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EXCLUSIVE

STAR WARS

**HOW THE U.S.S.R.
COULD DESTROY
THE U.S. SATELLITE
DEFENSE SYSTEM**





FIRST WORD

By Freeman J. Dyson

● *The only political force strong enough to abolish nuclear weapons is the military establishment itself.*

Nuclear weapons are deeply entrenched not only in the concrete blocs of America and Russia but also in the structure of international relations and in our ways of thinking. It is difficult to imagine the process of transition that could save us from the world of today to a time when nuclear weapons would no longer be important. But the fact that a historic transition is unimaginable before it happens. History is full of examples of transitions that leave deeply entrenched institutions and deeply held beliefs.

It has happened not infrequently that a dominant technology, accepted by contemporary observers as permanent, disappeared from the scene without lasting witness. Sometimes a technology disappears because it is replaced by something more powerful. Sailing ships succumb to steam, and carrels succumb to motorcars. Sometimes a technology disappears because it is replaced by something less powerful, there may be social or political forces that create a less powerful technology to prevail. I call a transition from less to more powerful technology a transition of the first kind, and a transition from more to less powerful technology a transition of the second kind. Transitions of the first kind are similar to us. Transitions of the second kind are rare and less well-known. Since the transition to a world without nuclear weapons must be a transition of the second kind, it is important for us to study transitions of the second kind with special care to understand how and why they have happened.

In his book *The Camel and the Wheel*, Richard Buxton, a historian of early Arab civilization, describes a striking example of a transition of the second kind. He demonstrates with ample documentation that in Roman times the entire Arab world, extending roughly from Tyre to Afghanistan, based its economic life on the same infrastructure as the Roman Empire, namely, on the technology of wheeled vehicles and paved roads. South, east, and north of the Mediterranean, the basic unit of freight transportation was the oxcart. About A.D. 500, a few hundred years before the rise of Islam, a drastic change occurred. Throughout the Arab territories, caravans of camels took over the freight business, roads fell into disrepair, and wheeled vehicles disappeared. For more than 1,000 years, until Europeans moved in with steel rails and locomotives during the industrial Revolution, the camel reigned supreme.

Another transition of the second kind, described by Noel Perrin in his book *Living Up the Gun*, occurred in Japan in the seventeenth century. In the sixteenth century, after the first European ships visited Japan, Japanese craftsmen quickly learned to make guns. They manufactured guns of superior quality. Large numbers of Japanese guns

were exported, and still larger numbers were used by Japanese emissaries abroad and at home. Perrin illustrates his book with old Japanese drawings of seventeenth-century warriors carrying and firing guns. For half a century the corps of samurai was heavily addicted to guns. The warriors fought gun battles with great losses of life. The losses were so heavy that the leading samurai became convinced that guns were ruining their honorable profession. They decided to go back to fighting with swords. For two and a half centuries the sword was reinstated as the basis of military power, while guns were used only in small numbers for ceremonial purposes. The supremacy of the sword was maintained until 1879, when the samurai were defeated by a new-style army intent upon modernization and armed with European weapons.

These two transitions of the second kind have much to teach us. In both cases, the driving force of the transition was the political power of a skilled, professional elite—the camel drivers in Arabia and the samurai in Japan. In both cases the ideology of the transition was conservative, aiming to perpetuate an old social order and a traditional way of life. In neither case was the transition permanent, but it lasted more than 1,000 years in Arabia, more than 200 in Japan. If we could successfully abolish nuclear weapons and make the abolition stick for 200 years, that would give our species time to adapt itself to new technologies and to tackle some of the other urgent problems of survival.

A practical program leading toward the abolition of nuclear weapons must be based upon three principles. First, it is not possible to replace something with nothing. To replace a wheel we need a camel. Our camel must be a robust and versatile technology of nonnuclear weapons capable of defending our rear and our allies without destroying us. Second, the only political force strong enough to abolish nuclear weapons is the military itself. The move away from weapons of mass murder must be presented to the public not as a response to fear but as a response to the demands of military honor and self-respect. Third, the military establishment of the Soviet Union must be allowed to share equally in shaping the program. The establishment of a nonnuclear world is a conservative objective, and the hope of achieving it rests mainly on the profoundly conservative traditions of the military professionals in all countries. To succeed, we need to have on our side not only the camel drivers but also the samurai. □

Freeman J. Dyson is professor of physics at the Institute for Advanced Study, in Princeton. His most recent book, *Weapons and Hope*, (Plaster & Row), discusses the struggles men must go through in abolishing nuclear weapons.

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Many of the more than 100 satellites in geosynchronous orbit, 22,300 miles above Earth, keep track of potentially hostile rocket launchings. Many others handle a steady flow of defense-related data whizzing by at billions of bits an hour. The high sentinels appear invulnerable. But in an exclusive report, "Pearl Harbor in Space," distinguished space writer James E. Oberg describes a frightening scenario. He warns that our fleet in space could be wiped out by a single, unmanned enemy spacecraft.

Oberg's warning comes as the United States continues to test a highly sophisticated air-launched antisatellite (ASAT) weapon. Experts believe the missile is superior to the Soviet ground-launched ASAT. But current ASATs under development by both superpowers are no threat to satellites in high orbit. The Soviet weapon's range is estimated to be only 1,400 miles. Our ASATs' range is classified but would certainly fall short of 22,300 miles. Oberg's alarming conclusion, however, is that no new technology would be required to loft a hostile vehicle into a position to threaten our geosynchronous satellites. "The attacker would need no nuclear weapons, a small cloud of plastic pellets thrown in the path of the oncoming satellites would turn our space fleet to rubble." He reveals on page 42 how it could be done.

The current frostiness in relations between the Soviet Union and the United

States makes Oberg's scenario all the more frightening. But America's best-known prophet and polemic, George Gallup, Jr., reports this month that Americans remain resolutely optimistic about the coming century. Far from fearing scientific advances, Gallups subjects base their optimism in part on the promise of future technology. The excerpt on page 64 is from the book *Forecast 2000*, by George Gallup, Jr., with William Proctor. It will be published in July by William Morrow and Company.

Futurists base their insights on massive polling of experts and the public at large. Russian-born Nobelist Wessely Leontief has another technique for predicting the future: an input-output table. And in this month's interview (page 70) conducted by Anthony Liveridge, Leontief explains how it works. Most economists, Leontief grumbles, are too enmeshed in theory to generate specific predictions.

When it comes to microprocessors, however, predictions are fulfilled before we can contemplate their effects. Technology appears to be running away with itself. Tomorrow's chip will be designed for those of us who don't know bauds from bytes and don't speak Pascal. According to freelance writer Richard Wolkomr, "Computers will explain, offer support, and act as your associate. They'll learn your job and adapt to your needs." But this sophisticated capability depends on hardware just now coming into the marketplace. IBM recently

announced a new chip, as small as a shirt button, that can hold 1 million bits of information—about 100 pages of text. In "Megachip" (page 74), Wolkomr provides a preview of these new technologies—then Intel's latest bubble system to Silicon Valley's latest advances in "parallel processing."

In "Mission to a Mind," on page 60, investigative journalist James Reston, Jr., explores an even more impressive kind of hardware: the human brain. In the late Fifties, Robert Monroe was just another upscale radio executive working in New York. Then he began to have strange experiences in his sleep. Removed entirely from his own body, he reported he could pass through walls and explore unknown "energy systems." He gave up his career to explore these realms. After years of research into altered states of consciousness, he has concluded that it is possible to misperceive out-of-body experiences.

Reston allowed himself to be subjected to several short mind-expanding tests. "Even asleep in the preparation room," Reston comments, "I never thought more intensely I know I exist now... all the time. Will I exist when my body falls mo? Stay tuned." Reston has just completed the book *Sherman's March and Vietnam*, which will be published by Macmillan.

This month's fiction story, "New Rose Hotel" (page 48), is a high-tech thriller by the hot, new punk writer of the Eighties, William Gibson. ☐

DIALOGUE FORUM

Omri welcomes speculation, theories, commentary, dissent, and questions from readers in this open forum. We invite you to use this column to voice your hopes about the future and to contribute to the kind of informal dialogue that generates breakthroughs. Please note that we cannot return submissions and that the opinions expressed here are not necessarily those of the magazine.

Don't Do Unto Animals

I found Frank Kendig and Lisa Buck's article "Guinea Pigs" (February 1984) to be rather thoughtless in the way it side-stepped some important issues regarding the use of animals in research labs.

The article makes it clear that when studying human problems, humans make the best subjects. But it also indicates that humans are not willing to allow researchers to do to them what they do to animals. And no wonder! One of the main reasons animals are utilized is because they cannot say no to physical and mental abuse.

I am in no way against medical progress, but research does not have to include animal experimentation. The solution lies in alternatives.

The article attempts to do and on a cheery note by reminding us of the wonderful agreement we have with lab animals. But it takes two to strike a bargain, and I seriously doubt that any lab animal has given its consent.

Stacy Aspley
Long Beach, CA

Forum editor Leslie Epstein replies: The massive and stately American Museum of Natural History, in New York City, is an unlikely setting for an angry demonstration. But in a highly publicized drive to end animal experimentation (specifically, research on the sexual functions of cats) in the museum's laboratories, animal-rights activist Henry Spira and his followers marched to the museum's steps. They vowed to stay until the research was halted. Faced with the prospect of continued protests and a lot of bad publicity, the museum's directors were

persuaded to end the experiments.

Demonstrations protesting experimentation on animals have challenged scientists across the United States. And recently, the animals have been winning. At Howard University, in Washington, D.C., a group of activists broke into the school's laboratory and released the animals from their cages. Later, new homes were found for the freed animals. National Institutes of Health researcher Dr. Edward Taub's work on nervous disorders was permanently halted when he was tried and convicted of cruelty to animals. An activist had infiltrated Taub's lab and photographed the procedures taking place. Taub insisted that his techniques were justified and humane. He appealed the court's decision and won, but the National Institutes of Health did not renew his grant.

Scientists insist that animals are essential to their research. "Virtually every medical and surgical advance of the past century was based on the study of animals," according to Frederick King, of the Yerkes Regional Primate

Center, in Atlanta. Without animals, researchers could not have developed a vaccine for polio, or insulin for diabetes. Surgeons would not have dared perform organ transplants without first trying the procedures on primates and cattle.

The protests are harder to deflect when they are aimed at cosmetic companies. One test for chemicals in cosmetics involves placing droplets of test substances into the eyes of rabbits. The procedure, called the Draize test, takes advantage of the fact that rabbits' eyes are more sensitive than those of humans. "Is it worth blinding rabbits in order to have a new shampoo or longer lasting eye shadow?" asks Spira, head of the Coalition to Stop the Guinea Rabbit Blinding Test. After an ad appeared in The New York Times with the headline HOW MANY RABBIT EYES HAVE BEEN BLIND FOR COSMETICS since the cosmetic company donated \$750,000 toward finding an alternative method of testing, but so far no new test has been approved. "We try to reach companies on a humanitarian as well as an economic level," Spira says. "Rats like the Draize and LD₅₀ [Lethal Dose 50 percent—a test that studies how much of a substance would kill 50 percent of the test animals] are redundant and not true indicators of human reaction to any given substance. They waste money and are cruel."

Alternative methods are currently being explored. Computer simulations and test-tube studies have been adopted as auxiliary tests. But cell cultures in test tubes do not go blind, and a computer does not have a brain. The alternatives can't totally replace living creatures.

Scientists contend that although they continue to look for alternative methods of testing, there is not enough research money available. They argue that they would be losing valuable—perhaps life-saving—time if they did not continue to use methods already available.

"Live animals," according to King, "are still essential and will continue to be so for many, many decades if we are to continue our advances in human physical and psychological health." □



Lab animals: suffering for science's sake?

ORANGE IN NAM

EARTH

By Ben Barber

Early in January 1989 a plane-load of American scientists surveyed mutilated forests and farmlands en route to their destination, Ho Chi Minh City (formerly Saigon), Vietnam. The desecrated landscape below was a grim reminder of the purpose of their visit. They would soon be convening with a panel of international researchers to discuss the lingering effects of the potent herbicide agent orange.

In all, some 11 million gallons of agent orange (laced with 500 pounds of the powerful carcinogen dioxin) rained on South Vietnam between 1961 and 1973. Initially, when Operation Ranch Hand began its systematic destruction of jungles and crops, Vietnamese newspapers published reports of stillbirths, rampant reproductive disorders, and "monster" babies born in the sprayed areas. But by 1975 the last American advisors were leaving by helicopter from the roof of the U.S. embassy in Saigon, and the country had grown silent on the wounds inflicted by the deadly toxin.

The seven-day conference, called by

North Vietnamese physician and former health minister Dr. Ton That Tung, represented the first attempt in almost a decade to fit the veil of secrecy. The gathering drew more than 100 interested experts including representatives from West Germany, Italy, the Netherlands, Sweden, England, Israel, Czechoslovakia, Australia, and Vietnam. Although the conference was closed to the press, the participants did write a report that was made public. It was sober in tone, but several attendees later revealed that they had found extensive—perhaps irreversible—damage to people, plants, animals, water, and land. Here is a sampling of their postconference comments.

"The most dramatic evidence was a tenfold increase in molar pregnancies among Vietnamese women," says Columbia University Medical School epidemiologist Maureen C. Hatch. Molar pregnancies, also called hydatid moles, are pregnancies in which the placental tissue clings to the uterus and may cause cancer of the reproductive organ. Ordinarily, molar pregnancies are rare.

"There is a ring of truth that only women exposed to agent orange have it," notes Eloi Carlson, professor of genetics at the State University of New York at Stony Brook. In the United States, he adds, geneticists have linked molar pregnancies to genetic damage from chemical exposure, but Vietnamese scientists were unaware of this link before their experience with agent orange.

"I'd like to see a scientific exchange with Vietnam," Carlson proposes. "It's a perfect laboratory of an exposed population. It's not like Seveso, Italy, where a chemical-plant explosion spread down over the city. The population of South Vietnam really got clobbered."

During the six months prior to the international conference, Vietnamese doctors assessed the number of birth defects and stillbirths among 4,064 women who lived in the unsprayed north but whose husbands had probably been exposed to the herbicide while fighting in the south. Dr. John Constable, surgeon at Massachusetts General Hospital, in Boston, estimates that the incidence of "reproductive misadventures" in these families is 500 times that of the prewar level in Vietnam.

Hundreds of nonhuman populations were also exposed to the herbicides. Ecologist Mark Leighton, of Harvard University, says: "It's hard to convey the amount of destruction the south underwent. Who knows what the payoff was for such an assault on the environment?"

Leighton links the disappearance of animal species, including the already endangered rhinoceros, to the destruction of huge swaths of forest up to 12 miles long and two miles wide. Many of those areas remain economically useless savannas or grasslands, unsuitable for the animals that once lived there. What's more, by dividing the forest into isolated islands crisscrossed by barren patches the spraying has made it impossible for wide-ranging species to forage.

Dr. Vo Quy, of the University of Hanoi, and his colleague Dang Huy Hayn, took counts of birds and mammals in the heavily sprayed forests of a Laotian valley.

CONTINUED ON PAGE 100



After years of silence about the effect agent orange has had on its people, Vietnam speaks up to CNN.

ELECTRIC ANESTHESIA

LIFE

By Brian Goldman

A forty-two-year-old Russian woman was wheeled into the operating room at the Vishniewsky Surgical Institute, in Moscow, for surgery to remove her gallbladder. Dr. Mikhail Kuzin, her surgeon and the director of the institute, motioned to the anesthesiologist to attach electrodes to the woman's forehead and behind each ear. He then switched on the nearby Anesthale-MP02 electroanesthesia device, developed in France by René Limoge, professor of physiology at René Descartes University, in Paris. Instantly, the current began coursing through the woman's brain, gently placing her into a deep level of anesthesia. The operation proceeded as scheduled, and the woman was spared the risk of drug-induced death. In North America alone about 1,000 people die from the effects of anesthesia each year.

Using electricity to anesthetize the brain is not a new idea. Research abandoned on both sides of the Atlantic during the first half of the century. But American anesthesiologists lost interest

in the early Sixties, when experiments that used a single current produced convulsions, muscle twitching, heart irregularities, and closure of the test animals' air passages.

But Limoge, then a dentist and electro-physiologist, refused to let the idea die. After experimenting with a variety of different currents, he developed a device that combined two currents. The combination, he reported, eliminated the side effects. Still, no one is certain today what effect the current has on the brain. Preliminary studies indicate that the Limoge current stimulates the release of endorphins, which help relieve pain.

At the Vishniewsky Surgical Institute, Kuzin says that surgeons now use Limoge's invention for the whole gamut of surgical procedures. "Patients wake up two or three minutes after the current is stopped," he explains, "and without the usual postanesthetic drowsiness."

Over the past three years, Limoge's company, ESA, has produced and sold more than 200 Anesthale-MP02 machines, costing \$3,500 each, to interested physi-

cians in France, Belgium, Switzerland, Spain, and the Soviet Union. Those physicians have found electroanesthesia to be useful in many situations, including lengthy neurosurgical procedures and open-heart surgery. Dr. Jean-Claude Prie, an anesthesiologist at the Centre Hospitalier Régional Robert Debre, in Reims, France, has used the Limoge current on more than 1,000 patients. "The major advantage," says Prie, "is that we can obtain a seventy-five percent reduction in the amount of narcotics required during or after surgery." This, he explains, is beneficial when dealing with elderly people or those with chronic respiratory diseases. In such cases, narcotics can depress the patients' breathing.

Other anesthesiologists have found the Limoge current to be particularly successful in treating postoperative pain in infants (another high-risk group) and in women giving birth.

Despite its popularity in Europe, the Limoge current remains controversial in the United States. In part the skepticism is a result of shoddy experimental evidence. Jean-Pierre Thirumy, a public-health technologist with the Center for the Study of Advanced Technology, a French government-funded agency that has tested the device, admits that Limoge "learned to run before he learned to walk," promoting the current for clinical use before extensive animal and human studies had been performed. Only now are large-scale double-blind studies being carried out.

Some American anesthesiologists, though, are greeting the invention more optimistically. Dr. Theodore Stanley, a professor of anesthesiology at the University of Utah, observed Limoge's techniques while he was a visiting fellow in France. He also collaborated with Limoge on two published studies demonstrating the current's effectiveness when combined with other anesthetics. He agrees that more research is needed to convince the North American medical establishment. "It could be an invaluable addition to medical science," he says. "But it has a long way to go." □



Electricity can be used to anesthetize the brain without risking drug-induced death

APOLLO PLUS FIFTEEN

SPACE

By James E. Oberg

A small news item earlier this year held both literal and metaphorical truth: **BACK TO MOON** SETS 20-CENTURY MARK, ran a New York Times headline on March 2.

"Tonight the moon will be farther away from Earth than it has been since the year 1750," the story began. "and it will not be as distant again until the year 2100." The record distance, 252,719 miles, resulted partly from the rare planetary lineup that occurred a few months previously, according to University of Minnesota astronomer Mark Slovak.

Fifteen years after the first manned lunar landing (and more than 11 years after the last), our natural satellite seems distant in practical, as well as absolute, terms. NASA's next big project is a permanently occupied space station, and some scientists believe that a manned lunar trip is a project not for the next decade but for the next millennium.

But the moon is coming back, both literally and figuratively. It's beginning to stir old longings and new plans for a lunar quest. The long hiatus in lunar

exploration and in mankind's interplanetary voyaging is probably just about half over.

Plans currently under discussion call for a return to the moon "by the end of the decade"—John Kennedy's bold marching order—although today's planners are looking toward the end of the Nineties. The missions would not be a replay of the half dozen quick dashes of Apollo. Instead, the expeditions would be more rewarding—and less costly.

Since the Apollo missions told us what the moon is made of, future voyagers can go armed with plans to use lunar resources. The moon's materials could support in-space construction and transportation. The cost of getting up the first 200 miles from the earth's surface is greater than the cost of getting all the way back down from the moon. So even the added expense of lunar manufacturing may still allow economic use of the moon's resources, such as oxygen for rocket propellant. After future astronaut/engineers set up oxygen mining bases, lunar metals and slag for radiation shielding would become profitable.

Science, too, can expect a new harvest. Planetary geology will have digested the revolutions in knowledge brought by Apollo and will then face a new generation of questions. The long-awaited "backside radio observatory," enabling us to look deep into space, may be feasible once the original bridgehead is established for other purposes.

The Apollo program's rewards were far reaching. Revolutions in science and technology were ushered in far more quickly than scientists predicted, and some of the harvest was possible only because of the project. The same massive payoff can be expected from a reprise.

Thanks to Apollo, a whole new generation—the first in history—has been raised with unlimited horizons. They know they are not locked into their homeland by any lack of capabilities or technology but merely by will. And they have the will to go wherever they choose.

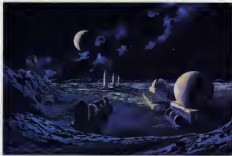
If there is one major disappointment in the way in which Apollo has, like a fly in amber, been petrified in history, it is that John Kennedy's 1961 vision has been blunted. He wanted the project to demonstrate American technological superiority to the world and particularly to the Soviet Union. There was a frantic "moon race" in progress, and the United States was years behind. It appeared that it would take a miracle to catch up.

But when the miracle, a product of American political, managerial, and technological virtuosity, was delivered, its heart and soul—the victory in the race to the moon—was torn out. The story was changed by a clever Soviet propaganda play and the eagerness of leading Western newsmen to swallow it.

A decade ago Walter Cronkite said that there never had been a moon race; he was voicing the views of his colleagues but not of the experts. That is also what the Soviets said, but they had led.

Recent evidence shows that in the Sixties the Soviets were trying their utmost to build spacecraft and boosters to fly cosmonauts around the moon and ultimately to land them on its surface. This new evidence consists of the

continued on next p.



Future lunar outpost: The next explorers will use the moon's materials to build colonies.

SELF-HARM

MIND

By Patrick Huyghe

For days, the twenty-two-year-old woman has felt a sense of intolerable dread. "It overwhelms me," she says. "I don't know what to do but I feel that I must do something." Then panic strikes. She reaches for a razor and makes three cuts on her wrist. She feels immediate relief: no pain. "I feel good now," she says. "I'll be okay for a week. Then it'll start all over again."

The scars covering her body are testimony to previous episodes of self-mutilation. But the woman is neither psychotic nor suicidal. Though self-destructive during these bizarre and gruesome episodes, she does not wish to die. Between the attacks, she functions quite normally.

Because this kind of behavior is distinct from suicide, two psychiatrists at the Medical College of Georgia—in Augusta, have proposed that such cases be regarded as a distinct new category of mental disorder. Doctors E. Nemesi Pattison and Joel Kahan call it the Deliberate Self-Harm syndrome, or DSH.

"This is a syndrome of late adolescence," explains Pattison, head of the school's psychiatry department, "in which young people do some type of low-lethality damage to their bodies without the intent to kill themselves. The behavior is repeated an average of ten to fifteen times over a period of eight to ten years."

Deliberate self-harm is a world apart from both psychotic and suicidal behavior. To begin with, those who practice DSH behavior do things that, while horrifying, are not life-threatening: deliberately biting or burning themselves, cutting or otherwise mutilating their genitals, even cutting off an ear or gouging out an eye or the tongue. Psychotic and suicidal behavior, by contrast, is marked by one or two episodes in which a person may attempt to perform a potentially fatal act—chooking or hanging himself or jumping from a great height.

After analyzing 56 cases of self-harm, Pattison and Kahan found there were also differences in age and motivation between the suicide-prone and those with DSH. Suicidal individuals usually are

middle-aged—forty-five years old and older—and are plagued by feelings of worthlessness and helplessness. Self-mutilators tend to be much younger and act from deeper anxiety or anger.

According to Pattison, self-harm is more prevalent than suicidal behavior. Each year there are four times as many incidents of DSH as there are suicide attempts. But he suspects that this estimate may be too low, because many cases of the syndrome are incorrectly included in the suicide statistics.

While the suicide rate is relatively unchanged over the past two decades, according to Pattison and Kahan, the incidence of DSH has increased. One reason, they suggest, is that an ever-increasing number of young people are being placed in penal institutions. "We have more institutionalization today than we had thirty years ago," says Pattison. It is his guess that DSH behavior is a by-product of incarceration. "This is an everyday occurrence in prisons. At a juvenile reformatory, you're likely to see it every couple of days. At a youth deten-

tion center every week. We might be artificially provoking such behavior."

Some cases of DSH may be overlooked altogether. "Often no one will pick up on them," Pattison notes. The injury will be treated with no thought to what caused it. During the DSH victim's first visit to an emergency room, he might be treated by a surgeon. The next time, he might see an internist, and a year later, an ophthalmologist or dermatologist. "Very few of these cases are referred to a psychiatrist," Pattison says. Even when they are noticed, these people may be dismissed as manipulators, malingerers, or attention seekers, because their self-destructive acts are not lethal.

Self-mutilation, sometimes labeled *parasuicide*, *autoaggression*, or *symbolic wounding*, is not a new concept to psychiatrists. (Pattison himself prefers the term *self-harm* to *self-mutilation* because it includes consciously harmful acts that produce no external mutilation: pill swallowing, heavy drinking, even staring straight into the sun.) Doctors have usually regarded this sort of behavior as a symptom of the borderline-personality disorder, a condition found in people who have not formed strong egos. Yet studies by Pattison and other psychiatrists have not found any clear association between deliberate self-harm and any specific personality disorders. One feature DSH victims do seem to have in common, says Pattison, is that they never adequately separated from the nurturant maternal object—their mothers—at a critical time in their lives.

It is during the second year of life that most children first start to notice when their mothers are absent. Typically, a child will become anxious and will search frantically for her and may even begin bawling, hitting, or clawing himself when she disappears.

The behavior, according to some psychologists, is the child's misguided attempt to duplicate the mother's physical contact. If the mother returns and holds him, the child's anxiety disappears.

Normal children are usually able to resolve that anxiety by age three, but those



Self-mutilation: How does it start?

SUPERCRITICAL POTATO CHIPS

BREAKTHROUGHS

By Richard Wolkoff

When he greets visitors in his Cambridge, Massachusetts, office, Richard De Filippi, the president of Critical Fluid Systems Inc. (CFS), likes to offer them potato chips. "Go ahead, don't worry about calories," he says. "These are special potato chips."

They are, in fact, high-tech potato chips, just one product of a new technology that could prove to be an industrial blessing, improving everything from corn oil for cooking to offshore petroleum drilling in the Atlantic. The technology, called supercritical fluids, is based on a fact chemists have known since the nineteenth century: At a specific combination of pressure and temperature, a gas reaches its critical point, becoming neither a gas nor a liquid, but a substance with many of the properties of both states. In particular, it becomes an unusually powerful solvent.

Consider, for instance, the effect of such a substance on the humble potato chip. In a laboratory at CFS's parent firm, the international consulting company of Arthur D. Little, Inc., De Filippi holds up a slice of raw potato. "Cook this in a deep fryer, then it's salted, and you've got the standard potato chip—thirty-five percent oil," he says. "Treat it with critical fluid carbon dioxide and you cut the oil content to virtually zero."

Most citizens, confronting a new solvent, maintain their calm. But industrialists get the jingles. That is because most wastes, at some stage in their transition from raw material to finished product, rely on solvents for such services as stripping grime or decontaminating chemical goods about to solidify over electronic components. Thus, potent new solvents can be worth billions to industry. To tap that market, Arthur D. Little began CFS and hired De Filippi, a chemical engineer, to develop new chemical processes. De Filippi's team pioneered a way to use critical fluid carbon dioxide as an industrial solvent, and they are now putting this magic gas-liquid to work on a broad range of projects.

For example, offshore oil drillers must avoid certain promising sites because

the drilling process poses a pollution threat. But now CFS has designed a solution that could open up new areas for petroleum exploration.

Drillers use fluids—called drilling fluids—to lubricate and cool their drill bits. Generally, these fluids are water-based and nonpolluting. But when the drill must bore into the seafloor at a steep angle or at a great depth, drillers need the lubricating power of oil-based muds. To prevent pollution, they must clean these oily muds from the cuttings their drills bore from the seafloor. Usually, that means transporting tons of oil-saturated dirt and rock to shore for treatment, but the process is so costly that drillers frequently forgo exploring such sites, however promising they may be. CFS proposes using critical fluids to clean the cuttings at sea. "You can dump the cleaned dirt and rock back into the ocean without risk of pollution," says De Filippi, "and turn the oil you recover with the critical fluids into more drilling mud."

Critical fluids may also eventually be used to help clean up the country's toxic

waste problems. For instance, when Missouri was puzzling over what to do about the dioxin-contaminated soils in Times Beach, De Filippi's company offered to develop a critical fluid technique for extracting the contaminant. The state never approved the plan, but De Filippi is confident the technique would have worked. In laboratory tests, CFS engineers have extracted lubricating oils from steel-mill refuse, and vegetable oils from clays used in food processing.

In addition, CFS recently licensed the Illinois Water Treatment Company (a division of Allegheny International) to market the critical-fluid technique for cleaning chemicals from industrial wastewater. The chemicals, pollutants if allowed to enter the environment, are too valuable for industry to simply discard. Using critical fluids, industries can extract the chemicals from their effluents and then reuse them.

CFS is not alone in developing this new technology. The U.S. Department of Agriculture is now experimenting with supercritical carbon dioxide, using it at a pressure of 8,000 pounds per square inch and a temperature of 122°F to extract oils from corn, soybeans, and other crops. As Agriculture Department chemist John P. Friedrich points out, this is a job currently handled by hexane, a solvent—made mostly from imported oil—that costs ten times what it did a decade ago. Critical carbon dioxide is considerably cheaper, and food-processing companies can recycle it. In addition, Agriculture Department chemists have discovered that once supercritical carbon dioxide has absorbed a vegetable oil, the oil is easily recovered by simply increasing or reducing the pressure. "It just falls out," Friedrich says.

Industrialists, then, have good reason to be excited, as does the average consumer, who may benefit from at least one recent application of the process. De Filippi's engineers have successfully extracted oils from avocado, a process that the cosmetics industry will eventually use to create supercritical—and superfat-free—body oils. **DD**



Not the age of the greaseless potato chip



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a standing ovation."*

*"When I play, I strive for
the highest quality in my performance."*

*"I look for the same standards in my vodka. I know
that Smirnoff® vodka is distilled from the finest grain,
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*"When it comes to vodka, Smirnoff
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Smirnoff
LEAVES YOU REBATHING
There's vodka, and then there's Smirnoff.

SUBLIMINAL SOFTWARE

ARTIFICIAL INTELLIGENCE

By Phoebe Hoban

David Murray, an employee with Michigan's State Health Department, and his wife, Marcia, have discovered a new way to lose weight. Every evening, the couple turns on the TV and watches the *MacNeil/Lehrer NewsHour*, but it's not current events that kills their appetites. Whether they tune in to the national news or the latest juicy episode of *Dallas*, the Murphys are digesting the same messages cleverly masked behind the medium: I AM THEN I AM ATTRACTIVE. I AM SOULFUL. Half lost 11 pounds. She's shed 16.

If the attacks of the *Hidden Persuaders* Vince Packard's classic indictment of the media's use of advertising to secretly subvert the public's subconscious, there's one major difference. The Murphys' subliminal seduction is strictly voluntary. They are plugged into a new product called *Expando-Vision*, which uses computer technology to zap suggestive messages right into their living room.

Psychiatrists have argued about the effect—if any—of subliminal programming

ever since a scandalous New Jersey screening of the movie *Psycho*, back in 1957. Star Kim Novak's performance didn't sat long as wagging, but what could not be seen on the silver screen did: split-second messages urging audiences to buy soft drinks and popcorn. Viewers reportedly rushed the refreshment stand and bought record quantities. Since then, volumes have been written on subliminal perception, but many researchers remain unconvinced.

"It's a wonderfully romantic idea," says Joe Smith, president of Oxoby-Smith, a consumer-research firm, and past president of the American Psychological Association's consumer-psychology division. "But to my knowledge, subliminal programming doesn't exist. There simply is no corroborative evidence that can be reproduced."

Meanwhile, research into the technique continues. Subliminal programming is based on the theory that the unconscious can absorb information that is imperceptible to the conscious mind. This effect

can supposedly be achieved visually or aurally—by flashing messages so fast that the eye cannot catch them or by playing soft audio messages.

This may well be the year that subliminal programming makes it into the home. *Expando-Vision* is just one of several programs designed to communicate directly with your subconscious.

Manufactured by Stimulech, in East Lansing, Michigan, *Expando-Vision* is a \$80 black box—called an electronic interface device, or EID—that connects any home computer with a TV set. The user loads disks or software cartridges containing the subliminal programs into the home computer. The EID interrupts the television program at random intervals to flash the text onto the screen for just one thirtieth of a second.

Eight self-help programs are available and sell for \$40 each. Goals range from controlling weight and smoking to improving sports scores, to building sexual confidence. (One bliplike message: LET US BE NAKED.)

How much TV do you have to watch to get the message? According to Wallace LaBonne, the Michigan psychiatrist that Stimulech hired to write the messages, an hour of *Expando-Vision* a day should have a noticeable effect within a three-month time span.

LaBonne does not believe the programs pose any serious danger to most people, since TV viewers naturally filter out painful or unpleasant messages. But not everyone agrees. Lloyd Silverman, a New York University professor and author of the book *The Search for Consciousness* (International Universities Press), cites his own research. He discovered that the ostensibly harmless message *POKES ARE WEAK*, delivered at high speed, struck terror into the heart of one young woman whose father had punished her by making her walk in the snow. "There's no doubt the technique is effective," he says. "And there are exciting possibilities. But to ensure that a Frankenstein monster isn't created, there should be strict government regulations to protect people." □



The open mind: Some programmers believe the computer can communicate with the unconscious.

DISCOVER COMPUTERS WITH ATARI.



Atari® presents the
five greatest advances
in the creative arts
since someone put
72 crayons in one box.

What would Celine say to an electronic orange? Surely Van Gogh would go for some flowers painted in phosphors (those glowing things in your TV screen.) And you bet Beethoven would be blown away by a computer synthesized symphony.

The bad? They were all born too early. But luckily you weren't. Because Alan makes several home computer products to help you create all these things and more.

First, there's ATARI Paint™, the program that turns the joystick you already own into a computerized paintbrush that helps you explore the fascinating world of computer art.

Get the magic touch with Atari Touch Tablet.



The ATARI Touch Tablet with Atari-Artist™ software cartridge turns your TV into a magic palette of 128 dazzling colors.

The Touch Tablet works a little like an electronic slate. Hook it into any ATARI Computer and what you draw on the tablet will instantly appear on your TV screen. You can draw on the Touch Tablet with the unique electronic stylus that comes with it—or even with your finger.

And all the on-screen commands that control your Touch Tablet are labelled with simple sym-

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Atari Light Pen lets you write right on the screen.

ATARI Light Pen with Atari-Graphics™ software cartridge is among the best tools available for teaching hands-on computer creativity. To draw circles, rectangles, or simply fool around with freehand sketching, just press the pen to your TV screen and VOILA.

A trail of sparkling color follows it. You can fill in your sketches with one or more of 128 colors. Or choose from over 2,800 patterns.

Roll over Beethoven, AtariMusic is here.

Sure, Beethoven took music lessons. But even he didn't get the head start you'll get with AtariMusic™ I or AtariMusic™ II. And once you understand the

basics you'll be ready to move up to ATARI Music Composer® and create original compositions in four part harmony!

All of these programs were designed to get the best from your ATARI Computer including the ATARI 800XL™ or the less expensive ATARI 600XL™. Both machines give you unsurpassed Atari graphics and four sound channels. And whether you're painting with light or composing at the computer keyboard, you can store your creation on the ATARI 1010™ Program Recorder or the more sophisticated 1050™ Disk Drive.

And it all that doesn't convince you that our new programs are a giant step beyond crayons, consider this: the kids will never write on the wall with a computer.

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WHAT YOU AND
ATARI
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CONTINUUM

MICROCHIPS FOR MICRONESIA

Imagine a planet on which the heaves play with microchips, lasers, and robots while the have-nots lack televisions, telephones, and even running water. On such a planet, which we'll call Earth, the technology gap between rich and poor worried one science-fiction visionary, Arthur C. Clarke, so much that he recently spent \$25,000 from his Marconi Prize to help launch a center, headquartered at the University of Moratuwa, in Sri Lanka, to grapple with the problem. The Sri Lanka parliament, the university, and UNESCO also chipped in to fund the Arthur C. Clarke Centre, which aims to bring such things as computer chips and Earth stations to the Third World.

It may not strike you as especially tragic that untold millions in Zambia or Indonesia are deprived of *The Duke of Hazzard*, but consider: "Right now the Third World has four hundred million people unemployed or underemployed," according to Joseph N. Pelton, the organizer of the Arthur C. Clarke Foundation of the United States, a support group for the Sri Lanka center. "And by 2000 those countries will need six hundred twenty-five million additional jobs."

There are, of course, humanitarian reasons to slice up the technological pie a bit more evenly. And then there's the cold-blooded fact that Western firms will simply run out of markets for their gadgets if they leave the Third World out of their long-range plans. That, at any rate, is Pelton's message. Take television sets, 90 percent of which are presently in the hands of a bare 15 percent of the world's population. The TV market is nearly saturated in the West, according to Pelton, but helping the Third World boost its video capabilities would add an immense new population of viewers. Third Worlders would, of course, have to be able to afford the sets, yet another reason to provide developing countries with high-tech jobs.

The same fortunate minority that is endowed with sitcoms and network news also owns 90 percent of the world's telephones. Thanks to the technical ingenuity of Massachusetts' Institute of Technology scientists, however, there's a new group of phone customers in Egypt. The typical Egyptian village has one telephone, perhaps belonging to a well-to-do merchant, so a joint MIT-Cairo University team developed a chip that converts a private line to a party line, enabling the less prosperous villagers to buy phones. Whenever the private line's owner wishes to use

his telephone, a ten-second warning tone sounds, and the party-liners get disconnected. Thus, Egyptian telephones proliferate (at minimal cost), and the private-line owner's only penalty is an occasional ten-second delay in reaching out to touch someone. This sort of east-meet-cooperative venture, Pelton thinks, ought to be the wave of the future.

What does the Arthur C. Clarke Centre have to do with all this? Its sponsors envision it as a catalyst in the great technology transfer of the coming decades, and the organization is already training engineers and technicians to install high-tech equipment in low-tech lands. Meanwhile, back in the United States, the Clarke Foundation will arrange for American engineering professors and industry experts to teach at the center while on sabbatical. It will also ship donated textbooks, software, and teaching equipment to the Sri Lanka center.

The long-range plan is to design new technologies in four major areas—telecommunications, broadcasting, computer science, and energy—according to Third World needs. The organization's energy scientists, for instance, will probably work on generating electricity from ocean waves, a technology that is currently a very low priority in the United States. If the oil runs out, however, we may be happy to find that Clarke Centre researchers already have wave power harnessed.

The center will also foster technological seed projects in developing countries. For example, one member of the Clarke Foundation board, Albert Horley, head of the Vitalink Communications Corporation, is considering a low-cost Earth station to market in the Third World. Horley's U.S. firm would manufacture the electronics and have companies in developing countries make the antenna reflector and other components.

Could anybody oppose such a laudable goal as technology transfer? The Reagan administration, for one, is seeking ways to stem the flow of high tech out of the country, since considerable U.S. know-how flows under the Iron Curtain. Besides, technological innovation is costly. Why give it away?

Needless to say, Pelton disagrees. "What our government's attitude might be, I can't say," he states, "but I'm convinced we have to think differently about technology—for everybody's good. Why must it be a zero-sum game in which someone has to lose for us to win?" —RICHARD WOLKOMIR



CONTINUUM

BONES IN SPACE

One consequence of extraterrestrial travel may be broken bones, according to researchers who have been examining the skeletons of astronaut rats.

Our bones constantly renew themselves, explains orthopedics professor Myron Spector, of Atlanta's Emory University, and they do so partly in reaction to the pressure of gravity. It makes sense, then, that an astronaut's bones would stop growing temporarily during spaceflight: only to resume normal growth as soon as he or she returns to Earth's gravitational field. But a memento remains—in the form of a hairline defect at the bone's stop/start point—and that could lead to fractures.

Evidence for his theory, Spector says, comes from experiments with laboratory animals, which generally

develop bone defects after only 10 days in space. "Since the bone-cell behavior seems to be similar in humans," he points out, "astronauts might have problems after only a few weeks."

These minuscule skeletal defects eventually do get replaced by healthy bone, but Spector and colleague Russell Turner warn space travelers not to exercise too vigorously too soon after touching down. Ironically, Spector adds, the rigorous in-flight exercise that astronauts now perform to counteract the bodily effects of weightlessness may actually harm their bones.

—Paul Dussault

"The tongue is the deadend of all blunt instruments."

—Shannon Rice

"All sunshine makes a desert."

—Arab proverb



Can you hear the northern lights? Most likely, birds can, and the bursts of infrasound may interfere with their homing systems.

LISTENING TO THE LIGHT

On a not-so-clear day, you can hear the northern lights, according to Eskimo folk wisdom. And if you don't believe the Eskimos, believe the birds. Not only do they hear such things, according to the University of Pittsburgh's Melvin Kriethen, but their navigational know-how depends on this ability.

The exquisite homing system of birds has often been ascribed to electro-magnetism, but Kriethen proposes a different solution to the mystery—infrasound. When charged particles from the sun bombard the ionosphere—during periods of aurora borealis activity, for instance—the atmosphere is abuzz with low-frequency noise. (Since some of it falls within the lower ranges of human hearing, the Eskimos aren't kidding.) Birds seem to be specially equipped to detect infrasound, according to

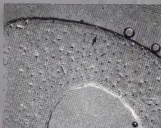
some recent experiments, and a newly discovered sense organ: the *Jepena*, may have something to do with this. At least, that's Kriethen's theory, and it might explain "both the successes and bizarre failures of bird navigation." If birds do use infrasound cues to find their way around the atmosphere, what happens when auroral activity is high? Kriethen thinks that the resulting sudden bursts of low-frequency sound (and not the accompanying electromagnetic) play havoc with avian homing systems, driving birds miles off course.

"All the fuss over birds navigating with the magnetic component of the aurora borealis may be just so much mythology," he says. "Infrasound may well turn out to be the ultimate key to bird navigation."

—Anthony Serafini

"Man is the only animal that spins."

—Dr. Donald A. Lard



Bone of astronaut rat. The hairline defects are mementos of growth stop/start points that could lead to fractures on Earth.

LEFTOVER AFRICA?

A rare fossil of an ancient "crab" discovered in South Carolina has many geologists convinced that part of the southeastern United States was once African or European soil.

University of South Carolina geologist Donald Secor Jr. received a National Science Foundation grant to seek the boundaries of the "foreign soil belt" after one of his graduate students stumbled upon the fossil. On a field trip near Batesburg, South Carolina, Sara Samson found a *Paradoxides inebriatus*. This particular type of horseshoe-crab-like creature, which lived 500 million years ago, is "definitely not American," Secor says.

For years geologists have argued about whether or not the Carolina slate belt, which runs from Alabama to eastern Virginia, repre-

sents foreign soil picked up when continents seeweeded collided, then separated about 400 million years ago. Samson's find, with others discovered at the site, convinced even skeptics. "These fossils are the first hard evidence that a piece of Africa or Europe was left behind when the continents collided," Secor explains.

Now Secor and his graduate students are looking for "boundary terrain with contrasting geological histories," he says. What appears to be one important boundary has already been found in Union, South Carolina. The southeast and northwest sides have different deformational and thermal histories," he maintains.

Secor hopes to match the fossils and rocks on the southeastern boundary with those of Africa, France, or Spain. —Alan Maurer



Discomfort for facial paralysis often leaves the patient with sad and unnatural expressions. Now there's a new method.

CHEWING WITHOUT BLINKING

An estimated 5 million persons in this country suffer facial paralysis from disease, injuries, or faulty plastic surgery. Most operations to correct the condition are only partially effective. The patient can't smile, for example, without having his eyes close, and chewing produces a weird synchronized blink.

Now a surgeon at the New York Eye and Ear Infirmary has come up with a new operation, providing a more natural-looking solution than ever before.

The problem, according to the operation's inventor, Dr. Michael E. Sachs, occurs when the facial nerve is severed by accident or disease. The nerve acts like a bundle of phone lines. A main line emerges from in front of the ear and branches into two trunk lines that carry signals to various parts of the face. Doctors have long been

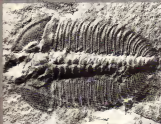
able to repair the main fiber but could not prevent the smaller fibers from firing at the same time.

Sachs' operation improves on all that. Like others, he patches the main trunk line with a piece of another nerve, restoring movement to the upper part of the face. But he then attaches part of the chewing muscle, or masseter, to the upper and lower lips, giving the mouth a brand new source of control. A couple of years of eating and smiling gives the patient enough practice to make the new system work.

"It's still not completely natural looking," says Sachs, who's performed the operation on more than 50 patients so far. "But it improves things significantly. The patient can chew without blinking and blink without smiling." —Douglas Starr

"Parenthood remains the greatest single pressure of the amateur."

—Alvin Toffler



Reptile: A fossil of a distinctly non-American type of the horseshoe crab-like creature was found in South Carolina soil.

CONTINUUM

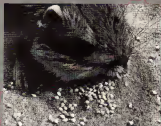
SECRETS OF THE KANGAROO RAT

Each year the U.S. Department of Agriculture (USDA) and the Food and Drug Administration sink millions of dollars into researching effective ways to protect our nation's grain supply from insects, microorganisms, and rodents. But now USDA mycologist Don Wicklow is actually looking to one predator—the kangaroo desert rat—for answers.

According to Wicklow, the kangaroo rat is so good at storing and preserving its seed supply in an underground burrow that farmers may someday borrow its methods.

To uncover the animal's technique, Wicklow and colleague John Reichman, a rodent ecologist from the University of Kansas, sped into rats' burrows with a fiberoptic scope, a small, flexible microscope. The scientists thus discovered that kangaroo rats divide their seeds by species and move the seeds to different areas of the burrow. They do this, Wicklow theorizes, because they know which varying environmental conditions, such as airflow and temperature, will promote the growth of particular molds.

"Molds produce mycotoxins," Wicklow explains, "substances that cause disease in many of the animals that might eat the kangaroo rat's food." So the rats seem to be manufacturing their own natural pesticides. Wicklow points out "The



Kangaroo rat at work on its seeds. Scientists sped on this nocturnal rodent and discovered new grain-storing techniques.

rats live only two to two and a half years," he adds, "so they can consume the toxic seeds with impunity."

To illustrate their method, Wicklow explains that the rats stored legume pods in the very location that would spur the growth of the mold *Eurotium amstelodami*. "Legume pods are often infested by bean beetles, but these weren't any in these pods. So the rats must've known the mold would keep them away."

Besides observing the rats at work, Wicklow and Reichman also installed plumbing tubes in the burrows, with seeds screened off at both ends so that they were out of reach. Then Wicklow compared those seeds to seeds that the rat had harvested in his burrow to "see what had happened microbiologically in the two sets." According to Wicklow, "the seeds the rats had man-

aged were much less rotted and matted than the others," demonstrating that by moving the seeds around, the rat can not only promote but also control the growth of certain molds and thus prevent the molds from ruining his seed supply.

Human application of the rat's technique still lies in the future. "Now we're just looking for new ideas but the rat may lead us to some method we never thought of for storing grain," says Wicklow.

—Kathrine Jason

"Nothing in progression can rest on its original plan. We may as well think of rocking a grown man in the cradle of an infant."

—Edmund Burke

"It is change, not love, that makes the world go round. Love only keeps it populated."

—Charles H. Browner

BUCKTEETH

Most people with buckteeth owe their overbites to underdeveloped jawbones—not the position of the teeth themselves. As a result, efforts to correct the problem with standard braces often prove unsatisfactory. Many youngsters are chagrined to see their buckteeth reemerge after the braces come off.

In and around Atlanta, however, bucktoothed children are finding that a simple, passive device developed in Germany some 30 years ago is actually changing the shape of their jaws. Named after its inventor, Dr. Rolf Frankel, the Frankel appliance is unlike braces in that it exerts no pressure or force. Made of stainless-steel wire and acrylic, it is basically a training device that the child wears most of the day to exercise his muscles and facilitate normal bone growth. If used for 18 to 24 months, conventional braces need be worn for only a relatively short time (less than a year) to adjust the position of the teeth.

Dr. Michael Dierkes of Emory University School of Dentistry, who worked to introduce the Frankel appliance in this country, has used it successfully with about 1,200 children since 1976. "Every orthopedic doctor knows that muscles influence bone growth," Dr. Dierkes explains. "Bone yields to muscle. The Frankel appliance reminds the child to hold his jaw in a forward position. This

effort strengthens the jaw muscles, and when they are working well, they promote normal growth of the bone."

Deerkes and his colleagues at Emory have set up the first American university program to train orthodontists to use the appliance. "The technique," he concedes, "is almost in its infancy in this country."

—Eric Mahala

"What is the use of running when we are not on the right road?"

—German proverb



Constricted blood vessels can lead to migraine

MIGRAINE BREAKTHROUGH

Medical science may be on the verge of a breakthrough in the treatment of migraine headaches.

Using a class of drugs known as calcium channel blockers, which were originally developed to relieve the symptoms of such cardiovascular diseases as angina and hypertension, John Meyer and Jeffrey Hardinburg, of Baylor University in Waco, Texas, and the Veterans Admin-

stration Medical Center in Houston, have been able to "significantly reduce migraines in up to 90 percent of their patients."

Calcium channel blockers are so named because they stop the movement of calcium ions across the cell membranes of smooth muscle tissue in the blood vessels. Since calcium ions are at least partially responsible for constricting blood vessels, cutting those ions off at the pass as it were, allows the blood vessels to open again.

That's where migraine comes in. The headache itself is preceded by constriction of blood vessels in the head. The pain begins when those vessels open again and fill rapidly with blood. Meyer and Hardinburg reasoned that if the constriction phase could be short-circuited with calcium channel blockers, the migraine itself could be stopped before it started.

Tests with 35 migraine sufferers showed that Meyer and Hardinburg were right. Of the four calcium channel blockers used in double-blind experiments, "the best by far," says Meyer, "is nimodipine [Nimotop] because it's designed specifically for blood vessels in the head."

According to Meyer, side effects of nimodipine are minor: slight constipation in some patients or mild muscle cramping in women. Doctors hope that the drug will be approved by the Food and Drug Administration and released sometime in 1985.—Bill Lawren



Pollution from cities can precipitate acid rain, which then pollutes our rivers. Antacid pills are probably not the best solution.

RIVER ROLAIDS

R-O-L-A-I-D-S is how Seattle anti-Buster Simpson spells relief from the acid rain that is killing America's freshwater ecosystems. He has carved oversize antacid pills (each one weighs 42.5 pounds and is 18 inches in diameter) and plopped them into a half dozen acid-polluted rivers and reservoirs in Washington and New York.

"The Roloids are limestone, which neutralizes acid," Simpson says. "They work in incredibly slow time-release fashion."

But river Roloids don't have a measurable impact on the acid that poisons the rivers and reservoirs, Simpson admits. Instead, he intends his limestone pop sculptures to heighten public awareness of the acid-rain problem.

A major source of acid rain are the smokestacks at

coal-burning plants that emit sulfur dioxide, which chemically changes in the atmosphere and rains acid down on the earth. But rather than do something constructive to clean up the plants, Simpson says, big government temporarily neutralizes acidified bodies of water by dumping massive amounts of powdered limestone.

"Are we going to continue dusting lakes with limestone, constantly increasing the dosage as the situation gets progressively worse?" Simpson asks. The Roloids, he says, "are a metaphor for this situation where the bigger the problem becomes, the bigger the pill that's needed to treat it."—Eric Mahala

"Men's progress is but a gradual discovery that his questions have no meaning."

—Antoine de Saint-Exupéry

CONTINUUM



A cool cow is a happy cow. Better still, a well-cooled cowder will pump out an extra 700 to 1,200 pounds of milk per year.

COW SHOWERS

Want to keep old Elsie content and productive during those hot summer months? Then keep her cool, says University of Arizona agricultural engineer Frank Wiersma.

A cow, Wiersma explains, has to work her metabolism overtime to keep up a normal output of 50 to 100 pounds of milk a day during the summer, when the heat can raise body temperature from the normal 101.5°F to as much as 104°. And things get especially bad when cows are huddled together in crowded conditions such as outdoor sheds or holding pens, where they wait as long as 45 minutes for their turn to be milked. "I don't know if you've ever stood in the middle of a cattle holding pen on a hot day," says Wiersma, "but I can tell you it's right on the borderline of unbearable."

Recognizing the problem, Wiersma first installed evaporative coolers in outdoor sheds, thus lowering

the ambient temperature from 103° to about 90°. Cows exposed to the coolers delivered about 1,200 pounds more milk per year than their hotter sisters.

Next Wiersma tried giving cold showers to cows waiting in those unbearable holding pens. Again production rose, this time by the equivalent of up to 700 pounds a year per cow. At current milk prices, this amounts to an increased income of nearly \$100 per cow far more than the per-animal cost of the cooling system itself, which is a modest \$10.95.

So far cow showers have been installed in three Arizona dairies, with at least two more in the planning stages. But the system's advantages are not restricted to the bake-oven heat of desert summers. Although the improvement in yields may be somewhat less in humid climates, Wiersma says, "I think the system would be good anywhere where dairying is done in hot weather."

—Bill Lawren

ANTICAVITY PILL

Remember the old days when toothpaste commercials promised fewer cavities and when trained professionals, called dentists, actually filled people's teeth? That, of course, was before the anticavity pill.

Immunologist Richard Gregory, of the University of Alabama in Birmingham, says that a cavity-preventing medication may finally be on the horizon. "Dental plaque, the filmy buildup of bacteria and food on teeth causes cavities," explains the researcher. "And what causes plaque is the bacterium *Streptococcus mutans* in particular." If you got rid of *S. mutans*, then you'd virtually wipe out cavities.

which is what a new vaccine being tested at the University of Alabama reportedly does.

The vaccine, which works by stimulating the body to produce antibodies against the bacteria, was put in gelatin capsules and administered to five people for

ten consecutive days, Gregory reports. The initial dose was followed by an other week's worth of the vaccine several months later. The result: All five subjects had virtually *S. mutans*-free mouths.

If you don't like pills, Gregory adds, you might be interested in plaque-fighting milk. Cows immunized with the Alabama vaccine proceeded to produce a milk rich in antibodies against the bacteria, he says. "And when the milk is fed to rats, they are protected against cavities."

Says Gregory, "We envision this milk freeze-dried, then coated on Wheaties or cereals for breakfast." —Eric Mahara

"The wilderness is disorder. The wilderness is the earth itself and the dust between the stars, from which new worlds are made."

—Ursula K. LeGuin

"What scientists have in their breakfasts is fantasy!"

—Nikola Khrenko



A smile is nothing more than home sweet home to *Streptococcus mutans*, the bacterium that promotes cavity-causing dental plaque.



In Cameroon, mandrills can end up in butcher shops.

GORILLA CONTROVERSY

It's an old controversy with a new twist. In one corner there's the San Diego Zoo, which wants to import a pair of baby gorillas and two rare mandrill baboons from their home in Cameroon, West Africa. In the other corner is the International Primate Protection League (IPPL), which wants the animals left right where they are.

Therein lies the problem—and the twist: The Zoological Society of San Diego found the gorillas in a butcher shop in the city of Yaounde, and the mandrills were on their way to another Cameroon slaughterhouse. Because both primate species have been an important source of dietary protein in Cameroon for hundreds of years, they are now near the top of the endangered species list. According to Zoological Society President Sheldon Campbell, the zoo is trying to save the species in general from extinction

and the individual animals in question from becoming steaks.

But the IPPL has entered a strong protest. Each animal can be worth up to \$60,000 in the black market, and IPPL Chairwoman Shirley McGreal fears that any purchasing of mandrills and gorillas will encourage wholesale poaching. Calling animal dealers "the most predatory of men," she says, "I don't believe the dealer involved will not get something in return."

The implication that the Zoological Society is dealing under the table has zoo officials bristling. According to Campbell, "If the dealer is willing to give us the animals, fine. But we will not pay him one cent."

It all boils down to differing viewpoints on how best to save the species. McGreal and the IPPL maintain that the zoo should be supporting native game reserves where the animals can breed in the wild. But Campbell feels strongly that "the only way to restore gorilla and baboon populations is to have a viable captive-breeding program to keep them going." With present San Diego breeding stock at a low point, he sees the present rescue mission as a step in the right direction.—Bill Lawren

"The individual is the end of the universe."

—Miguel de Unamuno

"...act, that each tomorrow find us further than today."

—Henry W. Longfellow

JAPANESE DRUNKENNESS DISEASE

For Charlie Swart, the nightmare began right after World War II, when he was a soldier in charge of an information unit in occupied Japan. On a visit to Tokyo, Charlie suddenly discovered that he was roaring drunk. "I had to be poured into bed," he says, "and I spent the whole weekend with a monumental hangover. The only trouble was, I hadn't had a drop to drink in three days."

Swart was an unknown victim of *mori-cho*—Japanese drunkenness disease—a rare and mysterious malady that makes even the saniciest of teato sakers act and feel as if he were in his cups. There were years of unsuccessful attempts to convince American doctors that Swart was not merely a closet drunk; until the nature of his ailment was finally explained by microbiologist Kazuo Iwata, of the Univer-



Some Japanese need not drink in order to get drunk.

sity of Tokyo School of Medicine. Iwata had studied 30 cases with symptoms similar to Swart's and had discovered that the blame lay with an intestinal yeast called *Candida albicans*.

The yeast is ubiquitous, and in humans it constitutes a normal part of the population of intestinal flora. In most who victims, though, the yeast has run wild. For example, Swart's *C. albicans* count was about 6,000 times as high as it should have been. The net effect was that the yeast acted like an internal moonshine still, transforming any carbohydrate in Swart's diet into pure alcohol.

Iwata and Swart (a former medical writer) think that *mori-cho* is caused by a mutant strain of *C. albicans* that might have been created by radioactivity surrounding the atomic blasts in Hiroshima and Nagasaki. Since the Japanese use human feces as fertilizer, the *candida* could have been passed on through the food chain.

Although this interpretation is controversial, some American researchers—like Dr. Ann Levin, of the University of California at San Francisco, and Dr. Sidney Baker, of Yale—are blaming overabundance of *C. albicans* for everything from depression to simple colitis to such immune-system diseases as AIDS. In fact, Baker calls *C. albicans* nothing less than "the most important issue in our medical culture today." —Bill Lawren

CONTINUUM

ULTIMATE DIET PILL

Remember endorphins? The brain's natural opiates, endorphins seem to play a role in everything from pain relief to learning to various sorts of euphoria and, yes, appetite. And anything that opiates do, the opiate-blocking drug naloxone can turn off—and that includes appetite.

Is naloxone, then, the ultimate diet drug? Scientists have known for years that naloxone makes animals eat less, but the human picture has been sketchy and anecdotal—until now. "It certainly seems to

pill in a few years. If so, it will be an improvement on amphetamine-containing diet compounds, which are addictive and affect a whole range of body functions, including heart rate and blood pressure." Naloxone is not addictive, says Levine, "and it may not have any serious side effects, except that people may feel a little manic."

Of course, the drug does block the body's opiates, which have other functions besides stimulating appetite. "You might not want to take naloxone if you were in pain." And it would be dangerous for drug



An opiate-blocking drug may be the answer for persons with overactive appetite—and it could also help their sex lives.

work on people," says Allen Levine, who, with fellow researcher John Morely, has been testing naloxone's appetite-suppressant properties at the Veterans Administration Medical Center, in Minneapolis. "Morely used naloxone [an opiate blocker] to stem the appetite of an obese, brain-damaged patient who, without the drug, ate uncontrollably."

Levine thinks the current research may lead to a commercially available diet

addict to ingest," Levine adds. "They would immediately go into withdrawal." On the other hand, if you're looking for a good aphrodisiac while you're taking off those pounds.

"It's an unusual finding," says Levine. "We would expect that an opiate blocker would decrease sexuality. But in animals it actually seems to heighten sex drive, and it may well prove to have the same effect on people."

—Sherry Baker



The new cordless technology can talk up your phone bills.

UNTANGLING CORDLESS PHONES

Yes, now you can talk to Aunt Hortense while weeding the garden, but your new cordless telephone has a drawback. Your next-door neighbor could be eavesdropping on your conversations—or worse, charging his long-distance calls to your phone.

"These are not high-security instruments," warns Harvey Stuart, president of The Phone Booth, a telephone retail outlet in New York City. "Anyone within range can listen in."

All cordless phones, he explains, are similar in principle to walkie-talkies and operate over five frequencies. Since many of the phones have a range of over 700 feet, you and your handiest can travel two foot-

ball-field lengths away from your wall outlet and dial or receive calls. Now the bad news: The more popular the cordless phone becomes, says Stuart, the greater the likelihood that someone else has a phone operating on the same band and within your range.

If that person happens to be closer to your base station at the time he makes his call, the charge will show up on your bill. Overlapping frequency ranges can also give you static or other people's conversations on your line—both common complaints.

Fortunately, the phone manufacturers are trying to combat these problems with new units that have security features, like programmable codes that prevent noncoded units from placing calls. And the Federal Communications Commission plans to authorize five more frequencies in 1984, thereby cutting in half the chances of interference. —Scott Kanya

"Eternity is passion."
—W. B. Yeats

"We can neither put back the clock nor slow down our forward speed, and as we are already flying pitiless, on instrument controls, it is even too late to ask where we are going."
—Igor Stravinsky

"One becomes a critic when one cannot be an artist, just as one becomes a stool pigeon when he cannot be a soldier."
—Gustave Flaubert



The hostile craft would speed unnoticed toward Earth from the far side of the moon

PEARL HARBOR IN SPACE

BY JAMES E. OBERG

Shining in almost continuous sunlight, the satellites in geosynchronous orbit (GEO) seem to float motionless, like ships at anchor. But the fleet is active: It sends billions of bits of information every hour to and from the earth, 22,300 miles away. To a traveler in GEO, the blue-green planet would appear delicate and beautiful, a treasure shining against the flat darkness of space. And many of the more than 100 sentinels at their posts in GEO are ~~never supposed to~~ detect the deadly ball with all of their computerized resources.

The fleet is a vital communications and control link in our defense system. And its very distance from Earth would appear to make it invulnerable to enemy attack. But some new studies of geosynchronous orbit suggest that our satellites at GEO may be as vulnerable as were the ships in that other harbor and sunny American outpost, Pearl Harbor, in December 1941.

The blackboard studies indicate that with a bold, long-distance mission—involving a trip to the moon and back—potential enemies could wipe out our fleet. It would take but a single vehicle, making a single pass in a lunar voyage. The attack would be over in less than 12 hours. It would require no nuclear weapons. It would render the Western world blind, deaf, dumb—and open to a full-scale missile attack.

The lines of this frightening scenario—certainly already well-known to Soviet scientists—surfaced dur-

PAINTING BY H. K. WIMMER

H. K. WIMMER

ing some recent informal investigations conducted by space engineers and others. The findings were by-products of research into a different space mission—one with benign intentions. Its objective would be to send humans into geosynchronous orbit, almost 26 times farther from Earth than we have ever orbited before. One major goal: to fix aging satellites the way astronauts repaired *Solar Max* last April.

The astronaut's-eye view of Earth comes in two varieties. In the more common, witnessed by more than 100 men and four women, the planet is seen from an altitude of several hundred miles. *Solar Max*, a satellite that observed the sun for ten months until it blew a set of fuses, circled approximately 300 miles up. From this height, land-mass was in sight for no more than a minute or two before passing far astern.

In the other view, experienced by only 21 men and not likely to be repeated much before the turn of the century, Earth is a full round disc, seen from the parheloche of a moon- or Earth-bound Apollo spacecraft.

Both views elicit different reactions. From low Earth orbit, or LEO, space crews remark on the wide expanse of Earth's surface and the incoherence of the works of humankind. From lunar trajectories—passing through GEO—the astronauts were struck by the contrast between the brilliance of Earth and the blackness of space.

The visionary Russian theorist Konstantin Tsiolkovsky outlined the theory of geosynchronous orbits in the Twenties. The principle is simple. At 22,300 miles above the equator, satellites following circular orbits go around the earth at the same speed our planet rotates. So to any point on Earth's surface, GEO satellites appear to hang motionless in the sky. In 1947 Arthur C. Clarke proposed placing radio relay satellites in GEO. And in 1961 the first such device—called Syncom, for synchronous communication—was launched. Today more than 100 active satellites and an equal number of derelicts are strung along the full "great circle" in a near-made ring around Earth's equator.

Besides communications relay satellites, surveillance satellites for both military and civil purposes are also operating in GEO. Infrared sensors hang continuously above the Indian Ocean, peering northward for a clear, constant view of the entire Eurasian land-mass, waiting to monitor Soviet and Chinese rocket launchings. At other points, meteorological monitors send back full-disc imagery of an entire hemisphere a cloud cover.

The road to GEO has recently appeared rocky. Satellites such as NASA's Tracking and Data Relay Satellite (TDRS), along with payloads for Western Union and the Indonesian government, went astray in 1983 and 1984 because of booster malfunctions during their journeys from LEO to GEO.

A satellite jettisoned from the space shuttle

is moving at approximately 25,000 feet per second about 180 miles above Earth's surface. To boost itself into a transfer orbit along out to GEO's altitude, the satellite must gain an additional 8,100 feet per second from an attached rocket stage. Upon reaching the high point in the new elliptical orbit, the satellite would begin falling back toward Earth unless a second rocket burn, adding 5,900 feet per second, were performed. That burn circularizes the satellite's new orbit. It also "turns the corner" or changes the plane of the orbit from that of the transfer orbit (usually equivalent to the latitude of the launch site) to a perfectly equatorial one.

The conditions at GEO are quite different from those closer to Earth. Space may seem the same all over. But it's not.

The first difference is the radiation environment. Above most of Earth's magnetosphere, satellites at GEO are subjected to the full force of solar and cosmic radiation and charged particles. These are not weakened by the earth's magnetic field, so space

*•A passenger
in such a satellite could
continuously watch
weather develop, Earth would
appear to be
living and breathing with
the grace of
a beautiful giant's head•*

vehicles are bathed in unadulterated interplanetary radiation. The solar high-energy particles can induce electrical charge buildup across the structures of the vehicles, leading to sparking in electronics systems. In the Saties many such satellites were lost when spurious computer commands were caused by such signals. If humans were to venture here, they would need "storm shelters" against solar flares. And they could not bary unprotected in the face of the continuous high-level radiation.

Sunlight is also stronger at GEO than at LEO, not because the vehicles are closer to the sun but because for months at a time the sun never sets. Since Earth's equator is inclined 23° to its orbital plane, a satellite orbiting high over the equator seldom passes through Earth's shadow.

So the environment at GEO is unique. Conditions there cause design problems. But the advantages are worth the trouble.

The view is new and spectacular. Earth fits in an 20° across the sky (about the same size as a basketball held at arm's length), and our home planet runs through its phases, from now to full to now again, every 24 hours. When new, the unit Earth is hardly visible in

the bright sunlight bathing the geosynchronous satellite. When full, the earth is spectacular, casting shadows 5,000 times brighter than the full moon casts on Earth. During the occasional eclipses (occurring in groups six months apart), the whole Earth is surrounded by a luminous ring of light reflected through the atmosphere. A passenger in such a satellite could continuously watch weather patterns develop over hours and days. Earth would appear to be living and breathing with the slow-motion grace of a beautiful giant's head.

Unmanned spacecraft operating in GEO will grow larger and more complex in the future. Very wide antennae and large optical devices require extremely fine adjustments and alignments. Already there have been suggestions that future GEO platforms serving dozens of users on Earth will be assembled by shuttle crews and then gently pushed out toward their operating altitudes.

Once they are in GEO, any future servicing (such as refueling or replacement of electronic boxes) could be done by robot "monkeys" sent up from LEO. But such operations are difficult. For one thing, it takes more than a quarter of a second for a signal from Earth to reach GEO, an agonizingly long time to wait for a mechanical monkey to jump into action. Problems like this mean that someday people will have to venture out to GEO, too. Some repairs are going to be just too complex for robots.

NASA engineers in Houston recently completed a study on just how such a servicing mission could be conducted. The basic flight plan called for two astronauts to spend several days at GEO. They would be launched from the payload bay of a shuttle and would coast upward for two hours. Then they would rendezvous with the target space platform. Several days later they would fire onboard rockets to fall back toward Earth, where they would skim through the upper atmosphere to kill off excess speed and would change plane as required to swoop alongside the still-orbiting shuttle. After more maneuvers to complete a rendezvous, the crew would transfer to the shuttle for return to Earth. The GEO ferry capsule would remain in orbit for future use.

The engineers discovered that the mission could be accomplished with a five-ton Apollo-class command module atop an updated Centaur rocket stage. The command module would either have to be already in orbit or brought up on a different flight. One entire shuttle mission would have to be dedicated to carrying the fully fueled Centaur rocket alone.

The old Apollo landed in mid-ocean where it was cushioned by parachutes and water. But the seawater precluded reusing the craft. (The original Apollo design called for three refills of the hardware, but this plan was abandoned when the splashdown mode was selected.) If the proposed ferry to GEO were stripped of parachutes and flotation gear and loaded with extra maneuvering fuel, a precision guidance system could steer it into a retrievable "parking or-

FICTION

NEW ROSE HOTEL

*In the skull wars
a corporation will try anything
to gain the Edge*

BY WILLIAM GIBSON

Seven started right in this collar, Sando. New Rose Hotel. How I want you now. Sometimes I let you. Re-play it so slow and sweet and mean. I can almost feel it. Sometimes I take your little automatic out of my bag, run my thumb down smoothly, cheap chrome. Chinese '22, its bore no wider than the dilated pupils of your washed eyes.

Fox is dead now, Sando.
Fox told me to forget you.

I remember Fox leaning against the padded bar in the dark lounge of some Singapore hotel, Denmore Street, his hands describing different spheres of influence, internal rivalries, the arc of a particular career, a point of weakness he had discovered in the armor of some think tank. Fox was point man in the skull wars, a middleman for corporate crossovers. He was a soldier in the secret skirmishes of the zaibatsus, the multinational corporations that control entire economies.

I see Fox grinning, talking fast, dismissing my ventures into intercorporate espionage with a shake of his head. The Edge, he said, have to find that Edge. He made you hear the capital E. The Edge was Fox's gift, that essential fraction of sheer human talent, nontransferable, locked in the skulls of the world's hottest research scientists.

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You can't put Edge down on paper. Fox said, cut punch Edge into a cassette.

The money was in corporate defectors. Fox was smooth, the severity of his dark French curls offset by a boyish forelock that wouldn't stay in place. I never liked the way the effect was ruined when he stepped back from the bar his left shoulder skewed at an angle no Paris tailor could conceal. Someone had run him over with a taxi in Bern, and nobody quite knew how to put him together again.

I guess I went with him because he said he was after that Edge.

And somewhere out there, on our way to find the Edge, I found you, Sandy.

The New Rose Hotel is a coffin rack on the ragged fringes of Nanta International. Plastic capsules a meter high and three long, stacked like surplus Goddard's teeth in a concrete cut-off the main road to the airport. Each capsule has a television mounted flush with the ceiling. I spend whole days watching Japanese game shows and old movies. Sometimes I have your gun in my hand.

Sometimes I can hear the jets, faced into holding patterns over Nanta. I close my eyes and imagine the sharp white contrails fading, losing definition.

You walked into a bar in Yokohama the first time I saw you. Eurasian, half Asian, long haired and fluid in a Chinese knock-off of some Tokyo designer's original. Dark European eyes. Asian cheekbones. I remember you dumping your purse out on the bed later, in some hotel room, pawing through your makeup. A crumpled wad of New Yen, discolored address book held together with rubber bands, a Mitsubishi bank chip, Japanese passport with a gold chrysanthemum stamped on the cover, and the Chinese 22.

You told me your story. Your father had been an executive in Tokyo but now he was disgraced, disowned, cast down by Hosaka, the biggest zaibatsu of all. That night your mother was Dutch, and I listened as you spun out those summers in Amsterdam for me, the pigeons in Dam Square like a soft, brown carpet.

I never asked what your father might have done to earn his disgrace. I watched you dress, watched the swing of your dark straight hair, how it cut the air.

Now Hosaka hunts me.

The coffins of New Rose are racked in recycled scaffolding, steel pipes under bright enamel. Paint flakes away when I climb the ladder, falls with each step as I follow the catwalk. My left hand counts off the coffin hatches, their multicolored dials warning of fires leveled for the loss of a key.

I look up as the jets rise out of Nanta passage home, distant now as any moon.

Fox was quick to see how we could use you, but not sharp enough to credit you with ambition. But then he never lay all night with you on the beach at Kamakura, never listened to your nightmares, never heard an entire imagined childhood spill under those stars, shift and roll over your child's

mouth opening to reveal some fresh past, and always the one you swore that was really and finally the truth.

I didn't care, holding your hips while the sand cooled against your skin.

Once you left me, ran back to that beach saying you'd forgotten our key. I found it in the door and went after you, to find you ankle deep in surf, your smooth back rigid, trembling, your eyes far away. You couldn't talk. Shivering. Gone. Shaking for different futures and better pasts.

Sandy, you left me here.

You left me all your things.

This gun. Your makeup, all the shadows and blushes clipped in plastic. Your Cray microcomputer, a gift from Fox, with a shopping list you entered. Sometimes I play that card, watching each item cross the little silver screen.

A freezer. A fermenter. An incubator. An electrophoresis system with integrated agarose oak and transilluminator. A tissue embedder. A high-performance liquid chromatograph. A flow cytometer. A spectrophotometer. Four gross of borosilicate scintillation vials. A microcentrifuge. And one DNA synthesizer, with in-built computer. Plus software.

Expensive. Sandy, but then Hosaka was footing our bills. Later you made them pay even more, but you were already gone.

Hiroshi drew up that lot for you. In bed, probably Hiroshi Yomuri. Maas Boelals GmbH had him. Hosaka wanted him.

He was hot. Edge and lots of it. Fox followed genetic engineers this way, a fan follows players in a favor to game. Fox wanted Hiroshi so bad he could taste it.

He sent me up to Frankfurt three times before you turned up, just to have a look-see at Hiroshi. Not to make a pass or even to give him a wink and a nod. Just to watch.

Hiroshi showed all the signs of having settled in. Hed found a German girl with a taste for conservative looks and riding boots polished the shade of a fresh chestnut. Hed bought a renovated townhouse on just the right square. Hed taken up fencing and given up kendo.

And everywhere the Maas security teams, smooth and heavy, a rich, clear syrup of surveillance. I came back and told Fox we'd never touch him.

You touched him for us, Sandy. You touched him just right.

Our Hosaka contacts were like specialized cells protecting the parent organism. We were mutagens, Fox and I, dubious agents adrift on the dark side of the inter-corporate sea.

When we had you in place in Vienna, we offered them Hiroshi. They didn't even blink. Dead calm in an L.A. hotel room. They said they had to think about it.

Fox spoke the name of Hosaka's primary competitor in the gene game, let it fall out naked, broke the protocol forbidding the use of proper names.

They had to think about it, they said.

Fox gave them three days.

I took you to Barcelona a week before I



MISSION TO A MIND

BY JAMES RESTON, JR.

"Do you feel comfortably?" the soft voice asks, seemingly from here and now.

"Very comfortable," the explorer replies from a water bed in his darkened capsule. He is not 170 miles up in the stratosphere, but in Nellysford, Virginia. His mission: to explore the outback, the lower depths of man's subconscious mind.

"How does the library appear to you now?" Control asks, carefully checking the gauges on the console before him.

"Same as usual." Though the explorer is still aware of his physical senses, not yet very deep in the hole, his words echo from a distance. He has been to the library three times before, and there is no excitement or anticipation in his slow, eerie drone from subterranean regions. Nevertheless, even in this state, he knows that he must probe the contents of the library, not just view it from the outside as he has done before.

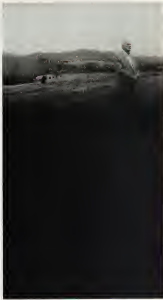
"Very interesting," the explorer murmurs pleasantly. "I sense energy forms." It sounds like an offhand observation.

"Is there anything unusual or different?" Control asks.

"There is an area here that I did not perceive before. The exterior looks like a kind of airplane. It sits on a flat rock over a large cavern or cave."

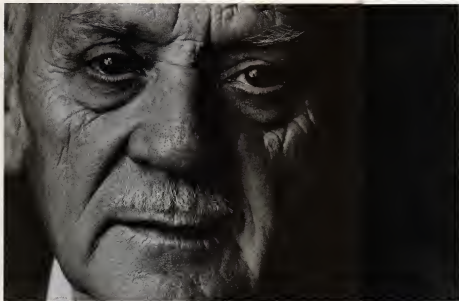
"The library is a vehicle of some sort?" Control remarks in a tone of some surprise.

"Apparently. The exterior is very large. . . . The interior is small."



PHOTOGRAPHS BY
DAVID KENNEDY

“On occasion he can leave his physical body, visiting other worlds with his spirit alone.”



Robert Monroe, the sixty-nine-year-old leader of the New Age community, in profile (above); a former radio executive, he is seated at his console (far right)

ectrics: “a sacred thing.”

“Are you ready to probe the Abyss?” Control asks, an urgent seriousness to his tone. “Yes.”

The mission begins. I drive through the winter landscape of the Shenandoah Valley headed for Jerry Falwell country. The preacher’s aura, expanding with the sweep of radio waves from his giant transmitting tower in Lynchburg, is strong enough to interfere with television reception and drown out all other broadcast voices.

My final destination, Nelson County, borders on the city of Lynchburg, and it feels easily within the preacher’s enunciation of the Word. Yet, the county finds its identity more in mod-

ern television than in hard-shelled Baptism. This is the mythical site of *The Walkers*, and these are the hills that John Boy and Grandpa Walton warmed with their love.

Driving past old tin-canper shocks, through streets without a single traffic light or parking meter, I turn off onto Adial Church Road and drive up a ridge to Nellysford. Inside the old Baptist church, a community center since 1954 when it was built with a balcony for blacks and a separate section for the ladies, I pass over the north fork of Rockfish River which swelled to a great wall of water, killing more than 200 people during Hurricane Camille in 1969. Pondering the folklore of the backwater spot—Falwell, the Wal-

tons, and Hurricane Camille—I come upon Robert’s Mountain, home of an exotic complex known as the Monroe Institute of Applied Sciences.

The natives, steeped in their own brand of mystery, are not sure what to make of the Monroe Institute (opening spread, on left, with its creator Robert Monroe; at right). It has been here for eight years, and they still understand little of what it is, except that it has something to do with the human brain. Even when the Waynesboro, News-Virginian ran an article detailing the institute’s work—explaining that it uses sound waves to induce altered states of consciousness—local people did not get the facts quite straight.

Did you read that story in the

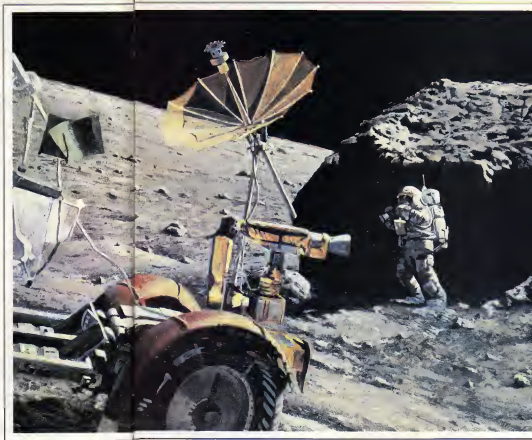
CONTINUED ON PAGE 53



MEMORY OF THE MOON

BY FREDERICK C. DURANT III

Alan Bean was the fourth man to walk on the moon. He had also been a naval engineer and a test pilot. But in 1981 he resigned his NASA position to become a full-time painter. "I knew it was a gamble," Bean says. As it's turning out, that gamble has produced a unique collection





of artistic and historic artifacts: astronaut Eugene Cernan waving the American flag across the barren surface of the moon (previous page, left); astronaut and later U.S. Senator Harrison "Jack" Schmitt changing a camera lens on the lunar surface (previous page, right); a lunar portrait of Cernan (above); and liftoff of the first orbital test of the shuttle in April 1981 (right). Like Fredrico Remington, who preserved scenes





of the Western frontier in landscape paintings, Beas is documenting his vision of some of the most significant events of the twentieth century, including the Apollo lunar module's approach to the moon (left) and astronaut Alan Shepard (right) taking samples of the moon's soil. Transforming personal reality into an artistic form has always been the work of artists. For Alan Beas, that reality is our dream of a once and future frontier.

∞

PEARL HARBOR

CONTINUED FROM PAGE 44

ter" near the waiting shuttle instead of relying on a surface-impact trajectory. This was the route chosen by the NASA engineers. Rendezvous eliminates the development for water-landing systems and water-recovery operations," their report concluded.

The engineers estimate that such a mission could be flown by 1990 at a comparatively low cost of about \$1.5 billion. Each subsequent flight would cost about a tenth as much as the inaugural mission.

A companion vehicle to the GEO sortie tug would be the "line shack." This 12-ton module would remain near GEO and would contain spartan living quarters for visiting teams of astronauts. Most standard tools and the heavy artwork could be left attached to the line shack. So the home base in GEO would help keep the weight of the ferry capsule down. But the line shack would cost an other \$1.5 billion to build and launch.

In late 1983 the study results were presented to NASA headquarters in Washington. Reportedly, Washington thought that the research was nice, that you very much, but the project was too dangerous and too expensive for any mission in the next ten years.

The NASA engineers weren't alone, however, in their ambitions to put humans into GEO. At Eagle Engineering, a consulting firm in Houston, Hu Davis has long been an ad-

vocate of the development of manned geosynchronous capability. But he sees little purpose in merely going out there to show it can be done. His plans involve developing a significant in-place work capacity.

I want two things beyond a bare-bones demonstration. Davis told me early in 1984. First, "We need to be able to cover a significant fraction of the geostationary arc while we're there. And we need to stay for a week or more." Since no shuttle could tarry in orbit that long, the GEO ferry capsule—in contrast to the vehicle envisioned by NASA engineers—would have to contain its own Earth-landing system. This would probably be a parachute for a dry-land touchdown.

Second, "I want at least one ton of discretionary payload," Davis demands. No stripped-down capsule could carry enough cargo to do anything useful once it got to GEO, he argues. But with a cargo capacity, sortie vehicles would be able to bring up hydrazine propellant, new batteries, spare appliances, and improved radio transponders for installation on degrading communications relay satellites. "These are useful payloads to enhance the value of orbital assets," Davis says.

The larger vehicle would need more launch power. For each GEO expedition Davis foresees one full shuttle launch and one full launch of a shuttle-derived vehicle, a heavy carrier capable of putting double-size payloads into orbit.

Such a capability would allow some really

useful missions for flights at least once a year. Davis believes, "Most GEO satellites that die, starve," he says. Relieving with new propellants could restore some satellites to life.

Currently, most users of GEO satellites figure that after seven to ten years, the satellites technology is so obsolete that it makes more economic sense to replace it entirely. "Sure, there's no incentive right now for repair missions," Davis points out, "because the communications satellite manufacturing companies sell new satellites and replacement satellites."

Instead, Davis suggests that the older satellites could be sold to customers with less need for the latest technology. Or if high technology were the object, the satellites could have their radio transponders replaced, while leaving the still serviceable power command and other systems.

Sooner or later the large GEO platforms now being planned will demand this servicing capability. First by robot, "teleoperators" and then by on-site humans. Davis predicts astronauts will visit GEO space on service missions as early as the end of the Nineties.

It's an implicit part of NASA's new space-station program, he says, since the agency will be placing its permanent station at a 28° inclination—a convenient angle for voyaging deeper into space. "Washington has called for a bolder, more innovative and broader-reaching space program," Davis recalls, "and this could be part of it."

Davis eyes twinkles. "Bessies," he says. "GEO sort of is a back door to the moon."

The odd numbers of space navigation show that Davis is right. It actually takes less fuel to go all the way to the moon, orbit 100 miles above it, and return to Earth than it does to reach and return from GEO. Sure the lunar trip takes longer—three days each way instead of six hours—but any GEO-satellite ferry that is built to support astronauts for a week at GEO could just as easily support them on a return voyage to lunar orbit.

And Davis thought of one more reason for developing a manned geosynchronous capability. "You might need it to remove a threat," he says. What kind of threat? Davis first lists out of control objects interfering accidentally with neighbors. But other threats—some deliberate—are possible.

With all these tempting targets lined up along the GEO arc, how would an attacker design his flight plan? There is no need to be coy about the identity of the players. The primary targets in GEO are Western, and the leading (essentially only) candidate for attacker is the Soviet Union. The Soviets have no military assets in GEO. Their space vehicles there are presumably commercial communications and navigation systems; their military systems are in different orbits. So they have the freedom to fire against anything they want to shoot at.

The Soviets could use a large Proton booster to place one of their currently operational "killer satellites" into a GEO orbit. For GEO targets, they would use a smaller ICBM derivative, called the F-class. Skopets point out that the Proton is five times bigger than



the F class and is correspondingly harder to launch. But the Soviets launch the bigger booster more often than the smaller one. So it would be no great problem to hit several killer satellites atop such boosters.

Once near the GEO rim, the weapons could drift along until they made radar contact with their targets. Under ground command, they would close in and execute their shrapnel attack.

Most experts have concluded that although the Soviets might be able to put three or four killer satellites into GEO, they could hardly make a dent in the American military assets there. This is all the more comforting because it would take a long time—days or weeks—to get into the proper attack approach path. And the endangered targets, under ground control, would be able to take evasive action.

But suppose the tables were turned. Or rather, suppose the attacking Soviet satellites were at the same altitude as the GEO alt., but moving east to west instead of west to east; the direction in which the earth and the GEO satellites rotate. This so-called retrograde geosynchronous path is far more threatening. The Soviet orbital weapon would be running head on through the space occupied by the necklace of satellites, like a car hunting the wrong way on a superhighway. Accidental collision would be unlikely in space. However, since a cross section of the arc is at least 100 kilometers across.

The hunter-killer vehicle could pick out one target at one pass, track its path precisely and on the next pass 12 hours later, fire a small homing missile (of which it could carry a dozen or more). The missile could carry a miniaturized radar guidance system, with the radar transmitter on the main killer satellite. Assemblies a simple optical sensor would be more than adequate since the target is in full sunlight. Desired targets could be picked off one by one over a period of several days.

In another scenario, the Soviet killer sat, after merely evading a cloud of particles ahead of itself. At a combined speed of 16,000 feet per second, the target satellites and the particles—grains of sand, for example—would destroy one another. With a suitably thick cloud, the entire GEO arc—including the Soviet communications satellites, which have little if any military use—could be reduced to junk in 12 hours. A thinner cloud would merely tear more pieces—perhaps five, ten, or twenty—to eventually turn GEO into a new asteroid belt.

If the Soviets wanted to recapture the orbit later, they could use plastic pellets, which would pulverize under solar ultraviolet and eventually blow away on the solar wind.

Could any of this happen? It's easy to dismiss the threat. After all, putting satellites directly into retrograde geosynchronous orbit is an almost impossible task. If the booster takes off from Earth westward instead of eastward, it loses at least a fifth of its total power because it must work against Earth's rotation. If the reversal burn occurs at the top of the long GEO transfer arc, swinging out from parking orbit to the point the second

rocket burn must occur, then an enormous amount of fuel would be required to set off the original mission and apply "full reversal" to get into a retrograde orbit. Little if any payload would be left for the warhead.

But unfortunately these comforting arguments assume that anyone wishing to throw an object into retro-GEO is not very clever. Putting a hostile craft into "backward" orbit is actually comparatively easy.

The broad lines of the mission can be worked out on a blackboard. While the Soviets may be short of black boxes and esoteric gadgetry, they have plenty of blackboards—and clever orbital mechanics to write on them.

To get to retro-GEO the smart way, you merely pretend you are going to the moon. You actually perform a lunar flyby. The chosen path is very much like the free-return trajectories followed by Apollo lunar expeditions, except that the lunar flyby altitude is a little higher.

On the return to Earth, then, the enemy craft would fly by at an altitude of about 22,000 miles. At that point after about a week of flight, instead of whipping on past and back up and out into the depths of interplanetary space, the vehicle would perform a rocket burn to enter retro-GEO.

The killer satellite could also get into position secretly. The initial launching would of course be deflected. But Moscow could merely announce another scientific lunar probe. Something (a small transmitter, for example) could be dropped off in lunar orbit as sateddropping American antennas would be satisfied. Or else Moscow could simply report that the probe had crashed. And as the killer satellites rounded the moon and headed for its rendezvous, no tracking system on or off Earth could follow it.

Even if it could, what could be done about such a retro-GEO threat? The worst defense the West could mount would be to blow up the weapon because resulting fragments would merely carry out the original mission and destroy all the satellites.

The only feasible response would be a manned mission to retro GEO via the moon to rendezvous with the killer satellite and disarm it. Presumably, if such a mission were at all feasible, the Soviets would body trip the satellite to explode if tampered with. So the tamperers would have to be very clever and very gentle because the jewels of the GEO necklace would be booming past their heads at three miles per second.

Trust, countertrust, perry and thrust—the quest for the high ground goes on, even in the depths of space. With current boosters and warheads, such a mission is feasible already. But the nightmare may be prevented by the mere existence of effective countermeasures and by awareness of the threat. And countermeasures in turn provide unadvertised capabilities for much more beneficial space tinkering.

In the nighttime, the moon is a back door to retro-GEO and destruction. In a more hopeful and benign dream, GEO will be a back door to the moon and stars. **DO**

SPACE

CONTINUED FROM PAGE 21

testimony of Soviet émigrés, as well as snippets of Soviet spokesmen, who characteristically forgot yesterday's cover story and blurt out some revealing new detail.

A few years ago, during one of the periodic worldwide panics over falling Soviet satellites carrying nuclear reactors, the satellite Kosmos-434 burned up somewhere over Australia. When it was launched, during the moon race, Western observers thought it might be an unmanned flight test of a man-rated lunar spacecraft. It maneuvered through its orbits in a pattern analogous to what a lunar vehicle would have to follow near the moon. But at the time, the Soviets officially called it (and three other flights like it) routine scientific satellites for research in outer space. Then, after many years of gradually slipping closer and closer to the atmosphere, the satellite finally burned up.

To relay tears down under an official spokesman of the Soviet foreign ministry in Moscow, assured Canberra that there was no radioactive material on board Kosmos-434. The satellite was merely an experimental lunar module, he said. This is what Western observers had suspected all along. The Soviet officials who had lied about it more than a decade ago were apparently never consulted by the other bureaucracy in need of a new story.

Lunar modules (in Russian, *lunarydy* *Arbiva*, the same term used for the Apollo lunar module) are built and tested to be flown by men. Another crack had appeared in the wall of Soviet secrecy.

This summer is the fifteenth anniversary of another moonlight-related event, which significantly shaped the paths of the earth's two major spacefaring nations. On a launchpad north of Tyuratam in Soviet Central Asia, a giant booster rocket twice the size of America's Saturn V was destroyed in a spectacular explosion. Two later launch attempts also failed, marking the end of any Soviet attempt to match or surpass the Apollo program.

With a slightly different distribution of luck, the history of manned lunar exploration could have turned out differently. The payoff from Apollo would have been argued with disappointment, had the Soviets won the moon race.

Americans are still the only people who ever walked on the lunar surface, and they still recite the cliché: "If we can go to the moon, why can't we—?" The question is complicated with unrelated dreams: solving the problem of world hunger or curing the common cold.

But there is another dream. It is connected with the original source of the cliché, the moon itself. If we can go to the moon, why can't we go back to the moon? There is no reason why not. We can, and will, whenever we want to, and that is probably the greatest success of Apollo. **DO**

The more complex the circuit, the simpler you can be. Computer dunces rejoice: Here comes the

MEGACHIP



"What's that modem's best?"

"Ready to boot?"

"What K you got in EPROM?"

"Hey, man, dump the screen!"

"You running a Winchester?"

Peek into the computer room at Anywhere High School, USA, and you'll find the local techopunks riding at the keyboard, slinging lingo back and forth. It's like NASA's Mission Control; this brotherhood (and sisterhood) of the micro. Out of the way, old-timers, here we come: the merry chipsters, ready for the microcomputer's tomorrow and the supermines.

In California's Silicon Valley and other high-tech bastions, such as the arc of electronics companies around Boston, these New Age computers are now taking shape. Ultrapowerful, they promise to jerk the entire society around. As Chris Morgan, a vice president at Lotus, a leading software company, puts it, "This is going to be the next industrial revolution."

Any forty-year-old Methuselah looking into the computer room will remember when the machine was a primitive beast called UNIVAC, big as a boardroom but dumb as any of today's \$19.95 loss-leader calculators at Radio Shack. He isn't completely computer-illiterate; this product of the prechip Tube

Age, on his office desk sits the ubiquitous IBM PC. But like great-grandpa driving his first Model T, he has an urge to say giddyup when he turns on the machine. The brotherhood, on the other hand, seems to have begun every morning since they were weaned, with a bowlful of transistors, milk, and sliced bananas. Bring on the supercomputer—they're ready just as Dad was into '56 Fords and overdrive, the kids are into Macintoshes and 32-bit processors. Luck up all your data banks!

BY RICHARD WOLKOMIR



In just a few years, we'll have machines with 25 times the power of today's IBM personal computer.

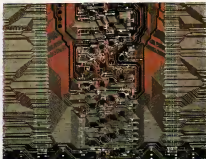
The high-school technologists don't need Good-years to get around. They can punch a key and go anywhere. Like the car in its day, the computer is reshaping society to suit itself. Of course, it's still warming up, but this analogy has not been lost on the microcomputer industry.

"Right now compared with the automobile, computers are at about the year 1915," says David Kay, vice president of the Kaypro Corporation.

"We need to have an infrastructure like the one developed for the car," Aladi Venkatesh, a University of California management expert, recently told a group of computer professionals in Boston. "For cars, we have highways, streets, parking lots, gas stations, and repair shops. If computers are to reach the popularity of cars, they need something similar. That means computers that can do our shopping for us and provide electronic mail services, library and data retrieval, education access, as well as access to a wide variety of entertainment."

It also means computers that can think back at you—that is, machines that can actually sense when you need help and what specific help you need. But that takes more power than today's microcomputers command. Thus, at the moment, the computer industry is engaged in what any graduate of the horror Fifties can easily understand: a horsepower race.

In the sleek and low palaces of the high-tech companies, laid back among Silicon Valley's palms and pines, the hardware neobeats are sipping in their hot tubs, pondering ways to torque up their machines. But—why twist?—they are not thinking of those kids in the high-school computer room, the electronic hot rodents. Komputer Kids, face it: You are a wee market. The neobeats have declared you obsolete. The future—twist again!—is all those Methu-



sals out there who don't know beads from bytes and speak no Pascal.

The neobeats want a computer in every florist's shop and dentist's office and two in every suburban split-level and ranch. That means programs so easy and slick that old Methuselah won't even notice he's using a computer. It also means programs of dazzling complexity requiring super-powerful machines.

"In just a few years, we'll have machines with twenty-five times the power of today's IBM PC," says Kay. "Programs will have advanced to the point of being able to sense what you don't understand and help you along. When that happens, a huge market will open up because nobody will have any excuse not to use a computer."

Leading to the Oz of bullet-fast minds with memories like the national archives are many yellow-brick roads. And the engineers are following all of them.

For instance, IBM has just developed a new chip that stores 1 million bits of information (small photo, opening spread), nearly four times the capacity of today's best chips. Capable of holding approximately 100 pages of double-spaced typewritten text, the chip is the culmination of improvements in both photolithography and processing technology. These advances made it possible to fabricate circuit elements on the chip as narrow as one micrometer—about a fifth the width of one human hair. Consequently, the IBM designers can pack in more circuits, mak-

ing the chip extra dense.

Other engineers are working on bubble technology, an alternative to silicon chips for computer memory and logic devices. These units contain tiny blobs of magnetism—called magnetic bubbles—that can move about under the influence of magnetic fields and electric fields. By changing position, these magnetic bubbles can record information in binary form. Bubbles have several advantages over ordinary chips. They are more rugged; they retain their memory even after the power is turned off; and they can store more data. Consider the limit: company's latest bubble system

it can store 4 million bits of information—roughly 400 double-spaced typewritten pages—on a device the size of a tack's head. Researchers say the technology could theoretically lead to a billion-bit computer no bigger than a portable radio and powered by flashlight batteries.

In the meantime, bubble technology has two drawbacks. Bubble memories are more expensive than standard chips, and they work more slowly. But rising production will cut costs. And according to Mark Kryder, director of the Magnetronics Technology Center at Carnegie-Mellon University, engineers are now striving to speed up bubble devices. "Silicon is clearly much further along the learning curve and slowing down," he points out, "while bubble research is still early on the curve, with a considerable distance to go."

Bubbles already have many applications in robots and other systems where game and vibration can maim standard chips. For example, they are now incorporated in tiny computers that fit in briefcases and, in the future, may supplant magnetic tapes for use in space shots. Kryder reports that the Japanese also have a major push under way to incorporate bubble technology in personal computers. "They let you make a smaller machine," says Kryder, "and the bubble's ruggedness can be a big asset because the average consumer is not notoriously careful with disk drives."

Other researchers believe the next cen-

CONTINUED ON PAGE 126

Preceding page: Cloaked in dust-free garments, IBM workers use an advanced tool to fabricate a slice of the all-millicon-bit chip (small photo). The experimental prototype will one day supplant the quarter-megabit chip (above) which is just now going into mass production.



*Computers, automation, and robots
hold the promise of a
vast economic recovery, says this Nobel
Prize-winning economist,
but first people must learn to live with
less work and more leisure*

INTERVIEW

WASSILY LEONTIEF

In 1929 a young Russian was sitting with his comrades in a sidewalk cafe in Kiel, Germany, discussing economic problems at the top of his voice, when one of a group of Chinese sitting nearby came over and asked for his card. Soon afterward a telegram of invitation arrived from the Nanking government, and the gifted twenty-three-year-old spent the next year in China as adviser to the minister of railroads.

The experience was typical for Wassily Leontief, whose talent was recognized early and who, as a result, has never in his life had to apply for a job. Fifty-five years and a Nobel Prize later, Leontief, a depressive and very practical theorist, hasn't slackened his pace. A hale and hearty seventy-seven, he still loves to discuss ideas at restaurant tables, and heads of government continue to listen. Of the 70 intellectual leaders present at the 1983 Cultural Congress of Paris, Leontief was one of a

select group asked to join French President François Mitterand and friends for a private dinner in a small restaurant.

Leontief's influence, however, is seen in practice as well as in talk. His ideas have probably seen wider practical application in this century than those of any other economist, including even John Maynard Keynes, the British genius who first demonstrated that governments should not cut back but should spend their way out of depression and recession. Governments of more than 70 countries, employing armies of statisticians and analysts, have gone to colossal expense to apply Leontief's methods. The *International Encyclopedia of the Social Sciences* mentions his name in the same breath as Adam Smith, the father of economics, and other leading economists "whose ideas have left a permanent imprint on the history of economic thought."

Background and temperament incline Leontief to take an eco-

PHOTOGRAPH BY DAVID MICHAEL KENNEDY

nomie world view. Born in 1906, he grew up in Petrograd (now Leningrad), the only child of a university social-sciences professor. His mother was an art historian who helped catalog the royal works in the Hermitage the winter after the Revolution. He vividly recalls the whine of stray bullets Lénin making a speech in front of the Winter Palace, and a young Vladimir Horowitz playing "fast and loud" to delirious audiences. Léontief himself, taught by a pupil of Liszt, was encouraged to become a pianist, but declined in favor of "more intellectual" pursuits.

Jailed briefly a year after entering Leningrad University at fourteen for arguing too rashly with a tutor, Léontief he remained as outspoken as ever. He survived to graduate in 1925 with the degree of Laidned Economist and traveled to Berlin for his Ph.D. Then he joined the Institute of World Economics, in 1926. When the invitation came from China, he took the slowest boat available, stopping in numerous ports en route, despite the inconvenience of having a Russian passport, which raised unending official suspicion.

Upon his return to Germany, he accepted an offer to join the National Bureau of Economic Research, in New York, and he left Europe permanently. Within months Léontief moved on to a post at Harvard's economics department. The department chairman agreed to fund Léontief's pet project, which the research advisory committee believed was "totally impractical." If Léontief promised to report its "eventual failure" and give a careful accounting so that they could close the books properly.

Léontief's inspiration was his famous input-output table, a concept that has since become a cornerstone of contemporary economics. Léontief sought to build a detailed model, on paper, of the workings of the U.S. economy. As momentous insights often are, the input-output table is clear out in principle. Like a mileage chart on a gas-station road map that allows you to read off the distances between cities, the gridlike table shows the flow of goods and services from different parts of the economy. The basic idea is that much of the production of farms, factories, and businesses goes into other industry before it reaches the consumer. The industries listed down the left-hand side of the table also head columns across the top of the table. Starting at an industry on the left and running your finger across the page, you find in each box the share of that industry's output taken in by the industry atop each column. Like an economic crossword puzzle, the number in each box can be read either as part of the output of one industry or as part of the input of another.

Just as the home-computer program VisiCalc expresses the interdependence of items in a household budget or business plan, so an input-output table—the national, even global VisiCalc—provides a picture of all the interlocking inputs and outputs of a given economy. The general

pattern of all the cars, computers, movies, insurance, and other desirables produced and consumed by Americans can be followed across the page. The supplies that go into each—the lumber and glue in furniture, the cement and tiles in houses—can be tracked as well. A powerful tool of economic analysis, the input-output table presents the economy in macroform. If designed with a sufficient degree of sophistication and subtlety it can be of great use in economic forecasting.

Working in the precomputer age, Léontief labored painstakingly to ensure the accuracy of his calculations. After a decade of toil, he published his first sizable table in his 1941 book, *The Structure of the American Economy*. The grid featured only 42 industries or sectors, but even so it promised to answer for the first time, such questions as: "If automobile manufacturers lose sales and have to fire ten thousand workers, how many jobs will be lost in parts supplies and other related indus-

•The Soviet economy is like a sailboat that has an oversize rudder held by a strong hand but bobs up and down in the water for lack of the propelling power of the profit motive •

tries that contribute to producing a car?

The Department of Labor, concerned with coordinating production for the war effort, had Léontief to draw up a 30-sector input-output table for the United States. The expanded table proved its mettle when it was used to predict correctly that contrary to widespread opinion, there wouldn't be depression and massive unemployment at the war's end.

Léontief, by then the Henry Lee Professor of Economics at Harvard, extended his research project, becoming the first social scientist to use computers. His work was funded in part by the Air Force, which wanted to learn how to avoid procurement bottlenecks in case of another war. Similar projects proliferated in government and in other universities as input-output became briefly fashionable. Then enthusiasm waned as critics attacked on complicated theoretical grounds and argued that the expense of collecting and validating the necessary statistics was exorbitant, compared with the costs of less detailed approaches. In the early Fifties the Air Force brass decided that the whole thing smacked too much of a planned economy

and withdrew their backing.

This typically American fear of government interference in the free-wheeling private economy has dogged Léontief here ever since. Government interest in input-output has been less enthusiastic in the United States, where it was born, than in almost any other country. An understaffed section in the Department of Commerce currently prepares input-output tables for the United States on a regular basis, but compared with those of other major countries the U.S. models lack detail and are out of date by publication time. The input-output table for 1977, promised for February 1984, is still struggling to see daylight. By contrast, the Japanese table for 1980, a work of much greater scope and the product of the combined efforts of 13 ministries, was completed in 1983.

Academic economists have not been much more receptive, though the input-output approach is a staple of coursework. For his part, Léontief has not been shy to chastise his colleagues. When elected president of the American Economic Association in 1970, he lambasted his audience for endlessly theorizing without checking their assumptions against the real world. Academic economists, he said, had fallen in love with mathematical formulations because these were more glamorous and less costly than grubby fact-finding. Léontief has also criticized the economic models that business forecasters rely on to peer into the future. These widely used models, essentially lists of simultaneous equations with multiple variables that are solved by computer, produce forecasts that are often disappointingly inaccurate. Léontief bluntly calls these models "utterly unreliable."

Throughout the rest of the world, however, many decision makers are highly receptive to Léontief's techniques. Such giants as ITT and GM use input-output tables to plan corporate policy. And in Norway, where the national table is carried in a central computer, input-output statistics are gathered so efficiently that the census has been canceled. At his Nobel award ceremony in 1973, Léontief outlined plans for an enormous input-output model that would project the economic future of the entire world from 1970 to 2000. Undertaken as a United Nations project, it was published in 11 languages in 1977 as *The Future of the World Economy*. His latest book is *Military Spending* (coauthored with Fayo Duchene), a study of the potential economic impact of arms trade and disarmament.

After 35 years at Harvard, Léontief and his wife Estelle, a poet, moved to an apartment in Greenwich Village, near New York University, where he directs his Institute for Economic Analysis. Science writer and former economist Anthony Lewis later interviewed Léontief in his office, where he held forth in a voice spiced with a strong Russian rasp, his discourse punctuated with cries of "Eggschicki!" and "It's incredible!" He was lively, bawling with joy at

CONTINUED ON PAGE 10

*America's master pollster
looks to the next millennium with his
book of prophecy called*

FORECAST 2000

George Gallup, Jr., the man who makes and stakes his reputation on knowing what Americans think, has brought all his polling strategies together to identify and analyze what he calls future forces. Already they are shaping what form our society will assume by the end of the century. And to prepare for that era, he has sought help from two groups of predictors. One group was huge. He sought the views of millions of individuals. With broad-based polls, he tried to plumb what he calls the "intuitive, almost mystical corporate sense of where we are going—a sense that no one individual possesses." He

put his questions to the nation's youth, for example, because his polls have shown repeatedly that one's values and attitudes about life—the seeds of future actions—are formed and fixed before a person turns twenty. Finally, Gallup sought the opinion of a select group of experts of all kinds—lawyers, judges, economists, business executives, artists, scientists, the clergy—to get as sharp a focus on the future as possible. On the following pages is a compendium of visions of the millennium.

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NUCLEAR FUTURE

When asked how life in the year 2000 might differ from today's, all the experts headed their lists with dire predictions of nuclear war. Nearly 80 percent not only favor a United States-Soviet Union agreement to stop building nuclear weapons but urge the destruction of all existing stockpiles. And 50 percent of those polled suggest there be a global referendum to allow the citizens of every nation to vote on nuclear disarmament.

ONE-SHOT PRESIDENTS

Fully half the American public would like to see our presidents elected for one six-year term of office, with no time or energy spent outside the Oval Office in pursuit of reelection—an idea that seems to be gaining popularity. Gallup's findings also predict that presidential selection will begin with search committees that will choose a few top candidates to run in party primaries. When the public gets to vote directly on major pieces of legislation, Gallup says, voter turnout will about triple.



ANSWERED PRAYERS

Although a majority of the world's experts believe that organized religion today has failed to help us handle the problems of modern life and has left us spiritually bereft, about a third still believe that a renewed faith in religion will be part of life in 2030. Even now, a small percentage of those who are optimistic about the future of the world in general, and the United States in particular, cite their own religious faith as a prime shaper of their high hopes.

When asked to enumerate plans or programs that could improve U.S. society, experts mentioned revitalization and reform of organized religion. And nearly 10 percent advocated that society make a return to traditional moral standards, values, and ethics.



UTOPIA

What would be considered an ideal society? Gallup's visionaries see it as a society with universal education, zero population growth, shared technology worldwide, and wealth equitably distributed.



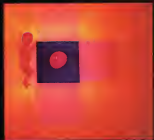
VISIONS OF HOPE

Even with the specter of the mushroom cloud, those optimistic about the future outnumber the pessimists by about three to one. They base their sunny beliefs on human ingenuity, the basic good sense of people, religious faith, and the expected bounds of technology.

FORECAST 2000

FUTURE PERFECT

Gallup's seers on how to craft a better future. Defuse the population bomb; raise the quality of education in the United States; readopt our more traditional social values, and intensify support for scientific research.



MEDICAL PROGNOSIS

A most encouraging trend, say Gallup's opinion leaders, is an increased commitment to medical research. In the next century, Americans will enjoy longer lives.

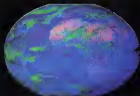
INDIVIDUAL 2001

Future society is expected to be more impersonal and more regimented. Yet the individual, by contrast, is expected to become more self-reliant. To prepare for such a future, individuals should improve their grasp of global issues, according to poll respondents. People planning for the year 2000 should concentrate on gaining more vocational skills and should follow another positive trend already set, assuming greater personal responsibility.



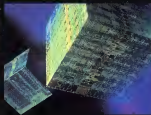
SPACESHIP EARTH

The future is our common destiny, and Gallup's interviews predict that a heightened awareness of world problems will make us a truly global society.



TECHNOFUTURE

Technology, especially automation and computerization, will foment the greatest changes in history by 2000—more so than the economy, overpopulation, or politics.



GEOPOLITICS

A face-off between the superpowers isn't as likely, Gallup predicts, as a "limited" regional nuclear war, since as many as 31 countries will be able to produce nuclear weapons by 2000. A terrorist incident in the United States involving nuclear weapons is an even likelier scenario. The CIA has found that more than 140 terrorist groups from some 50 countries are linked in a vast network. One solution: Improve the United Nations.

FORECAST 2000

ECOCONCERN

Reports of deadly pollutants in our air, water, soil, and even food are on the rise, Gallup notes, and growing numbers of people have moved beyond mere concern to outright fear over these developments. More than half the opinion leaders surveyed cited ecological or environmental woes as major crises to face by 2000. Another development: The environmentalists of the Sixties and Seventies, who were more concerned about wildlife, are now concerned with the quality of human life. Today there is a new kind of ecological consciousness spearheaded by people who either have been forced to evacuate their homes because of toxic-waste dumps or who are threatened by such hazards.

Today the majority of Americans believe environmental protection is so important that standards cannot be set too high. The threat of nuclear warfare may be more dramatic, says Gallup, but these environmental dangers are just as real.

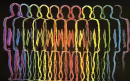


ENERGY FUTURES

Oil and fuel shortages of recent years no longer worry the nation, Gallup has found. His experts do not really expect we will outgrow our need for petroleum, but in the decades to come they foresee a greater reliance on the so-called alternate energy sources, using the sun's power directly with photovoltaics and solar panels, mimicking the sun's interior in the form of controlled nuclear fusion, and tapping into the underutilized power of wind and waves.

THE GOOD LIFE

As the result of positive trends—from our concern about fitness to rejuvenating our communities—the quality of life in the twenty-first century will improve dramatically.



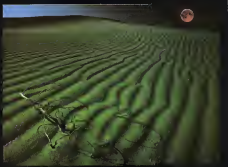
FAMILY FLUX

In the future, raising children will no longer be the sole duty of the family, say Gallup's seers. It will become a communal, or even an institutional, responsibility.

FEEDING THE MULTITUDES

One thing seems certain: Tomorrow's world will be a more crowded place, with food, water, clothing, and shelter in even scarcer supply. Even so, the hope persists that by paying more attention to controlling population and by concentrating on efficient food production, we will avoid some of the suffering such shortages could bring.

"Our environment is aching from the wounds inflicted on it," Gallup says. "Our economy is in an uncertain state, and the distribution of our population is still lopsided. The problems we face are many, but fortunately so are our abilities to solve them. In spite of the risks, we are decidedly hopeful about our future. The positive forces of moral and spiritual values, broad public education, and volunteerism run deep," Gallup concludes. "And they make me optimistic in the long run about our prospects." □



NEW ROSE

CONTINUED FROM PAGE 49

took you to Vienna. I remember you with your hair tucked back into a gray beret, your high Mongol cheekbones reflected in the windows of ancient shops. Strolling down the Rambles to the Phoenician harbor, past the glass-roofed Mercado selling oranges out of Africa.

The old Ritz, warm in our room, dark, with all the soft weight of Europe pulled over us like a quilt. I could enter you in your sleep. You were always ready. Seeing your lips in a soft round O of surprise, your face about to sink into the thick, white pillow—archaic linen of the Ritz. Inside you I imagined all that noon, the crowds surging around Shinjuku Station, wired electric night. You moved that way, rhythm of a new age, dreamy and far from any nation's soil.

When we flew to Vienna, I installed you in Hiroshi's wife's favorite hotel. Quiet, solid, the lobby tiled like a marble chessboard, with brass elevators smelling of lemon oil and small cigars. It was easy to imagine her there, the highlights on her riding boots reflected in polished marble, but we knew she wouldn't be coming along, not this trip.

She was off to some Philippine spa, and Hiroshi was in Vienna for a conference. When Maas security allowed us to scan the hotel, you were out of sight.

Hiroshi arrived an hour later, alone. Imagine an alien, Fox once said, who's come here to identify the planet's dominant form of intelligence. The alien has a look, then chooses. What do you think he picks? I probably shrugged.

The zebrafish, Fox said, the multinational. The blood of a zebrafish is mutation, not people. The structure is independent of the individual lives that compose it. Corporation as life form.

Not the Edge lecture again, I said. Maas isn't like that, he said, ignoring me. Maas was small, tall, ruthless. An activism Maas was all Edge.

I remember Fox talking about the nature of Hiroshi's Edge: Radioactive nucleosides, monoclonal antibodies, something to do with the linkage of proteins, nucleobases. Hid, Fox called him, hot proteins. High-speed links. He said Hiroshi was a freak, the kind who shatters paradigms, invades a whole field of science, brings on the violent revision of an entire body of knowledge. Basic patents, he said, he should fight with the sheer weight of it, with the high, thin smell of tax-free millions that clung to those two words.

Hiroshi wanted Hiroshi, but his Edge was radical enough to worry them. They wanted him to work in isolation.

I went to Mannheim to the old city, the Medina. I found a heroin lab that had been converted to the extraction of pheromones. I bought it, with Hiroshi's money.

I walked the marketplace at Djamaa-el-Fna with a sweating Portuguese businessman, discussing fluorescent lighting and

the installation of ventilated specimen cages. Beyond the cry walls, the high Atlas Djamaa-el-Fna was thick with jugglers, dancers, storytellers, small boys turning lathes with their feet, legless beggars with wooden bowls under animated holograms advertising French software.

We strolled past piles of raw wool and plastic tubs of Chinese microchips. I hinted that my employers planned to manufacture synthetic beta-endorphin. Always try to give them something they understand.

Sandis. I remember you in Harajuku, sometimes. Close my eyes in this coffin and I can see you there—all the glitter, crystal maze of the boulevards, the smell of new clothes. I see your cheekbones ride past chrome racks of Paris leathers. Sometimes I hold your hand.

We thought we'd found you, Sandis, but really you'd found us. Now I know you were looking for us or for someone like us. Fox was delighted, grinning over our find, such a pretty new tool, bright as any scalpel.

Imagine an alien who has come here to identify the planet's dominant form of intelligence. The alien has a look, then chooses. What do you think he picks?

Just the thing to help us sever a stubborn Edge like Hiroshi's, from the jealous parent-body of Maas Biolebs.

You must have been searching a long time looking for a way out, all those nights down Shinjuku. Nights you carefully cut from the scattered deck of your past.

My own past had gone down years before, lost with all hands, no trace. I understood Fox's late-night habit of emptying his wallet, shuffling through his identification. Held up the pieces out in different patterns, rearrange them, wait for a picture to form. I knew what he was looking for. You did the same thing with your childhoods.

In New Rose tonight, I choose from your deck of pasts.

I choose the original version, the famous Yokohama hotel-room text, recited to me that first night in bed. I choose the disgraced father, Hiroshi executive, Hiroshi. How perfect. And the Dutch mother, the summers in Amsterdam, the soft blanket of pigeons in the Dam Square afternoon.

I come in out of the heat of Mannheim into Hilton air conditioning. We shirt-clinging cold to the smell of my back while I read the message you'd relayed through

Fox. You were in all the way. Hiroshi would leave his wife. It wasn't difficult for you to communicate with us, even through the clear light film of Maas security, you'd allowed Hiroshi the perfect little place for coffee and lemon! Your favorite waiter was white haired, kindly walked with a limp, and worked for us. You left your messages under the linen napkin.

All day today I watched a small helicopter cut a tight grid above this country of mine, the land of my exile, the New Rose Hotel. Watched from my hatch as its patient shadow crossed the grease-stained concrete. Close. Very close.

I left Mannheim for Berlin. I met with a Wehrmann in a bar and began to arrange for Hiroshi's disappearance.

It would be a complicated business, intricate as the brass gears and sliding mirrors of Victorian stage magic, but the desired effect was simple enough. Hiroshi would step behind a hydrogen-cell Mercedes and vanish. The dozen Maas agents who followed him constantly would swarm around the van like ants, the Maas security apparatus would harden around his point of departure like epoxy.

They knew how to do business promptly in Berlin. I was even able to arrange a last night with you. I kept it secret from Fox, he might not have approved. Now I've forgotten the town's name. I knew it for an hour on the autobahn, under a gray Rhein-sky, and forgot it in your arms.

The rain began, sometime toward morning. Our room had a single window, high and narrow, where I stood and watched the rain fur the river with silver needles. Sound of your breathing. The river flowed beneath low, stone arches. The street was empty. Europe was a dead museum.

I'd already booked your flight to Mannheim, out of Orly, under your newest name. You'd be on your way when I pulled the first strip and dropped Hiroshi out of sight.

You'd left your purse on the dark, old bureau. While you slept I went through your things, removing anything that might clash with the new cover. I'd bought for you in Berlin. I took the Chinese 22, your microcomputer, and your bank chip. I took a new passport, Dutch, from my bag, a Swiss bank chip in the same name, and tucked them into your purse.

My hand brushed something flat. I drew it out, held this thing, a diskette. No labels. It lay there in the palm of my hand, all that death, latent, coded, waiting.

I stood there and watched you breathe, watched your breasts rise and fall. Saw your lips slightly parted, and in the jut and fullness of your lower lip, the faintest suggestion of bruising.

I put the diskette back into your purse. When I lay down beside you, you rpled against me, waking, on your breath all the electric night of a new Age, the future rising in you like a bright fluid, washing me of everything but the moment. That was your magic, that you lived outside of history, all now.

And you knew how to take me there
For the very last time, you took me
While I was shoring, I heard you empty
your makeup into my bag. I'm Dutch now,
you said. I'll want a new look.

Dr. Hiroshi Yamurai went missing in Vienna,
in a quiet street off Singerstrasse,
two blocks from his wife's favorite hotel. On
a clear afternoon in October, in the presence
of a dozen expert witnesses, Dr.
Yamurai vanished.

He stepped through a looking glass.
Somewhere, offstage, the diked play of Victorian
clockwork.

I sat in a hotel room in Geneva and took
the Webbsmith call. It was done, Hiroshi
down my rabbit hole and headed for Mar-
rakesh. I poured myself a drink and thought
about your legs.

Fox and I met in Nantia a day later, in a
sushi bar in the JAL terminal. Had just
stepped off an Air Maroc jet, exhausted
and triumphant.

Loves it there, he said, meaning Hiroshi.
Loves her, he said, meaning you.

I smiled. You'd promised to meet me in
Shinjuku in a month.

Your cheap, little gun in the New Rose
Hotel. The chrome is starting to peel. The
machining is clumsy, blurry. Chinese
stamped into rough steel. The grips are
red plastic, molded with a dragon on either
side. Like a child's toy.

Fox ate sushi in the JAL terminal, high
on what we'd done. The shoulder had been
giving him trouble, but he said he didn't
care. Money now for better doctors. Money
now for everything.

Somehow it didn't seem very important
to me, the money we'd gotten from Ho-
saka. Not that I doubted our new wealth,
but that last night with you had left me con-
vinced that it all came to us naturally, in the
new order of things, as a function of who
and what we were.

Poor Fox. With his blue oxford shirts
crisper than ever, his Paine suits darker and
natter. Sitting there in JAL, dabbing sushi
into a little rectangular tray of green horse
radish, he had less than a week to live.

Dark now, and the coffin racks of New
Rose are lit all night by floodlights, high on
painted metal masts. Nothing here seems
to serve its original purpose. Everything is
surplus, recycled, even the coffins. Forty
years ago these plastic capsules were
stacked in Tokyo or Yokohama, a modern
convenience for traveling businessmen.
Maybe your father slept in one. When the
scaffolding was new, it rose around the
shell of some mirrored tower on the Ginza,
swarmed over by crews of builders.

The breeze tonight brings the taste of a
pachinko parlor, the smell of stewed veg-
etables from the pushcarts across the road.

I spread crab-flavored krill paste on or-
ange rice crackers. I can hear the planes.

Those last few days in Tokyo, Fox and I
had adjoining suites on the fifty-third floor
of the Hyatt. No contact with Hosaka. They
paid us, then erased us from official cor-
porate memory.



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But Fox couldn't let go. Hiroshi was his baby, his pet project. He'd developed a proprietary, almost feverish interest in Hiroshi. He loved him for his Edge. So Fox had me keep in touch with my Portuguese businessman in the Medina, who was willing to keep a very partial eye on Hiroshi's lab for us.

When he phoned, he'd phone from a stall in Djemaa-el-Fna, with a background of wailing vendors and Atlas peripetes. Someone was moving security into Marrakech, he told us. Fox nodded. Hosaka.

After less than a dozen calls, I saw the change in Fox, a tension, a look of abstraction. I'd find him at the window staring down fifty three floors into the Imperial gardens, lost in something he wouldn't talk about.

Ask him for a more detailed description, he said, after one particular call. He thought a man our contact had seen entering Hiroshi's lab might be Moenier. Hosaka's leading gene man.

That was Moenier, he said, after the next call. Another call and he thought he'd identified Cheanne, who headed Hosaka's protein team. Neither had been seen outside the corporate ecology in over two years.

By then it was obvious that Hosaka's leading researchers were pooling quietly in the Medina, the black executive Leers whispering into the Marrakech airport on carbon-fiber wings. Fox shook his head. He was a professional, a specialist, and he saw the sudden accumulation of all three prime Hosaka: Edge in the Medina as a drastic failure in the zaibatsu trademark. Christ, he said, pouring himself a Black Label, they've got their whole bid section in there right now. One bomb. He shook his head. One grenade in the right place at the right time.

I reminded him of the saturation technique Hosaka security was obviously employing. Hosaka had lines to the heart of the Diet, and their massive infiltration of agents into Marrakech could only be taking place with the knowledge and cooperation of the Moroccan government.

Hang it up, I said. It's over. You've sold them Hiroshi. Now forget him.

I know what it is, he said. I know. I saw it once before.

He said that there was a certain wall factor in lab work. The edge of Edge, he called it. When a researcher develops a breakthrough, others sometimes find it impossible to duplicate the first researcher's results. This was even more likely with Hiroshi whose work went against the conceptual grain of his field. The answer, often, was to fly the breakthrough boy from lab to corporate lab for a ritual laying on of hands. A few pointless adjustments in the equipment, and the process would work. Crazy thing, he said, nobody knows why it works that way but it does. He grinned.

But they're taking a chance, he said. Bastards told us they wanted to isolate Hiroshi, keep him away from their central research thrust. (Balls. Bet your ass there's some kind of power struggle going on in

Hosaka research. Somebody bag's lying his favorites in and rubbing them all over Hiroshi for luck. When Hiroshi shoots the leg's out from under genetic engineering, the Medina crowd's going to be ready.

He drank his scotch and shrugged. Go to bed, he said. You're right, it's over. I did go to bed, but the phone woke me. Marrakech again, the white staccato of a satellite link, a rush of Inghaired Portuguese.

Hosaka didn't freeze our credit, they caused it to evaporate. Fifty gold. One minute we were millionaires in the world's hardest currency, and the next we were paupers. I weeped Fox.

Sandra, he said. She sold out. Mass security turned her in Vienna. Sweet Jesus.

I watched him sit his battered suitcase apart with a Swiss army knife. He had three gold bars glued in there with contact cement. Soft plates, each one proofed and stamped by the treasury of some extinct African government.

I should've seen it, he said, his voice flat.

“Hosaka didn't freeze our credit, they caused it to evaporate. One minute we were millionaires in the world's hardest currency, and the next, we were paupers.”

I said no, I think I said your name.

Forgot her, he said. Hosaka wants us dead. They'll assume we crossed them. Got on the phone and check our credit.

Our credit was gone. They denied that either of us had ever had an account.

Hail ass, Fox said.

We ran. Out a service door, into Tokyo traffic, and down into Shinjuku. That was when I understood for the first time the real extent of Hosaka's reach.

Every door was closed. People we'd done business with for two years saw us coming, and I'd see steel shutters slam behind their eyes. We'd get out before they had a chance to reach for the phone. The surface tension of the underworld had been tripled, and everywhere wild meat that same last membrane and be thrown back. No chance to sink, to get out of sight.

Hosaka let us run for most of that first day. Then they sent someone to break Fox's back a second time.

I didn't see them do it, but I saw him fall. We were in a Grains department store an hour before closing, and I saw his arm off that polished mezzanine, down into all the works of the new Age.

They missed me somehow, and I just kept running. Fox took the gold with him, but I had a hundred New Yen in my pocket. I ran. All the way to the New Rose Hotel. Now it's time.

Come with me, Sandra. Hear the noon humming on the road to Harbin International. A low late night trade stop-mopon croaks around the floodlights that shine on New Rose.

And the funny thing, Sandra, is how sometimes you just don't seem real to me. Fox once said you were ecstasium, a ghost called up by the extremes of economics. Ghost of the new century congealing on a thousand beds in the world's Hyatts, the world's Hiltons.

Now I've got your gun in my hand, jacket pocket, and my hand seems to be away. Disconnected.

I remember my Portuguese business friend forgetting his English, trying to get it across in four languages. I barely understood, and I thought he was telling me that the Medina was burning. Not the Medina. The brains of Hosaka's best research people. Plague, he was whispering, my businessman, plague and tower and death.

Smart Fox, he put it together on the run. I didn't even have to mention finding the diskette in your bag in Germany.

Someone had reprogrammed the DNA synthesizer, he said. The thing was there for the overnight construction of just the right macromolecule. With its in-built computer and its custom software. Expensive. Sandra. But not as expensive as you turned out to be for Hosaka.

I hope you got a good price from Meas. The diskette in my hand. Run on the wires. I know, but I couldn't face it. I put the code for that marginal virus back into your purse and lay down beside you.

So Moenier died, along with other Hosaka researchers. Including Hiroshi. Cheanne suffered permanent brain damage.

Hiroshi hadn't worried about contamination. The proteins he punched for were harmless. So the synthesizer hummed to itself all night long, building a virus to the specifications of Meas Blobs GmbH.

Meas. Small, fast, ruthless. All Edge.

The airport road is a long, straight shot. Keep to the shadows.

And I was shouting at that Portuguese voice. I made him tell me what happened to the girl, to Hiroshi's woman. Vanished, he said. The whir of Victorian clockwork.

So Fox had to fall, fall with his three pathetic plates of gold, and snap his spine for the last time. On the floor of a Grains department store, every shopper staring in the instant before they screamed.

I just can't hate you, baby.

And Hosaka's helicopter is back on lights at all, hunting on infrared, feeling for body heat. A muffled whine as it turns, a kilometer away, swinging back toward us, toward New Rose. Too fast a shadow against the glow of Narita.

It's alright, baby. Only please come here. Hold my hand. **OO**

•When we analyzed
the data, a relationship between
UFO sightings and
earthquakes jumped out at us •

ANTI MATTER

UFOs are not necessarily exotic beings that come down from the sky. They might be powerful natural forces that come up from the earth. So claims Canadian scientist Michael A. Persinger, who believes that 85 percent of UFO sightings are nothing more than luminous electromagnetic field effects produced at stress points along geological fault lines.

A psychologist and geophysicist at Ontario's Laurentian University, Persinger programmed a computer to correlate UFO reports with high-energy natural phenomena such as earthquakes, hurricanes, tornadoes, and volcanic activity. The relationship between UFO reports and earthquakes, a very robust effect, jumped right out at us. Furthermore, Persinger notes that the relationship holds true from ancient to modern times.

Where tectonic plates interlock, Persinger explains, immense pressure builds up, grinding quartz and other crystalline rocks in these regions for brief periods. The strain causes the atomic bonds in the rock to vaporize, creating a plasma resembling "a tiny piece of the sun."

"This luminosity, surrounded by an intense electromagnetic halo, rises to the surface and follows the local topography. People see these fields anywhere there is an electrical charge source—near crunch sleepers, the tops of hills, near radio or television antennas."

Since the Curies discovered the effect in 1880, scientists have known that crushing crystalline rock under great pressure creates an electromagnetic field



UFO UPDATE

but without a computer, says Persinger, "no one could have correlated all the data pointing to a relationship between sighting, luminosity, and fault strain."

Studies of the phenomenon have been further complicated by a problem in our powers of observation. Persinger says, "Since our minds are sensitive to electromagnetic fields, he notes, "our ability to measure them is impaired. Sometimes energy generated at these geological stress points can produce seizures and hallucinations."

The kinds of alien life forms most often

reported in UFO encounters frequently resemble the distorted perceptions created when the brain is electrically stimulated during surgery, Persinger adds.

Some UFO field researchers, including those who supply Persinger with reports to aid his studies, question his theories. One asks, "Could the UFOs be using the electromagnetic fields along fault lines as guidance systems the way airplanes sometimes follow railroad tracks?"

Persinger rebuts: "I could say that all human neuroses are caused by invisible pink elephants passing on us. That's hard to disprove, but it has limited value to a scientist. For hard-core proof, you need data."

Persinger, who has published maps showing the relationship between fault strain, earthquakes, and UFO sightings, believes he has the data. Could UFO reports near fault lines predict upcoming earthquakes? "That's what we're looking for," he enthuses. And we think we have the evidence. —ALLAN MAURER



MONSTER MONKEYS

In 1979, Frank Gordon, an Australian herpetologist engaged in fieldwork deep in the mountains of New South Wales, was calling it quits for the day. But when he boarded his Land Rover he was surprised to find a 17-foot-long log blocking the road—and even more surprised when the “log” rose up on four powerful legs and dashed into the dense surroundings.

According to Rex Gilroy, curator of the Mount York Natural History Museum, in New South Wales, this description perfectly fits *Megalania prisca*, the giant Australian monitor “unfortunately,” says Gilroy, “these lizards have been extinct for thousands of years, though we know from the fossil records that they were twice as big as the famous Komodo dragons of Indonesia, which are a mere nine foot long.”

To find out whether the “extinct” lizard still lives, Gilroy led an expedition into

the jungle, where he collected numerous reports from the natives but saw nothing himself. “Mostly,” Gilroy claims, “the giants were spotted dragging their tails across fields, looking shy and harmless. There were no reports of these monsters attacking people. Yet some farmers said they had caught the giant beasts snacking on cattle.”

Skeptic Alvin Novick, a Yale University biologist says, “This is all nonsense. I’ve seen ten-foot-long Komodo dragons, and even they aren’t formidable enough to bring down and eat a cow. Sure, maybe a lizard could find an aborted calf and take a chomp out of it. But in my opinion, it’s unethical for a scientist to name these creatures *Megalania prisca* without a shred of tangible evidence. It could be something else, couldn’t it?”

—Jerome Clark

“A monster from the Northeast will admit that he is Adolf Hitler’s love child.”
—Glenise Bernhardt

INVISIBLE SHIP

Invisibility is a popular theme in science fiction, but did the U.S. Navy actually perform this feat, with tragic results, in 1943?

A secret experiment at the Philadelphia naval yard, conducted in an attempt to give the allies the ultimate weapon to win World War II, allegedly rendered the destroyer escort USS *Eschscholtz* temporarily invisible. It is believed that weird aftereffects suffered by the ship’s crew, such as spontaneous human combustion, caused the government to cancel and cover up the project.

“There was some kind of experiment, and I think some unusual things happened as a result of it. But just where the facts end and the myth begins is uncertain,” says William L. Moore, author of *The Philadelphia Experiment: Project Invisibility* (Grosset & Dunlap, 1970). Written “in con-

sultation with ‘Charles Berlitz (of Bermuda Triangle fame), the book is subtitled “an account of a search for a secret Navy wartime project that may have succeeded—too well.”

I believe that the Navy was using a powerful electromagnetic field, and in those days scientists didn’t understand the harmful effects such things have on the central nervous system. They weren’t attempting to achieve optical invisibility. They were trying to make ships invisible to radar and magnetic mines. Some crewmen may have been injured by getting too close to the energy source involved, and that’s how the story originated.

The Navy, which receives frequent queries on the subject, denies that it ever attempted to make a ship invisible, and claims that the story was concocted in a 1955 UFO book. Occasional retellings in the press since that time have sustained



public curiosity in the Philadelphia experiment, and this month a fictionalized film version will be released.

My life on this case is still open, and I occasionally receive new information, Moore says. Our book is a study of the evidence that we were able to collect. We leave it up to the reader as to the answer. All kinds of charges have been leveled at Berlitz and me for having said the Philadelphia experiment actually occurred. But in fact we've never done that. At least I never have."

—Brian McKernan

Generations of machines, perhaps better than we, will go on living and speaking lives and words that were also ours."

—Isaac Asimov

SCIENCE/PHILOSOPHY

A diurnal, bloodcurdling ululation fills the night with fear. Taking up the chilling chant, domestic and wild animals howl, bay, cry and shriek in a helmed uproar. It's not the latest Spielberg thriller, but a real-life scenario being enacted on rare occasions in a remote Washington State valley near Snohomish. Frightened farm dwellers suspect the night screamer is Bigfoot, according to Bigfoot researcher Peter Guitilla, who investigated the screams in 1989.

Guitilla also claims another Bigfoot encounter. Ray Wallace, once trapped a female Bigfoot in a Washington cave, where he was



able to tape 45 minutes of her screaming before she escaped. "However," Guitilla admits, "Wallace has spent twenty-five years hunting the creature. And though he's also made movies of the monster, I've seen these films, and well, you could see the zipper on the Bigfoot costume."

Nonetheless, Guitilla points out, Wallace has given some of his many recorded night screams to researchers for analysis by psychological stress evaluation (PSE). According to Guitilla, chief PSE examiner William Al, of Maryland Security, found the stress patterns were so far out of the range of man's ability that they had to come from something that was "neither human nor of known animal origin."

Jim Rastatter, the editor of an Ohio UFO newsletter, is not convinced by the evidence. "Although we did publish the results of Al's PSE sound analysis," he says, "we suspected the findings had been faked. I know Al's research group had defunded, and I guess I was afraid to make an issue of it then."

—Alan Vaughan

SCIENCE/PHILOSOPHY

If you think there's safety in numbers, science writer Dean Koontz may give you cause for second thought. "History," he says, "is full of bizarre examples of crowds just vanishing into thin air."

For example, he claims, tens of thousands of people vanished from several huge Mayan cities in A.D. 610, leaving behind all the other treasures. Then again, on December 30, 1939, a Chinese army of 3,000 marched toward battle with the Japanese—and vanished long before reaching the front lines. "More recently," adds Koontz, "in Africa, during 1980, a tribe of more than four thousand just disappeared without a trace of violence or illness."

Where did they go? Koontz sat down with his editor and decided that answer would make a great plot for his latest novel, which he called *Phantoms* (Berkley, 1983). Koontz explains, "I developed a horror story about a doctor

who returns home and finds everyone in his town has vanished. What's so scary about that? He also finds himself stalked by a supernatural mass of flesh, a kind of blob that has been surfacing periodically since the Stone Age."

"Of course," Koontz adds, "I don't believe such a creature exists. Nor do I believe God is a blue-skinned alien blowing a party horn. I suspect there's a rational explanation behind all this. In researching the case of the missing African tribe, for example, I discovered that Cuban soldiers have been quietly exterminating the natives."

Robert Warth, president of the Society for the Unexplained, doesn't buy Koontz's explanations. "In these cases," says Warth, "eyewitness reports claim that a blood-red cloud just came down and swept these people off the earth. I believe every one's been taken by aliens to another dimension—and we'll never know why."

—Peter Randonone



UFO SIGHTINGS

When radio station KRMH's transmission tower crashed to the ground last year, Steve Bridges, manager of the Muscatine, Iowa, station, concluded that high winds had caused the mishap. But a phone call from a UFO buff placed a doubt in Bridges's mind. The caller suggested that a spaceship might have knocked the tower over.

His curiosity piqued, Bridges asked people who had experienced close encounters with flying saucers or strange lights to call the radio station with their stories.

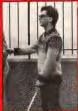
Hundreds of people contacted us. I was amazed at how similar these reports are," comments Bridges. "People who see a UFO often begin to experience psychic phenomena, like automatic writing. Many feel like they are being watched. Some of these stories are difficult to believe, but I'd have a hard time challenging at least thirty per cent of them."

John Timmerman, of the Evanston, Illinois-based Center for UFO Studies, says that the rash of UFO reports in Muscatine is not unusual. "It's not that the region is a particular hotbed of sightings," says Timmerman, "but when you go public and talk about UFOs, people always come forward."

Steve Bridges recently began broadcasting excerpts from some of the UFO reports over the air along with a greeting to aliens who might be flying by. The message (sent alternately in Russian, Chinese, English, French, German, and eight other languages) bears KRMH's latitude and longitude, the fact that the earth is the third planet from the sun, and the statement, "We believe you are here."

Bridges hopes this greeting will pacify any UFOs passing by the radio station. "This is our insurance, since we've just raised our new tower another one hundred feet."

—Sherry Baker



SEEING IN THE PAST

According to James Parejo, philosophy professor at Chicago State University, reincarnation is one belief for which there is abundant evidence. People, he claims, often recall previous lives in such precise detail that it's a wonder reincarnation isn't accepted as a fact. But the Western scientific mind demands evidence.

With this in mind, Parejo conducted an experiment to see whether persons blind from birth could be regressed to former lives. The reason: If a blind person, says Parejo, could reveal a past life that he's seen, describing people and places, wouldn't that go a long way as evidence of reincarnation?

To test his theory, Parejo hypnotized three blind people. As he had hoped, his subjects recalled being able to see in past lives. "They talked about floating candles," says Parejo, "yellow teeth, and people

with bidches on their faces. Now think . . . How could a blind person perceive such things?"

The blind, Parejo also insists, recalled reactions and habits of sighted persons. In one case, he explains, "a subject told of having to look away when the sun shone on the jewelry of a rich person. Think of it! That's a sighted person's reaction, incongruous to the experience of someone born blind."

In fact, Parejo adds, blind subjects often report that the visions in their dreams are distorted, unlike their remembrances of past events. "And though skeptics believe these blind subjects could get their descriptions from books," says Parejo, "I think not. I met a man who had his sight restored 'just upon seeing the moon for the first time,' he asked. What is that ball of fire? His idea of the moon was formed by lyrics like 'Moon River'."

Surely," Parejo concludes, "this is a case of the blind leading the blind. But unfortunately, most blind people are skeptics who choose to remain in the dark by refusing to accept this proof of reincarnation."

—D. Scott Rago



paper this morning about that place over the mountain?" I asked at the Moose Club is said to have revealed.

"Sure," came the reply. "They take a bribe from one body and put it in another and it still works!"

As I climbed the dirt road to the top of the ridge, I find myself in a complex of three modern, steel-roofed buildings, positioned to overlook 850 acres of the institute spread out below. The community was established here in 1981 upon certain precepts: Man's physical existence is only a temporary manifestation of a permanent spiritual identity. He can, on occasion, leave his physical body, visiting other worlds with his spirit alone. Upon death, he returns to the spiritual reality from which he came, taking with him the wisdom he gained on Earth. Man can communicate with the creator; indeed, he is part of the creator, and as a citizen of the New Age, he is obliged to search for truth.

If it's truth you're after, the main pavilion of the Monroe Institute seems to be the place to start. The building has the spare decor of a mountain lodge, including fragrant cedar paneling and brownish-red rugs, the color of Virginia mud. Downstairs I come upon the CHEC units, short for controlled holistic environmental chambers. These capsules, complete with bed, instrument panel, and stereo headphones, are designed for the institute's exiles. They are psychonauts who, like the library-bound traveler, spend a large segment of their week in total darkness listening to the voice of Control.

Stepping outside for a moment, I soon see a maroon pickup truck bounce toward me, and from newspaper clippings I've read, I recognize the man behind the wheel. Robert Monroe, sixty-nine, greets me with open friendliness, and I pile in for a quick tour of his New Age community. His polished tie is lined, and his tan mustache provides a whimsical balance to dark, protruding eyes.

Monroe's language is the idiom of camouflaged. He points to the bathroom in case I miss a "can't wait" mode. He speaks about using the sound-wave technique to "access all systems down the line" in the brain. And he bridges the comparison of his world to the world of psychedelics. "We're not in the tune-in drop-out mode here," he says.

Despite the high-tech syntax, I have no difficulty imagining Monroe in a more conventional setting. I envision him as a radio executive in a plush New York boardroom, or a hard-driving director in a radio studio, chain-smoking the same long cigarettes he smokes now as he ponders programming decisions. That was his first career, when, during the Forties and Fifties, he produced checked waxes and composed the background music for more than 400

radio programs, including the popular Rocky Gordon, a railroad adventure series inspired by his own brief stint as a youthful hobo. From these years as a radio producer, his voice retains the tone and pacing of the studio. From the succeeding years as vice president for programming at the Mutual Broadcasting System, he acquired his boardroom presence. Both serve him well in his second career.

Monroe took big-time broadcasting in 1961 and retreated to Nelson County. The ostensible motive for his move was the opportunity to own several black radio stations in North Carolina and Virginia. But there was a more important reason. In 1961, while running his own business as an upscale executive in Westchester County, New York, he began having strange and inexplicable experiences during sleep.

First came a vibration, and before long, he recounts in his cult classic *Journeys Out of the Body* (Doubleday, 1971), he found himself hovering ghostlike above his

Upon death, he returns to the spiritual reality from which he came, taking with him the wisdom he gained on Earth. He is part of the creator and is obliged to seek truth.

physical form on the bed. While in this near-mindless state, which he called the second body, he was able to journey away from the bed, drop through the floor and pass through walls, traveling down the street to spy on friends and neighbors. Though invisible, he managed to pinch some of them occasionally; he reports leaving black-and-blue marks as tangible proof. Eventually he believes he even escaped the earth to reach unknown realms of time and space.

At first Monroe wondered if he were maddened by "abnormal" daydreams, hallucinations, or the hellish beginnings of schizophrenia. Finally he gathered the courage to seek advice from a friend, psychologist Foster Biddshaw.

"Why, there's nothing else you can do but look into it and see what it is," Biddshaw replied. "Anyhow, it doesn't seem you have much choice. If it happened to me, I'd go off in the woods somewhere and keep trying until I found the answer."

With a family to support, Monroe couldn't just take off for the wilderness. But he did vow to explore his "wild talent." He began living a double life. By day he was the tra-

ditional, high-powered businessman, and by night a closet investigator the Don Quixote of the beyond.

Acting as his own guinea pig, Monroe learned to induce waves of vibration through his body. Reasoning with these waves, he soon discovered that he could "unhook himself from the physical with n-duplicate ease" and consciously decide where he wished to travel.

In the beginning, he says, he merely visited islands in the here and now—people and places that exist in the material world at the moment of the experience. He dubbed this sphere of things *Locale I*, but soon discovered that his limbo second body could also sojourn in *Locale II*—a "non-material environment with laws of motion and matter only remotely related to the material world. In the realm of infinity and eternity," Monroe says, he met up with the newly dead and assorted subhuman entities, including devilish parasites that clung to his back. At first, he says, he was terrified, but later found the experience awe-inspiring, even ecstatic.

Finally Monroe found yet another region—*Locale III*, which he suggests is an antiraster version of the known universe. Traveling through this alternate plane, in fact, Monroe claims that he inhabited the body of his human counterpart, complicating the poor fellow's love life and causing moderate stress.

Monroe's adventures in short convinced him that most human beings separate from their physical bodies during sleep. If everyone could master the technique, he felt, we would come to understand nature, alter our view of death, and resolve religious conflict.

Medical science would explore the relationship between physical health and the second body and explanations for neurotic psychoses, the unconscious, and dreams would be revised or discarded. For the first time, we would truly understand the workings of the mind.

Thus, when Monroe left for Nelson County in 1961, his goal was to mass-produce the out-of-body experience (OBE). Since his OBEs were always induced by a sense of vibration, he reasoned, similar vibrations might cause others to experience the phenomenon.

It's no surprise that Monroe, a sound specialist, used radio technology to recreate the effect. He reckoned that out-of-body vibrations were in some way related to electrical frequencies in the brain. Such frequencies, like sound waves, are generally measured in cycles per second, or hertz (Hz). Thus, Monroe figured all he had to do was discover which brain wave frequency was associated with the OBE, then re-create that frequency with sound. The brain, he guessed, would automatically resonate to the sound in a phenomenon he called "frequency following response" (FFR) and generate the appropriate electrical frequency invoking the OBE.

By 1961 of course, scientists measuring

brain-wave frequencies with an electroencephalograph, or EEG, already knew a few things. Beta waves (16 Hz and above) indicate wakefulness, alpha waves (12 to 7 Hz) indicate relaxed awareness, theta waves (7 to 4 Hz) are characteristic of the borderline between sleep and wakefulness, and delta waves (below 3.5 Hz) mark a deep, almost comatose sleep. Most states of consciousness are a combination of two or more waveforms, and the variety could be infinite.

Drawing upon this information, Monroe set up a small lab of his own. Working through the Sixties, he charted the brain waves associated with OBEs, intense concentration, and the very deepest sleep.

He also set out to induce these brain waves with sound. At first the task was daunting. While most brain waves are less than 16 Hz, the human ear cannot pick up anything less than 30 Hz. And if subjects couldn't detect the auditory cue, then the use of this technique seemed impossible.

But by 1975 Monroe's expertise in acoustics had provided the solution. He was, of course, familiar with a basic principle of physics: if two tuning forks of slightly different pitch are struck simultaneously, the resulting sound waves and waves periodically. These modulations are called beats, and their frequency is equal to the difference between the frequencies of the original tones. Thus, if one tuning fork is resonating at 200 Hz and the other at 206 Hz, the beats will be produced at a frequency of 6 Hz.

Monroe knew that the human ear would never detect such low-frequency sound. But, he reasoned, if he introduced separate sounds into each ear, then the neural pathways of the brain itself might resonate to the inaudible beat. Soon he says he found he was correct. "If I sent sound of one hundred hertz to one ear and one hundred four hertz to the other ear," he explains, "I would detect alpha brain waves at a frequency of four hertz—the difference between the two sounds." Moreover, he adds, the resulting alpha waves would invariably induce a state of deep relaxation or sleep.

Monroe says he also used his patented technique, dubbed hemispheric synchronization, or hemi-synch, to induce the OBE—a state of consciousness marked by a complex series of alpha, beta, theta, and delta waves. The trick, he explains, is to start by inducing physical sleep with alpha, theta, and delta waves. Then, just as the subject is losing consciousness, you introduce beta waves. "These put the mind awake while the body stays asleep," he explains, "setting the scene for an OBE."

It is 12 minutes into the mission, real time. Sitting before the console, Control keeps his eyes on the instruments, adjusting the metatadar signal that is pushing the explorer deeper into relaxation, deeper into the hole. It is three days after Christmas, and Control prepares to direct his explorer

into a seasonal section of the library.

"Now then look back into the accurate history of one whom our civilization labels Jesus Christ," Control instructs. "See what you can find out."

In a slow, gravelly voice revealing great concentration, the explorer ponders his problem. "How can I interface with this energy column?" he says to proof himself. Even from these depths the dialect jargon of computerland is natural to him, by day he is an electrical engineer. "The reason has to do with the consolidation of ideas," he says finally. "There were too many ideas and this is interesting. It [the coming of Jesus] wasn't the first time it happened."

"When did it happen before?" Control asks calmly.

"On a number of occasions," the explorer replies definitively. "Sometimes before the time of the Greeks."

"Does our recorded history know of these other visits?" Control asks diffidently. A multipatterned combined sound

◀ This man Jesus
was a little crazy I mean,
people called him
crazy. He was seeking truth.
Apparently he
had special knowledge.
How in hell
can I translate this? ▶

flows steadily to the explorer now, placing him in the furthest reaches of Locale II, a realm where time has ceased to exist.

"His primitive man knows of this. The teacher walked among two or three Indian tribes in the Americas. He was there only a short while—less than ten years—and then he vanished. In all these ways the physical manifestation is similar. Tell man, six foot two or so, very large for the period. Auburn hair. Light skin, no olive tint."

Let's move into an arena where there is recorded history," Control interjects. "When this being entered the body of Christ, was it at birth or later?"

"It was later," the explorer answers strongly without hesitation. "He entered, and then he was called. This man Jesus was a little bit crazy for his time. I mean. People called him crazy. He was one hundred eighty degrees out of phase with his time. He was seeking truth. Apparently, in his lifetime, he went into the desert. I see a tremendous amount of meditation and physical sacrifice. In his attempt to grasp truth he tried to stay away from the politics of the time. He went to a center of learning where there were people strong enough to

be different. Apparently he had special knowledge." From the capsule the explorer's breath quickens with effort. "Oh, how in hell am I going to translate this?"

Control waits, appreciating the familiar problem. Since this mission is an exploration of new territory, the medium of translation is inherently difficult. The explorer is receiving total information, thought bits in Control's lexicon, a complete package of data from Locale II. The explorer is trying to peel off individual layers of the thought bit, and once peeled off, to interpret and translate the layers into words comprehensible on the terra firma of Locale I.

There was a vast necessity to mask ideas," the explorer strains. "Jesus chose an esoteric mystification that was different from all others. All other mystifications were dependent upon physical reward."

"Very good," Control compliments, encouraging the explorer. "Next point. Can you state the exact details of Jesus?"

"Hold on a minute," the explorer replies it as if he must search through the pages of a vast encyclopedia in which all knowledge is stored, or as if he thrusts an inverted periscope down to the deepest depths. "The answer is kind of neat," he finally says with a lift. "The ideal is the interaction of all elements of the human race. The state on the line is fear. Christ came to show that there was no need for fear. That was the whole idea, to establish that there was fear, and that fear was nothing. Love of fellow man was the ideal, but it was far more encompassing than that. It's like a tree growing." His voice trails off.

"Take it a point further," Control commands. "As we have recorded the physical life of this man called Jesus, is it accurate or inaccurate?"

"Hold on a minute," the explorer answers. Down periscope. "I'll find out. It's an interesting question."

It is 31 minutes into the mission.

"The life of Jesus as it is chronicled is inaccurate," the explorer proclaims.

If Monroe and his team of explorers thought they were getting answers, others let they could benefit as well. In 1977 the Esalen Institute in Big Sur, California, invited Monroe to conduct a hemi-synch workshop. Some 40 people participated, and the success convinced Monroe to hold workshops—he calls them traveling roadshows—around the country.

He also developed hemi-synch cassette tapes for relaxation, concentration, calligraphy, enhanced senses of touch, and even for playing better golf and tennis. (In the tennis tape, which plays sound waves that induce relaxed concentration, you are encouraged to imagine the best game of tennis you've ever played, and then to repeat: "Love tennis, love tennis" as you stroke into the court.)

Refining the tapes further, Monroe established his Gateway Program, in which, seven times a year, some 20 people come to Nelson County for a week of training

Many of those who come have a professional interest in the workings of the brain: psychologists, psychiatrists and educators are prominent. Other participants range from high-powered business executives to "seminal hippies" who have tried Esf or other self-awareness programs and think hemi-sync may be more scientific.

According to Monroe, that assumption is correct. The Gateway tapes, he claims, improve alertness, clarify thought, focus attention, induce calm, permit unusual feats of strength, and even make one a "super conversationalist." For the frequent traveler, he says, his tapes can cure jet lag. And for the pressured student or doctor, they can squeeze the benefits of a 90-minute sleep cycle into just half an hour.

Monroe's technique, in fact, has spread far and wide. In Providence, Rhode Island, medical students use the tapes to reduce anxiety at test time. In Tacoma, Washington, hemi-sync tapes have been designed for courses in psychology, philosophy, humanities and speech. In that same city, first graders listen to a stereo system that plays slow hemi-sync music constantly. (The principal is "fabbegasted" at how orderly and engaged the youngsters have become.) At Fort Benjamin Harrison, Indiana, the U.S. Army reported a 75 percent increase in trainee efficiency after a hemi-sync anxiety-reducing signal was used as background. And because hemi-sync can desensitize the sense of touch, it is being used to reduce pain for surgery patients in Oak Ridge, Tennessee.

Futur applications, Monroe adds, may be even more intriguing. Since certain hemi-sync tapes induce sleep without chemicals, he sees the 30 million insomniacs in America as a potential market. (The institute is not nonprofit.) He also thinks that hemi-sync tapes might replace methadone and Antabuse as benign substitutes for heroin and alcohol, respectively. Those who have suffered stroke or other brain damage may be helped or at least distracted, because the tapes stimulate new neural pathways. And language students might one day listen to French, Spanish or Arabic tapes laced with hemi-sync waves.

Hemi-sync's ability to influence behavior and induce suggestibility is put forward as a virtue, but Monroe knows it can be a vice too. Who can say that the substance of political propaganda might not be similarly induced? What if Jerry Falwell were to place hemi-sync in the background of his sermons? And who's to prevent the ad tycoons on Madison Avenue from taking advantage of the technique? Moreover, since certain frequencies are said to induce brain seizures, might not this knowledge be developed into a new weapon?

In sleepy Newbyford, such applications seem heretic. "We've never lost anyone," Monroe dares to reassure me.

In fact, his literature, reminiscent of that found in pop self-improvement programs, promotes hemi-sync as a method "to allow

you to become more than you ever thought you could be." While Monroe insists that he is not practicing psychotherapy, he claims that ten sessions at his institute can be equivalent to ten years on the couch.

"Our process accesses hidden drives," Monroe tells me. "Fear and guilt inevitably come out. It gives a person a perception of his total self. It can profoundly change how that person approaches life." And by inducing altered states like OBE, he says, the sessions may change an individual's view of the world. Indeed, more than 3,100 people have gone through the Gateway experience, and, as a man of statistics, Monroe has computed more than 90,000 OBEs among them.

Dispatch from the library

"Did Jesus maintain the being in the physical body until death? Is the death as represented?" Control asks.

"The death was as represented," the explorer replies after a pause. "But he didn't

◆ Since certain hemi-sync tapes are able to induce sleep without chemicals, Monroe sees the 30 million insomniacs in America as a potential—and profitable—market ◆

die on the cross. He died before he was nailed to the cross."

"I see. Oh huh," Control mumbles.

"And he wasn't nailed to the cross. His body was hung by ropes, and the soldiers drove spikes into the wood and tied his body by the ropes to the spikes."

Control shifts ground again. "What was the purpose of Jesus? What function was he performing?"

"The learning of man had become stagnant, and Jesus came as a kind of Ark in the pants."

"One more thing," Control presses. "Who truly was this being that entered the body of Christ? What was his origin?"

Suddenly, for the first time on the Control console, a wondrous fluctuation in body voltage is indicated.

"I get a horrendous answer. It is fascinating. I have to say to you in these words: Bob Monroe already knows the answer. I'm supposed to tell you that. And then I get a laugh. With the laugh I get a flood of faces. Not human faces. Just a presentation of humanity. An essence."

The explorer is breathless as if his vision has caused him fear and awe. He is

trying to remain calm, but his polarity—the balance between negative and positive electrical impulses in his body—swings wildly. There have been hints of polarity change before, at moments of intense emotion. Control wants to know more. He seizes the opportunity and presses on.

"Is this being accessible to us now?" he asks. "Can we communicate with him?"

"Let's see," the silence is long.

Control worries that his explorer may be lost. "If the answer is yes, the question is, How can we make contact?" Control persists, feeling his breakthrough.

"That's what I'm trying to do!" the explorer replies in exasperation. "I'm getting whipped around here quite a bit. We've we've got a problem here."

It is as if warning lights have lit up NASA's control board in Houston. Fluctuations in monitoring have become wild, and polarity is shifting markedly. The explorer's emotions are intense during this overwhelming pattern of energy.

Control considers feeding the beta signal to bring the explorer back, under an emergency procedure. The danger is a searing, scarring memory that the explorer could carry into the here and now. But given the experience and unflappability of this explorer and the significance of the moment, Control waits.

"When I answered, I got into some sort of different operational mode," the explorer reports. "There's a new window—how interesting. I don't feel as if I have any control. It's really interesting. I'm being blasted apart in all directions. All of a sudden, I'm accessing thought balls that are linear as well as horizontal."

"I understand your window very well," the steady voice of Control drones, masking his concern for the wild behavior on the gauges. "You are very close to it."

It's touch it and see, the explorer announces bravely. It is a gutsy decision—only a seasoned explorer would have the courage, and only for him would Control allow it. They are both, Control and explorer, in a completely unknown, uncharted area now. "I'm afraid to touch it. Hold on a minute. It will take me a minute to push that crap out of the way." The crap is the fear. There! That's it!

The line goes dead. The polarity shift is complete, and there is only silence. The explorer is on the other side of the barrier—the remotest regions of Locale II—and he cannot speak.

Control hits the beta signal. "We have a good enough answer for the moment, all right," he says, and begins to pull the explorer back. "Start to make your return. Slowly. Easily. Release your energy. Count yourself back."

The explorer begins his ascent from deep in the hole. He counts scale. By the count of four he regains his toes, his being centering the physical body of Locale II, the here and now. In this moment it becomes a perfect touchup rather than touchdown. He will remember going

The Artist

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What do you think?



I think your name could become a household word



through that new window; that critical barrier, so exquisite ecstasy.

"Watch out when you get up!" Monroe calls out as he walks over to the dark capsule, where the explorer sits on the side of the water bed. It has been a successful, if not entirely trouble-free, mission.

Was this truth or gobbledygook? Was the explorer in touch with another, higher energy system or only with psychic symbols deep within himself? Was this really a library or only a brilliant, meaningless kaleidoscope of light? Just how far can hemisync take its practitioners, anyway?

Monroe won't take a position. More questions are raised in his laboratory than are answered, he concedes. As an engineer, his focus is on the applications of his breakthrough rather than on comprehending the pure science of it. He sees his group operating in an "exploratory mode" and he is "content to leave the double-blind studies to others."

"Pure science simply likes to find out and doesn't like to apply its findings," he tells me. "My great joy is making something of value out of this discovery. I know the phenomenon exists, but I don't know the scope. To do the real science is the province of others. Why does hemisync work? Sometimes I get into the morass of that question though I prefer not to. If something works I always say, 'use it!'"

But with this overt dismissal of the need for scientific proof, Monroe invites skepticism. "Don't believe me. Don't believe anyone," he says. "The truth is available. It is personal. It can be taught and learned. You can gather it within yourself. I can provide you with the tools."

I take Monroe up on his offer and soon find myself on the water bed in the explorer's darkened capsule. A flat speaker, shaped something like the bill of a platypus, hangs from the ceiling above me. Monroe attaches electrodes to my fingers and hands, me the earphones from the panel behind the bed. Then he leaves.

I wait for what seems like an eternity while Monroe throws switches in the next room. Abruptly, his soft radio voice not so much explodes as grows within my head.

"Are you comfortable?" he asks.

"Very comfortable," I answer. Soon afterward I hear the pounding of the ocean surf against a beach. I see a storm of constantly moving blue clouds against a black background. While I am technically asleep, I can never remember being as alert. And so, my own brain session ends.

Will a series of such experiences lead to profound thoughts, great creativity and deep religious faith? No one can say for sure, so one must turn to those who are familiar with Monroe's work.

First is the testimony of loyal disciples, professionals who have used hemisync for enhanced relaxation, concentration, and learning; these people do seem satisfied. Dance therapist Kathryn A. Bright says that hemisync tapes have helped her autistic

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patients gain greater awareness of others. And experimental psychologists Devon Edington and Richard Gex, of Tacoma Community College, say that students learning with hemi-sync in the background tested 10-19 percent higher than a control group not exposed to the tapes.

But a number of experts studying brain waves at the nation's leading institutes don't share this opinion.

Dr. Gerald Oster, a scientist at the Mount Sinai School of Medicine in New York who is studying the effects of sound waves on the brain, is one such skeptic. Oster, whose work is widely published, has used a technique similar to Monroe's, introducing sounds of varying frequencies into each ear and recording the results. His EEG studies showed that the brain did in fact respond to the beat—to the frequency difference between the two sounds.

"I see no evidence, however, that the technique is therapeutic," he says. "I've done it to myself and felt no mood change at all. Then again," he adds, "I'm very inattentive about it. Maybe that hurts."

If hemi-sync is being questioned, what about CBE? Ronald K. Siegel, psychopharmacologist at the Neuropsychiatric Institute of the UCLA School of Medicine, is an expert on the subject of hallucinations. He has studied CBEs produced by drugs, isolation, and stress.

The CBE, Siegel says, "can be understood as a dissociative reaction of the brain. People on certain drugs or in isolation tanks tend to feel removed from their bodies because ordinary sensory input has been suppressed. The isolation alters perception in much the same way that going alone diving for the first time does. 'You achieve weightlessness and the unusual sensation gives you a different view of the world.'"

Monroe may be inducing the CBE with his sound waves, Siegel concedes. But neither Monroe, his explorers, nor any of the Gateway participants have ever left the body for real. "People who aren't used to sensory deprivation or deep introspection are like Carlos Castaneda taking drugs for the first time," he says of workshop participants. "They misinterpret the experience as instruction, believing anything they Don Juan guide says."

The CBE is a valid, even powerful, experience, Siegel adds. But it is experience in the form of hallucination, something taking place within the physical brain, not outside of it. "These people are traveling in mental, not physical space. I believe Monroe when he shows me the moon rocks or when I see replicable experiments published in accredited, peer-reviewed journals. I am forced to reserve my acceptance until then."

But not everyone agrees. Some "new thought" Christian sects have become intensely interested in the work of the Monroe Institute. To them, Monroe is addressing nothing short of the breakdown and reconstruction of the Holy Trinity. To such avant-garde Christians, Monroe is on the

verge of proving that the Holy Spirit lives within the mind and that the soul survives death and lives in eternity. Documenting the CBE, they say, could provide us with nothing less than verifiable, scientific proof of an afterlife.

In his office, Monroe leans back in his chair and looks out at the spare hills. A tattered boxer's hat is pushed back on his head. He sports a flannel shirt and comfortable sheep-wool slippers. Struggled in his lap is a black cat, which he strokes as he gropes for words.

He talks about the soul cautiously for he rejects the way the famous preacher in the next county uses that term. Such rigid usage, he believes, has led to the rejection of the overall concept of an afterlife.

"Preachers put the concepts of afterlife, soul, and eternity into a religious structure that modern man cannot accept," Monroe says. "Our work puts these concepts into a scientific structure that is acceptable. There is a matrix, a technology at work in this world. We know the facts, but we don't know the language or the base from which it operates. When we do, that's man plus."

Man plus, Monroe has made repeated references to this grandiose concept during our several days together. Man's new found ability to encompass both sexuality and astringency through the altered state and especially through the CBE, renders him a thinking being, according to Monroe. He survives death and transcends the constricting local traffic of primal needs. Monroe speaks with the certainty of one who believes he has already experienced death, walked in the deep past and for future, and visited higher beings and souls of the dead.

If his discoveries are heeded, Monroe believes, a new species of man—one who has tripped the light fantastic of Locales I and II—will result. Man plus, says Monroe, will control both sleep and wakefulness. He will be able to hold a bowl of rice in his hand and, through brain power alone, turn it into the equivalent of 2,000 calories. Woman plus will be able to ovulate when she wishes and will require clothes only for fashion and modesty.

"Man is approaching a window of opportunity," Monroe proclaims. By expanding his consciousness, he has the chance to make a quantum jump in evolution. Those who don't convert to man plus will become phased out. And, he adds, "there are already about three thousand man plus in existence today."

Why wouldn't these 3,000 man plus try to control the world? I ask.

"The process by which man becomes man plus precludes the desire for that kind of control over other men. The way of achieving the advanced status teaches out that kind of thinking. These men plus may band together. They would know how to do that. But their purpose would not be to control the world. With their abilities and behavior they would seem like gods, angels, aliens, or devils." **DO**

INTERVIEW

CONTINUED FROM PAGE 10

view, very much a living advertisement for the health benefits of his own stubborn brand of intellectual integrity.

Qwv: Why do you think that computers and automation threaten us with technological unemployment?

Leontail: The paradox is this. In the beginning, human labor was the most important resource after nature itself. By the Industrial Revolution, electricity and other sources of power began to eliminate the need for human physical exertion.

Now with computers, technology is learning how to replace the human mind. A very large part of the human contribution to the production process consists of performing relatively simple mental operations. These are now being replaced by automated machinery. Even repair is being replaced. Instead of asking someone to fix a computer, you throw in a new modular component. In fact, a machine can do even mechanical repairs. It can track an old model, see where it is beginning to malfunction, and automatically substitute a component. So you see, man is being crowded into a corner.

The usual observation is that humans are so flexible that there will always be something else for them to do. That is a loose argument. They aren't all that flexible in his latest book [Reviews and Promises]. Allen Toller says that everything will be all right. We'll decentralize everything and completely abandon mass production for small-scale electronics. I am skeptical of these general observations. All right, Toller says, everybody will handle information. But what is this so-called information handling? Marshall McLuhan anticipated this when he said the medium is becoming the message. What medium is it that we are getting McLuhanized? Nobody cares what the information is. They use it simply to bamboozle people.

The usual idea is that while mechanical production can be done without human participation, service industries require large amounts of human labor. Actually, the new technology invades the service industries, too. Even there you will not need large amounts of human labor!

Qwv: Aren't there still many things the human mind can do that computers can't?

Leontail: Oh, certainly. It may take centuries to complete the process—the functions and capabilities of the human mind are incredibly complex. But for the first time, labor is beginning to lose out completely as the principal. You can produce goods and services with less and less human contribution of any kind.

Qwv: That should be a popular trend; humans won't have to work anymore if they don't want to.

Leontail: But we are left with a problem: A manager will pay for labor only if it contrib-

ules to production. Here we are talking of replacing people entirely. If you replace horses with tractors, say, you don't pay the remaining horses more; you just get rid of them. When [Chairman Theodore] Murphy of General Motors, negotiated with [former United Automobile Workers President] Douglas Fraser about wages, he obtained what amounted to a wage reduction. I can imagine how Murphy did it. He could have shown Fraser a blueprint of an automated plant that turns out the same cars more cheaply with much less labor and have said, "Of course, if you reduce wages, I will not introduce it at once." Fraser would have had no counterargument.

Ques: But suppose we do end up with so many robots and so much automated technology that everything in the United States could be produced by a few people. Could I people then work ten or even five-hour weeks?

Leontief: I have suggested reducing labor hours. But we should make sure that people receive the same, not less, for the fewer hours! This is the point. When you describe any economic system in theory, the position of horses and people in it is exactly the same. Both work, and both get paid. We eliminated horses, and now the position of people to put it crudely is exactly the same as that of horses. Not quantitatively qualitatively. In our economy we have eliminated horses, and there is no problem. But what would have happened if horses were able to join the Democratic Party and were allowed to vote? You would have a very different story.

Ques: If you gave horses or people one day a week instead of five days a week working hours, why should they object?

Leontief: You would still have the problem of income. You can spread the work. But why should you pay them more? You see, you solve the unemployment problem by reducing the workweek, but you don't solve the income problem. We could employ as many people as before, but the employer won't pay the same wage because there is no business justification to do so. My solution is to pay people out of production even if they themselves don't earn it.

Ques: How much unemployment can we expect in the years ahead?

Leontief: Paradoxically it will depend on our prosperity. The faster we grow, the more we'll get. New technology takes terrific investment. If American industry doesn't invest very much, there will not be much technological unemployment, because there will be no new factories! You see how tricky it is.

Ques: Won't you still get unemployment if high-tech imports such as Japanese computers replace out-of-date U.S. products?

Leontief: Yes, but that's a separate problem, and I think we'll just put tariffs up. I had an incredible exchange with the leaders of the steelworkers union recently. They came to me and politely said, "We understand we have to cooperate with industry and we know that you always say industry

and labor should cooperate on economic problems, so could you help us?" And we had a meeting in an elegant restaurant in [New York's] World Trade Center. After two hours I discovered that they wanted to cooperate with management on only one problem: to organize a lobby to interdict imports of steel! Whereupon I said, "Sorry, this is not my idea of cooperation!"

Ques: But when the steel industry goes under to imports, what will happen to all the not-very-smart people who can't be easily retrained as computer operators?

Leontief: First of all, it won't happen in fifteen years. The Industrial Revolution in England lasted from about 1800 to 1900, so relatively it's now about 1900. Interestingly enough, computerization replaces labor in service industries faster than in manufacturing. The computer really replaces people in offices. In 2000, by not reckoning the percentage of the labor force in middle management will decline, because middle management is essentially

“In our economy, we have eliminated horses, and there is no problem. But what would happen if the horses were able to join the Democratic Party and began to vote? You'd have a different story.”

paper shuffling. Computers and humans can shuffle papers with equal facility.

Ques: How do we light the threat that people might starve in paradise?

Leontief: What should be done first is to gradually shorten the number of years and hours a person works over his lifetime—shortening the workday, lengthening the schooling period, inducing earlier retirement, and so on. We must then pay out supplemental income in different ways—social security, unemployment, rental, medical, educational grants. It's not such a radical idea. Already many people in this country and in Europe live on government handouts, that is, services are provided for which they don't pay. In European countries, a much higher share of peoples income is transferred.

Ques: In this economy of the distant future, how much work will humans actually do?

Leontief: Some amount of work will be necessary, but already you see we are reversing history. The way things began economically is well expressed by the tale of a colonial power coming to a primitive country and trying to set up organized plantations. None of the natives want to

work on these plantations. They already live quite comfortably picking breadfruit from the trees, which is not very onerous work, and they spend the rest of their time in ceremonies. The colonizers can't get a labor force, so they introduce money and taxes. Whereupon the poor natives are compelled to work on plantations to earn money to pay their taxes. Now we must do just the opposite! We have to teach people to work less. All of the Victorian work morality the Puritan ethic will sooner or later have to go by the board. We will face a serious cultural and moral problem.

Ques: What do you foresee for the U.S. economy of the twenty-first century?

Leontief: We will unquestionably have access to a vast amount of atomic power, and so the improvement of the material conditions of life will be very great indeed—it were not blown up by atomic bombs first. With machines and computers doing routine kinds of work, we will need to work only two or three days a week. Educational standards will be raised, since people will be able to study more and will also engage in other activities—sports, theater and so on. Choices will depend on the future state of our civilization. Look at the so-called leisure classes in the nineteenth century. These upper classes didn't work for a living but produced a flourishing literature and superb science.

Ques: They also did a lot of eating, visiting, letter writing, and reading!

Leontief: Exactly, and I hope the will happen again. Whenever someone tells me that people have to work or they wouldn't know what to do with their time, I disagree. People don't have to work very hard to enjoy life. But this is where the whole burden will fall on our civilization. One thing technology doesn't do is tell us how to spend our leisure time. That depends on the nature of our tradition, history, education and values. What do we feel is worthwhile? Of course, we might just have more football or Abing games, or simply watch more television. That would be too bad. I would work even if I were not paid—don't tell that to the president of New York University! I like being paid, but I wouldn't be. The majority of people work because they're paid.

Ques: It seems that those who love their work—in the arts, for example—often get paid less than those who don't.

Leontief: Only exceptional people get paid well for doing what they want. Painters, for example, like playing piano, and they like acrobats, and the outstanding ones are paid very well. But in the future the difference between work and play will be reduced in all occupations. In every economic system there is an upper class that has income without having to work for it. Some of these people have been very creative, and science could not have developed without them. Science was not developed by people of the lower classes. Newton had his income. Adam Smith was a former professor. John Stuart Mill had a sinecure as a civil servant in the India office.

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Omni: The American Puritan ethic upholds work as a discipline. Won't there be a fear that society will become spineless and self-indulgent?

Leoniel: Yes, and this explains much of what is happening today in the United States. The Moral Majority and Reagan are completely asleep in Puritan attitudes toward life and work. I don't blame them; they were educated that way. Morality usually changes slowly to correspond to social conditions. We are ready to relax on sexual morality, but we are not ready to relax on work morality, which, even slightly loosened up, would make things much easier. We refuse to pay money to support people. Policies that provide income to non-working people are considered immoral.

Omni: Will the gap between rich and poor disappear?

Leoniel: You will always have rich men and poor men if you simply let the price and competitive systems determine who is rich and who is poor. On the other hand, the government can establish a pump to siphon some part of income from one side to the other. In the days of Dickens, poor houses did exactly that: now income is redistributed on a much larger scale. Nevertheless, I don't want to kill competition, because material incentive is still the driving force in most, if not all, human pursuits. This is why in the Soviet economy ordinary industry and agriculture work very badly—people have no incentive to work hard. Yet if you look at their scientific institutions, their performance is pretty good. This is because people in science work out of interest, not out of pay incentives. So the income policies or redistribution would have to be subtle.

Omni: Is there time or resources in the world for the poor nations to become rich without the richer nations having to lower their standards of living?

Leoniel: It will be a very long time before the gap between the two is reduced. Many poor countries really live in the fifteenth century, and you cannot easily leap out of the fifteenth century into the twentieth. It will be a slow process, but possibly the gap will be closed by the rich slowing down and the poor accelerating. I don't think that this will happen without great political and social convulsions in the less-developed countries. The new technology threatens the less-advanced countries far more than it threatens us. Those with natural resources, such as oil and valuable ore, will always be on top. But to the extent they try to sell us industrially manufactured products, as they do now because their wages are low, they will be in trouble. Once our industry is automated, low wages will no longer enable them to compete with us.

Omni: Then we will have to redistribute income from rich countries to poor countries that get into trouble?

Leoniel: The poor countries will just linger because this redistribution will not take place. The rich countries, except for Sweden and a few others, resist giving money

to the poor countries. The United States contributes a smaller proportion of its income to poor nations than it did twenty years ago. We don't want to sacrifice anything. I am not heated up about moral justification; it's just the way things go. It will be a very difficult situation. I say there will be no redistribution.

Omni: Would a politically unbiased observer from Jupiter say agree that we are governing the economy well in the United States today?

Leoniel: The economy is not governed! The economy is operating as a kind of natural phenomenon! People pretend to govern it, but actually they don't. Worse, the people in government who run the economy are particularly poorly equipped to do so. The important political figures of today such as members of the cabinet, are inferior to those of the past. The problem is that our politicians are not selected in such a way that the best minds prevail! [Economicist Joseph Schumpeter pointed out that while capitalists are very creative, they tend to have absolutely no political capabilities. When capitalists try to run their own society, they fail. England was lucky in this respect. The political leaders of England in the nineteenth century, when it entered its phase of economic development, were not free people but aristocrats.]

Japan, too, is better off. The Japanese social and political structure is really a feudal structure. It's incredible, but their feudal institutions have proved more adequate for running a modern economy than institutions developed for that purpose at the turn of the century.

Omni: You've described President Reagan's policy as "denying most of the crowd setting full sail, untethering the tiller and lowering the poor, the old, and the sick in leaky dinghies overboard. Is this fair?"

Leoniel: The modern technological economy cannot operate automatically. Yet the Reagan idea, essentially that of economist Milton Friedman, is that the modern economy is a big computing machine that poses and automatically solves its own problems. When I teach, I do use that image as an example in explaining to students how an ideal competitive-price system works. And certainly, to a large extent, we have an economy still running automatically. Nobody plans what or how much to produce—it all just works.

Omni: Why in your opinion, won't a hands-off economy work?

Leoniel: First, the mechanism doesn't work perfectly. No one who works with computers will put a problem into a computer at five o'clock, push a button, lock the door, and go home expecting that next morning the computer will have automatically printed out the solution. A transistor will break down; there will be a short circuit; whatever. Well, the economic system is much more complicated than a computer. Second, there are unemployment problems, which the computer won't solve. **Omni:** Do you think the United States

should have an industrial policy? It's a big issue in the current presidential campaign. **Leontief:** Absolutely, but we have to decide what kind of industrial policy. The government helping rich corporations to invest and so on—we don't need that. Individual corporations have very limited horizons. We need government to organize research that is too expensive for individual corporations and that's not confined to individual corporations. How does individual business decide whether to introduce new technology? The introduction of new technology will completely change the price system. A businessman does not know the consequences of introducing new technology into other businesses. The businessman does not even have the information to tell whether the new technology will be more profitable.

Omniv: U.S. businessmen have done pretty well so far. Our gross national product (GNP) is one third of the total world GNP. **Leontief:** Our share is eroding. It used to be fifty percent, then it was forty percent, now it is thirty percent. Give us twenty years more and it will be twenty-five percent. In electronics we are losing markets right and left, for the same reason our automobile and steel industries are going bankrupt. We didn't make the right choices. Now we are saying let's do what the Japanese do, but by that time, the Japanese will be doing something else.

Omniv: What industries should we go into? **Leontief:** The research hasn't been done, so how can I tell you? Industrial policy without research means nothing. First you have to do the research to decide what kind of industrial structure you would like to have five, ten, and fifteen years from now, taking into account technical changes in different industries, available resources, and the world market. After that decision is made, you use all possible means to promote those industries. I don't care how subsidy, government takeover, banning development or making it difficult—even protection against imports is sometimes quite justifiable. Currently, because we haven't done the proper research, we are proposing tariffs to protect industries that should be liquidated. The government is just thrashing about, taking action without any good idea what the results will eventually be. We say we need an industrial policy, but what we get most often is government meddling. I'm absolutely against government meddling. And with the political organization we have today, these government actions simply serve to satisfy different interest groups, not the national interest. Very often this meddling is detrimental to the country's economic development. This is why, despite urging, I don't join in the discussion—because much of it is superficial. I don't testify before Congress anymore, it's an exercise in futility.

Omniv: What stands in the way of progress? **Leontief:** It's partly ideological and partly cultural. The current government believes that if you limit the role of government to



THE UNCOMMON IMPORT
DOS EQUIS

producing atomic bombs and other arms, the economy will run all right. That is their well-considered ideology.

Omni: At least Reagan seems to have inaccurately killed inflation.

Leonief: The miracle has consisted of being able to avoid great social disturbances despite having ten percent of the population out of work. No one ever doubted that if you beat down the economy, prices will go down. But he didn't do anything to prevent another cycle starting. He's thrashing around. It would be better to have no government at all than to have the actions that government is taking now.

Omni: Washington policymakers, you have said, are extremely ill informed about the economic facts. Why?

Leonief: We are living in an information age without information. Washington is gutting the government's statistics. They are cutting appropriations. Next year we will know less about the American economy than we know last year. We cannot effectively take advantage of modern computers, which enable us to deal with masses of information, because we haven't got the information. Pieces of information are like a pile of bricks, not a building. You don't collect information before you know what to do with it. The United States is the only advanced industrial country that does not have a real, central statistical office to collect facts and figures.

Omni: But the United States became the world's strongest economy without one!

Leonief: Yes! But remember the German tribes overran Rome. America is bound to lose its predominant position, simply because other countries will grow. But possibly it is losing it faster because of internal inabilities to handle the situation. Let me give you an example. The effect of computers on our economy is very important. Computers are automatic machinery. So how will the Age of Automation affect our economy? The Austrian government has already made a big study to see how new technology will affect the Austrian economy. We haven't got such a study, and we have no means of doing one.

Omni: We need a central statistical office to organize one?

Leonief: Yes. All the pieces of information must fit together. We need an information system fit for a modern economy. But information by itself is not enough. Information requires analysis. Information by itself is just facts. At present we have marvelous computers, but statistically speaking, it's all GIGO—garbage in, garbage out. The computers have nothing to draw on. If the government has all the power and doesn't know what to do with it, the result is a mess. It's a tragedy!

Omni: Businessmen spend hundreds of millions of dollars annually on forecasts made by economic models. How can you call these projections ingenious but utterly unreliable?

Leonief: Just taking a coin and flipping it would give you about as good a forecast

as taking the average of all the economic models. If you have twenty models and all of them forecast different things, of course one will be right. The more thoughtful of these forecasters would agree with me. Larry Klein [of Wharton Economic Associates] might agree with me, saying that typical economic forecasts are terribly weak, really just extrapolation. You look at the past and you get the future!

Omni: The United States has an input-output table prepared by the Department of Commerce. Isn't that good enough?

Leonief: The people who work on the American input-output table are very good people—I would implore their competence. But the table is prepared by a relatively small group of possibly fifty professionals, and it is published as a paperback pamphlet of about two hundred pages. By contrast, the Japanese input-output table is four folio volumes of twenty-five hundred pages, properly bound. Ours is compiled in a little research unit that is part of a bu-

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reau that is part of a division that is part of the Department of Commerce. The Japanese model is compiled jointly by thirteen ministries in Japan under the supervision of a committee of the cabinet of ministers. Furthermore, the Japanese input-output table describes the labor force in terms of about one hundred twenty different professions. Ours has three or four. Their total number of industries is between seven hundred and eight hundred, ours is approximately six hundred. Another problem is that our census doesn't permit publication of information on a separate region of the country because there might be so few companies in a particular region that too much information on any one company could be revealed to competitors. This is absolutely ridiculous. If their needs spend enough money, they can find out the information anyway. Furthermore, the public interest requires some things that private interest might not desire.

Omni: Couldn't companies use such a model to find out, say, whether a rival were going into a new product venture?

Leonief: Absolutely not. The information is not so specific. Besides, we have private

profit-making companies whose job is to find out information about other companies. Look at me. Companies that know and value my work give me volumes of information! They know I won't publish the proprietary figures I use. We work in that spirit, and the companies should work in the same spirit with the government. Actually, the costs to the company and society of being generally sluggish and backward are much higher than the costs of certain minor competitive disadvantages that cooperation might incur.

Let me tell you about Japan! Two years ago I was visited by a young Harvard Law School professor who had been a member of the U.S. State Department team negotiating with the Japanese on certain problems of technology transfer. He was shocked and embarrassed to discover that the Japanese knew more about our economy than we ourselves did. And it was not because they were spying. There was nothing undercover about it. They now have a multiregional input-output table that covers the whole Pacific area, and they have tables of the United States. It enables them to approach problems with incredibly active rationality. If the United States functioned in this way, we might pursue much better economic tactics and strategies.

Omni: You have exhortated economists as an "irrational trade union." Can you define that rationality?

Leonief: They build theories without relating them to facts. It's purely abstract reasoning, mathematical game playing. The journals have lots of formulas but no figures. I am not against theory. The whole science is a combination of facts and theory. I find academic economists terribly funny and boring, but I don't blame them. It's not a moral deficiency. It's how they were brought up. The academic establishment is extremely indoctrinating. As young people these economists might have had better ideas, but these ideas were completely washed out of them.

But I do find them terribly dull. I have few friends who are economists. The trouble is this: Given how it has evolved, economics will attract nobody unless he's a little dull, because when he looks at economics, he gets bored. So you see the logic. Economists are dull because only dull people go into economics! It's mainly noneconomists who are interested in input-output.

Omni: What do you feel about Keynes now?

Leonief: I think Keynes is obsolete. He was incredibly intelligent but more of a politician than a scientist. He really wanted to gain certain objectives, and public relations played a terrific role for him in influencing people. A scientist in economics who says that in fifty years we will all be dead—by which he meant that we should think beyond fifty years—is giving you a somewhat cynical answer.

Economics was founded by Adam Smith, a very great man. When he wrote his book [The Wealth of Nations, 1776] all the eco-

omic facts were well-known to the average man, so Smith didn't have to collect any. He organized the facts and produced a theory to interpret them. From then on economists simply interpreted what was already common knowledge. But there came a point when the economists rehearsed all the known facts. Because collecting facts is so terribly expensive and difficult, they went in the direction of theorizing and when facts were missing they made assumptions.

Economists simply built purely imaginary worlds based on convenient artificial assumptions. When statistics developed, everyone knew you needed them, so a statistical methodology was developed that enabled you to describe facts by curve-fitting. You put just dots in a graph, draw a line that fits them, and that seems to be an explanation of the facts. Statistical methodology enables every dumb student to copy some figures out of the computer using a program that computes all the averages, and this is considered analysis. My point is that economists kill facts by averaging everything out.

Ques: But can you take into account every individual economic fact in the United States? There are billions of them!

Leonid: No. Scientists lack three kinds of quantitative problems. Some problems involve very low variables, as in Newtonian mechanics or in astronomy, where you might describe exactly the relations between three planets in space. But you would get very uncomfortable when you try this type of analysis with fifteen planets—it gets too complicated. Then there are relationships that have millions of variables, such as in the theory of gases, where you use stochastic statistical methods to average it out. Probably theory embraces millions of facts and the more facts or individual players, the more accurate your estimates. But in economics as in biology, you may have two hundred or even two thousand variables—and dealing with them I regard the statistical approach. I say each variable is significant. You cannot substitute one for another. With input-output analysis, I construct a big system using many variables, but each one has its own name and address. Orthodox economists have never listed input-output but for some reason, the scientific world keeps me. I am not pushy. I just do my work.

Ques: Can the United States learn from Russia in managing its business?

Leonid: From the system no. No. The Russian economy is just a mess. Our economy, you see, is a sailing ship propelled rapidly by the strong wind of private profit motive. It often runs on the rocks because there is no helmsman at the wheel. The Soviet sailboat has an oversize rudder held by a strong hand, but it just bobs up and down in the water for lack of the propelling power of the profit motive. But you should not underestimate the Russian capability. If they want to concentrate on something, they can do it.

Ques: What is the theme of your latest book *Military Spending*?

Leonid: First of all, I assembled all the uncollected facts. In Italy, for example, the government told us that the information we wanted about arms production was so secret, so a radical political party there organized an investigation that went to all the provinces and visited all arms installations in Italy. They sent me a beautiful map like an automobile-club road map, with all the installations marked and described. They laughingly informed me that the war ministry had bought numerous copies from them since it was better than the government's map.

I treat arms production as an industry whose product happens to be arms. We project what would happen if you reduced a particular kind of arms or reduced military expenditures in all countries—how this might affect the world economy and, in particular, how it could help the less-developed countries a bit more. I consider

● *A Harvard professor
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were spying. There
was nothing undercover.* ●

for example, the possibility of poorer countries making arms for themselves instead of buying them. In general, these countries would be much better off because they pay such terrible prices.

Ques: What will happen if Reagan continues military spending at high levels?

Leonid: Our military budget is not so huge. Like the deficit, it's a slight exaggeration. It won't bankrupt the country. If we cut it, however, we'd be able to reduce taxes and turn the money back to the people, or we could devote it to all kinds of useful projects. We might rebuild New York. I have a niece of thirty-five, a Belgian who is a dress designer and often visits here from Paris. Two weeks ago she was walking along Sixth Avenue at Twelfth Street with her boyfriend, when she stepped on a subway ventilation shaft grate. It gave way under her, and she fell eight feet onto concrete. The fire department had to come and extricate her. This is the state of affairs we face in public infrastructure.

Ques: What would be the economic effect of a big reduction in military expenditures?

Leonid: It requires industrial policy and detailed planning. One easy thing would

be to give aid to less-developed countries. We don't need a situation in which the president of the central bank of Brazil resigns, as he did recently, because the conditions that the World Bank and Western bankers impose on Brazil to settle its debt problem would produce economic collapse there. When I read that, I recalled that Keynes resigned from the English delegation to Versailles and predicted that forcing Germany to give reparations would plunge Europe into another disaster, which is what happened. Reparations destroyed the German economy, produced unemployment, the Nazis, and another world war. Now we're making the same mistake with the less-developed countries. Instead of scolding the American bankers for giving them loans, we should support them.

The bankers organized their own Marshall Plan. Now of course they cannot sustain it. The government should bail out the banks and give them more. I'm not known as a fellow who congratulates bankers, but for once the bankers did the right thing. They took the Saudi Arabian oil money and recycled it to Brazil, which developed fast. Omar is there another way to kill inflation other than through deep unemployment? **Leonid:** Oh, absolutely. For a very long time the Austrians, till their economy finally began sinking two years ago because that of the rest of the world was sinking, had three percent inflation and two percent unemployment. Austria had it by negotiating it. The workers in Austria reasonably agreed not to make very high wage demands because the government guaranteed their real income. The government didn't just say "Bargain!" but rather "Through negotiation and legislation, we will see that your income is reasonably increased in proportion to the rise in general—not only labor—productivity."

Inflation is a social, not a monetary problem; it's a symptom of social maladjustment, not simply of monetary maladjustment. There are worse things than inflation. The present inflation light has been used to undermine progress in our social system. For many years it was moving ahead pretty well.

Ques: Are you motivated by concern for the underdog?

Leonid: My passion is really for science. Fundamentally, I do economics not to help human beings but to see how the damn thing works. Helping humanity is not my motive, though I try to do it. I was surprised you knew that input-output analysis proved to be so useful in practice. It never became popular among academic economists here, but in Germany and many other countries, it is a required course.

Ques: Do you aggressively attack ideas that you believe are wrong?

Leonid: Very seldom. One cannot advance science by attacking other people. I leave them alone. It is no use. I just do my stuff. This is my fundamental attitude. I don't think I have written more than ten critical articles in my life. **DD**

MEGACHIP

CONTINUED FROM PAGE 76

bury's computer chips will be made not of silicon crystals but of large organic molecules. Such biocomputers might simulate the human brain, processing myriad amounts of information at once, making decisions, drawing conclusions, weighing evidence, perhaps even exhibiting creativity. Biological computers, however, are still theoretical. At best, they are many decades away.

Closer to reality is a souped-up silicon technology called parallel processing, which industry experts say is almost ready.

In parallel processing, the computer contains several chips, each specializing in a specific job. One, for instance, may handle calculations, another memory processing, and so on.

"You can put many interconnected computers on one chip, and they can work on different parts of a problem simultaneously, like the neurons in your brain," says Ronald Kautz, director of the computer-engineering center at Pittsburgh's Mellon Institute, a branch of Carnegie-Mellon University that does consulting work for industry. He says the advantages are high speed and the ability to handle programs far more complex than today's software. Parallel-processing computers, for instance, might well carry on conversations in ordinary English. Engineers at Carnegie-Mellon and throughout the computer industry are currently wrestling with such difficult problems as how to control parallel processing's multiple simultaneous operations without losing the speed advantage. The tasks are formidable, but most industry experts are highly optimistic.

"It will take a while, but the cheapness of processors will make it happen within five years or so," says Mike Jones, vice president for engineering at Peachtree, a leading software producer. "The result will be computers that are much faster, much easier to use, and that allow you to work on several tasks at the same time."

As just one example of what parallel processing can do, Kay suggests that your computer and telephone would be connected. A call comes in while you're doing word processing, and a window opens on your screen to tell you who is calling," he says. "Or you might bring up information from a database and plug it directly into the report you're writing." The industry buzzword he says is multitasking, meaning computers that can do several jobs at once. For example, while you are writing a letter, the computer might be calculating sales figures you need preparing a pie chart, and printing out 5,000 envelopes, drawing the addresses from a database. Researchers are confident that such power will lead, in a decade or so, to computers that can see, listen, talk in ordinary language (such as English or Japanese), learn, and make judgments.

Even more immediate will be the impact of yet another technology: videodisk storage. Lasers write information on the disks in binary form, burning a microscopic hole in the disk to represent one and leaving a blank space to represent zero. The lasers also read the inscribed disks. Videodisks, of course, already allow owners of videodisk players to see movies or Michael Jackson's latest, see it while-you-beer-it performance. The next step will be to make the personal computer to videodisks, and it is coming soon. In fact, the computer industry has been humming with the news that IBM recently ordered 1.5 million compact-laser-videodisk drives, possibly as an addition to the firm's PC line.

Videodisks offer immense storage capacity. One new disk can hold the equivalent of 2 million typed, double-spaced pages of data on a single 14-inch platter. They also offer visuals comparable to motion pictures, which are light-years ahead of the simple graphic displays now avail-

• **Look up your data banks! The Fifties hot-rodder got around on Goodyears. Now the high-school technopunk can punch a key and go anywhere.** •

able on personal computers. The possibilities are intriguing.

"You can perform very exciting graphic simulation with the technology. For instance, you could play a game of computer football in which the players on the screen are actual NFL athletes," says George Heilmeyer, senior vice president and chief technical officer at Texas Instruments in Dallas. Simulation games like this could be highly educational, he adds. "Imagine exploring the moon by gliding over moonscapes based on real NASA footage, or teaching yourself to fly and being able to safely see the consequences of your maneuvers. If you're too light on the throttle, well, then you plow into the power lines!"

He says that tomorrow's encyclopedia will probably be stored on such a computer videodisk machine. "Suppose I wanted to look up something on supply-side economics," he says. "On the left side of my screen I might see [supply-side economics] Arthur Laffer delivering a lecture on his theory and on the right side I'd see an outline of his ideas. The possibilities, of course, are enormous. Look up a

ger in your computerized encyclopedia, and up comes a snowy Bengal, bouncing through the Indian jungle, while a leading zoologist, interrupted by an occasional roar, describes its physiology, behavior, and ecological niche.

Video-computer systems already are beginning to appear in video encodes (see "Video Worlds," January 1984). You can get artwork, for instance, dogfighting in an advanced jet plane from Clint Eastwood's movie *First Blood*. Computerized training courses are also available on videodisk. But Heilmeyer notes that the disks are not yet interactive, so the computer user cannot write on them or change their contents and store his own information. According to Heilmeyer, truly interactive computer videodisk equipment is approximately three to five years away.

Norman Waser, a senior analyst for the computer industry at Arthur D. Little, Inc., the international consulting company headquartered in Cambridge, Massachusetts, says that videodisks will eventually contain both a program—for instance, word processing—and the instruction manual needed to operate it. The user will then have the option of either studying the instructions on the screen or of having them printed out. Among other things, the manual will offer audiovisual how-to demonstrations. "You could get a couple of hours of video instruction on the disk in addition to the program," he says.

We could put our entire software library on one videodisk," says Peachtree's Jones. "The disk drive is a peripheral attachment to your computer, will eventually cost about two hundred fifty dollars, and a disk will be about ten dollars."

The density of storage in these beer-disks is spectacular. The entire Library of Congress card catalog can fit on just two of these disks, says Lotus's Chris Morgan. He adds that read-only disks will be available for computers in just a few years. Disks that a computer can both read and record new information upon (read-write disks) should be available in about seven years.

By then, he thinks, the video images will be as sharp as reality. When holographic displays come along, you'll have live performance in your living room with three-dimensional projections.

Denser chips, magnetic bubbles, parallel processing, videodisk storage—as such technologies reach the marketplace over the next three to seven years, computers will acquire ever larger memories. And they will be able to process ever more complex programs in less and less time. As a result, software companies will be able to produce far more complex programs. Yet, because of that underlying complexity, the programs will be so simple and natural to use that any bright teenager could operate a computer.

I'm an ex-programmer for mainframes, and I know all the languages—I'm computer literate—but I don't see any reason at all why my twenty-year-old son needs

will take for people to feel really comfortable talking to machines.

Meanwhile, as machines develop more power, software designers will develop entirely new kinds of programs. Just what form they will take is still unclear, but some of the latest programs are indicators.

To considerable fanfare in computer circles, Living Videotek, Inc., a small Palo Alto, California, company, recently introduced a new program called ThinkTank. Essentially it is an idea processor, according to the company's president, Dave Winter. The program generates an onscreen outline that lets you organize and rearrange thoughts. Suppose you are planning a new store that will sell computer software. You type in a possible name, sort words, which appears on the screen. Then you could create categories to think about: customer populations, suppliers, advertising themes, and so on. Then you could brainstorm, slapping down ideas under the different categories as you go, switching them around, changing the categories, refining the ideas.

Eventually, your computer will have in its memory a definite plan for the new store, complete with details for financing, starting up, and eventual expansion. Such a program is a harbinger of software to come because it is useful to virtually anyone, whether he is plotting a corporate takeover or planning an awards banquet for the local bowling club. Programming must evolve in that direction—universal usefulness—before the industry can achieve its cherished goal of a micro in every spin level.

ThinkTank is a prototype for a new kind of programming. It's going to be a mass market, and we're going after that," says Winter. "You're also going to see computer networking so that we're no longer working as isolated little islands. Computers are going to link us together so that we can accomplish what individuals cannot.

A step toward that networked nation is now under way at Carnegie-Mellon University, where campus workers are currently stringing fiberoptic cables from building to building. By 1990, the university will be a microcosm of the city of tomorrow. Its microcomputers—approximately 7,000 of them—will outnumber people linking freshmen deans, janitors, and everyone else on campus to a central data bank and to one another. Students, for instance, will write term papers on computer terminals and send them electronically to their professors, who will grade them on the computer and electronically return the annotated versions. IBM and Carnegie-Mellon are cosponsoring this scale model of the computerized future.

"I used to work at Xerox's Palo Alto Research Center, where we had this kind of system, and the effect was a much higher quality of communication between people," says James Morris, director of Carnegie-Mellon's Information Technology Center. Morris is designing the programming for what university students already

You never forget your first Girl.



are calling Computer U. One reason, he says, is that written communication forces pupils to express thoughts more clearly than they would in everyday speech, while electronics speeds up the tempo of communication. "You can involve more people in a discussion because they don't have to be there physically," says Morris.

Eventually, he says, the university may extend the computer connection out into Pittsburgh, first for off-campus students and eventually for the entire city. But computerization already is having an effect on education at Carnegie Mellon.

A good example is history. Traditionally undergraduates have been unequipped to do genuine research," says psychologist Jill Larkin, director of Carnegie Mellon's Center for the Design of Educational Computing. "Now the history department has a database of grievances filed by people in different parts of France just before the French Revolution. Students are tapping into the database to do studies that actually increase our knowledge of the revolutions causes."

The unknown quantity in the computerization program, she says, is its psychological and sociological effects on students. "The best analogy is the advent of the mass-produced automobile—I don't think anyone at that time guessed that the car would completely reorganize society."

"You have to realize that tomorrow's microcomputers will be as powerful as today's mainframes. We're working with IBM right now to develop them," Larkin adds. "I think we're putting together a prototype of what will be common throughout society. Lord only knows what it'll be!"

As the computer revolution takes hold, the big winners may be schoolchildren. So says Judith L. Schwartz, professor of engineering science and education at the Massachusetts Institute of Technology and a leader in the new field of educational computing. "Technology is no problem—it's here now," he says. "But we have to learn to use the technology to support what education really is, which is the process of helping people to ask questions about the world around them." He believes that teaching children to program is unnecessary. "That's like giving them a machine shop and saying 'Go build your own tools.' I say give them the tool kit—a screwdriver and a word processor are both tools."

At MIT, Schwartz and his associates are developing programs that will put computers to more effective use in classrooms. One of these programs lets students learn geometry by exploring for themselves the relationships between different figures. "For instance, you can put up on the screen any triangle you want and do anything to it that you want. Then you can formulate theorems and keep trying them out on different triangles to see if they hold up," says Schwartz. "We've tried it with fifth graders and they've discovered new theorems, and we've had slow learners duplicate every theorem in the book."

Tomorrow's microcomputers, souped up with artificial intelligence, glazing with user friendliness, are sure to affect everything from fourth-grade geometry classes to Fortune 500 decision making. No one is quite sure, however, where the computer revolution will take us.

"The car analogy finally breaks down because the car is a static tool—it just gets you from here to there. By contrast, the computer is open-ended, with no limits on its ultimate uses," says Lotus's Morgan.

That's why the effect of the computer will be both more profound and less predictable. Except for the human mind, the computer is the first open-ended tool ever.

According to Texas Instruments' Helmeier, tomorrow's computers will be ubiquitous but inconspicuous. "Everything from your toaster to your home's heating system, to your car will be controlled by tiny internal computers. You will not even know they are there. And as computers become ever more potent, they will shrink. Eventually," says Helmeier, "you may carry your computer in your shirt pocket, plugging into a seminar—probably your telephone—to access databases. But even before the pygmy computer arrives, computers will be doing a bigger share of our thinking."

Within the next few years, expert systems—artificial intelligence—will be in the personal-computer marketplace. That, in turn, will speed our entire culture to start thinking in a more productive way about the nature of knowledge. The impact will be analogous to the introduction of books, predicts Ira Goldstein, director of the Application Technology Laboratory at Hewlett-Packard's Palo Alto laboratories.

He says that programs will soon be available to serve as your tax adviser, attorney or personal physician. Because the programs will be intelligent enough to make judgments, they will be able to serve as librarians. "You call up a database and say 'I want to know about dangerous animals in North America,'" says Goldstein. The program decides that you must mean dangerous to people. It decides you probably mean large animals, not disease-bearing microbes, that you mean extant animals and it asks you questions if necessary. In other words, it thinks."

In about ten years, he forecasts, we can anticipate the debut of machines learning which will allow us to program our computers by talking to them much as we might talk to a student. And in 15 years, he says, "machines will be learning from one another across a worldwide network and from their own observations. We'll no longer be able to say that in all situations, people are always smarter than computers."

My grandchild's best friend will probably be a computer, Goldstein continues. "It might well be that every child will grow up with a computer nanny who, in time, will change with him, becoming his lifelong companion. It's difficult to imagine how such a society will work, but the potential is much greater than the risk." □

MIND

COMPUTER'S PSYCHIC PAGE 26

who do not may experience this agonizing conflict of individualization and separation from their mothers during late adolescence. This is a particularly vulnerable stage of life when a young person is trying to achieve adulthood and separation from his parents. Conflicts from an earlier age are evoked at this time, and the pattern of self-harm may be the result.

Cutting and burning oneself may seem to be far-fetched substitutes for maternal contact, but from the DSH victim's point of view, he is experiencing a psychic release.

He focuses on the stimulating effects of the contact rather than on the act of inflicting pain," Pattison explains. "Afterward, he may feel embarrassed or ashamed, but he doesn't feel guilty. I can't help it," he says. "I have to do this in order to survive. So we think the act may be an attempt, paradoxically, at self-preservation."

Pattison and Kahran found that certain social factors, such as feeling isolated or having a disruptive family life, seem to provoke deliberate self-harm. Other factors associated with suicidal behavior—the recent loss of someone close or having a serious disease—are not related to DSH, although the syndrome may mark a person as a potential suicide risk.

No one yet understands why it usually takes about a decade for the syndrome to play itself out. But like other kinds of impulsive behavior, self-harm seems to have a kind of burnout phenomenon. It's as if they have finally begun to learn the lesson of life," Pattison says.

Many psychiatrists seem to feel that Pattison and Kahran have accurately described what is happening to many of their patients. These doctors are in favor of having DSH recognized by the American Psychiatric Association. "About half the cases of self-mutilation that I see fit into this syndrome," says Dr. Armando Favazzia, a University of Missouri professor of psychiatry whose book, *Shores of Life*, discusses the broader topic of self-mutilation as a social and psychiatric phenomenon. "I think Pattison is right in saying that we should define DSH as a separate syndrome. That would focus our attention on the behavior so that we might begin to think about what causes it and how to treat it."

For now, the medical establishment is experimenting with different ways to treat the bizarre problem. We try drugs, states Favazzia in a matter-of-fact tone. "If a patient tends to be a little psychotic, we give him medication. If he tends to be a little depressed, we give him medication. If he is a little anxious, we give him medication. We try and talk with him."

Therapy sometimes helps a person recognize his separation anxiety and learn how to cope with the panic he feels. "Unfortunately," concludes Pattison, "there are no fifty-dandy answers." □

COMING IN THE AUGUST

Omniv

SOULS ON ICE



They hover out on the edge of our solar system: four menmoth bells of ice named Europa, Ganymede, Enceladus, and Titan—the moons of Jupiter and Saturn. At some time in the future we may be sending robot hailprobes or even dolphin astronauts to their surfaces to look for the citizens of these ice worlds. Long ignored by astronomers and astrobiologists—those searching for life out there—these frozen satellites are now candidates for repositories of extraterrestrial life forms. Read the August issue of *Omniv* about the bizarre, eyeless, fishlike creatures that might dwell in the oceans of slush, methane rivers, and hydrocarbon snowfields of these distant moons.

PLANET HEALER



Wind and sun, fish and seeds—John Todd applies the tools of nature to “planetary healing.” Hie to the synergy philosophy of Buckminster Fuller, Todd has designed and built solar-energy and desalination projects, wind-powered fish farms, systems for reforestation. He has turned deserts green and transformed barren lands into tangled banks of vegetation. The founder of the New Alchemy Institute, Todd is currently designing a biosphere as tall as the Statue of Liberty for a cathedral in New York and has plans for turning the Big Apple into a network of canals and lakes.

CELESTIAL HORIZONS

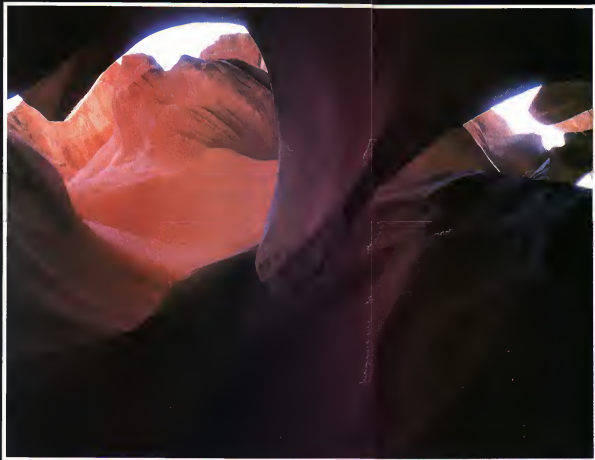


On the rocky terrain of Mars, in the whirlpool of Jupiter's magnetic fields, on the edge of Uranus's rings—up close, the worlds of our solar system display a dazzling array of colors, shapes, and geological activity. Earth is not alone in its majesty. In this month's *Omniv*, artist Ron Miller takes us on a guided tour of our solar system. Using the data gathered by Voyager and other space probes, he transforms the vision we have of our planetary companions into a beautiful reality.

NEW-WAVE SOFTWARE



Tired of zapping aliens and gobbling up yellow blobs? Mental relief from mindless video games is on the way. For the first time, software designers are interfacing programmers with artistic talent—painters, musicians, animators, writers, game designers. The result is programs—both fun and educational—that open up a new frontier of creative possibilities for computer interaction. With *Movie Maker*, for example, people with little computer experience can create fully animated cartoons using a few simple mnemonic commands. For youngsters, a program called *Little Tyland Junior* lets them compose musical compositions, draw pictures, animate shapes—and then combine those three components into a filmstrip. Still another game, *Movie Musical Madness*, lets older children act as writers, composers, and directors of what might be described as a computer musical. If *Donkey Kong* and *Pac-Man* are wearing thin, don't miss August's *Omniv*.



PHENOMENA

Some 100 feet below the earth, the light of the western sun bounces off glowing waves of gold, the sandstone walls of an underground canyon. Slot canyons like this one in Arizona, says photographer Tom Till, can be deceptively unimpressive from above. People may step over a crack in the ground without realizing that directly underfoot is a mammoth nook extending hundreds of feet. These grottoes, etched into the earth by seasonal floods, may be stone alleys no wider than a few feet, or large, cathedral rooms. This particular canyon—whose location he keeps a personal secret—is a favorite of Till's. He visits it often, rapping to its bottom, where he watches and photographs the kaleidoscopic play of light and color in the underground chamber as clouds pass overhead. Till recorded this scene on Ektachrome film, using a 65mm Super Angulon lens on a tripod-mounted Toyo field camera. **DO**

Your Mind is the Hub of the Universe



Know the Underside Of The Wheel Of Life

Around you revolve myriad Cosmic forces and energies. Silent, formless, they await contact with your mind, to be transformed into realities, substances, potential with vast possibilities. Extending from you—like spokes from the hub of a wheel—your senses reach out to draw these ethereal powers to the center of your being. Five of them—seeing, hearing, feeling, tasting, and smelling—are commonly known to you. However, to measure all existence by them alone is like trying to judge a great orchestration by the notes played on a single instrument.

From the underside of the wheel of life radiate other spokes, faculties of your mind—of which you are not aware, ordinarily. Only by their discovery and mastery can you increase your domain of intelligent living and accomplishment.

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There is an unused part of you, that is, potentiated with greatness. There are faculties of the mind just beyond the surface awaiting your command, not magic or fantasy—but little known natural laws. Challenge these statements. Let the *Mystery of Life* Book tell you how the Rosicrucians can help you know about your self. Not a religion.

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EARTH

CONTINUED FROM PAGE 15

Then they made comparison counts in two unsprayed forests. Their tallies speak eloquently: 24 bird and 5 mammal species remain in A Luoi valley, as opposed to 145 bird and 30 mammal species in one of the unsprayed forests, and 170 bird and 55 mammal species in the other.

Peter Ashton, director of Harvard's Arnold Arboretum, predicts that the slow-growing, valuable hardwood trees of the Vietnamese forests will need 150 years to regenerate and that some species may never return. A more optimistic assessment comes from Carl F. Jordan, of the Institute of Ecology at the University of Georgia, in Athens. He believes that defoliated forests may produce a restored canopy within the next half-century. And the government is now devoting considerable time and money to reseedling the coastal mangrove forests, which were destroyed by repeated spraying.

Surprisingly even after the war ended, the communists who united North and South Vietnam under one flag kept quiet about the agent-orange issue. Instead of appealing for help and sympathy, they played down the effects of chemical warfare. Even at the international symposium, notes Jordan, the Vietnamese quashed efforts by Soviet scientists to write harshly anti-American attacks into the final report. Why the silence?

The reason is purely pragmatic, according to Ngo Vinh Long, a Harvard-educated Vietnamese historian who is writing about the war. "The Vietnamese want to avoid a panic," Long avows. "The government is hiding the truth because 'they have no facilities for treating people' who would 'load the hospitals'."

In order to quell fears of those living in defoliated areas, Long continues, "monster babies who survive birth are being moved with their families to a special village north of Hanoi. But still, in the south, I saw kids with four legs and four arms."

In March 1983, shortly after the international symposium, however, a study of Australian veterans of Vietnam found "no evidence that army service in Vietnam resulted to the risk of fathering a child with an anomaly." The *New York Times*, reporting these results, noted that the Australian government had praised the study.

A just released \$11 million Air Force study of all 1,289 Operation Ranch Hand participants, however, highlights subtle and unexpected medical problems. Although none of the findings were statistically significant, the report notes that infant mortality and birth defects (primarily birthmarks) among the offspring of Ranch Handers are four times more common than might be expected. Among the men themselves, there was a 30 percent higher rate of skin cancer and a doubling in the incidence of genital urinary and ear-throat can-

cer as compared with an unexposed population of military men. To clarify these findings, the Air Force will conduct a follow-up study of the same participants five times over the next 18 years.

In the meantime, the Centers for Disease Control (CDC) in Atlanta, is collecting data on the effects of agent orange. The study, which CDC public-health adviser Robert Diefenbacher calls the largest epidemiological investigation of its kind, will include interviews with 30,000 veterans. Researchers will perform intensive medical examinations on 10,000 of them. The Veterans Administration has allocated \$54 million to support this work.

"We're looking at long-term effects of herbicide exposure, effects of 'Vietnam service' and the risk of contracting certain cancers, such as nasal, soft tissue sarcoma, lymphoma, and liver cancers," Diefenbacher says. Findings should be reported by 1987.

Clearly the final verdict is contingent upon the results of such longitudinal studies. Yet Dow Chemical Company and six other manufacturers of agent orange have been inundated with so many veterans' damage suits that they recently agreed to a surprise out-of-court settlement. Pooling their resources, the producers have created a \$180 million relief fund for servicemen and their family members who claim to have been harmed by the herbicide. Under the terms of the tentative agreement, the manufacturers deny liability for any health problems. The huge sum of money, however—the largest ever won by a class of claimants for wrongful injury—spells another story.

For many studies on herbicide damage will come too late. For others—especially the Vietnamese—there may be no remedies or treatments available. Ultimately research into what agent orange did to Vietnam may have the greatest impact on our future—as a deterrent and a reminder that technology itself is a blind power. We who invent it must also control its direction and limit its use. **CC**

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The official contest results of
the 2064 Olympics

GAMES

By Scot Morris

Last February we announced Competition #32, a special contest to describe the sports events that will be played in the 2064 Olympics. By then, we predicted many games will be played in space, on the moon, and in space habitats.

An extraordinary contest demands extraordinary judges. *Cyber art* director Elizabeth Woodson assisted the Games editor in picking the best illustrated representations of futuristic games. In judging the other finalists (best written description and best combined writing and illustration), we received generous assistance from former astronaut Buzz Aldrin and Gordon Cooper and from William Haynes and Ed Goldstein, of the American Institute of Aeronautics and Astronautics (AIAA).

Prizes in this competition were also extraordinary, and a grand prize-winner was chosen in each of the three categories. In addition, five runners-up received cash prizes of \$50 each.

The three grand prize-winners will be flown to Los Angeles during the third week in July to attend a series of special events commemorating the fiftieth anniversary of the first manned lunar landing. On Wednesday, July 18, they will be guests of honor at the AIAA's Space Week luncheon, at which Buzz Aldrin will be a featured speaker. Then, on the following Saturday, these three winners will attend the grand-opening reception for the new California Museum of Aerospace Science. The rest of the weekend, they will be given VIP tours of such local attractions as the Jet Propulsion Laboratory, Rockwell International's space-shuttle mock-up, and Hughes Aircraft's gigantic flying boat, the "Spruce Goose." In addition, the best entries will be placed on display at the California Museum of Aerospace Science during the first weeks of its grand opening, which will coincide with the 1984 Olympics.

Since this contest, Competition #32, is so timely, we announce its results this month, ahead of our report on Competition #31, which seeks new entries for *Cyber's* Fractured Dictionary. The results of Competition #31 will appear soon.

132 CMM



Schofield's *Space Flower Slalom*, chosen the best illustration of an event in the 2064 Olympics.

GRAND PRIZE WINNERS

Best written description

Spaceball. This is played in a spherical chamber ten meters in diameter, with six "goal holes" at locations north, east, south, west, "up," and "down." Each goal is identified by a different color. Likewise there are six rubber balls, each a bit larger than a softball, each a different color. The object is to be the first to score all six goals by getting each ball into its matching goal. A few seconds after a ball enters a goal, it is shot back into the sphere so that all the balls remain in play.

Players push off from the walls of the sphere, grab balls in flight and maneuver toward the appropriate goal. Dairing a ball out of an opponent's grasp is fair, as is a block or body check to knock him off course. A well-executed check can cancel an opponent's momentum and leave him stranded at center court. In singles play this usually means the end of the set, in doubles or in triples play a teammate may execute a rescue.

—Tim Rubin, Bend, OR

Best illustrated representation (above)

Space Flower Slalom. A test of man and machine, through a specially laid out asteroid field.

—Glen Schofield, Roseland, NJ

Best description combining writing and illustration (detail at right, page 133)

Coneball. The game is played under the rules of handball in a transparent, cone-shaped court. The playing cone rotates to produce 0.25 g, which allows server to gain the leverage necessary for a power serve. The base wall, against which balls are hit, does not rotate. An automatic win is scored for an "ace in the hole" when the serve is aces and exits the playing cone through the hole at its apex.

—Jonathan McComas, Raleigh, NC

RUNNERS-UP: \$50 EACH

Skydivers Over Jupiter (Painting)

—Michael Carroll, San Diego

Zero-g Pocket Billiards (55 Ball) Played in a spherical arena. The balls are racked in a tight 5 x 5 x 5 octahedron.



LAST WORD

By E. J. Gold

●Don't worry about those strange new sensations and cosmic thoughts. They're not important. After all, you're dead. What more can happen?

colorful. Here, as part of Lerner's continuing commitment to public service, we offer this primer on how to deal if you are going to die. So much misanthropism has been disseminated on the subject that we felt it was almost true that we finally set the record straight.

If you're about to die, you'll begin to notice several terrifying sensations and cosmic revelations as the phenomenal veil is ripped away, revealing, for the first time since the last time you passed away from the organic world, the endless, eternal, unrolled kingdom of the void.

At the same time, you'll experience a mind-boggling personal catharsis as you're purified at twice the speed of light into a dark and unknown world in which everything seems almost the same as it was before, only more so.

Don't worry about these strange new feelings and cosmic thoughts. They're not important. After all, you're dead! What more can happen? After you've taken death, you'll be able to look back on all this and laugh.

These sensations are useful for anticipating your quiet moments of passage. And if you've been practicing at our popular workshops, you will be able to use these sensations to call forth a sense of special psychological, emotional, and instinctive mechanisms, which will help you maintain a sense of equilibrium—above time—during the total loss of memory, vision, sensation, and identity you'll experience as you are dropped inevitably through the portal of death.

It's so easy to just accept your fate. Breathe a sigh of relief and fall face-first into your plate of spaghetti and meatballs, in total surrender to the perfect, shining, endless void, which is without objects, states of consciousness, identity, time, space, fixed parking lots, and those empty weekends you've been struggling to hold onto. When you have finally given up the effort of trying to maintain your organic head-bede personal identity, you'll understand the mystique of pleasant water by the roadside.

As the veil is ripped, you'll feel several sensations grouped together as a series of symptoms, the first of which is a heavy pressure, like molting into an all-wood union suit while wearing a pair of heat boots. Don't worry about this; you've probably got a good 15 to 30 minutes left to handle any but-minute details, and if you have a friend voicing your distress—and your friend is so inclined—you still have time for a wonderfully refreshing foot massage.

The second sensation will be a stunning crispness alternating with awning, as if your body were burning up. This is just one symptom of hypothermia, in which the body's heat is reduced to lethal levels.

Here, nothing to worry about—this stage is still controllable.

The third sensation is a definite feeling that your body is about to explode. You may actually feel that you've been blown to smithereens and dispersed by the wind. Now you have something to worry about! Passage is only moments away. Try to relax and think of something pleasant.

The fourth sensation isn't really a sensation—it's a total lack of sensation. Suddenly, although your mind has miraculously opened up and provided a breathtaking and profound view of all creation, it doesn't refer to anything. This vision plus 50 cents will get you a one-way ride on a city bus.

In addition to these sensations, there may be other feelings, psychological events, interludes, fugues, or other minor discords, which occur prior to passage from the organic world to wherever you're going. You might experience a loss of control over your facial muscles, causing an inquisitive or that unoccupied look usually reserved for high-school seniors.

You might periodically lose your hearing, or words and phrases that made sense before might not make the same sense they made before when you understood what they were saying by the words and phrases they might be understood and made sense before what you understood what they meant by what they said to you as you were listening.

There may be a loss of sight or radical changes in your vision. Vision vision. Your vision might be rigged, particularly if you're getting more than just a foot massage. It is possible that you will find yourself shivering or sweating and having an uncontrollable desire to remove your clothes and walk around. Unless you're expected to recover, this may well be a good idea. Who knows what last-minute adventures might be in store for you?

You may feel a lethargic calm descend over you. If you've spent your life as a lawyer or if you were on a graduate fellowship, you probably won't notice this. There might be a loss of attention, caused by talking over unconscious on the floor. You may notice that your breathing stopped several minutes ago and that you can't move your limbs. In this case, don't bother trying to talk.

When all these symptoms of approaching death have been completed, someone should gently whisper the following words into your ear: "So long, sucker, you're on your own." ☐

There's an excerpt from this book, *The Lazy Man's Guide to Death and Dying*, by E. J. Gold, published by BANTAM, Inc. Copyright © 1983 by E. J. Gold. Gold is a California-based acupuncture teacher who, as we heard, was still very much alive and breathing steadily