In the future, energy will be much more expensive, and as a result, infrastructure will be obsolete.

To manage the twenty-first century, we must understand not just the technology or product but also the culture and religion of countries in which they work. The most important biological characteristic of contemporary man is our ability to institutionalize, and the role in this will be especially visible against our biology. We must invent, cultivate, and improve a "strong network" to lead the interesting, selection of our biological make-up. I should have they responded that it is—genetics. I think you'll find them very interesting and very unusual. Notwithstanding the above, aggressive, non-conformist as a radical. I'll be very even and up with you. I should have they responded that it is—genetics. I think you'll find them very interesting and very unusual. Notwithstanding the above, aggressive, non-conformist as a radical. I'll be very even and up with you.

Global planning. Future managers must learn about strategic planning in a global environment. As we move increasingly to multinational corporations, managers will have to cut much of the manufacturing, as well as the research and development, in the hands of local nationalities. The real danger is that the huge infrastructure that now exists will be obsolete. In the future, energy will be much more expensive, and as a result, infrastructure will be obsolete.

the world. In fact, I believe that the most national product will be performed at an indicator of environmental performance, with minimum indicator of environmental destruction.

Third World problems will travel around the globe. The first step will be through change. Anyone involved in education knows what it's like to have much children in the schools. In a few or ten years, corporations will be offering those children jobs.

Another way undeveloped countries will get back at us is through the migration. One of the ways in which we can have an enormous advantage over the U.S. and Europe is that it has this big, most—the ocean—plus restrictive entry regulations. We, on the other hand, have a 2,000-mile-long opening to some of the poorest people of the world. Another way in which we can have an enormous advantage over the U.S. and Europe is that it has this big, most—the ocean—plus restrictive entry regulations. We, on the other hand, have a 2,000-mile-long opening to some of the poorest people of the world. Another way in which we can have an enormous advantage over the U.S. and Europe is that it has this big, most—the ocean—plus restrictive entry regulations. We, on the other hand, have a 2,000-mile-long opening to some of the poorest people of the world.

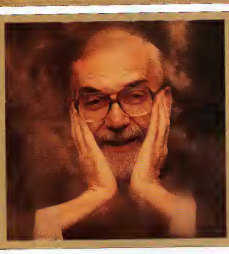
Finally, I see a danger on the part of the labor force to limit the way they spend their resources. To deal with all the problems of the future, the best managers will have to help their organizations become learning organizations, in which the company itself is open to growth, change, and which

fusion of power, and to achieve a flexible approach to work, it's not a lot about the company itself, but about the company's life.

With so many women in the workforce, we are also seeing the rise of the two-income household. Those in two-income households have brought their own a total place commodity—the nuclear family that comes from having a backup source of support, and a built-down, more very simple thing. You don't, you can take your children job and show it. I don't have to get up with you, you can take your children job and show it. I don't have to get up with you, you can take your children job and show it. I don't have to get up with you, you can take your children job and show it.

From Marvin Calkins, President, Forecasting International

Be The Small AK.—In the Earth in the twenty-first century, the big use businesses will be gone. In the twenty-first century, the big use businesses will be gone. In the twenty-first century, the big use businesses will be gone. In the twenty-first century, the big use businesses will be gone. In the twenty-first century, the big use businesses will be gone.





ARTICLE

The body heals itself when scientists trick it into growing replacement organs next to those too sick to treat

INTERNAL MEDICINE

BY SHERRY BAKER



I have always believed that the human body is capable of total regeneration," says John "Jory" Thompson as the summer sky outside his tiny Birmingham office turns black with rain. Winds skim tree branches against the single window while the University of Alabama biochemistry professor describes his efforts to grow new livers, pancreases, and kidneys inside patients whose own organs are damaged beyond repair. "I'm convinced it's possible," says Thompson, pointing out that amphibians such as frogs and salamanders can regenerate lost parts. Flashes of light-

ning cast eerie shadows on the walls as the scientist speaks, conjuring up images of the scene in Frankenstein in which an electrical storm charges the mad doctor's monster with life. But this isn't fiction. Thompson has already succeeded in creating biologically active neo-organs, or "organoids," in laboratory animals, and he says they could eventually make modern transplant surgery obsolete. While organoid technology has a long way to go before researchers consider trying it out on people, Thompson and Robert Gallo—chief of tumor cell biology at the National Cancer Institute and

PAINTING BY ÉTIENNE DELESSERT

codiscoverer of HIV, the virus that causes AIDS—think it could be used to deliver gene therapy to prevent HIV from infecting cells.

A handsome, forty-three-year-old with prematurely silver hair and striking green eyes, Thompson describes his work as an adventure in uncharted territory, a quest to decipher the secret language of cells. "If salamanders can regenerate lost parts," he says, "it's not too farfetched to think that humans can. We need to understand the ways cells communicate with each other and what their signals for growth are."

Thompson's interest in manipulating cell signals toward the creation of man-made organs began in the mid-Eighties, when he joined gene therapy crusader French Anderson's lab at the National Institutes of Health (NIH) in Bethesda, Maryland. The concept of genetic therapy is simple: Take a cell out of a sick person, reeducate it to do something it's not currently doing, and replace the modified cell. "The tough part is figuring out what calls a new gene can be introduced into and how they can be put back into the body and continue to function," says Thompson.

The Anderson team was looking for a way to get genetically engineered cells to survive in animals. Thompson and his colleagues used rats bred to be chronically jaundiced because they lacked the gene necessary to break down bilirubin, a normal product of red blood cell degeneration. (When bilirubin remains in the bloodstream it

causes jaundice, the missing gene enables the liver to break it down into bile acid, which it then secretes to aid in the digestion of fat.) The scientists extracted liver cells from the sick rats, altered them genetically so they could break bilirubin into bile acid, then injected them into the jaundiced rats.

The experiment was not a total success. Bile acid is toxic when it remains in the liver, and the new cells produced more than they could dispose of naturally. The excess killed them. But the team learned lessons. "We found we needed a blood supply to eliminate toxic wastes and bring nutrients and oxygen into the cells," Thompson says. "But how could that be accomplished?" The scientists were stumped.

In the end, serendipity played a role in the resolution of the problem. It entered in the guise of Tom Maciag, a pioneering researcher in angiogenesis (the formation of blood vessels) at the American Red Cross's Jerome H. Holland Laboratory in Rockville, Maryland. Thompson and Maciag met at a working lunch hosted by a small biotechnology journal in 1986. The two men hit it off immediately. "He told me about his work and I started talking about growth factors," Maciag recalls with a laugh. The Red Cross researcher has made a career out of studying the dozens of human growth factors, proteins linked with cell growth, that scientists have discovered in the last 25 years. He suggested Thompson try incorporating one called heparin-binding growth fac-

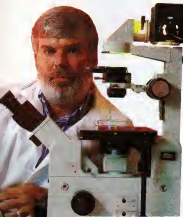
tor-1, or HBGF-1, in his experiments.

HBGF-1 is potent stuff. Abundant in fetal tissues, it's the substance responsible for triggering the staggering amount of specialized cell proliferation that turns a fertilized egg into a baby. Adults, however, seem to harbor little HBGF-1. Researchers believe that as soap manufacturing fresh supplies once we reach maturity, storing only small amounts of a latent form. That kind of HBGF-1 gets activated in response to specific traumas, such as wounds or ulcers. When you cut your hand, for example, your immune system sends cells called macrophages to the site. They clump a protein that chews up the damaged skin and triggers the release of dormant HBGF-1. The growth factor then signals the body to grow new cells and repair the wound.

"It wasn't too much of an intellectual leap to think Tony might be able to use it to grow new blood vessels in animals," Maciag comments. If the idea worked, the new vascular system could provide a means of piggybacking genetically altered cells into the body and providing them with the blood they'd need to survive.

Thompson was intrigued. He had recently moved on to a private biotechnology firm, Genetic Therapy, Inc., affiliated with Anderson's lab. In 1987 he and his co-workers there dipped small surgical gel-foam sponges into the growth factor and implanted them in animals. They succeeded in growing blood vessels, but when the sponges

"WE'LL REGENERATE ORGANS THAT OUTLIVE THE REST OF THE BODY."



Scientist Tony Thompson used HBGF-1—the stuff that triggers specialized cell growth and turns a fertilized egg into a baby—to get embryonic organs to grow next to lab rats' diseased livers, then fed in genes that code for healthy liver function to get the new organs up and running.

dissolved after a few weeks—so they were designed to do—the vascular growth collapsed.

Convinced that he was on the right track, Thompson called Maciag to a brainstorming session. We called it dinner, but in reality we were where most of science originates—in a neighborhood bar," Thompson jokes. "Over a couple of beers, Tom came up with the idea that we paint the growth factor on Gore-Tex, the synthetic material used in sleeping bags and skiwear. It doesn't dissolve in the body and it doesn't cause an immunological reaction." Gore-Tex patches and vascular grafts have been successfully used in open-heart surgery for ten years.

Collaborating with Anderson and Maciag, Thompson tried again. The researchers sterilized a puff of Gore-Tex fibers the size of a cotton ball, clipped it in collagen to give the growth factor something to stick to, and coated it with HBGF-1. They implanted the mass in the abdomen of a laboratory rat near the animal's liver. When they opened the rat's belly several weeks later, the researchers stared in disbelief



"In the future I see virtual reality as a medium where people improvise worlds instead of words, making up dreams to share, an objective form of the Jungian dream. You might even call it the collective conscious"

INTERVIEW

JARON LANIER

On the living room wall of Jaron Lanier's deconstructed bungalow in Palo Alto, California, hangs a poster of the four-armed Hindu goddess Kali. Her 16 fingers and 4 thumbs dexterously play a sitar. Most Westerners would find the image an exotic one, but in the context of virtual reality, the emerging field of which Lanier is the unquestioned guru, Kali looks as normal as Betty Crocker.

Virtual (or artificial) reality is the hot new computer technology that lets you do the impossible—from swimming through the heart's aorta to walking the dog on Saturn's rings. Technically virtual reality is a full-color, full-motion 3-D environment manufactured by computer and displayed inside a pair of goggles worn by the virtual traveler. Psychologically it's poised to become an open-ended, no-holds-barred experience that enables people to create their own

dreams in Technicolor and then let their friends jump in. VPL Research, Inc., of which Lanier is the founder, CEO, and spiritual leader, is the first company to bring virtual reality technology to the market. VPL's customers include NASA, Apple Computer, Pacific Bell, and an assortment of universities and research labs. On a visit to VPL, a cruise overlooking a swank Redwood City sailboat marina, interviewer Doug Stewart explored a simple world that Lanier had spent barely an hour mousing together on a Macintosh II computer. To enter this world, Stewart pulled on a pair of VPL's cumbersome, opaque EyePhones and a wired-up Data-Glove made of black Lycra. Sensors on the glove and goggles steadily sent a silent flood of signals to a powerful Silicon Graphics computer sitting on the floor. Stewart instantly found himself in a room filled with semirealistic objects: a red



apple on a table, a bunch of purple grapes, a banana spinning lazily end over end in midair, a yellow rubber duck bobbing in the rippling water of a hot tub. Periodically a small pterodactyl swooped down a spiraling chimney and out of the room.

"Reach for the grapes," Lanier suggested to Stewart, who groped with his gloved hand and watched as a virtual representation of his bending fingers closed on the bunch. He moved his



finger, and then the grapes moved with it. Learning back in satisfaction, Stewart saw the room abruptly enveloped in red. He'd accidentally backed his head into the apple in minutes. Stewart had mastered the "fy" gesture (pointing a gloved forefinger while curl-

ing the thumb under), rocketed up the chimney, and was soaring through the gray billows of a distant computer-generated cloud.

A self-taught thirty-year-old with neither a college nor high school diploma, Lanier's, not surprisingly, a onetime video-game designer. Virtual reality (VR), however, promises to be much more than the utopian wraparound adventure game. VR systems would be the perfect command post for sending remote-controlled robots where humans prefer not to go (a melted-down nuclear reactor, the asteroid belt). Medical students could practice surgery on virtual cadavers that spurt virtual blood after a misplaced incision. Such uses are speculative so far, but few people doubt the technology's potential.

No one offers more enthusiastic speculation than Lanier. A champion of virtual reality as a key to unlocking humankind's imagination, Lanier is probably the first man with full-length dreadlocks to be profiled on page one of *The Wall Street Journal*. Barely, with heavy-lidded blue eyes and a soft, sometimes dreamy voice, Lanier dominates a room. Stewart interviewed him over five hectic days and nights punctuated by midnight drives, unexpected visits by delegations of Japanese industrialists, sudden afternoon naps, dinners with computer moguls eager to pick Lanier's brain, and the occasional 5:00 A.M. staff meeting.

Lanier, the hacker-turned-capitalist, struck Stewart as more hacker than capitalist. With breathtaking nonchalance, Lanier disregarded scheduled appointments and housekeeping details (he even had his unlisted home phone inexplicably disconnected midweek) or changing clothes over the course of

five days. Most of the interviews took place in the living room of his rented bungalow. Lanier is an accomplished improvisational musician, and the room was crowded with more than 100 instruments, from bagpipes to xylophones to unidentified horns and gongs. During breaks Lanier repaired to his grand piano and sent fluent, atonal chords crashing through the room.

The Pied Piper of a growing technological cult, Lanier has many of the trappings of a young rock star: the nocturnal activity, attention-getting hair, incessant demands on his time. He is casual, goggley, his heedlessness verging at times on arrogance. Yet during the interviews he seemed oddly spontaneous. When he found something amusing—which was often, he paused a beat before expiring a staccato burst of giggles. Hearing good news on the phone, he screamed in delight but hesitated before whipping an object across the room in celebration. (*How? Should I throw that pen or should I?*) Lanier believed, in fact, as if he were observing himself from a distance.

Q: What is virtual reality?

A: It's an alternate reality filling the same niche otherwise filled by physical reality. It's created when people wear a kind of computerized clothing over the sense organs. If you generate enough stimuli outside one's sense organs to indicate the existence of a particular alternate world, then that person's nervous system will lock into gear and treat that simulated world as real. You might be in a Moonish temple or a heart that's pumping. You might be watching a representation of hydrogen bonds forming. In each case the world is entirely computer generated. Now, imagine that you had the power to change that world quickly—without limitations. If you suddenly wanted to make the planet three times larger, put a crystal cave in the middle with a giant goat bladder pulsing inside of that and tiny cities populating the goat bladder's surface, and running between each of the cities were solid gold railways carrying tiny peribot playing accordions—you could build that world instead of talking about it!

Q: Okay... How does the computerized clothing work?

A: The goggles put a small TV in front of each eye so you see moving images in three dimensions. That's only the beginning. There is one key trick that makes VR work: The goggles have a sensor allowing a computer to tell where your head is facing. What you see is created completely by the computer, which generates a new image every twentieth of a second. When you move your head to the left the computer uses that information to shift the scene that you see to the right to com-



You put on virtual reality goggles and suddenly find yourself in an altered version of your

home. You might slide like water down through the drain in the kitchen sink, or fly over the rooftops.

Animators
can now create
realistic
images of app-
earing from
future space-
craft (top)
and planets
and creatures
(far left) to
human forms
(center left)

PICTORIAL
AS COMPUTER
ANIMATION APPROACHES
THE LOOK OF LIFE,
HOW WILL WE KNOW
WHAT IS REAL?

BY ROBERT K. J. KILHEFFER

ILLUSIONS



But are they
difficult
to distinguish
from their
real-life counter-
parts. Some
day, testing the
real from
realism will
become
impossible.



CHALLENGE & RESPONSE

CONTINUED FROM PAGE 27

spend less of their income on, say, a VCR or dishwasher. As money stretches further, living standards will rise.

In addition, more and more professionals, consultants, executives and laborers will become entrepreneurs in the small market niche, out of the no-man's-land of the big competition. They may not enjoy economies of scale, but they will be able to set themselves up with a computer, a fax machine, a telephone, and a good idea. This will give the economy thousands of new sources of innovation and will offer a source of jobs to replace those lost with the decline of mid-size companies.

From Michael J. Quinlan, VP and Assistant General Manager, IBM

Re Long Views and Electronic Gray

Corporations generally keep a short-term focus. The volatility of the stock market now drives our research and our strategic planning. But the short-term view keeps corporations from focusing on long-term issues that will be crucial to success in the next century—training talent, for instance, or promoting employee health. Successful managers of the future will need to forecast and influence long-term, strategic futures.

Taken education, which clearly warrants strategic consideration. The corporation, however, has no notion of how to engage in the politics of education. Corporations know how to throw money at education, they know how to be philanthropic, but they do not know how to marshal their own enormous resources politically to force fundamental change. Without such long-term strategic abilities, corporate managers will not succeed.

I also believe that managers will have to pay more attention to the elderly, who will have a dramatic impact on U.S. public policy. As people get older, they will communicate with each other through easy-to-use home computers. I think many of the elderly will use their computers to debate environmental and national health issues. Eventually these informal discussions will actually turn into de facto referenda. Though electronic consensus may not have legislative power, it may, in many ways, herald the dilution of representative government. Finally, as the twenty-first cen-

tury approaches, I see a fortified First World. Managers will be on the lookout for unstable situations such as the one in Iraq. Wary of Third World turbulence, managers will pursue business opportunities in the First World.

From John Diebold, Chairman of the Board, The Diebold Group

Re The Nurturing Manager

One of the big issues for management of the twenty-first century will be attracting talent with the promise of flexibility. Future managers will need to find ways to allow people to participate in organizations in whatever way they want. Some people want to work all the time. Some people want to work an absolute minimum. Some want to work in the morning, and some at night. Information technology will help management accommodate talented individuals, but the main invention must still be in the human sphere. Managers must create a commonality between the human being and the corporation.

From Robert Holland, Senior Economic Consultant, Committee for Economic Development

Re Workforce 2000

Managers usually expect human development to take place outside the corporation, thinking that moms and dads will raise kids and schools will educate them. Then corporations can pick the cream of the crop.

But increasingly the institutions we count on to develop talent have proved deficient. It is now in business's own enlightened interest to take an active part in introducing and

pushing along the solutions for the development of talent from the time the baby is conceived. This is particularly true if the company is in a disadvantaged geographic area, where health is a real problem and can destroy the lifelong productivity of a youngster before he or she is born.

Good managers must now not only pay close attention to cash flow but also to talent flow, which will be relatively costly in the short run. After all, it takes more than 20 years for a youngster to be born and brought up and educated by a decent university. That's the biggest burden business will face in the years to come.

From Robert H. Smith, President, The Futures Group

Re Multinationals Rule the World

If you grant the hypothesis that the Cold War is over and that the U.S. is in a state of decline, then you must ask: "Who or what will take its place in the

future? Where will ethical and economic leadership be found in a fragmented world where political strength has evaporated? Most likely global corporations will fill the role superpowers once played. Governments meanwhile will return to their past role—taking care of the elderly and the dependent, population, education, foreign policy, and defense.

Even if one doesn't believe that governments will lose political power, the presence of the multinational corporation still challenges the theory that the world economy will be ruled by economic blocs such as the European bloc or the Asian bloc.

In the early part of the twenty-first century the multinational corporation will cover much of the globe. Discontented with government's inability to operate in a world economy, global corporations will fill the vacuum to survive. The multinational, which in the next century may operate in up to 60 countries, should become the driver of change.

From Lynne McFarland, Founder and Chairman, Leadership Into the Next Century (LINC)

Re The New Age of Empowerment

As we look forward into the next century there are three "omni-paradigms," or all-encompassing trends, that I see taking place. The first twenty-first century paradigm is "omni-leadership." This is a broadly distributed leadership that reaches out in every direction and touches every human being. In essence, omni-leadership invites each individual in an enterprise to be a leader and to fully develop his personal and professional excellence. Omni-leadership calls into action every person and empowers his vision, creativity, wisdom, and freedom of choice.

The second major paradigm is what I call "omni-networks," which are dynamic linkages of individuals, families, enterprises, communities, and nations. There will be an explosion of alliances in every direction. Omni-networks will link up teams of interdisciplinary collaborators to more effectively resolve the economic, educational, social, environmental, and governmental issues that are crucial to survival in the twenty-first century. These networks, composed of large blocs of consumers and enterprises representing the global marketplace, will set standards, policy and action for large populations.

The end result will be a living global communications and interchange system that leads to the next omni-paradigm—an "omni-civilization," a truly an age global economy and society. The financial, technological, governmental, and cultural elements of the omni-civilization will work in unison to resolve our mutual global challenges and help us evolve from our current information Age to the new Age of Empowerment. **CC**



FICTION BY JACK CADY

IN A HIDDEN OREGON VALLEY, A RELIGIOUS
CONGREGATION LIVES A LIFE OF PEACE AND
THE
SONS OF
NATURAL HARMONY, UNTIL A DETERMINED
NOAH
DEVELOPER BRINGS PROGRESS TOO NEAR.

PAINTINGS BY JOSÉ ORTEGA

And the fear of you and the dread of you shall be upon every beast of the earth, and upon all fowl of the air: upon all that creep upon the earth, and upon all the fishes of the sea, into your hand are they delivered.

—Genesis 9:2

When darkness edges through this valley, shading long ligures of cattle moving toward milking barns, last light falls on the weathered steeple of Sons of Noah Church. The church stands on stilts beside Troublesome Creek as do all our barns and houses. The valley is a flood plain. Visitors to our northwest valley always ask why we, the country people, stay in a place bound to flood every seven years. Why do we choose to live in houses founda-

tioned on twenty-foot timbers heaved from ancient oceans? Why live where cattle climb ramps to elevated barns? We reply that floods renew the soil and make good pasture. Our milk and produce are the purest in the world. What we say is not false.

What we do not say is that this valley casts a spell. It is shadowed by eight thousand-foot mountains. The valley is twenty miles long, seventeen miles wide. Weather systems bred in the Aleutians bring rain nine months each year. Darkness often covers the land, even in daylight, and not all darkness is threatening. The mountains are protectors, because the world beyond these mountains is beset by demons.

From this mountain valley our sons sometimes go away to the Army. Those who survive always return, and they tell crazy tales. They speak of endless streams of automobiles, and of demonic voices chattering from television screens. They speak of billboards and politicians, wars, suicides, whoring, rape, drugs, satanic worship. Visitors describe us as "peculiar," and maybe that is true. On the other hand, we hear of the outside world and describe it as insane. We do not mind if the rest of the world chooses insanity as long as that world leaves us alone. At least we have not minded until now. I am elected to write of this. My name is Thaddeus Morris, which of course means little, although around here the name carries weight. I am not the oldest man in the valley—the oldest is our preacher, Jubal Petersen—but I'm old enough. My fingers are cracked around the pen as I write, and lamp-light, fueled by finely rendered sheep fat, glows smoky and slack across these pages which are at your salvation. We do not want to harm you. We wish to be known as builders, not destroyers. We hope that you will be warned.

Allow me to show how life is with us, then tell the sad story of a terrible destruction which has caused us to be-

come troubled. First I must recount a bit of history.

Our ancestors came to this Pacific Northwest from upper New York State in the 1660's, following the Oregon Trail. They had strong leadership and holy purpose. From their very beginnings they called themselves the Sons of Noah. Their beliefs centered around the mistakes and sins of Noah after The Flood. They saw themselves as quiet people who would eventually reclaim the world through decent behavior and piety. Old claims kept by womenfolk told of that harsh trek of worn-out Conestogas, of privation, of dying deer, of Indian raiders.

Our people found coastal Oregon overpopulated. Trees fell before pioneer ambitions. Log houses some-

times stood no more than a thousand rods apart. Indians wearing neckties, or colorfully dyed cedar bark robes, clustered around settlements. They traded furs for guns and whiskey. The world seemed filled with heteroskeler. The leader in those days was a man named Aaron Schmidt. In prayers Schmidt received solace, and in dreams he received direction. There was a northwest valley he was told, avoided even by the Indians. In written records the harsh journey northward to the Olympic Peninsula is known as The Pilgrimage.

This valley finally lay revealed. It lies two thousand feet above sea level and above a mighty rain forest. Our pastures are vibrant and lush, and the darkness of this valley is a good thing. With more sun the pastures grow

would carry frenzy. A road now runs partway in, but the last two miles are corduroy road, suited only to coccarts.

These days we sell produce and cheese to merchants who monthly send trucks to fill head of the road. That original congregation arrived and first built a church and a graveyard. The long pilgrimage took its toll on older members, including Schmidt. The earliest grave markers were simple stones from the mountainside. To this day they sit as equal reminders of both among the multitude of carved markers. In a hundred years many are born, and many die.

The original congregation looked about in wonder. Grass grew lush, and a constant supply of pure water ran in Troublesome Creek. The valley spawned life. Our forefathers took two hundred-pound fish from the creeks, fish so bizarre that they seemed ahmost as creation. Fish with teeth like the canines of wolves. Fish with winglike fins—that when tanned became fine leather—and walking fish with appendages stiff as legs. Bear and cougar and elk shuffled and stalked and ran through the valley. Beaver and possum, weasels, foxes, and wolverine contested for food and life. Our people gave thanks



THE FISSURE HOLDS WATER AS OLD AS THE CREATION, WE DO NOT KNOW EVERYTHING THAT LIVES DOWN IN THERE.

in prayer, but they were also mystified. These days we have more knowledge, because we are not aware of new ideas. We learn a great deal, because we take in more of the world's coin than we can possibly spend. Our only purchases from that outside world are salt and books. We study books of today and books of the past. In this way we figure out our world.

Our valley sits atop a great fissure. When these mountains were created, the rock structure split, then tumbled back on itself. Beneath our feet lies a powerful lake. Troubleome Creek, which seldom runs more than forty feet wide, is also bottomless. Living water from melting snow in the mountains runs along the surface of the creek. It passes over water that may be two thousand feet deep, or more. The rock is impermeable. The entire fissure holds water as old as the original creation. We do not know everything that lives down there, but sometimes we get indications. It works this way.

Every seventh year the valley floods. There are biblical explanations for this, but none are scientific. As flood spreads across our fields we check our boats. Water does not often rise more than ten or twelve feet while our houses are twenty feet aboveground. Only twice in this century has water risen to cover the floors of our houses. In 1917 it rose to twenty-one feet. In 1945 it rose to twenty-three. Flood covers the graveyard like a protecting hand, and no grave is ever disturbed. Even the upright markers do not tilt. We have flatboats to carry our horses—oxen, cattle, sheep, fowl, and swine. Ordinarily we pass between houses and barns and church in rowboats. Water rises quickly. Flood replenishes the land, and the flood seems driven by a mind of its own. Waters flow then concentrate. Some years they may greatly enrich the Jensen acres, sometimes the Petersens' or other farms. The valley lies for forty days beneath flood, then the water slides away, down the mountains or into the fissure of Troubleome Creek.

The water level sometimes drops quickly. Huge shapes like across the fields, dashing back to the safety of deep water. Silver streaks intrude. They are flashes of light sparkling above the drowned pasture. When water drops too quickly strange fish are stranded in the fields, although there is a type of fish that is never stranded. The variety is fleet and many-colored, like shooting rainbows through the forest. These fish have nearly human eyes, but larger, seeing wider than do we. It is a busy time for our whole community. Men harness horses and oxen to huge mud sleds. The sleds skid to the

fields, and a process of selection begins. We try to protect the original creation. Those fishes still living get dumped back in the creek. Then the men use pitchforks to load the rest onto the sleds. There is no waste of the creation. Men dress out the fish and women dry them. We have never had seven lean years here but are prepared should they occur. Twice there have been fish that had to be towed by two oxen.

And so we live, living among the primal forces and original fury that brought this planet into being. Power grows. We walk beside great waters.

On Sundays, after services, we gather in front of Sons of Noah Church. The Andersens, the Jensens, Adems, Schmdis, and two dozen other families. Traditionally it is a time of quiet joy.

Beside the church, the churchyard with its grave-stones, becomes a living presence. Our ancestors lie at our very elbows, so to speak. Children, who have learned to sit patiently through morning services, romp among the graves. They are like flitting butterflies, brightly colored, dancing in games of hide-and-seek behind tombstones. We talk among ourselves the way our people have sought truth since the 1860's. We used to discuss crops and ideas. Unhappy I am to report that these days we are forced to speak of power.

A demonic world presses close. Aircraft sometimes pass overhead, where once passed only the birds of the air. More beasts of the field, deer and elk and wolves, are driven to our high valley as a demonic world logs the rain forest. We are careful in our speech. "We do not command these waters. To think we command is the sin of pride." Our preacher, Jubel Peterson, says this. He was once a man of immense strength, and even in his age he still drives oxen. His shoulders are square, and his hair is a cloud of white above a high and furrowed brow. The children play here and there young wives and husbands whisper together. One girl's waist has grown, in a few months there will be both hands chattering. The generations are intact.

Men stand in silence, waiting for the spirit of truth to guide their words. We are not a hasty people. The men are fair of face. Their suits are subdued colors of gray, blue, brown. Work-hardened hands hang restful at their sides. The men stand like protecting trees of the mountain forests.

"Do we serve at the threshold of divine power?" one says. His name is Lars Landstrup; his father was Eric, his grandfather was Swen. Lars' strength is great, and of all of us, he works most about right and wrong. "May-



WHEN THE WATER DROPS TOO QUICKLY, VERY STRANGE FISH ARE STRANDED. THESE FISH HAVE NEARLY HUMAN EYES.

For those years of highest wa-

be," he says thoughtfully, "we protect the creation."

"The waters protect us," a woman murmurs. Mercy Adams is a grandmother now, but there is that about her which recalls the beauty of her youth. If our women have a leader, then surely Mercy leads. "We are in delicate balance," she says. She glances toward the younger woman, toward the young wife who is with child.

The graveyard lies silent except for children's play. Our women stand like flowers. They dress in gowns showing the many colors of natural dyes. Above the graveyard the steeple rises like a benediction.

"Our cause is just," another woman murmurs.

"We do none of this for gain," a man says. "We are not engaged in spurious adventures."

Our disputations rise because some men from that outside world are most hideously dead. We fear that we had a hand in matters. We do not yet question the tenets of our faith, but clearly something is ake. Our ancestors believed that their quiet ways and piety would overcome the world. They believed in the power of reverence, not the power of force.

And yet great forces aid us. Power accumulates. I must now record the manner of those terrible deaths.



OUR CAUSE IS JUST. OUR DIS- PUTATIONS ARISE BECAUSE SOME MEN FROM THE OUTSIDE WORLD ARE MOST HIDEOUSLY DEAD.

We did not immediately understand that the man was insane. Perhaps we might have helped him. One cannot hate the means, only pity them. At the same time, however, if a wolvenote gets loose in your streets, then it must be contained.

On an April morning last year, when sun glowed like a blessed spirit through mountain mist, the solitary figure of a man appeared at the head of the road. His outfit exceeded his need. Perhaps such waste should have warned us. He wore wool knickers, tall boots with much lacing, and a down parka quilted like a sleeping bag. He rolled pack aside on heavy shoulders, a pack filled with enough implements and supplies to last—if he knew what he was doing—for many months in the forest wilderness. Yet he had only hiked in two miles from the paved road where he left his truck.

And the truck itself was another mark of insanity, had we been clever enough to read its meaning. One of our sons who has been outside described it as an all-terrain vehicle. The truck proved capable of driving over rough country but was too small to haul anything. We thought it rather silly.

We have always welcomed our few visitors to this valley. We've hoped they would feel the serenity of this place and thus learn to be serene. Our message of piety would go with them when they returned to the outside world.

The man was bluff but friendly. At the same time, he at first spoke to us as if we were children. He was a man

accustomed to commanding others. In the grand illusion of his power he regarded us as simple, ignorant folk. We have had other visitors who thought us simpleminded. We always tolerate their pride, knowing they will leave.

For three days he camped at the head of the valley. The Jensen family invited him to supper and offered him a bed in the large room used by their sons. The man—Hamilton—"Joe Hamilton to my friends," he said—took supper but refused the bed. He pitched his tent at the far edge of Jensen's western pasture. The tent stood as a glowing spot of unnatural blue among the gray-and-blue mist of our valley. Hamilton spent three days walking the lower reaches of the mountains. In April, scour-

ingsome Creek runs swift from melting snows. People who live at the far end of the valley carry goods to market on rafts.

On Sunday Hamilton attended church. He joined in hymns, singing in a strained and nearly boyish voice that was most unlike his speaking voice. We know now that either eagerness or tension pinched his song. We enjoyed his presence, thinking him a willing and possibly able man. We have never, in this century, had a convert.

After services matters took an unsettling turn. We stood in groups after church. Muted sunlight casted pale shadows behind gravestones. Muted breezes touched spring grass around graves where tulips grew in thick patches of yellow and red. A few crocus remained. Hamilton stood among Landslups and Jensens, as our minister Jubal Petasen approached. Hamilton's voice did not carry. He seemed trying to cooperate with the quiet of Sunday service but was awkward with quietness. His large shoulders huddled inside the down jacket. We thought him shy, not manipulative.

"This must be the most peaceful place in the world," he said to Lars. "Although you work very hard." His face was roundish, like a pairing of a Dutch sea captain. Blond hair receded above a high forehead. His lips were thick, his speech precise. His large hands were unmarked and carried no callus. The high-boled boots shone with mink oil. He was somehow aggressive, although he seemed shy.

"Tibet," Lars said. "I expect Tibetan monasteries are the most peaceful places in the world. We could probably learn something from them."

"I have means," Hamilton murmured. "What a convenience it would be if this valley had a water system." He said this with a straight face, and we tried to receive it with straight faces. "For the convenience," he said.

"Troublesome Greek is convenient," Lars told him. "That's why we live beside it."

For sanitation purposes.

"Our people solved those problems a hundred years ago," Jubal Peterson joined the group. He looked uneasily toward the graveyard, then toward hitchhiking trails where hollows stood waiting to pull wagons home. Children ran among the horses, clambered over wagons and comages. They laughed and shouted after being freed from Sunday sermons, but on the Sunday they did not go near the graveyard.

"Perhaps a stranger might come to belong here," Hamilton said quietly. "If he required no land and paid his way."

It was a strange statement. It would be difficult to pay one's way around here without working the land. Even our minister is a farmer who earns his family's keep.

"It would make life easier," he said, "if your roads were paved." He looked at the creek and the swamps. "A man could build flatboats engaged with a drive on each end. It would be easier to get to church." His voice did not conceal a sort of boyish excitement. Nor did it conceal the notion that he wished to show us his version of salvation. We've heard it all before. Bring burdens to the head of the road. Install electric plants. Bring in oil, gasoline, fire engines, tractors, flush toilets, chain saws. Life would be easy then. Joyful. We've heard it from visitors, and

occasionally even from our sons who have just returned. After our acre have been home for a year or two, they regain their senses. Still, we had never heard it said with the missionary zeal of Hamilton. He spoke with the fervency of a disciple of "progress." His fingers tap, tap, tapped at air as he attempted to drive home his points.

"It is true that we work hard," Lars told him. "Whether it's a virtue or not, hard work is the price we pay for the peacefulness you admire." Lars also looked uneasily toward the graveyard. He was a head shorter than Hamilton but he seemed as tall. He has the blue eyes and thin lips of a Dane, but his voice is always gentle. "You've been here for three days," he said, "and you've heard no sounds of arginine. Luten." Children's voices tinkled joyfully across Sunday silence. Above the mist a hawk circled, and the faded shadow of the hawk sat across fields. The liquid murmur of Troublesome Creek blended beneath the far-off crowing of a cock. Horses snuffled, shifted in lightly crackling harness. From the Peterson place a new calf bawled for its mother.

And then silence deepened. For moments none of the voices of children seemed muted. From the graveyard came a lack of sound that we had never heard before. The best description

would say that it was active silence. Always before our forefathers have lain passive and tranquil. Their message to us is a message of faith.

Jubal Peterson looked at Lars, then at Hamilton. If the rest of us heard only active silence, it may be that Jubal heard more. "Of all the sins available," he said to Hamilton, "perhaps the sin of pride is most dangerous. Zealousness is often a form of pride." His voice was kind but firm. "We are aware of something happening here that you are not. I must accuse myself." Jubal turned to the churchyard and walked slowly among the graves. We stood in wonder. Our minister was obviously consulting with the dead. His dark-suited figure moved easily and he occasionally murmured as if answering questions. At first his wrinkled face showed sadness and then a sort of fear. Jubal is not a man to fear anything, and he deprecably would not fear our dead.

When he returned he spoke quietly, first to us, and then to Hamilton. "Do not underestimate the eternal power of the human spirit," he told us. To Lars he said, "There's a mystery here, and what I've just said has nothing to do with pride." To Hamilton he said, "You are welcome as a guest. Confide yourself to being a guest. If you do that, all will be well."

He raised his hand, not to bless us but to dismiss us. There was plenty of wretched talk among the families during the ride home, and during the following week.

During that week madness overcame Hamilton. To his credit he tried to remain respectful, yet his insanity compelled him toward destruction. It seemed that because he had the power to change things, he could not deny use of the power. We forgive him because of his insanity, but we do not forgive the power that corrupted him.

On Monday morning he folded his tent and disappeared down the road to the outside world. We supposed we were safe of him and were greatly relieved. At the same time we felt loss. Had the man remained among us for a few months, his urgency would have faded. A good, strong man is never a burden. We knew he was ambitious, but we did not know that in the world's terms he was not.

On Friday the distant sound of truck engines came fairly across fields nearest the head of the road. Shortly afterward we heard the chug, chug, rattle of a helicopter, and we looked toward the pass where Troublesome Creek begins its slide down the mountain in its rush to the sea. A large silver box hung beneath the helicopter. It proved to be a

house trailer. One of the Jorgensen men started to investigate.

He found Hamilton consulting with surveyors, workmen, and an engineer. The house trailer sat on an ledge and was used as a field office. The men evidently set to work. Though hard to believe, they wore hard hats as they climbed along the mountainside at the head of the road. Ancient trees have not survived at that elevation because warm winds sometimes blow in winter. There are misty avalanches. Orange hard hats moved through the light green branches, and surveyors broke or cut young trees to take sights. The crest of a small stream saw etched like a stream of curses.

April is a busy time. Work continued in the fields, but at our backs we felt Troublesome Creek surm from rapid flow to unbridled violence. Waters rolled as dark shapes moved just beneath the surface. Occasionally huge blackleaf trees hovered in the sunlight, then disappeared. This was not a seventh year, a year of flood. Yet Troublesome Creek gawk active. Against our storm we quit work two hours before dark. After supper everyone assembled at Sons of Danish Church.

Families lingered before the church. Soon we would climb the many steps to the church, but at first it seemed nec-

essary to remain clustered before the churchyard. If our ancestors had a say in this matter, as we reverently hoped, we wanted ears that would hear.

What we heard caused a strange combination of emotions. We were both comforted and made to fear, although we feared not for ourselves.

It is hard to say whether the voices come from the graves or from Troublesome Creek. The murmuring was vast as if it rose from creek and fields, from barns, eels, grasses as if it rose with controlled anger from sloping sides of mountains, from the steeples of the church, from the delirious fly. Power rose amid murmurs of prayer, a power fantastic, a power that was fabulous.

In our quiet lives there is no equation for such power. There can only be sin in such power. We did not know what we had brought. The voices assured us that all would be well. The voices were serene with power.

We entered our church. There are many stories and a railed balcony. One of our some says it reminds him of a ship's bridge. The church is thoughtfully made, with clear windows that allow starlight and starlight.

"You must tell us everything the man said," Jubal talked to Billy Jorgensen, who I forget is still answered. But who can already do a man's work. Billy will



1991. For the priest.

soon be known as William and will take his place among our men.

Mr. Hamilton has a plan," Billy said quietly. "He schemes a special kind of lodge. I told him about avalanche. He talked about retaining walls."

I am compelled to report that a spirit of fierce and possessive pride overtook our congregation. We watched Billy listened to his straightforward speech, and each of us no doubt thought of him as our son.

"He plans to sell peace," Billy told us. Noble thought. But peace cannot be sold, only earned. It developed that Hamilton would treat our way of life as a commodity.

He would build a lodge for the use of those who suffer too much time. It would be a haven for politicians and generals and movie stars—a place where guests registered only by their first names. He would build a lodge where if one guest recognized another, it would be the height of discourtesy to acknowledge the other's name—a place where those who suffered little might retreat and for a while become anonymous.

"He means it as a compliment," Billy said. "At least he told me that."

Any man or woman even reasonably sane would understand that Hamilton's plan was a deadly insult. However, insult was not the threat. We have han-

dled insults and misunderstanding since the 1880's.

"He will change what he touches. We must reason with him. Lars is slow to anger, but should he ever turn to anger it would show itself as cold and deliberate fury.

People spoke quickly, agitated, and younger men urged action. Beyond darkened windows wind carried a quick storm of mist, like mighty clouds sweeping the valley. Candles flanked the altar and stood in torches beside the aisle. We suddenly felt small and helpless, but not hopeless before the ambitions of Hamilton. A torrent of rain began to walk the valley, and rain drummed on the roof of the church. The voice of Troublesome Creek deepened. Storms pounded, throwing gales of wind like cannon. We knew what was happening in all the streams and tributaries of the mountains.

"Hamilton and his dreams are removed from our hands," Jubal said, and he was sad. "He is delivered unto other hands." For a moment Jubal looked tenderly at his congregation.

"We have lived beside the forces of creation," he said, "and we have underestimated them. We thought, no doubt, that because we are patient, they are patient as well. See to your basins and your boats. Dawn will light over raggy waters?" Our lanterns gave light unto

our feet as we brought basins to the barra, and yet we were aided by powerful forces. We are accustomed to rain, but on this night where we traveled—to barns, fields, storage sheds—rain only feathered around us. Our swinging lanterns were washed by mist, while everywhere beyond us in the fields and mountains, rain pounded like the tramp card of heaven.

A clear dawn displayed our well-washed valley where Troublesome Creek ran boiling. Before we ever lifted our eyes toward the end of the valley we knew that the laws of nature were set aside by nature's God. Troublesome Creek stood three feet above its banks, but it did not flood beyond the banks. It ran like a compressed rod of water standing above the surface of the ground. Great fishes streaked flashes of light. Some of the fishes were dark, but others were cast in lustrous colors. Through the years there are more fishes with nearly human eyes. These now dominated the waters. They basked, dove, then rose to crest in sunlight.

At the end of the valley the creek no longer discharged down the mountain. It built higher and higher, the voice of water like the sounds of thunder. It rose, as though an ocean were being upended. The turmoil of water echoed the surf. The flood rose as if the great fishes themselves pushed the water, and we could not distinguish crashing waves from the flash of silvery backs. The waters surged here, there, rose and fell in a grand orchestration. The waters sped according to their own designs, or on the commands of unbreachable power. Water sealed the entrance to the valley, and it steadily rose toward Hamilton's camp. The trucks and house trailer were red and silver dots among the trees, and the wall of water reached forth. Voices sounded in the distance, but they were not the voices of Hamilton and his men. These voices were anecdotal. They were commanding but serene. They directed the waters, wife above the waters, sea eagles screamed dove, but the air rose high, only to again dive toward Hamilton's camp, where lightened men scampered like mice.

We clustered beside our church as our young men unhitched horses from carriages, preparing to ride in an attempt to aid Hamilton. They yelled to each other, and they planned to cast ropes by which men might be drawn to salvation. Our men were desperate in their godly aim of saving lives.

Jubal stood among us, our rock about which the stream of life swirls. He listened more than he watched, but he also watched our men. "Useless," he muttered, "but of course they must try." He turned to a group of us. "This is not about one man with shabby dreams,"



"I happen to take immeasurable pride in the work I make others do."

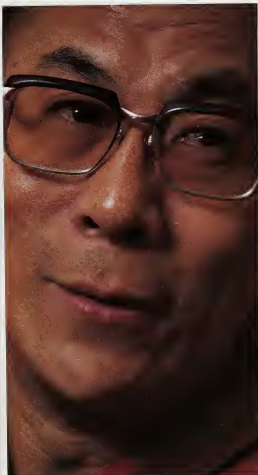
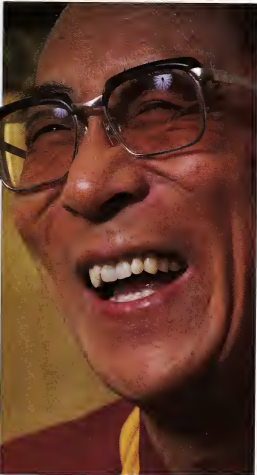
ARTICLE

DALAI LAMA:
HIS RESOLUTIONS

BY KETH HARARY

Those who call themselves holy men often seem intent on producing the credulous and ending up somewhere like Jonestown with the Reverend Jim Jones and the People's Temple. Typically charlatans, if not self-deluded seekers of money and power, or worse, self-styled holy men spoon out a dose of superficial asceticism a little less than their attitude and a deeper philosophy passing itself off as the kind of ancient wisdom that Sam Janke offered visitors to Shangri-La in the film *Lost Horizon*. Tibet's Dalai Lama, however, is not a self-proclaimed holy man. He is a spiritual and political leader of lifelong experience.

Recipient of the 1989 Nobel prize for peace and the "god-king" of more than 6 million Tibetan Buddhists, the Dalai Lama surrounds himself with none of the material trappings of a man whose followers would no doubt willingly provide every comfort a leader of his stature might desire. In the age of supersonic transports and jet-set seminars on "higher consciousness," the Dalai Lama still refuses to fly first class, his personal quarters, specially built for him at the Buddhist Learning Center in Westington, New Jersey, are no more cozy or extravagant than the average parson's home. Far from being claustrophobic, his perspective on science and technology, religion, politics, and the state of the global environment seems more appropriate



**IT MAY
BE HELPFUL TO
LOOK
DEEPER INTO
HUMAN
NATURE. THEN
WE CAN
COMMUNICATE
BETTER**

to the twenty-first century than the world today.

"Consider me your old friend," he tells a group of American executives. Gmiller tried to meet him in a room decorated with Buddhist tapestries and purchased by Western suits and leas. The monk was dressed in red and yellow robes and rubber sandals. The warmth radiating from his eyes was disarming, yet engaging. The lines around his mouth were those of a man who doesn't accustomed to smiling easily.

"Although we are meeting for the first time," he continues, "it may be helpful to look deeper into our human nature and ignore our complicated differences. At that level, we can communicate more easily."

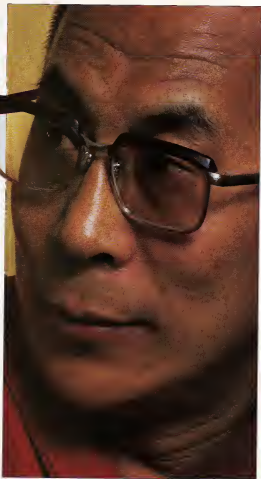
Like the Dalai Lama, I led me by the hand into a private meeting room in his personal quarters. It did indeed seem as though we might be old friends. He made time where none had previously existed in his busy schedule to talk with someone who had traveled overnight from California to meet him. As I click-trying not to make it appear intrusive, he leaned over and took the device from my hands, then held it himself to make things easier. Such unpretentious acts of courtesy express the character and humility of the Dalai Lama.

With only a decade remaining before the dawn of a new millennium, the Dalai Lama was eager to share his list of resolutions the world should consider making for the twenty-first

**MATERIAL
DEVELOPMENTS
WILL BE
MORE USEFUL
IF WE
FOCUS ON OUR
INNER
AND OUTER
NEEDS**

century. He began by suggesting that we balance the drive for material, scientific and technological progress with a focus on satisfying the basic psychological and social needs of the human spirit. "We are heavily dependent upon science and technology," the Dalai Lama says. "But if we pay attention only to material progress, without also developing an inner focus, it will inevitably lead to frustration and dissatisfaction. Even material developments will become more useful if we focus on both our inner and outer needs. The two realms need to be better combined in the way we live in the future."

- Develop a sense of responsibility toward the environment that transcends national boundaries. "In previous times, from village to village—let alone from nation to nation—people lived quite independently of one another. In those times, when great teachers spoke of the need to develop a sense of universal responsibility, people might have said, 'That sounds good, but it is not truly necessary.' Today, because of the global economic and environmental situation, and the population explosion, we are in a completely different situation. The destruction of the ozone layer and other environmental concerns are beyond the limited concerns of individual nations. One or two nations alone cannot solve these problems unless all humanity puts forth some



common effort. The situation in which we now find ourselves is itself telling us that some kind of genuine transformation in our official outlook is necessary.

- Develop alternative means to war for resolving conflicts and global economic problems. In spite of the fact that human beings do not, I think, prefer bloodshed, war has somehow always happened. In previous times, you might possibly win. Today if something happens leading to the use of nuclear weapons, no one would win. Destructive power has become so immense that the result of global war is almost unimagable.

The situation compels us to develop new ways of thinking. In Europe, for example, we have seen how every nation cherishes its own sovereignty. Many Eastern European countries have watched their Communist economic systems collapse. And within the next five to ten years, I also feel that a big change will occur in China. The modern economic system now requires nations to work together and be prepared to sacrifice certain elements of sovereignty in exchange for greater collective economic strength. Humanity must work more cooperatively and harmoniously if we are to survive.

- Introduce humanitarian values like compassion and kindness into the educational curriculum. "We can improve our external circumstances by over-

ing our basic human nature, which I believe is compassionate. If we make some effort to properly educate the younger generation, we can have a better human society. When people talk about kindness, compassion, tolerance and forgiveness, there usually is a misconception that these humanitarian values are some sort of religious ideals. If someone were to develop these values or begin to appreciate their importance, it might appear as though this person were suddenly taking an interest in religion. People who are not interested in religion might get the impression that they do not need to bother about these values at all. At birth, we are free of religion but not from compassion, even though we don't understand the concept of God. Religious faith is a luxury. You can survive without it. Kindness, compassion, tolerance and forgiveness, however, are a question of necessity of survival. So it is important to teach these to children. Presentation of their importance should not be made as though they are religious values, but as basic humanitarian values essential for our survival.

- Develop a sense of responsibility toward future generations. The present generation has a heavy responsibility to future generations. The Western attitude places too much emphasis on facts and figures, so that when we talk about fu-


ture generations it is as though we are talking about something that is yet to come, something that is not yet tangible. Because of this outlook, there is an unconscious neglect of the well-being of future generations.

- Place less emphasis on narrow specializations and more on the relationship between them and their long-term impact on the well-being of humanity as a whole. Specialists in a given area often cannot see the whole picture, all the connections, and do not realize their own responsibility in the equation. They seem to have an unconscious attitude that perhaps they will not personally see the repercussions and impact of progress on other areas of human life. And even if they do see it, they may not consider it their responsibility to resolve the problems their technologies may create. They simply pursue their own narrow interests and continue to achieve greater progress. Those scientists and technologists who create nuclear weapons and neutron bombs, for example, view them as great achievements. It is almost as though the negative impact somehow isn't obvious.

In any professional group, it is always vital to take into account the basic element of human feeling and try to be of service to humankind. Even religious and spiritual practices cannot be separated from the element of basic feeling for the whole of humanity. Otherwise, religion can also become a potential source of conflict and suffering.

- In responding to crises, study the basic underlying causes, rather than simply trying to find solutions that produce immediate results. "When we are confronted with a crisis, most people avoid dealing with the events or causes that led up to it. We see this even in the case of governments and organizations. But if you have a lot of sores on your body and treat them individually without treating the whole body and working on the underlying cause, those sores will simply pop up on another part of the body and you will not be able to get rid of them."

- Develop a sense of greater responsibility toward the needs of the less fortunate. In order to make further progress, we have to keep pursuing our natural drive to create. We must realize, however, that while some people are living in luxury and are selfishly wasteful, others on the same planet are facing starvation and disease. We are not morally responsible for ourselves but for the entirety of humanity.

The best approach would be to develop a balance between inner progress and creativity with responsibility for our fellow human beings. The approach, of course, will differ from person to person, depending on the individual's abilities and opportunities to help alleviate human suffering. 





ANTIMATTER

REMEMBERING ROGO:

The spirit of parapsychologist D. Scott Rogo, who thought the soul might survive bodily death, is with us still

The first time parapsychologist D. Scott Rogo called me, I gave him a hard time. I knew he had coauthored *Phone Calls From the Dead*, so I asked him for proof that he was alive, saying that I didn't want to waste my time talking to a deadhead. "Listen," he said, and hummed a few bars of "Ode to Joy." Then he quoted Woody Allen: "It's impossible to experience one's own death objectively and still carry a tune." We both laughed. I laid Scott right away and we struck up a professional friendship that spanned more than a decade.

Our conversations turned into a series of debates about life after death. Scott took a hard-line position: that the soul survives bodily death. His evidence: a veritable library of cases of mediums, ghosts, reincarnation, and near-death experiences (NDEs). Many of the cases were documented in the numerous articles he wrote, but the more intriguing ones were told in hushed tones over dinner or in the privacy of his library, where I sometimes worked. Surrounded by floor-to-ceiling shelves of books on the afterlife, I struggled to maintain my skepticism.

I argued that visions of the hereafter are really hallucinations. Come to the UCLA hospital, I told Scott, and I'll show you. He observed a session in which one of my research subjects was given the anesthetic drug ketamine. The subject reported an NDE, complete with an out-of-body experience, a tunnel, white light, and heavenly visions. Subsequently Scott published a paper, "Metamorphosis and the NDE," in which he retreated just a little from the survival position.

We started to share cases. My style was controlled experimentation; he was investigative journalism. It was a good match. I conducted exhaustive tests on the subjects at UCLA's Neuropsychiatric Institute, while Scott interviewed their families and friends. The case that brought him closest to the skeptics' camp concerned a middle-



aged woman. It called Gail. Gail suffered complications during major surgery and stopped breathing for several minutes. She reported an NDE with a unique twist. After leaving her body and floating over the operating table, she was whisked away by an alien spacecraft!

The most unusual aspect of Gail's story was that she told it in detailed, well-crafted phrases and sentences that Scott found uncannily familiar. When he went to her house to interview her roommate, he discov-

ered the reason why. She had a collection of his books with descriptions of NDEs and UFO abductions underlined! Scott was outraged. He confronted her, and after two hours Gail tearfully confessed that she had made up the story for attention. She never knew that the person getting her was the author of her own report.

By the time Scott wrote *Life After Death* (1996), he was no longer a true believer. His investigators had persuaded him that many NDEs could be explained in terms of hallucinations or outright fantasy. "These lines of skeptical inquiry have certainly not robbed these phenomena of their importance," he wrote, "but they suggest that we should keep our skepticism well fortified." His writings in *Qeios* were proof that he followed his own advice.

One of the things I liked most about Scott was that he always kept his word. When I asked him if anyone had ever received a fax from the dead, he said it should be possible and he promised to look into it. A few days later, on August '96, Scott was stabbed to death by an unknown assailant in his Northridge, California, home. He was forty. He never got a chance to answer my question or to finish his new book on benevolent hallucinations.

Rax us, Scotty. We miss you —RONALD K. SEGEF

Ronald K. Siegel is a psychopharmacologist at UCLA and author of a forthcoming book on hallucinations.



ANTIMATTER



INTERGALACTIC BUGS

Astronomers have spent years watching the heavens for radio messages from extraterrestrials. But now Joe Davis, an artist at MIT's Center for Advanced Visual Studies, says he has a better way. His project, called Micro-Venus, involves putting encoded messages in the DNA of a hardy strain of bacteria, which could duplicate and spread throughout the galaxy—hopefully for

generals from Harvard and the University of California, Berkeley, has synthesized a short sequence of DNA consisting of 47 base pairs with a brief coded message. (When converted to a grid of binary digits, the message becomes a sketch of the female genitalia.) At last count, Davis and Boyd had generated about 100 million copies of this message, which they stored in a vial.

Davis and Boyd are not of course, seriously planning to disperse bacterial spores throughout the galaxy.

Right now it's just something to think about and talk about," Boyd says.

The next stage will be to draft a much longer coded message consisting of 2,000 base pairs, but no one yet knows what it will say.

"Maybe the ideal message is to install the human genome itself within the bacteria," Davis says... "That may be the only practical way for humans to explore the cosmos."

DNA MESSAGES ENCODED IN A HARDY STRAIN OF BACTERIA COULD DUPLICATE AND SPREAD THROUGHOUT THE GALAXY—HOPEFULLY FOR CLEVER E.T.'S TO INTERCEPT AND DECIPHER.

clever extraterrestrials to decipher. The bacteria would survive a billion years, Davis declares, producing hundreds of billions of additional copies every couple of hours.

Believe it or not, Micro-Venus is already in the works. The artist's collaborator, Dana Boyd, a

The exercise has prompted Davis and colleagues to wonder whether some alien civilization might have already gone through this process—in other words, whether there might be a message sitting in our own genes, waiting for someone smart enough to figure it out.

—Steve Nadis

BIGFOOT IN CHINA

For years reports of a Bigfoot-like creature—called a Yeti or a wildman—have filtered out of China. But rumors of the hairy, bipedal, seven-toot-tail critter have generally received little credence—until now. This past spring a couple of American researchers filming a television documentary in Asia claimed they found the first real evidence that an undiscovered higher primate actually exists.

The new evidence, says Ohio State University anthropologist Frank Poirier, consists of hair samples from an unknown higher primate possibly living in central China.

According to Poirier, Chinese researchers studied the hairs in three ways. They analyzed the curl structure, discovering distinctive scales; they found special hair filaments with a microscope; and they discovered a unique ratio of iron to zinc, which often varies from one species to the next.

J. Richard Greenwell, secretary of the International Society of Cryptozoology, says, "The hairs were of a higher primate, but not human nor from any other known primate." The people conducting the tests, Greenwell adds, are "real scientists, entrusted with multimillion-dollar equipment and trained in the United States."

But not everyone believed the evidence will stand. Rana Delinden, a 30-year veteran in the search for Bigfoot, says that although many researchers have found supposed Bigfoot hair samples in the United States, no one has ever identified any of it. "A multitude of animals have hair," he says. "It could be impossible to prove the source of an unknown hair sample for sure."

Yet Greenwell and Poirier believe that the Chinese wildman may eventually be found. "Most of the country is desolate, remote, and mountainous," Greenwell explains. "The mountains are incredible, some rise at eighty-degree angles with vegetation literally growing sideways off the slopes. There could be thousands of wildmen in there and we would never know it."

—Michael R. Dennett





MYSTERY BOMBER

Broward County deputy sheriff Bob Lester was piloting a helicopter over Florida's Everglades, west of Fort Lauderdale, in the aftermath of a fire. As he scanned the scorched swamp, he noticed a small aircraft in the muck below. A search team soon discovered its identity: a T-ones TBM Avenger that had been hidden for 40-odd years. Could the plane have been part of the legendary flight 19, whose five torpedo bombers mysteriously disappeared after taking off from the naval base at Fort Lauderdale in 1945?

To find out, Lester asked former combat pilot Jon Myhre, who had been researching the fate of flight 19 for seven years. Visiting the crash site, Myhre and Lester found the remains of the plane's engine, wings, landing gear, and fuselage. "No bodies were found, though. A forensic expert said that they are probably under the ground in the mud," Myhre notes. "This was not a survivable crash."

The searchers did find a piece of rusted metal containing a number beginning with 41. If it was the plane's Navy bureau number, Myhre points out, then it wasn't even close to the numbers assigned to the missing flight 19 planes. "There's no question that it's a TBM and it has probably been sitting out there since the mid-Forties," he says. "But I'm positive that this particular sample wasn't part of flight 19."

What was the plane's

END OF AN ERA

Exactly 20 years after its birth, the Parapsychology Review is no more. One of the longest-running and most respected publications in the field, this bimonthly magazine of the Parapsychology Foundation in New York City came to an end this past spring. Faced with a serious decline in the funds available for parapsychology research, the foundation will now devote itself strictly to

workshops and psychokinesis. In 1970, says Coly, the foundation launched the *Parapsychology Review* "as a middle ground between hard-core research journals and ghost story collections such as *Fate* magazine." The review typically included philosophical discussions, book reviews, news bits, and descriptions of conferences.

The decision to stop publishing was prompted, says Coly, by reduced worldwide support for research. "Parapsychology has gotten a bad rap because of all the *whuh!* TV shows, movies, and Shirley MacLaine cocktail party talk," says Coly. "People have a lame idea that it's not a clear-cut science."

One of the few granting organizations in parapsychology (giving as much as \$50,000 in support annually), the foundation felt a responsibility to increasingly do this work. "You want money to go where it's most useful," says Coly. "If there's no money for research, the field won't progress." —Mark Tech

COULD THE PLANE HAVE BEEN PART OF THE LEGENDARY FLIGHT 19, WHOSE FIVE TORPEDO BOMBERS MYSTERIOUSLY DISAPPEARED AFTER TAKING OFF FROM FORT LAUDERDALE IN 1945?

origin? "We are pretty sure it came out of Fort Lauderdale because that was the training base for these planes," Myhre notes. "But no one knows yet who was flying it or when it crashed." He hopes to salvage the engine and use its block number to trace the history of the plane — Sherry Baker

supporting scientists working in the field.

Since 1961, explains vice president Luella Coly, the privately endowed foundation has financially supported "rational, impartial scientific research into the psychical aspects of human behavior," including telepathy, precognition, clair-



ANTIMATTER

FATAL VISIONS

If you've recently had psychic visions about a crime, you might think twice before calling the cops.

Tammy Bradley, now in an Alabama prison for murder, was convicted after he voluntarily came forward with "spiritual visions" of the slaying. According to police, he gave them details that only the killer could have known. He knew, for example, that the victim's driver's license had been burned and that she had been reading a James Michener novel. He also led police to where the stabbing had taken place and where the body had been found. None of this information had ever been made public.

At the trial, prosecutors presented one witness who had seen Bradley with the victim shortly before her death. Otherwise the evidence—while considerable—was circumstantial. "A jury might be able to explain one circumstance, maybe two or three. But the amount of circumstantial evidence in this case could not be explained except by the guilty decision," says prosecutor Teresa Tanner Pugh.

Bradley's vision, however, was the linchpin of the evidence. And that, according to San Francisco psychologist Keith Harary, who testified on Bradley's behalf, is a problem.

"The cops viewed Bradley's statement as a confession," Harary explains. "But Bradley said he was reporting a psychic vision. It shouldn't be

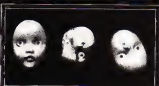
admissible evidence. Otherwise you're saying it's okay to use someone's internal experience to send him away. It sets a dangerous constitutional precedent if you have sufficient other evidence, it ought to stand on its own merits."

Harary points out that many good samaritans call the police with what they believe are psychic tips on crimes. On occasion, such information has been uncannily accurate. "Now these people will be up for grabs," Harary says. "The whole business could set us back to the Salem witch trials."

Bradley's attorney, Bill M. Dawson, has recently filed an appeal, hoping to either win a retrial or have Bradley released outright. Meanwhile, Harary warns prospective samaritans, "never call the police cold with your mental image of a crime. The risks are too great."

—Mark Teach

GOOD SAMARITANS SOMETIMES CALL POLICE WITH WHAT THEY SAY ARE PSYCHIC TIPS ON CRIMES. ON OCCASION SUCH INFORMATION HAS BEEN UNCANNILY ACCURATE. BUT NOW THESE SAMARITANS MAY BE ACCUSED OF THE CRIMES THEMSELVES. THEIR INTERNAL EXPERIENCE MAY BE USED TO CONVICT THEM AND SEND THEM AWAY



MOON BABIES

While a college student at Northwestern University in 1964, Roy Conklin was studying Lake Michigan's rocky beach when he noticed a tiny face staring at him from the gravel. Assuming it was part of a broken doll, Conklin gave the curved face away. But when he mentioned the find to his grandfather, he was told that the artifact was tangible evidence of a story the older man had been telling his grandson for years—that an ancient American Indian civilization had once thrived on the land currently occupied by Lake Michigan.

Last year Conklin returned to the site in Evanston, Illinois, and found three more faces. He also discovered that several children in the area had collected more than 50 of what locals call moon babies. The faces, which are about an inch wide, are all different. "Some have colored stones in the eyes," jade, amethysts, emeralds. One has a golden pyramid on its left temple,

and another has a black X over the face," Conklin says. "Most of them have chubbier faces, but I've seen a wolverine and a cat woman, too."

Conklin points out that the faces remained hidden until 1942, when the U.S. Navy used Lake Michigan for training maneuvers and hurled depth charges into the waters. The explosives, Conklin theorizes, must have loosened the faces from the lake's bottom, where, he believes, they had been hidden for tens of thousands of years.

But University of New Orleans history professor William Stetson says there's no evidence to back up Conklin's idea. "If there had been a high civilization in the Americas, you would expect to find more than isolated finds; there should be evidence of settlements, trade, and more extensive remains. It's difficult to imagine that everything would get buried under Lake Michigan and there would be no other artifacts around except these faces."

—Sherry Baker

The Artist

© ART CUMINGS

Who called
him ?!

The world
is paralyzed
with prejudice

We need a brain
not some clown
with a pencil



Hallelujah !

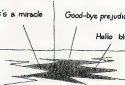
It's a miracle

Good-bye prejudice

Hallo bliss !

Once I realized
everyone looks
the same
in the dark -

the rest
was
easy



INTERNAL

CLIPPING FROM PINKETV

The Gore-Tex had worked better than they dared hope. As expected some of the rat's blood vessels had attached themselves to the tiny ball of synthetic fibers. But the fibers had also sprouted a new cablelike structure bearing an uncanny resemblance to an umbilical cord, nourished by the nearest network of healthy blood vessels—in the case, these branching from the rat's liver. The growing mass now resembled an embryonic organ before it assumes a specialized function—complete with the various kinds of structural cells it would need to mature into a distinct form: endothelial cells that line body cavities, smooth muscle cells, membrane-covering mesothelial cells, even nerve-like fibers. Around the mass the scientists found nascent capillaries, arteries, veins, and lymphatic vessels. Thompson dubbed it an organoid.

How did it happen? The growth factor remained active in the rat's body for just 24 hours. Apparently that was long enough for the HBGF 1 to ingrow cells that in turn colonized the implant and released their own growth signals. This mysterious communication between growth factor and cells, says

Thompson, holds the key to regeneration. "Once it started the organ formation process just kept on going on its own," he says. But the team still needed the opinion of a pathologist. They prepared a group of Gore-Tex implants, some coated with HBGF-1 and some not placed them in rats and sent the animals to Boston University pathology professor Christian Haudenschild for evaluation. "In every case where the growth factor was used—and in only three cases—I found organoids with healthy new blood vessels," says Dr. Haudenschild.

Now the scientists had to find out how well the HBGF 1 implants would work as a delivery system for altered genes. If they could feed genes into the organoids and get them to flourish, Thompson reasoned, they might eventually be able to signal the embryonic cells to mature into specific combinations of specialized cells and manufacture functioning organs.

Working as a unit, Thompson, Anderson, Maczaj, and Haudenschild stimulated the development of organoids in 12 chronically jaundiced rats lacking the gene needed to break down bilirubin. The scientists took hepatocytes with a healthy copy of the gene from normal rats and seeded them into the network of blood vessels growing from the

sick rodents' organoids. Would these genes, sustained by the blood supply from the animals' livers, kick in and start reducing bilirubin in the diseased rats? It took just one day for the sick animals' bilirubin levels to start dropping. Within four weeks, their bilirubin had plummeted to normal levels.

The scientists reported their results in the October 1989 issue of the *Proceedings of the National Academy of Sciences*. Although Anderson cautions that similar experiments with jaundiced rats were not as successful—the engineered genes don't always stay in place or do their job, he says—organoids have now been in place in some rats for their entire life spans (more than two years) with no ill effects. Researchers may soon try using organoids as internal drug factories to treat a variety of ills. Cells "reduced" through genetic engineering to secrete substances the body needs would be put into an organoid so they could dump their products into the bloodstream. Anderson says the neo-organs have the potential to treat any disease that can be corrected through the secretion of a drug or product—including diabetes and hemophilia.

The most immediate probable application for the technology, however, could be as a molecular decoy ther-

Why it takes legwork to flatten your stomach

You can't reduce stomach fat by exercising abdominal muscles alone.

Research has shown that exercises that work only the abdominal region are not effective. They simply don't involve enough muscle mass to burn the calories necessary to trim fat. Instead of flattening, they merely strengthen underlying muscles, providing no reduction in girth, inches, or total body fat percentage.

The exclusive NordicTrack® total-body aerobic exerciser is the most effective way to flatten your stomach.

The total-body motion involves all major body muscles. Which means you burn more body fat in less time than with any other in-home exercise machine. And while you're at it, you're toning and defining these muscle groups, as well. So you feel as good as you look.

Free information.

Call or write us today. We'll send you a free brochure and video that describe how NordicTrack can flatten your stomach and make you look and feel your best.



The exclusive NordicTrack® total-body aerobic exerciser is the most effective way to flatten your stomach.

The total-body motion involves all major body muscles. Which means you burn more body fat in less time than with any other in-home exercise machine. And while you're at it, you're toning and defining these muscle groups, as well. So you feel as good as you look.

NordicTrack®
A Calligym® Brand

Call or Write for a
FREE VIDEO
& Brochure

1-800-328-5888 (CALL 24 HRS)

- Please send me a free brochure.
 Also a free videotape. VHS Beta
 Please send the Free NordicTrack® Fitness or Home catalog.

Name _____
Street _____
City _____ State _____ Zip _____
Phone (____) _____
NordicTrack Dept #20081
2412 Jonathan Blvd., N. Chadds, PA 19318

py to short-circuit the HIV virus that causes AIDS. Thompson points out that HIV enters and infects cells by using its own protein to bind to CD4, a soluble protein found on cell membranes. If an organoid were designed to pump CD4 molecules into the bloodstream, he says, the circulating CD4 would serve as a decoy. The virus would bind to it, and if the CD4 were genetically engineered to target the kidneys, for example, it would carry the virus off to be eliminated with a patient's urine. Gallo had called Anderson in 1985 to propose a collaborative effort to apply gene therapy to AIDS. Working under the Anderson-Thompson team's direction, Don Mosher, scientific director of a private research lab called the Medical Biology Institute in La Jolla, California, has already cloned CD4 genes into human lymphocytes and infused them into immune-deficient mice. So far the approach has produced too little soluble CD4 to offer therapeutic benefits. But Thompson says that if the cells can be manipulated to secrete higher levels of CD4, the result could be a lethal weapon against AIDS.

Before researchers ask implanting organoids in people, however, they will have to address several problems. "Too much growth factor can cause uncontrolled, cancerous growth," says Haudenschild. "We have to make sure we don't

do more damage than good. And we need to find a more controlled carrier. Gore-Tex has randomly arranged fibers. If it's compressed, there's no room for blood vessels to grow." The pathologist also points out that scientists have to be sure they can control genetically engineered cells introduced into the body. "What if we put insulin-producing cells in a diabetic, for example, and they match out of the organoid and produce too much insulin? The patient would go into shock repeatedly and we'd have no way to remove those cells."

Some members of the mainstream medical community are dubious about the whole idea of growing working organs from scratch. Organoids could never replace the 100-plus functions of a healthy liver, for example, says Rued Krom, chief liver transplant surgeon for the Mayo Clinic in Rochester, Minnesota. "It is from my perspective very far-fetched—probably more Utopian than realistic," he says. "There are so many unknown signals and mechanisms in fetal life that I cannot imagine that you could re-create them."

Scientists facing drastic cuts in their own laboratory budgets may also question the propriety of allocating precious research dollars to a long shot like man-made organs. But as Haudenschild points out, the value of organoid technology could turn out to be incalculable

once it is applied to curing human ills. The pathologist is currently looking at how vascular connections created in neo-organs might replace existing diseased or damaged blood vessels. If new blood vessels could be grown between the heart and lungs, for instance, bypass surgery could be eliminated. "First we have to see if it would change any function of the heart or cause inflammation. But in three to five years, we'll know whether it's applicable or not," he says.

Organoid technology should take off rapidly thereafter, according to Thompson. He thinks scientists will start growing auxiliary organs to take over some functions of diseased human spleens, livers, and pancreases within a decade. Further down the line, he believes virtually any kind of cell regeneration will be possible. Even spinal cord injuries could be healed by stimulating bundles of nerve fibers at the site of the damage, he says. Brain diseases like Alzheimer's could be combated by growing new blood vessels and nerve cells to assume the functions of their diseased counterparts.

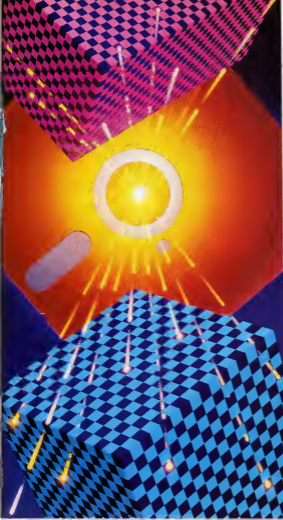
"All an organoid is missing are the cells that would commit it to becoming a specific organ," he says. "Everything comes from a germ layer of cells that respond to growth factors and differentiate down a pathway. As we learn what the signals are, we can educate cells to go down the route we want."

Thompson reaches across his desk and plucks a six-inch stack of envelopes from the liter of papers and journals overflowing onto the windowsill. Opening one, he pulls out some pictures, studies of a dying man's failing pancreas. All of the envelopes contain similar materials: documentation and desperate cries for help from sick people who have read about his work and don't understand that the research is still in a preliminary stage, that replacement organs for humans are years away. "I can't do anything to help them yet," Thompson comments. "It tears me up."

Like the changeable weather outside his window, Thompson's mood quickly brightens as he describes his dreams for the future of organoid technology. "When we learn the secrets of how and why a cell gets old, we'll be able to make one that never ages," he predicts. "We'll regenerate organs that outlive the rest of the body." Although eighty-year-olds with strong hearts and healthy immune systems are likely to lead more active lives than elderly people do now, Thompson doesn't think organoids will necessarily help us live much longer. "I'm not real interested in increasing life spans per se," he says. "I'm more interested in making the quality of life better, giving everyone an equal fighting chance." **DD**



"I was just thinking: *Dear, there must be a better spot in the house for our souvenir of the Berlin Wall!*"



SPECIAL SECTION

THE WORLDS OF ELECTRONIC GAMES

COMPUTE AND OWN!
PRESENT THE
ULTIMATE PLAYER'S
GUIDE TO
VIDEO AND COMPUTER
GAMES FOR
THE HOME ARCADE

ADD A SECOND DRIVE TO YOUR COMPUTER. FREE.



Take on the pros in the Special Maxell Edition of PGA TOUR™ GOLF by Electronic Arts™. Water hazards, sand traps and shifting wind add to the challenge as you battle the top names on the tour in THE PLAYERS Championship at TPC at Sawgrass. Realistic graphics and TV-style coverage intensify the action. You can play on IBM PC, XT, AT, PS/2 Family and most compatibles. It's free, while supplies last, on the free 11th disk inside specially marked MD2-D, MD3-HD, MF2-DD and MF2-HD 10-packs. So tee up. And see if you've got the drive to beat the pros. Fore!



SPECIAL SECTION

**THE WORLDS OF
ELECTRONIC GAMES**

OMNI AND COMPUTE LOOK AT AN ENTERTAINMENT REVOLUTION

CONTENTS**ELECTRONIC WORLDS WITHOUT END 84**

By Keith Ferrill

The past, present, and possible futures of interactive electronic games. How far can interactive electronics go toward creating artificial realities? How much interactive fun can we stand?

REALMS OF ADVENTURE 89

By Kerlee Monahan

The art of fantasy, science fiction, and computer games.

LEARN AND PLAY, PLAY AND LEARN 97

Educational software has a playful side.

THE GAMING GLOBE 98

By Bob Lindstrom

Different cultures look for different things in their video and computer games. Our games columnist looks at North America, Europe, and Japan, with an eye on the game cultures in each country.

FAR STARS AND DISTANT WORLDS 100

Science fiction and software are made for each other. Game designers and publishers are making the most of it.

EXPLORATION GAMES 104

Entertainment software makes it possible for everyone to be an adventurer. Where can you go via software? Just about anywhere you wish.

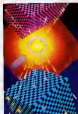
BUILDING WORLDS 106

Interactive games can give you the powers of a god, able to control the destiny of whole worlds.

STAR TECH 108

By Erin Murphy

The latest and greatest peripherals and devices to help you get more out of your games.



Electronic games grow more sophisticated every year. This special section looks at some of the exciting interactive worlds available today, and some that might be available tomorrow.

THE PAST, PRESENT, AND FUTURE
OF ELECTRONIC GAMES

ELECTRONIC WORLDS WITHOUT END

BY KEITH FERRELL

We are reaching a point where interactive electronics can re-create virtually anything.

They're everywhere! In less than two decades—remember Spacewar and Pong?—interactive electronic entertainment has become a global fact of life. In coin arcades in living rooms, and increasingly on portable game units, electronic play has never been more popular, more sophisticated, or more widespread.

It's easy to understand why. Today's electronic games, whether played on computer, dedicated game console, or coin-operated unit, are more than just diversions. Good ones become gateways to worlds we might otherwise never visit. The best achieve something like art.

Basically the appeal of inter-

active electronics is twofold. First, video and computer games draw on our sense of fun—our need for play. More subtly the games appear at least to provide some long-declined control over the television screen. This point might be argued by those dedicated gamers—and their parents, spouses, and friends—who spend dozens of hours locked in electronic interplay. Who is in charge—game or gamer? Interactive addiction, indeed, might well be a subject for investigation.

Rarely has an addiction been so appealing. Through interactive electronics, we can journey to the far future or the distant past, achieve athletic greatness, become armchair generals out to change the course of history, challenge our eye-hand coordination, simulate high-tech aircraft and vehicles, play games that teach while they entertain.

We are reaching a point where interactive electronics can re-create, to one degree or another, virtually anything.

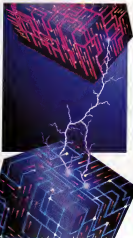
It didn't start out that way. In the Seventies, when the first video games were introduced, many thought the new entertainment media would be a flash in the pan. The first hint that video games had struck a responsive chord with the public came when those early arcade machines began jamming—from an overload of coins!

What worked in arcades worked even better at home, as Alan found with its phenomenally successful Alan 2000 cartridge console. Millions of consoles and tens of millions of games moved into households almost overnight.

At the same time, many households embraced early personal computers, notably the Commodore 64, the Apple II, and early IBM PCs. While the computers ostensibly served higher purposes than entertainment—word processing, financial management—the platforms immediately attracted the talents of game designers.

What the entertainment marketplace giveth, that same marketplace taketh away. By 1984 the initial video game boom had collapsed catastrophically, with dozens of companies going bankrupt as quickly as they'd flourished. Legend has it that millions of Alan cartridges, unwanted by retailers or the public, were buried in a desert landfill somewhere in the American West. Informed analysts suggested at the time that the video game boom was over, its flash-in-the-pan nature having simply taken a little longer to play out than was first suspected.

You can't keep a good entertainment medium down, though. The computer software side of the industry never shrank as much as the cartridge side, and excellent desktop games continued to appear throughout the Eighties. Nor was the cartridge environment as dead as the analysts thought. By 1987 a new name was making noise in the field of video games: Nintendo. By 1990 Nintendo had not only revived the video game market, it had nurtured that market to a size and scope far beyond even Alan's heyday. Nintendo clothing, Nintendo books, Nintendo television, even Nintendo cereal have all appeared over the past three years as



Spectacular Inter-Galactic Battles

Blast into the future for hours of adventure.

Join Buck Rogers and the New Earth Organization in the exciting 25th Century, and play the **BUCK ROGERS® XXVc™ Role-Playing Game and Countdown To Doomsday**, the new computer role-playing game.

The XXVc role-playing game is packed with adventure, fantastic civilizations, genetically-engineered races, and future-science technology. This game contains



action-packed adventures sure to thrill science-fiction fans and game players alike.

The computer game thrusts you into a race to save humanity from the enemies of the inner planets. Players must follow clues across the solar system, through the space ways, and to the surfaces of Mars, Venus and the orbiting satellites of Mercury to discover the awesome **DOOMSDAY Device**.

Earth's future is in your hands! Look for these games at book, computer, hobby and comic stores everywhere.



BUCK ROGERS and XXVc are trademarks used under license from the Silver Family Trust. ©1988 The Silver Family Trust. All Rights Reserved.



The TR logo is a trademark property TR, Inc. Copyright © 1988 TR, Inc. All Rights Reserved.

Before long, home entertainment systems will let us write, produce, direct, and star in our own movies.

the company achieved billions of dollars in sales each year.

Those sales made clear an important point: Interactive entertainment had become a fixture of the modern household and would remain so. In 1991, there are more approaches to interactive entertainment than ever before. Nintendo continues to dominate the cartridge scene, although its dominance faces stiff competition from Sega and NEC. Sega's Genesis system boasts a more powerful processor and more sophisticated graphics and sound than Nintendo's, while NEC's TurboGrafx offers a CD-ROM (compact disc read-

only memory) drive whose storage capacity is enormous. New systems such as SNK's Neo-Geo continue to ring changes on the basic game console format.

Portability is another area of excitement, again defined by Nintendo. The company's GameBoy achieved perhaps the clearest codification of interactivity's popularity when, on a recent edition of *Real Life With Jane Pauley*, a child was shown playing with a GameBoy in the back of the covered wagon in which his family was experiencing a "loner" vacation. As far as video games go, you can take them with you—and you may not be able to get away from them. Atari, NEC, and Sega are all mounting efforts to challenge Nintendo in the portable gaming marketplace.

I'll admit a prejudice right here: I think the best, most exciting games around are developed for personal computers. (Having said that, I'll also own up to my own interactive entertainment bias: I use a fast 386 PC with super VGA graphics, an NEC CD-ROM drive, and Ad-Lib soundboard with speakers attached. Now, there's an entertainment system.)

The best PC games are elegantly programmed, taking advantage of the machine's power and minimizing its vulnerabilities in order to enhance the electronic illusions being created. Indeed, some games are far more elegantly programmed than the business software for which the PC is primarily intended. Word processors and spreadsheet designers and programmers could take more than a few pages from the book of game maestros.

Today even education dances to an increasingly electronic, interactive beat. Educational software is often as entertaining as game software, with the added benefit that you're improving your mind as you play. Many games, in fact, have serious educational underpinnings, presented with distinct points of view.

That's a thumbnail sketch of today's worlds of electronic games. Diverse and diverting, the games have spread throughout the world and show no sign of retreating.

And tomorrow?

The skills learned over the first decade of interactive entertainment's life will serve as the foundation for the next generation of games. Programmers' toolboxes now contain thousands of routines and shortcuts. Just as film, recorded music, and television have libraries of effects, so will the entertainment software industry continue to add to its collection. Don't be surprised to see many interactive effects actually mirroring familiar film techniques. Before long, home entertainment systems will let us write, produce, direct, and star in our own movies.

The software itself, both on disc and on cartridge, will grow more sophisticated. The distance between electronic reality and the real world will continue to shrink. Already we're seeing sports games that simulate everything from the influence of a breeze on a baseball to the effect of blades of grass on a golf ball's trajectory. Action games incorporate social and political factors in warfare simulations. Simple arcade adventures are hardly simple anymore. With each mov-

CONTINUED ON PAGE 110



**MORE FRIENDS.
MORE FIENDS.
MORE ALLIES.
MORE ADVERSARIES.
THE ISLAND OF KESMAI
IS WAITING FOR YOU.**



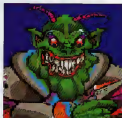
Finally, a role-playing game big enough for your imagination. The Island of Kesmai™. Up to 100 people can play at once, battling their way through 62,000 hexes of scalding deserts, towering cliff-top citels, clammy underground catacombs, and 3,250 truly disgusting computer-generated creatures.

No matter how many friends you make, or how many villains you dispatch, you'll never, ever get enough. And The Island of Kesmai is only one of the exciting multi-player games you can play on CompuServe. We also offer the treacherous British Legends™, as well as many others. All you need to play is a personal computer, a modem, and a CompuServe membership. To join, or for more information, call 800 848-8199.

And take a trip to the Islands that's anything but relaxing.

CompuServe®

WHICH ONE IS MORE ALIEN TO YOUR CHILD?



NOW KIDS WILL ENJOY LEARNING ABOUT THE FACE ON THE RIGHT AS MUCH AS THEY LIKE FACING THE ONE ON THE LEFT.

The world is full of fantastic beings, mind-boggling phenomena, and unsolved mysteries. And Compton's MultiMedia Encyclopedia™ is a great way to discover it all.

Compton's MultiMedia Encyclopedia isn't like any encyclopedia you've ever seen. All 26 volumes are stored on a CD-ROM disk that runs on a personal computer. With more than 32,000 articles. Thousands of color pictures. Animated subjects, including a world atlas. Sixty minutes of famous speeches, music and sounds. A complete dictionary. And a scientific glossary that actually pronounces words.

Introduce your kids to an exciting new world of learning. Discover Compton's MultiMedia Encyclopedia at a dealer near you, and watch their faces light up. For locations, call 1-800-4CD-NEWS, ext. 22. We deliver direct within 24 hours.

INTERACTIVE INFORMATION FOR A NEW GENERATION™



**BRITANNICA
SOFTWARE**

REALMS OF ADVENTURE

From dungeons and dragons to galaxies
far, far away, computer
games provide a wide world of fantasy

BY KELLE MONAHAN



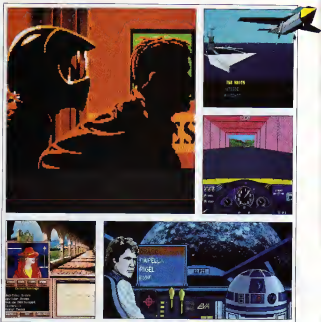


Who goes there?"

bellows the Dungeon Master. "I, the brave knight, I have come to defeat the Red Dragon, he who has robbed and pillaged the countryside. I've come to reclaim his lair's treasure, of which he is unworthy." The spell is cast and you enter the world of game role playing. The forces of evil stand before you. What will you do? This is medieval legend in the remaking. Role-playing gamers can journey to worlds of gothic horror, wild West adventure, or epic saga.



The more you know about the historical period you're playing in, the better off you are. Gary Gygax, a Chicago insurance broker, designed the first role-playing game, *Dungeons and Dragons*, in 1974. Now the game and publishing company TSR provides fantasy adventures for some 10 million players worldwide. Frank Beutell, a TSR executive, says, "In spite of the economy, business is strong. People would rather do without other things before giving up their hobby."



interactive adventure games take you around the world—and beyond. Clockwise, from upper left, Star Wars pilots race for the hangar in Origin's *Wing Commander*; Spectrum HoloByte takes off with *Flight of the Intruder*, based on the Stephen Coombs novel, and *Student Driver*, fulfilling every Sunday driver's fantasy; Broderbund combines entertainment and astronomy education in *Where in Space Is Han Solo?* And the company's *Carmen Sandiego* will be a Saturday-morning television program.

Today's Best Science-Fiction Magazine



Subscribe Now at **HALF OFF** — and **GET a FREE GIFT** too!

If you're a science-fiction lover, you won't believe your eyes with the new **AMAZING® Stories** magazine. In May, the world's oldest science-fiction magazine is being relaunched with a completely new look, new size, expanded contents, dazzling full-color illustrations — and monthly circulation!

Every issue is packed with top-quality science-fiction, fantasy and horror short stories, many from world-famous writers. For example, the May 1991 issue features stories by Robert Silverberg and John Brunner, both writers who have been at the top of the field for over 20 years. This issue also includes work from Kristine Kathryn Rusch, winner of the 1990 John W. Campbell Award, and a reprint of Arthur C. Clarke's first

appearance in print — from the February 1935 issue of **AMAZING Stories**.

Join thousands of science-fiction readers everywhere and celebrate this new era of **AMAZING Stories**. Call 1-800-558-5977 for **AMAZING Stories'** one-time charter subscription rates and save **HALF** off the newsstand price! Just \$24 for one full year (12 issues). It's like getting 6 great issues **FREE**.

In addition, subscribe by January 31 and receive a free **AMAZING Stories** gift — your very own **AMAZING Stories** hat. Call 1-800-558-5977 to reserve your subscription (VISA and MasterCard accepted). This offer is good only while supplies last!

AMAZING[®] STORIES

YES, please reserve a subscription for me!

Subscription Order Form

Name _____

Address _____

City _____ State _____

Country _____ Postal Code _____

Charter Subscription Rate

\$24 for 12 issues (1 year) —

U.S. Funds Only

Method of payment: Personal check Money order

Mail this form with payment to

AMAZING Stories, Subscription Dept.,

P.O. Box 5895, Boston, MA 02206

THE WORLD'S OLDEST SCIENCE-FICTION MAGAZINE IS NOW THE NEWEST!



You live in the twenty-fifth century. Earth is depopulated, Mars is habitable but controlled by an evil corporation, and the asteroid belt is home to outcast desperados. It's a tough universe out there. Your mission: Support Buck Rogers in his quest for freedom on planet Earth. The legendary space hero has appeared in comic strips, radio, television, and film. His return in the form of role playing through group, computer, or video systems is classic space adventure.



BUCK IS NOT

the only one concerned about the future: TSR has other worlds in mind. With half a million new gamers annually,

high technology is a constant interest for TSR. "We are looking to future applications of CDs with lifelike effects... computer bulletin boards, and virtual reality," says TSR West's creative director, Flint Dille. Players can even help clean up the world in which they role-play. "Buck displays an environmentalist approach from the darkest side," says Dille.

CC

GAMES THAT TEACH ARE MORE FUN THAN EVER

LEARN AND PLAY, PLAY AND LEARN

The computer has long been viewed as a boon to the educational process, and educational software designers are making the most of it. Many educational software publishers are taking lessons from computer game designers, using entertainment techniques to make learning more appealing to students.

Entertaining educational games and products span the classroom curriculum. Publishers such as Britannica Software, Davidson and Associates, The Learning Company, and Broderbund use software to make math, language arts, social studies, and the sciences more accessible to today's students both at school and at home.

The engagement offered by interactivity serves as a spur to study. At the most basic—and in some ways most important—level, that of drill and practice, the computer offers an unexpected advantage over human teachers: The software doesn't get tired, processors don't lose patience, an educational program is able to continue working with a student long after a human teacher would tire or grow impatient.

But drill and practice isn't everything, merely the foundation on which everything else rests. What do software designers build on top of drill-and-practice sessions? Problem solving, analysis, deductive reasoning, word problems, real world situations, and more—all of it educational and all of it disguised as play.

Consider The Learning Company's latest entry in its Super Solvers series: *Challenge of the Ancient Empires!* Using techniques familiar from ar-

cade games, *Challenge!* designers pit players against mysteries involving ancient treasures and lost civilizations. In the midst of arcade sequences, students also find themselves solving mysteries, putting together puzzles, and making decisions.

Davidson and Associates has produced a long-running series of educational software products aimed at coordinating students' mastery of basic

educational entertainment remains in its infancy, yet those companies that have made a commitment to the field are assembling an array of tools and techniques that will serve them well as technology evolves.

Oddly—or perhaps not so oddly—the technologies that have the strongest hold on the minds of the young have yet to make much of an effort to provide educational entertainment



Challenge of the Ancient Empires! (left) and *Math Blaster Mystery* (below) let kids play while they learn.

vocabulary and math skills and transferring those skills into higher-order thinking. *Math Blaster Mystery*, for example, helps students make the transition from fundamental math skills to applying those skills to real world problems.

Britannica Software's *Revolution '76* approaches nothing less than a re-creation of the American Revolutionary War, couched in the form of a game but filled with interesting facts and insights. Even young players discover very quickly the human, social, and emotional side of the war for independence, as well as its political and military nature.



for two players. Nintendo, Sega, and NEC doubtless know which side of the market their bread is buttered on, yet it would be refreshing, and probably profitable, for the big video-game companies to offer at least an occasional educational cartridge. □

DIFFERENT CULTURES PLAY DIFFERENT GAMES. OR DO THEY?

THE GAMING GLOBE

BY BOB LINDSTROM

North America, Europe, and Japan have all embraced electronic games. But not the same games, or even the same style of games.

Let's hear it for Mom, apple pie, and jaywalks: The video game and computer game are uniquely American inventions. And today, nearly 30 percent of American households own video games. In 1990 Americans bought \$5 billion of video game systems and cartridges. Much of this video game excitement must be credited to Japan-based Nintendo. The company's domestic subsidiary has sold 25 million Nintendo Entertainment Systems (NES) to American homes. Incredibly enough, 50 percent of those games are being purchased by adults, and not just to keep the kids quiet. "There is a change in awareness about video games among adults," says Nintendo GameMaster Howard Phillips. "Just as cartoons used to be just for children, animation is now seen as entertainment for adults as well as kids. Video games also used to be considered 'kid stuff,' but video entertainment is for everybody."

The computer game producers of video entertainment have always targeted adults. It's one of the reasons that American game designers remain the international champs of computer simulation software such as flight simulators, urban simulations, and other "you are occasionally there" fiction makers.

"In Europe the computer game industry was much more youth oriented than in the United States. In the States the disc-based IBM PC market attracted a much more mature audience looking for more mature games," explains Sid Meier, vice president and co-founder of MicroProse Software, Inc.



Meier notes that the next generation of video game systems may well be a growing source of adult entertainment in the future. And older gamers seem poised and ready to confirm Meier's theory.

"There is an opening for a standard game machine with the power to do simulations and the household penetration to be a commercial focus," Meier says. "Then you'll see cartridge-based simulators with a lot more sophistication."

Japanese students stand in line up to five hours to be the first to buy new games for the Nintendo Entertainment System (called the Famicom in Japan). Stores are asked to sell cartridges only during after-school hours in order to stem the waves of school absenteeism accompanying the release

of popular games. Role-playing enthusiasts snapped up 1.3 million copies of the latest installment of the *Dragon Quest* series in a single day in early 1990. And Japanese fans of the American-born *Ultima* game series clamor for *Ultima* comic books, compact discs, and a cartoon series appearing on Japanese TV.

There is a virtual video game mania in Japan, according to Corey Sandler, co-author of *Bartem Books' The Ultimate Unauthorized Nintendo Game Strategies* series. Last year in Tokyo's Akihabara district, which has a concentration of consumer electronics stores, Sandler found "hordes of children aged ten to those that went on two deep for about four blocks. In the Japanese style, it was completely order-



ly. Nintendo reigns in Japan as the most popular video game system. In 1990, NEC's TurboGrafx-16 (known as the PC Engine in Japan) approached NES's sales. Nintendo will counterattack with its powerful new generation Super Famicom, and the video game system "wars" will intensify throughout 1991.

Industry observers believe that the priced battle will rage in the United States in late 1991 with Nintendo, NEC, and Sega's Genesis as the principal combatants.

Depending on their generation, Americans perceive the United Kingdom and Europe as the battleground of the enduring popularity of the Beatles or the craze of post-bomb West-ern art and literature. Just don't look for much that is enduring or deep in British and European video game culture. "It's a lot of noise and no meat," explains game designer Chris Roberts, a Briton who is a director of new technology for Origin Systems in Austin, Texas, and designer of Origin's *Wing Commander* flight simulators. "In the United Kingdom and Europe, we don't go for great strategy games, or

deep and complex games. It's very flashy graphics, great sound, and arcade action," says Roberts.

In the high-driven European marketplace, a game for the popular Commodore Amiga or Atari ST computer may sell 100,000 copies during its first month of release. "Then it will be dead," says Roberts. As a result, European designers favor arcade games that are fast to create and provide the maximum in quick, instant gratification.

In the quest for buyer gratification, however, the Europeans have become the masters of breathtaking computer game spectacles. Products such as Britain-based Psygnosis' *Shadow of the Beast* and *A'Beast* exotically detailed artwork, stunning animation and ear-torching Euro-rock musical scores.

Unlike the United States, Europe has not taken cartridge-based game systems like the NES to its Old World heart.

"Since the Europeans are very sensitive to the quality of sound and graphics, not that many people want to buy Nintendo-looking games," comments Roberts. Game players who have fixed their eyes on the sizzling graphics of the Amiga or Atari aren't interested in the less colorful visuals of the NES.

But the new sixteen-bit machines may make inroads in the United Kingdom and Europe, equally and competitive pricing of these systems, compared with computer system prices and performance may attract Europeans, who tradition ally have limited disposable income. **DB**

SCIENCE-FICTION GAMES MAKE THE MOST OF COMPUTER TECHNOLOGY

FAR STARS AND DISTANT WORLDS

Science fiction and interactive electronics are made for each other. There's something, after all, science-fictional about interactive games themselves, about the act of plugging yourself in to an artificial world over which you exert total control.

For a while it looked as though electronic SF might consist solely of dueling space-

craft. *Spacewar*, one of the first successful arcade games, pitted starships against each other in a universe filled with gravity wells, stars, and black holes. *Asteroids*, not long after, made the universe simpler and struck a more popular chord: Give players a spacecraft and weapons, then let them blast away to their hearts' content. *Arcade* and video game consoles have gone far with this basic approach.

SF on computers, however, has become more sophisticated. In the mid-Eighties, for example, Electronic Arts' *M.U.L.E.* provided players with a more challenging universe, letting them dispatch robots to explore and establish

trade. *Ets*, from Firebird, created a vast starscape, populated it with warriors and pirates, and sent players forth to live or die electronically.

Some companies have even specialized in SF software. Texas-based Interstel built an entire gaming universe around its *Starflair* series. Fans of hard-core space combat flock to Omnitrend's products, notably the *Breach* line. In *Breach* you assume the role of a leader in an elite military outfit. Dropped into dangerous situations, it's up to you to command your troops, accomplish predefined missions and keep yourself alive so that you can fight again.

Software companies continue to hone their skills in the creation of science-fictional universes. Electronic Arts' *Starflight* series offers players hundreds of worlds ripe for exploration and exploitation, along with a galactic mystery to be solved. *Midwinter* from Microprose puts you in a post-apocalypse world challenging you to save civilization.

Virgin Mastertronic's *Overlord* gives you the tools to rebuild worlds and create a galactic empire. Sierra On-Line's *Space Quest* series gives interstellar adventure a satirical twist. Access Software makes deadly future streets come alive in games such as *Crimo Wave* and *Countdown*. And Origin's *Wing Commander* brilliantly reinvents spaceship combat in a game that screams for a fast PC and a good sound system.

In recent years some science-fiction writers' literary works have made the transition from printed page to electronic screen. Only contributors Wi-



B.A.T. (above) provides danger and adventure in time, while *Moonbase* (right) takes a hard look at exploiting the harsh lunar environment.



Iain Gibson and George Alec Efinger have seen their works become interactive computer games. Interplay transformed Gibson's *Mechanoid* into an interactive environment that captured many of the novel's cyberpunk details. Efinger himself worked with Infocom (a di-

bytes of data, imagery, and sound on a single disc. With that sort of capacity you can look forward to games that talk, image that are animated with almost lifelike movements, and even worlds whose visual richness approaches that found in a television program.

with the increasing respectability of interactive entertainment as an art form, will go a long way toward attracting better storytellers.

As interactive electronic media become more widespread, and their capabilities more supple, we may see whole

Crashing
sons and
exploding
spacecraft are
all in a
day's work
in *Star Control*.



vision of *Mechanoid*) on the creation of *Circuit's Edge*, an electronic version of the future Middle East he writes about in such novels as *A Fire in the Sun*. What, one wonders, might a Larry Niven or Robert Pohl produce if teamed with the right programmer?

New technologies, of course, will make electronic SF even more convincing. CD-ROM offers the vast storage capacity of a CD, making it possible to store hundreds of mega-

Further down the technological highway we can expect virtual reality games that will let you essentially "step into" your computer screen, or fool you into thinking you've done so. Imagine sitting in your favorite cozy chair and having it transformed as if by magic into the center seat of the starship *Enterprise*. *Gen Star Trek: The Next Generation's* holodeck is far behind?

The appeal and possibilities of the new technologies, along

new approaches to storytelling and world building. Science fiction creates myths for a technological world; interactive SF may well use technology itself to underpin those myths. Look for the next renaissance in SF to flow at least in part from interactive electronics as well as the printed page and film.

Science-fiction games are indeed growing up with computer and video game technology. Next stop, the stars. **DD**

**YOU NEED A
SET OF THESE**



**TO PLAY
ONE OF THESE**



These spheres represent the elements that contain mystic powers you must achieve... to stay alive in NEO-GEO's exciting new adventure, **MAGICIAN LORD**. As ELTA, you'll fight off brutal attacks by fiendish enemies as you travel through a terror-filled fantasy world. You'll need all the power you can get!

MAGICIAN LORD is just one of many challenging NEO-GEO action, sports & role playing fantasy games. All feature today's most advanced 4-dimensional graphics, with vivid detail and effects, 65,000 colors and an amazing 15-channel real voice stereo sound track. All pumped out by 330 meg hardware!

So NEO-GEO can deliver in-your-face realism that Nintendo, Sega, and NEC simply don't have the capacity to match.

NEO-GEO also has great Network capability, a unique Memory Card that lets you save your game at any stage, and coming soon, software applications for modem play, home shopping, banking and more.

NEO-GEO is clearly the system of choice for vid freaks of all ages. The question is, do you have what it takes?



A Quantum Leap Forward In Video Entertainment.

Authorized SNK Dealers:
• Video Express Inc.
• Neo-Geo Hotline

(800) 953-6945
(903) 800-Neo-Geo

NEO-GEO is a registered trademark of SNK Corporation.

INTERACTIVE ELECTRONIC VOYAGES OF DISCOVERY ATTRACT ARMCHAIR ADVENTURERS

EXPLORATION GAMES



Pirates! (top) sends you forth to conquer the Caribbean, while **The Secret of Monkey Island (bottom)** offers more humorous explorations.



The impulse to explore is as old as the human race. It's an impulse that's been eagerly adopted by developers of entertainment software.

Take a video or computer monitor. Place a character or a vehicle on it. Let the player know there's an electronic world awaiting discovery and watch what happens. That old human impulse comes into play and via keyboard, joystick, or mouse, the exploration begins.

Some of the earliest computer and video games were built around the explorative urge. Fantasy role-playing games such as Origin's *Ultima* or Nintendo's *Zelda* draw as much on the desire to see what's around the next corner as they do on the desire to face diabolical monsters or cast powerful spells. Just as much of the most popular fantasy literature is quest based—heroes on a journey through unlimi-

ted territory—so does much of electronic fantasy take the quest as its theme.

Some quests are more realistic. *Seven Cities of Gold*, an early title from Electronic Arts, re-created the Spanish exploration of the New World. A couple of years later MicroProse broke new ground with *Pirates!* which took as its universe the Caribbean during the great days of fighting out of buccanniers and colonial governments shifting alliances and intrigues. *Pirates!* appealed to that exploring impulse, providing players with the tools—ships and crews, maps and winds—to set sail in search of treasure and danger.

Empire, a classic war game, combines military strategy and confrontation with world exploration. Upon beginning the game you are confronted with a screen completely blackened, save for a single square. From that square you dispatch ground, air, and sea forces, uncovering a bit more of the world's nature at each turn. Continents and islands reveal themselves gradually, as does, eventually, the location of the enemy.

Exploration need not take place in a huge world or on a global stage. *Marisa Merano*,

from Lucasfilm Games on disc and *Jaleco* on Nintendo cartridge, presents players with a mysterious old house filled with slightly dotty, slightly dangerous residents. Poke around the mansion and discover secret passages, dreary dungeons, and startlingly interactive rooms.

In its most recent releases, Lucasfilm continues to mine exploration. *Loom* is a simple fantasy, set in a world where the very nature of reality must be woven—or unraveled. *The Secret of Monkey Island* is more lighthearted.

Players assume the role of Guybrush Threepwood, an earnest if somewhat foolish young man out to seek his fortune in a world filled with puns, tight gags, and silliness.

Among the most unusual exploring games is one currently under development by Infogrames in France. This is a haunted house game, one that takes place in the dark. As currently planned, the game will present players with a black screen, challenging them to navigate through the haunted house by way of sound effects.

As computer and video game technology grows, we can expect much more complex and sophisticated exploration games. Imagine, if you will, re-creating the voyages of Drake, the Antarctic journeys of Scott, the flights of Lindbergh.

Other explorers, real and imaginary, call out to our imaginations. Who knows what we might find? Before long, you may face a character deep in an unexplored region of your computer and say, "Dr Livingstone, I presume?" **DD**

TAKE OVER THE WORLD.



You get seven world scenarios plus advanced control panels. So you'll never be strictly controlled.



Mess with the world and it becomes an awfully nice place to live. When you're smiling through the whole world smiles with you.



SimEarth plays out your (oracle) oracles too, including volcanic, meteor strikes, earthquakes and continental drift.



Find out what precisely makes your world tick. And when it makes it tick, feeling.



Use your animal statistics and your planet will thrive, producing a rich abundance of life.



Make the wrong decision and you could wipe out life as you know it. Hey, nobody said the job was going to be easy.



The only way to follow an act like SimCity®-1990's runaway Number One game—is to think globally. The result is SimEarth™.

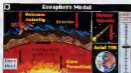
Instead of a city to run, SimEarth gives you the reins to the entire planet. Evolution, continental drift, climate, atmosphere, hurricanes, nuclear fallout, acid rain, civilization, and a bunch of other disasters. All the cool stuff you need to rule the world.

Play SimEarth to the end of time. About 10 billion years or so, give or take a millennium. Getting raves everywhere, SimEarth is indeed destined to take over the world.



GAMES CAN GIVE YOU THE POWERS OF A GOD, A PRESIDENT, A BILLIONAIRE BUILDING WORLDS

In Sid Meier's *Railroad Tycoon* (top), your world is the burgeoning frontier; you track the establishment of a successful railroad. *SimEarth* (bottom) gives you whole worlds to play with, entire ecosystems to explore.



Set in front of a computer screen large enough and it becomes a world in itself. A growing number of game designers are taking advantage of that to create games in which players build self-contained worlds.

"Environment" games give players the opportunity to control some aspect of a world's development, whether ecological, social, or industrial. *MicroProse's SimCity*, perhaps the most famous example of this type of game, provides players with undeveloped land and the tools to turn that land into a thriving metropolis—or a polluted, overpopulated nightmare. Planning a growing city is no more easily achieved in a computer

world than in reality.

Designer Chris Crawford whose *Balance of Power* translated superpower tension into a tense software experience, recently released *Balance of the Planet* through Accolade. The title Crawford's turf is the global environment itself, with players forced to make choices between ecological concerns and civilization's needs.

Sid Meier, whose *MicroProse* games such as *Road Storm Rising* and *F-15 Strike Eagle* helped define state-of-the-art military simulators, has turned to more peaceful pursuits with *Railroad Tycoon*. Players are transported to the early days of steam-powered transportation, provided with capital, and challenged to build a successful rail empire.

The team that designed *SimCity* set themselves the task of all possible tasks in *SimEarth*. Create a simulation of an entire world. Their starting point was the Gaia theory proposed by James Lovelock and Lynn Margulis, which, put very simply, views a planet as

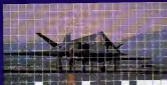
a single organism. In the game this vision becomes a living electronic entity as you guide the transformation of worlds—Earth among them, but also Mars and others—from primordial matter to thriving ecospheres.

From microcosm to macrocosm, there's a school of thought that argues that electronic life can be created or at least considered. Cellular automata—software representations of living, evolving life forms—are already replicating in computers around the world, producing some very surprising offspring. Mathematician and science-fiction writer Rudy Rucker has created one of the most engaging cellular automata programs, called appropriately enough *Rudy Rucker's Cellular Automata*.

What all of these programs have in common is a series of consequences, of the effect of decisions and actions on a larger world. Make the wrong decision and you have to live with its ramifications throughout the rest of the game. Make the right decision and watch its consequences flower. The best world-building games give latitude to "right" and "wrong" decisions, just as the real world does.

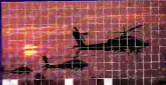
There's a fine line, obviously, between world-building games and educational software, but it's a line that many designers happily tread. By making learning "painless," environment games pass along quite sophisticated lessons to their players. Because the programs are malleable—your worlds reflect your choices—you are your own teacher. That's a learning experience to be savored—and enjoyed. **DD**

Three New Fantasies From MicroProse. Only One Of Them Is Make-Believe.



F-117A NIGHTHAWK

Piloting **F-117A Nighthawk Stealth Fighter 2.0** is fantastic, but it's no light of fancy. It's a thoroughly-researched, sophisticated simulation of America's radar-elusive jet. New scenarios (including Iraq), more powerful weapons and even better graphics than its F-12 predecessor. The Software Publishers Association voted *Simulation of the Year* in 1993.



GUNSHIP 2000

You've fantasized about it. Now, in **Gunship 2000**, it's much more than a dream. Pilot and command a squadron of the U.S. Army's most technologically advanced helicopters. Evaluate six types of choppers and select the five-chopper squadron you want for each of hundreds of authentic missions. Learn what would really happen in a war with Iraq!



DARKLANDS



Make-believe is best when it's believable. That's why **Darklands** is so exciting. It's a fantasy role-playing game through medieval Germany re-created just the way medieval Germans actually believed it to be. The troubled realm owes out for a busy hero to deliver it from its dark, demonic superstitions, unholy religions and a whole host of other fantastically believable challenges.



For the latest information on release dates and availability, call MicroProse Customer Service at 301-771-1101. © 1994 MicroProse Software, Inc., 130 Lakeside Drive, Hunt Valley, MD 21030

Coming Soon!

MICRO PROSE™

ENTERTAINMENT • SOFTWARE

Join the MicroProse Squadron and win exciting prizes from these great companies

KRAFT™

CompuServe

Roland™

Hayes

LOGITECH



STAR TECH

FASHIONABLE ACCESSORIES
If your video game system doesn't do enough,
try adding on the latest refinements

A NEW WAY TO PLAY

The *Needs Free* system opens up Nintendo video games to a new legion of users by using air pressure and chest movements to control the system. Cost: \$175. Contact: Nintendo of America, Inc., Box 97033, Redmond, WA 98073-9733; (800) 355-3700.



NO QUARTER

SNK's Neo-Geo: for the look of the best arcade games. Cost: \$649. Contact: SNK, Los Angeles, CA; (800) 353-6665.

TALKING HEADS

Lie up your target and destroy it with a word. The LaserScope communicates with Nintendo systems and Zapper games. Cost: \$39.95. Contact: Keoni, Inc., Buffalo Grove, IL; (708) 215-5111.





AN' A ONE AN' A TWO

Learn to play the piano by watching TV with the Miraclic Piano Teaching System. Cost: \$349.95. Contact: The Software Toolworks, Nevada, CA; (415) 863-5157.

AT YOUR FINGERTIPS

Let your fingers do the walking, driving, and pushing with Power Glove. Head movements control the action. Cost: \$90. Contact: Mattel Toys, Hawthorne, CA; (800) 421-2887.



GETTING CARRIED AWAY

Now you can carry your head-held Nintendo Game Boy when it's not actually in your hands. Cost: \$9.95. Contact: Nintendo, Redmond, WA; (800) 355-3700.



CONTINUED FROM PAGE 86

Imagine an interactive universe where people meet electronically from throughout the world.

ing in an increasing number of dimensions, using more vivid graphics and sound effects than those Alan players of a decade ago could imagine.

The software will grow smarter as well. Artificial intelligence has become an increasingly popular aspect of some games. Future entertainment software will quickly and effectively learn your gaming preferences, structuring its own responses accordingly.

The video game console, the coin-operated arcade machine, and the personal computer won't be the only media for interactive entertainment. Some form of interactivity will be built into future televisions themselves. As the tube becomes smarter, acquiring more and more of the characteristics of a computer, it's only logical that interactive entertainment be added to TV's traditional passive entertainment delivery.

On-line telecommunications services such as Prodigy, GENIE, and CompuServe are experimenting with new approaches to entertainment. Look for large on-line games to become even more popular and assume new roles. One can imagine whole interactive universes where people meet electronically from across the world to play together.

New storage media such as CD-ROM will add dramatically to the size of the games available to us. As data storage devices become less expensive and more widely distributed, game designers will leap at the opportunity to extend their visions with more convincing images and sounds.

Speaking as it were, of sounds, you'll probably be talking to your games before too many more years pass. While the bulk of the research effort into speech recognition and synthesis technology is aimed at the business marketplace, business advances have a way of being turned into entertainment opportunities. Some games are already "talking." In another five years you might find yourself training your favorite simulator to respond to your own words.

And that's just a glimpse. Travel back in time a decade or so and ask someone playing Pong or Spacewar what the future of video games held, and the speculation would doubtless be too conservative by half. As is, undoubtedly my own.

Interactive entertainment will continue to grow and prosper. As the technology becomes more widespread, via consoles, computers, and smarter televisions, there's a chance that we'll see interactive entertainment become the largest of all the entertainment industries.

There are opportunities and delights in such a future—who wouldn't want, for an hour or two, to drop into a convincing alternate world, to display skills and live through experiences the mundane world denies us?

There may be traps as well. The interactive additions I spoke of early in this piece may become a reality. Some teachers see video games as further lowering an already low literacy rate. The most popular games tend to be the most violent. Some games carry an increasingly sexual content. How far can games go?

The resolution of the and other, related questions will take years, and each resolution will in turn produce new questions, new areas of excitement and concern.

It is clear though, that far from being a fash in the pan, interactive entertainment has become part of the firmament of popular world culture. It is here to stay, ready to transport us, electronically to interactive worlds of entertainment without end. ☐





THIS GAME IS RATED X.
 Exciting adventure!
 Exceptional graphics! Excellent sound!

Konami® and Image Works™ bring the exhilarating big screen experience of Back to the Future II™ to your home computer—and the entire family.

As Marty McFly, you must trek through time to retrieve the sports almanac or else your yet-to-be youngsters will be doomed to a frightful future. Each of the five time warped levels recreates key scenes from the hit movie in authentic detail. You'll have to keep your son out of the slammer Race through dangerous Hill Valley and recover your DeLorean. And that's just the beginning. We've packed your mission with unrelenting odds and obstacles including Bill, Griff and their gang of muscle-bound melon heads. But don't rely on your martial arts moves alone. Because during the fevered fight through time, strategy comes into play as you try to rescue Jennifer and attempt to solve the baffling high school dance puzzle.

So grab a tub of hot buttered popcorn and take the fun of the film to its extreme. Get Back to the Future II today!

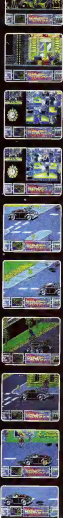
Free inside every package! Genuine Back to the Future II sports cap like the one Marty wore in the movie!

Available on Amiga, MS-DOS and compatibles, Tandy™ and Commodore™ 64/128.
 *Supports Ad Lib™, Roland™ and Tandy™ Sound Boards.

 **KONAMI**



© 1991 KONAMI & IMAGE WORKS. All Rights Reserved.
 Image Works is a registered trademark of Microsoft. All
 other names are the property of their respective owners. Konami Software Co., Ltd. 9500 Konami Dr.
 At P.O. Box 10000, Redwood City, CA 94063-0001



INTERVIEW

CONTINUED FROM PAGE 48

perse. This creates the illusion that your head is moving freely in a stationary external space. If you put on a glove and hold your hand in front of your face, you see a computer-generated hand in the virtual world. If you wiggle your fingers, you see its fingers wiggle. The glove allows you to reach out and pick up an artificial object, say a ball, and throw it. Your ears are covered with earphones. The computer can process sounds, either synthesized or natural, so that they seem to come from a particular direction. If you see a virtual fly buzzing around, that fly will actually sound as though it's coming from the right direction. We also make a full-body suit, a DataSuit, but you can just have a flying head, which isn't really so bad. The hands and head are the business ends of the body—they interact most with the outside world. If you wear just goggles and gloves, you can do most of the stuff you want in the virtual world.

Ques: What about touch?

Lanier: VPL is working on developing touch sensors. We've done experiments with tactile feedback by putting vibration simulators inside the fingertips. When your fingertips feel vibrations that match what you see in virtual reality, you associate them with the surface of the virtual object. It's surprising how many sensations you can create with vibrations alone. Another way to simulate touch would be with a grid of tiny elements that move back and forth like little pistons so that the overall grid can take on shapes. That's tough to build because it would have to be very thin to fit onto the surface of a glove. Touch is a very complex activity. Tactile sensation is an action; it's not passive. You're constantly rubbing things with your fingers, rubbing, squeezing things, feeling their weight and textures, judging the position of your arm and fingers, performing hundreds of subtle little tasks. To synthesize the full sensation of picking up an object in VR, you'd have to do a number of things, all difficult, some perhaps impossible.

Ques: Who are your customers?

Lanier: Most are companies and institutions with their own technical know-how. Some use VR to test designs before building them. Some are trying to understand scientific or engineering data better. Some are people who want to have fun.

Ques: Millionaires who want to play three-D games?

Lanier: There's only been one example of that so far, which I don't encourage. But there's nothing wrong with a technology that unites work and play. VR allows you to do work that you couldn't do otherwise by making a playful. Peo-

ple in the business world are sick of being told that things that aren't fun are fun, like using a spreadsheet. Virtual reality actually is fun. You might think of it as a general-purpose simulator, or as a fantasy machine.

But what makes it so special is that you and others wearing VR clothing can be networked together to share the same alternate reality. The content is completely variable—you could be on top of Mount Everest or the bottom of the sea—but the environment is the same for everyone in it. You and your VR partners can shake hands, dance together, play ball. You can construct buildings together. Virtual reality is an epistemological milestone, a new reality that's shared as the physical world is. Yet it is open and unattended like death's.

Ques: What are some applications?

Lanier: Each application by itself is a whole-amazing world, so in a way, anytime you talk about a particular application you're somehow losing sight of the overall picture.

Ques: Still, don't your customers view it as an efficient tool rather than a mind-boggling experience?

Lanier: Absolutely. It's extremely efficient. An architect can make a building real before it exists and bring people through it. In a demo with Pacific Bell recently, two architects got together

over the phone and explored a proposed day-care center in VR. One showed proposed features to the other, they could see each other moving around in the room and could make design changes. By holding the glove a certain way they could change their bodies to take on characteristics of children's bodies. So they were able to run around and test features like a water fountain from a child's perspective. Another example is city planning. Tom Furness is heading a lab at the University of Washington that's studying VR. We're helping them put a version of Seattle in to a VR that you can walk around in. You can add skyscrapers to the skyline to see what they feel like aesthetically whose views are blocked, and so on. Lanier: How can virtual reality advance medical technology?

Lanier: We take information about the human body from scanning machines and turn it into objects in virtual reality. This means doctors can put their patients through a scanner, then walk into virtual reality and pick up the patient's bones and internal organs. Suppose the patient has a serious deformity or injury. A surgeon could get a feeling for the three-D structure of that person's body to help plan surgery. This is still in the earliest testing phases, but we've done one project with the San Diego Supercomputer Center where we had peo-



"Notice how he only destroys those buildings with poor architectural qualities?"

ble drawing around inside patients and looking at the structure of their brains. You can have two physicians inside the brain at the same time, and they can talk about what they see. One can point to the structure and say, 'There's an abscess here.'

Orvi: What's the smallest world anyone's made a virtual visit to?

Lansier: Fred Brock and Henry Fuchs at the University of North Carolina have done some marvelous work letting chemists pick up molecules whose atoms are about fat size. You can figure out certain chemical problems quicker by holding on to a sort of robot arm that comes out of the ceiling and pushes back at you to simulate a molecule's forces. So you can literally feel where chemical bonds could occur.

A complicated organic molecule is something like a handful of little magnets in a cluster. Their forces combine to form a complicated, irregular field. As you move a new magnet over the big cluster, sometimes it's attracted, sometimes repelled. In a similar way, a molecule has a landscape of atomic forces around it. There might be little patches exactly complementary, so that two molecules will bond at one point. That's easy to study in simple molecules, but it's much harder with large organic molecules like an enzyme. The

systems that the North Carolina lab and others are developing are tremendous new tools for seeing and feeling how these molecules behave.

Some mathematicians and physicists are using it to make intangible worlds real. We're doing some work with actuators. They can fly over an abstract forest that represents various insurance statistics. It helps them notice patterns in the data more easily than they could on even a very large computer screen. Computer programmers could look at a whole program at once. A large program might look like a giant Christmas tree, and you could be a hummingbird flying around it. Landing on any one branch, you could see in great detail the structure of that part of the program. From a distance, you could learn to plan a very large program spatially.

Orvi: Do people send you suggestions about uses you never dreamed of?

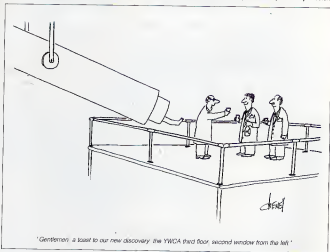
Lansier: Tom. Some of them are truly crazy. We've had inquiries about putting animals in virtual reality from people who design animal clothing. Ministers call up to ask if we could use VR as a kind of methadone treatment. And virtual sex—you should see how stupid my mail is on this subject! A lot of the inquiries don't make any sense, but it's important to be open-minded.

Orvi: The *National Enquirer* reported

that WPL was working on a spy glove. Lansier, [laughter] They said we were working with the CIA to make a robot resembling a covered hand that could be remote-controlled by a Data-Glove. It would crawl into enemy territory, climb over fences, steal enemy papers, and crawl back. It was silly. Orvi. Could virtual squash someday replace the real thing?

Lansier: Absolutely. Visually a simple squash game in low resolution might be usable right now on an inexpensive system. As for force feedback, you could design a robot that pushes back at your feet in a particular way. Perhaps there'd be a robot arm with a racket handle that comes out of the wall. You'd grab the handle, it would jerk back when the ball was hit. When the sensation is specific like this, you can go all-out and make it good.

What's hard is to build a general force-feedback machine. Here are some Rube Goldberg examples. Imagine having tiny rockets over your body with little thrusters that are pushing back and forth at you so that any possible force can be applied to any part of you. Or imagine that there are all these little robots all around you, and like tiny butlers, whenever you slam your hand down on a virtual table, they run up to receive your blow just before



'Gentlemen: a visit to our new discovery, the YWCA third floor, second window from the left.'

**ATTENTION
DIRECT MARKETERS!
MAKE NEARLY
4 MILLION GREAT
IMPRESSIONS
EVERY MONTH...**

INTRODUCING: THE OMNI EMPORIUM

OMNI now offers direct marketers a product showcase custom tailored to their special advertising needs.

The "OMNI EMPORIUM" will consist of 1/6-page, black and white ads, 2" wide by 4" deep.

**Display rates:
\$3,000 per 1/6th page ad.**

Camera-ready artwork is requested. If necessary, OMNI will provide creative assistance to advertisers at an additional cost. Payment must accompany all ad orders and must be in the form of a check, bank check or money order. Please enclose a sample of your product or catalog with your ad, as well as your street address and phone number; otherwise your ad will be returned. All ads are subject to acceptance by OMNI.

Deadline for materials is the 1st of the second month preceding the issue date. Closing for the March issue is January 1, 1991.

For further details write:
**OMNI EMPORIUM
1965 Broadway
New York, N.Y. 10023**

Or call:
**Glenn Smith at
(212) 496-6100 Ext. 1544
Fax (212) 580-3693**

your hand gets there. You can take any form you want. You might pull your nose to make it longer or choose from a drawer of extra snouts or horns. You might point to another person or animal wandering around in the environment and turn up a knob that says "LUSH" and gradually turn into them or something halfway between.

At VPL we've often played with becoming different creatures—lobsters, gazelles, winged angels. Taking on a different body in virtual reality is more profound than merely putting on a costume, because you're actually changing your body's dynamics.

What surprised us is that people adapt almost instantly to manipulating radically different body images. They pick up virtual objects just as easily with a long, spindly anachronist arm as with a human one. You'd think your brain is hardened to know your arm and that if suddenly it grew three feet, your brain wouldn't be able to control it, but that doesn't appear to be true.

I became curious about how far I could push this, and added fingers to my hand and limbs to my body. But how do you control this extra limb? Wiggle your nose? Let's say you want a third, virtual arm in the middle of your chest. The most obvious way to control it is to make its position an average of your two physical arms, so its thumb is always halfway between your physical thumbs and so forth. Now that's moderately interesting, but basically the new arm is just something that gets in your way. Imagine a more complicated way of controlling it: a bodypart that's constantly making dozens of measurements of different parts of your body—a little bit of ankle, wrist, neck—all controlled by the computer in a suit of garments to control how far the elbow in a new virtual arm is bent at any moment. You're essentially stuck in control of a new limb while letting each individual part of your physical body move freely. It's like a hidden resource. Okay. You'd consciously learn to control the new limb?

Lamer. It's too complex to do consciously. You'd learn to control it intuitively by getting feedback. This suggests that you might help people who are paralyzed have the experience of walking in virtual reality. Sensors placed on unjured parts of their bodies could let them control a complete body in virtual reality, allowing paralyzed kids to play sports with other kids. Would this activity keep parts of the brain awake that might otherwise atrophy through lack of use? This is completely unknown right now. I haven't studied it as a scientist. I've only hacked it as a technologist. The field is crying out for more study of phenomena like this, which VPL is not set up to do.

We were thinking of selling a book-



CABLE T.V. CONVERTERS

**WHY PAY A HIGH
MONTHLY RENTAL FEE?**

All Jerrold, Oak, Hamlin, Zenith, Scientific Atlanta, Pioneer and all specialized cable equipment available for shipment within 24 hours. For fast service MC/VISA or C.O.D. telephone orders accepted. 90 Day Guarantee (Quantity Discounts) 8 A.M. to 5 P.M. C.S.T. Monday through Friday.

Send self-addressed stamped envelope (50¢ postage) for FREE CATALOG.

110, Ross 3088
Suite 211
Cincinnati,
Ohio 45211

INFORMATION/ORDERS (800) 648-3030

Note: Decoders and Descriptors must be used without authorization by your local cable operator. No Check Orders Accepted.

OMNI TIME CAPSULES



Now the magazine of the future can be kept for the future. Store your issues of OMNI in a new Custom Bound Library Case made of black simulated leather. It's built to last and it will keep 12 issues in mint condition indefinitely. The spine is embossed with the gold Omni logo and in each case there is a gold trailer for recording the date.

Send your check or money order (\$8.95 each, 2 for \$21.95, 6 for \$49.95) postpaid USA orders only. Foreign orders add \$1.50 additional for postage and handling per issue.

To: OMNI MAGAZINE
Attn: James Industries 699 E. Dow Ave
P.O. Box 19166

CREDIT CARD HOLDERS (orders over \$25)
CALL TOLL FREE 1-800-925-8888
Or mail your order, clearly showing your account number and signature. No refunds, add 5% sales tax.
SATISFACTION GUARANTEED

COMPUTE BOOKS IS YOUR AMIGA RESOURCE

	Price
— CD18 Directory Amiga Base	\$14.95
— CD04 First Book of Amiga	\$16.95
— C129 Second Book of Amiga	\$16.95
— CD43 Nets and the Amiga	\$15.95
— CD20 Amiga Programmer's Guide	\$15.95
— CD50 Advanced Amiga Base	\$18.95
— CD5X Amiga Applications	\$18.95
— C181 Mapping the Amiga	\$22.95
— CD46 Inside Amiga Graphics	\$18.95
— C174 Amiga Desktop Voice	\$19.95

Total Number of books _____

Total cost of books ordered _____

Sales Tax (NY, NJ, NY residents add sales tax) _____

Shipping and handling \$2 per book _____

Total enclosed _____

(Check or money order in US funds only, cash pay adds to Complete Publications)

Please print

Name _____

Street Address _____

City _____

State _____ ZIP _____

Mail this entire coupon to:
Complete Books
 c/o CCC
 2506 McElfan Ave.
 Pennington, NJ 08109

Offer expires July 22, 1991.

Print and mail only, shipping extra.

Please allow four to six weeks for delivery.

AMIGA

ly, "100 Descriptions for 50 Cents."

Ques: What about vacations, say, in a virtual Maui?

Lerner: The existence of a virtual Maui will just make the physical Maui that much more precious and desirable. I don't think virtual reality will ever serve as a substitute for the physical world. It's not as good. A virtual Maui could never be a full simulation. By putting it into a computer, you remove its mystery; it's bland and clunkier. You turn it into a finite model.

Ques: Still, you talk about the awesome illusions possible.

Lerner: The emotional character of virtual reality is completely different from that of the physical world. VR is a craft you create. People say "I want to try virtual reality because I want the thrill of having those experiences wash over me," but in fact the experience is the opposite of that. It's very intentional. A better name for it, actually, might be intentional reality. The physical world is thrilling because it's intently subtle.

There's always more to perceive. It surrounds us with a sea of mystery. Those of us in science and technology tend to live under the delusion that we mostly understand the world, that there are just little patches that are mysterious. But in fact, we've just constructed around us a small set of things that we understand. Also, particular environments in VR will never be terribly exciting because they're so readily available. That creates river drudgery over there is an unusual object, which gives it a certain preciousness. If we swim in a virtual reality and you saw one of those, it would mean a damned thing, because you could make a hundred of them as easily as one. So particular forms become murders. What's exciting are the frontiers of imagination, the wisest of creativity as people make up new things.

Ques: How is it possible to build a virtual world?

Lerner: There's no one answer; anything's possible. We're working on technology that will grab a part of the physical world—an architect's rendering or brain scan—and translate that into the virtual world. Ultimately, though, the most efficient way will be to use virtual tools you find on the inside. For instance, if you saw a big block of stone in a virtual reality, you might also see a chisel that you could pick up with your virtual hand and start carving with. The difference is that virtual tools will have super powers. You might make an eye-dropper that could touch an object and squeeze it in, then squeeze it out somewhere else to make copies of the original. You might have another tool that stretched anything it came across and made it long.

Some tools could be very expressive. This room is filled with musical instru-

ments because I find them to be the most eloquent tools ever made. I want to make tools for VR that are like musical instruments. You could pick them up and gracefully "play" reality. You might "blow" a distant mountain range with an imaginary saxophone. You'd be using gestures instead of building something stone by stone.

When you can improvise while inside it, making it up as fast as you think and feel, you can reach other people. As babies, each of us has an astonishing liquid intensity of imagination on the inside that butts up against the stark reality of the physical world, which resists us. That the baby's imagination cannot be realized is a fundamental indignity that we only learn to live with when we decide to call ourselves adults. With virtual reality you have a world with many of the qualities of the physical world, but it doesn't resist us. It releases us from the taboo against infinite possibilities. That's the reason virtual reality electrifies people so much.

In the future I see it as a medium of communications where people improve words instead of words, making up dreams to share. An ideal VR conversation would have the consistency, spontaneity, expressiveness of a jazz jam but the liberal content that's missing from music. Things being made would be objects—houses, chemical processes, or whatever the conversation is about. It would be a really conversation, an objective form of the Jungian dream, the collective unconscious. You might call it the collective consciousness.

Ques: What about virtual sex? Is it a possibility or not?

Lerner: Oh, God [grimly]. I suppose virtual reality can contain any kind of imagery, so why not sexual? But the whole subject of virtual sex forces the question, What is sexy? What is intimacy? There are some interesting ways to have intimacy in virtual reality. Consider trading eyes: You'd hook up your virtual eyes to look out of another's head and vice versa, so that you control each other's point of view. It's hard at first, and you really have to learn to dance together at a very intimate level to make it work. I find that more interesting than the idea of virtual sex, which seems a little funny to me.

Ques: When it reaches the mass market, might people settle for lounging mass-market worlds?

Lerner: Once you get a taste for making up your own reality, you don't go in for passive realities anymore. I'm not saying that everyone will make up stuff all the time, there will be catalogs of old stuff. But I'll bet you a pizza in thirty years that people turn out to be creative. We're living in one of the strangest periods that has been or will be. In the twentieth century our society has been completely warped by technolo-

gy, but the technology is still astonishingly primitive. Considering that kids grow up with TV, a one-way medium, there's a tendency toward noninteractivity. This is the first century when technology has been the primary mode of people reaching each other. After this, it will be interactive technology.

Orin: Who first made VR work?

Larier: A lot of people. Ivan Sutherland [a computer graphics pioneer] built a head-mounted display with interactive graphics back in 1966. In the Seventies, Tom Furness, who was working for the U.S. Air Force, made enormous strides in the technology. My role has focused on turning this into a shared medium. That had never been done before. Until then, there'd be one person inside a simulation just looking around in it. I also figured out how to make it commercial for the first time. Tom Zimmerman, who was VPL's first hardware engineer in the early Eighties, built the first glove, and I integrated that into a way of picking up imaginary objects in space. Tom's original idea was to use the glove to play air guitar. You could play music with a guitar that doesn't exist. I've made a few elaborate versions of this glove, including one last year when I played Jimi Hendrix solos.

Orin: A *Wall Street Journal* headline said virtual reality was "electronic LSD."

Larier: That's stupid. The idea of spacing out in virtual reality is absurd. It would be like getting a model train in order to fall asleep over it. VR is a medium; it affects the world outside your sense organs and that's all. It has nothing to do with brain chemistry or your state of being. If one becomes euphoric in virtual reality, it would be because you were reacting to the outside world that way. The first moment of freedom is always ecstatic, but after that you're on your own. Actually I'm unqualified to talk about the subject because I've never taken LSD. I don't take drugs and I don't drink alcohol.

Orin: Why do you wear dreadlocks?

Larier: I think of myself as a student who experiments with different things at different times. I had much more conventional hair two years ago, and I'm sure I will again in two years. I had no intention of becoming a well-known person this year. One nice thing about my hair is that if I ever want to get out of the hassles of being well-known, all I have to do is cut it off. I can always save it as a wig and put it back on when I give talks.

Orin: You're a high-school dropout?

Larier: Escapew is more like it. I left at fifteen and then kind of snuck into college—New Mexico State and other places. I was never much on the rituals of

academia. By rituals I mean turning in papers and finishing degrees. Computer science is a splendid field and most of the founders are still alive. I learned by apprenticing myself to some of them. Marvin Minsky was extremely important to me, and I used to just hang out with him. He is rethinking the whole world from the bottom up all the time. That's an inspiring quality.

Orin: Did you invent make-believe worlds as a child?

Larier: What I remember most about my childhood isn't so much inventing make-believe worlds as being overwhelmed by the experience of different physical places. My sensitivity to the mood of a particular room was sometimes so intense I could hardly talk. I didn't know how to communicate that feeling to others. I love words—I love to read, write, talk—but I think words leave out almost everything. That frustration more than anything else—feeling that what we can share with other people is so much more limited than what we actually experience—is what has driven me into this technology.

Sometimes I think we've uncovered a new planet, but one that we're inventing instead of discovering. We're just starting to sight the shore of one of its continents. Virtual reality is an adventure worth centuries. **DO**

Over \$995 EACH COPY

OMNII THE NEW FRONTIER

WORLD'S FUTURE SPECIAL



BUILDING A BIONIC MAN
NEWSDEALS FROM THE FUTURE

BIONICS

Maximal Medicine Integrated

MUSIC

Technology and Humanity Joined

COMMUNICATION

With Other Space and World

COMPUTERS

The Creation of Super Humans

ON VIDEO THE MOST DAZZLING VIEWS OF THE FUTURE!

From the pages of the world's leading science magazine, The excitement of a look into the future brought to life in two new videos from ..

OMNII

See top OMNII video products. All prices in US dollars. Payment in US dollars.

Please rush me the video(s) I've checked below:

OMNII: The New Frontier...

\$9.95 plus \$3.00, postage and handling

OMNII: The Real E.T....

\$9.95 plus \$3.00, postage and handling

Total order (check plus postage and handling) \$_____

Name _____

Address _____

City _____ State _____ Zip _____

Check enclosed Money order enclosed

VISA MasterCard

Account # _____ Expiration date _____

Signature _____

Credit card holders call toll-free:

1-800-221-1777

Orders are available in US dollars only. International orders payable in US dollars. Please allow 4-6 weeks for delivery.

Available in Italian, Spanish, Portuguese.



ARE WE ALONE IN THIS
VAST UNIVERSE?

SEEK Search for Extra Terrestrial Intelligence
No Science Fiction Fantasy—A SERIOUS NASA study, listening for messages from other planets. An international project of first contact. UFOs—real or imaginary? Have the first aliens landed?
Space maps on Mars and the Moon... Making Mars Inhabitable... Making the Moon... And much more!

he muttered. "This is a message to us, and we do well to observe carefully. We'll have to understand the message."

I could see his point. That chaos of water could overwhelm great cities. It did not flow forth simply because of Hamilton, who might be destroyed by a small particle of such enormous energy.

Clouds, of a kind not seen since the creation, formed along ridges of the mountains. There were towering clouds of fire, and equally high clouds of ice, yet the fires did not consume and the ice did not destroy. Fire rumbled upward, darkly smoking, swirling toward the heavens, and sunlight gleamed from cascades of shattered ice. Sunlight penetrated black columns of smoke. Light winds swept the valley, interweaving cold and heat while massive chunks of ice, ripped from glaciers, appeared in Troublesome Creek. Then great winds began to howl, twisting in the high heaven, as if they blew through space from distant stars.

Frightened animals screamed from the safety of barns, and the creek rose steadily until it was a wall of water. The wall stood high, then higher. First it was above our heads, then rapidly grew until it stood above our rooftops, but it

still did not flood. Giant trees soon from mountainsides began to twist and turn in Troublesome Creek. Waves rose serenely above the tumult.

I heard the saddened voice of my mother long dead, and the firm voice of my father, long dead. The anxiety strode invisible among those waters, and we heard the congregated voices of our people. They spoke without hate, only sadness. Yet they commended the waters.

Hamilton died as men on horses pounded through the valley in an attempt to aid him. He outlasted his cohorts. After all the survivors and workmen and engineer were only men doing a job. Their last sight of this world was a rain of glacial ice that killed instantly, and then the bodies were tumbled into the waters and devoured by fishes. Hamilton's death, however, was prolonged. For a while the creek flowed backward. Then it ceased to flow in any direction and simply stood as a gigantic wall of water. Clouds black as the soul of night stood overhead as lightning crashed, jumped between clouds, illuminated a shadowed landscape that lay beneath volcanic shocks of thunder. When the wall of water, silver flashes streaked, and the flashes echoed human voices. The anxiety rode in those flashes, the eternal human spirit rising to protect—or warn—

or teach—we know not which.

Not everything in the creation is beautiful. That which raised its head above the surface and clasped Hamilton, caused even the bravest of our young men to rein back their horses. Even when the water form expanded, becoming elongated over half the length of the creek, we could not tell whether it led with mouths or eyes, for what we took to be mouths were also ledged. They blinked in unaccustomed sunlight, and smoke, and hail. Darkness and light shifted as if color were liquid, and the creature carried all colors and all darkness.

Hamilton was carried, his round face distorted by screams, just above the surface. The creature of the flood drove the flood, and the flood roared above the tiny voice of Hamilton. This strong man, so filled with pride, but also filled with possibility, thrashed amidst his screams. He called to us, and whether he screamed curses or apologies we do not know. His voice garbled with fear, perhaps with repentance, and then his voice was instantly silent. In the enormity of water, the great shape dove into the crevasse, sliding into darkness and the pressure of two thousand feet. Hamilton was only a small spot of color from his expensive clothes as he disappeared into eternal night.

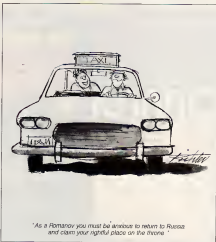
"We do not know. We do not know. Mystery surrounds us. We walk in fear of ourselves. To such power we have no right."

With the death of Hamilton the flood receded. Waters sucked into the earth, reamed to the crevasse, but no fish were stranded. Troublesome Creek resumed its normal course. Clouds whopped past, then dissolved like echoes. We stood anticipating the eternal promise, the rainbow which stands as sign from the Almighty that He will never again destroy the world by flood. The rainbow appeared, but it brought small comfort.

We returned to our families, our fields, and our beasts. Spring calves romped beside their mothers, and cattle mowed led and content in new grass. The steeple of Sons of Noah Church rose beside the creek, a loved and familiar silhouette against the surrounding mountains. We have always treasured peace and quiet ways.

Yet we have memories. The first ugly sound of the helicopter, crisp, chattering away like a tiny hatchet attacking a giant tree. We remember the easy confidence of Hamilton, the blindness of his power. He had the money and the equipment and the men that would allow him to alter the very peace he yearned for. He could not deny using his power, nor so, we fear, can we.

Another spring is at hand. Our congregation has met anxiously in fear and question for nearly a year. I need to explain carefully what troubles us.



"As a Romanov you must be anxious to return to Russia and claim your rightful place on the throne."

ARTS

HUMAN VIDEO GAMES

Use your body as a joystick to play inside
Myron Krueger's creations

Two video cameras signal your presence to the computer, and suddenly your silhouette is projected on the monitor alive with computer-generated imagery. Bright swatches of rainbow hues emanate from your image, amplifying your every move.

With a flick of the wrist, the bands of color pulsate. You wipe them out by walking back and forth across the screen. Touch the screen—playing it like you would a musical instrument, and the video environment responds with an

astonishingly accurate virtual self. A list-size gobelin dances around your head and shoulders and jumps into your hand if you hold out your palm. A laser fish chases you if you walk across Krueger's smart floor, which has electronic sensors to register footsteps.

For more than two decades, Krueger has been designing interactive computer exhibits that require participants to wave their hands, point their fingers, flap their arms, or pace the floor. In his quest to find a new artistic medium, he has changed art from a

technology to reward threatening. The "brains" of his own operation—30 custom-made circuit boards housed on a rack seven feet high—took hundreds of thousands of hours just to configure.

Krueger's work has often been lumped with other artificial and virtual reality projects because they share certain conceptual similarities—the notion of a computer-generated interactive environment that in some way engages the user, for example. But while artificial realities like Autodesk's CyberSpace (see *Explorations*, page 16) and Jaron Lanier's *Virtual Reality* (see interview, page 44) require cumbersome head- and hand-gear, Krueger's environments require no accommodations. Unlike Lanier and others in the field, Krueger is not motivated by technology. "To some extent, my work is a reaction against technology as practiced by technologists," who, he says, mistake the computer for "an inherently mathematical machine."

Having begun creating artificial realities as a graduate student at the University of Wisconsin, Krueger tried mostly in vain throughout the Seventies and early Eighties to persuade government and corporate sponsors to provide grants for his art. Last year he was finally recognized for his contribution to interactive art when he received the Pix-Aus Electronica, an award given at the International Electronic Arts Festival held annually in Linz, Austria.

Today he maintains a permanent exhibit of his work in a corner of the State Museum of Natural History at the University of Connecticut in Storrs. He is also besieged by invitations to take his exhibits on the road each year. Beginning January 7 he is setting up shop for five days at Colorado College in Colorado Springs. And in March, Philadelphia's Franklin Institute plans to sponsor a month-long exhibit. —Karen Wright **DD**

Watch out for that Ash-size goblin! You never know how the



computer might respond if you try to cheat at these interactive video exhibits.



amazing symphony of sounds.

Entering Myron Krueger's "responsive environments" is like playing video games and using your body as a joystick. When you first enter one of his creations, you have no way of knowing what effect a gesture, posture, or motion may have. There are 30 different ways that a virtual maze can retaliate if you try to cheat! Try to cross a maze's boundary lines, for example, and the wall might stretch like a rubber band and con-

spectator activity to a customized participatory event. And having conceived the idea of man-machine interaction as an art form, Krueger developed what he refers to as "the aesthetic of interactivity."

"The medium is the interaction, not the graphics or audio," Krueger says. "The beauty of the art lies in the relationship between action and

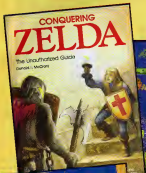
response. The dialogue between a person and the graphic creatures creates a coherent experience that is essentially ad-libbed by the system."

The application of computers in art has generally avoided established art forms, but Krueger argues, "It's not computer art if you can do it without a computer."

Even so, he understands why artists haven't leapt to the computer's defense. The traditional artist would find the ratio of technol-

CONQUER NINTENDO®

WITH THESE BOOKS
FROM COMPUTE



COMPUTE's Guide to Nintendo Games

Packed with hints and tips for better play and dozens of reviews of available game cartridges for the Nintendo Entertainment System. 272 pages, \$9.95

COMPUTE's Nintendo Secrets

More strategies, hints, tips, reviews, and ratings for dozens of the newest, most popular Nintendo games. Max-out scores on Super Mario Bros. 3, Batman, Ninja Gaiden II, and more—198+4 color pages, \$8.95

Conquering Zelda: The Unauthorized Guide

Finally—the hints and techniques you need to conquer two of the most popular Nintendo games. The Legend of Zelda® and The Adventure of Link™. Step-by-step instructions to rescue the princess! 128 pages, \$7.95

All orders
shipped
within 48
hours

YES! I want more hints and tips. Please send me the books checked below.

- COMPUTE's Guide to Nintendo Games (2214) \$9.95
 COMPUTE's Nintendo Secrets (2344) \$8.95
 Conquering Zelda: The Unauthorized Guide (2387) \$7.95

Name _____
 Address (Please list if MC, VISA, or DISC and appropriate sales tax for your state) _____
 Shipping and Handling \$2.00 and Cash-on-Delivery fee where no shipping and handling is added is over \$18.95 _____
 Total Enclosed _____

Check or money order MC VISA

Signature _____ (Please print)

Mail to _____ Dept. Code _____

Name _____

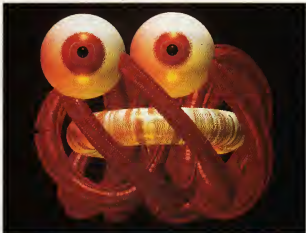
Street Address _____ (No P.O. Boxes please)

City _____ State _____ ZIP _____

The offer expires September 30, 1991. All orders must be paid in U.S. funds drawn on a U.S. bank. Orders will be shipped via UPS Ground Service.

MAIL TO: Compute Books
 c/o CDS
 2990 McCloskey Avenue
 Parametere, NJ 07652

Nintendo and The Legend of Zelda are registered trademarks of Nintendo of America, Inc. The Adventure of Link is a trademark of Nintendo of America, Inc.



PHENOMENON

The computer is rapidly becoming a sophisticated painter's palette: an artistic tool with seemingly unending possibilities. Computer scientist Clifford Pickover began creating his "computer sculptures," as he calls his pieces, while developing graphics programs to help scientists visualize and thus better understand complicated data. His art is derived from mathematical formulas that graphically render forms. He then embellishes them to fit his artistic sensibility. In *I Have Dreams At Night*

(top) for instance, Pickover used three mathematical curves to create the interwoven ropelike structures, then added the eyes for effect. "With journal plots, formulas you can describe the shapes of the curves you want to the computer and then add light and shading to give them a three-dimensional effect," the artist explains. "But the behavior of some of these formulas is hard to predict and visualize."

In his book *Computers, Pattern, Chaos and Beauty: Graphics From*

An Unclean World (St. Martin's Press) Pickover likens himself to a fisherman whose computer functions as the hook, rod, and reel. "A fisherman doesn't always know where the waters will yield," he writes. "However, [he] may know where the fishing is good, where the waters are fertile, what type of bait to use." And, though Pickover may not be able to say with certainty what fish he will pull from the water, it is just that surprise that makes the sport, and his art, enjoyable.—Jane Boonard **DD**

LAST WORD

PLAY, MUSIC, PLAY

Video game rock stars make the world safe for democracy

While they may not yet have come of age, video games have at least officially arrived at puberty. Michael Jackson has lent his name and considerable talents to a game cartridge from Sega. Not his real name, of course, but the name he took from the retrograde soft shoe he does: Moonwalker. He also lent some songs to the game "Beat It" and "Bad." For some reason, they seem to have left out "Rockin' Robin" and my personal favorite, the Jackson 5's 1972 cover of Jackson Browne's ode to social relevance, "Doctor, My Eyes." Doubtless the gray heads at Sega judged that these songs were too old for the kids who might buy the game. But need I remind them that "Beat It" is more than eight years old?

While the music plays, a Jackson (Michael, not Browne) simulator does his by-now famous moves on-screen.

"What is this?" I asked my editor, as we sat slouched around

my office-cum-computer graveyard. "A dance simulator? Kids twiddle their joysticks just to watch Michael Jackson dance?"

"No, it's a game," said a Sega publicist when I called. "It's a great game." He explained that Michael fights against the bad guys, using his dance "more as a weapon than anything else." Dance as a weapon? Has the Defense Department missed out on something here?

"I haven't played to this level," he continued. "But I'm told that at one point in the game a star falls and if you can jump up and catch it, you turn into a robot."

I felt as if I'd been flattered by inspiration. Pop stars in video games? There must be dozens of pop stars past and present whose acts and lives could be turned into video games. I know I was on to something.

•The New Kids on the Block game, *Hang Tough*. For all I know, this one may be under development. These five dolls of a vast audience of preteen females set out on an adventure to prove that you don't need the talent God gave a Monkee to succeed in the world of sanitized rock and roll. Players lip-synch and pretend to play their instruments to destroy the music critics and discerning parents who stand in their way.

•The Alice Cooper game, *Welcome to My Nightmare*. In heavy makeup and drag, Alice lures billion-dollar babies, smoke bombs, and bats at enormous speeds that stalk the stage. The player who makes it to the detox center wins.

•The Mama and the Papa game, *Dedicated to the One I Love*. Mama Cass, Papa John, and their minions destroy all the nudes in Golden Gate Park by tearing flowers in the hair of San Franciscans everywhere.

Other acts from the Summer of Love who didn't make enough impact to have their own games—Berry McGuire, Strawberry Alarm Clock, Spanky and Our Gang—get to do walk-ons. To win the game, you must avoid prematurely sinking into obscurity or choking on a ham sandwich.

•The Barry Manilow game, *ZZZZ*. Granted, for edge-of-your-seat excitement, this game can't compete with *Moonwalker*, but I think you will agree that there's enough evil in the world of video games to justify any weapons system we can lay our hands on. Anxious parents who are worried that their young ones aren't getting enough rest will appreciate the way this game lifts them off to dreamland in mere seconds.

Thinking about Barry naturally led me to the Freddy and the Dreamers game, *Do the Freddy*. Freddy's weird arm-flapping dance is converted into a form of mma combat. Unfortunately, Freddy's career was tragically cut short by unpopularity, so the game might not achieve the heights of success. Fortunately, it can be cheaply repackaged as the Miki Vanelli game, *Give You Know It's True*. Miki and Vanelli pool bad guys away with their peculiar serpentine movements, which have been identified simply as an updated Freddy. The 11-11 twins turn bad guys to stone with their Medusa dreadlocks.

•The Beatles game, *Follow Submarine*. A natural for the kids, this sense of adventure in hallucinogenic Day-Glo colors offers the best from the Beatles' psychedelic era. Game play will involve picking off Blue Meanies with love guns. Naturally, your kids will have no idea who the Beatles were. Explain that they were the band famous for launching the career of Ringo Starr. A warning label from the U.S. drug czar will ensure the position of this game at the top of the charts. **DD**

When he isn't listening to *Dixie* on the local blues station, writer and editor Robert Stuby is still trying to master *Pop-Mat*.

