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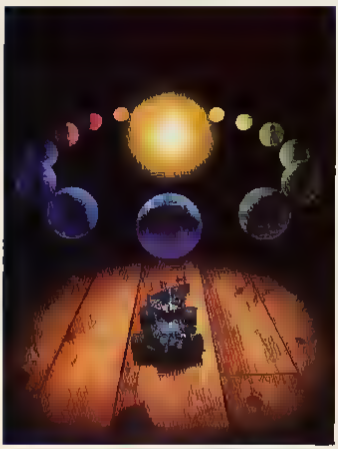

Freelance illustrator Tim White created Ring Around the Sun, *a high-tech vision of intrigue and espionage. A tiny armored emissary of Silicon Valley patrols the hardwood floors—observing, listening, storing and transmitting the secrets of the spheres. But to whom?*

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FIRST WORD

By T. A. Heppenheimer

"Better than a carload of computers in the classroom would be a new law allowing teachers to expel disruptive students and keep them out."

If you have ever had to read papers written by kids of high school age or younger, then you know how hard it can be to expect even legible handwriting and decent spelling or grammar, let alone writing that is worth reading. Now Manhattan's Bank Street School has done something about this. It has brought in word processors and set its ten- and eleven-year-old students to using them. As one of the school's teachers has remarked, "I've never seen so much excitement in fifteen years of teaching writing." Not only have the kids clamored for the chance to use these machines, but the teachers have been able to raise standards by demanding rewriting and revisions—a key to good writing.

Does this show that computers are the wave of the future in education? Not so fast. In a recent nationwide test of math skills, a number of thirteen-year-olds were asked: "An Army bus holds 36 soldiers. If 1,128 soldiers are being bused to their training site, how many buses are needed?" The answer is 32, the last bus carries only 12 soldiers. Of those without calculators, 24 percent gave the right answer. But of those with calculators, only 7 percent got it right. The rest said 31.33 buses, 31 buses, or gave a totally wrong result. Evidently they knew how to punch the calculator buttons, but they didn't know that they should check their result.

So it will not be enough just to plug in computers and calculators within a classroom and then announce that a new era in education has dawned. As these systems become commonplace, there will be increasing demands on teachers to use them effectively. English teachers may pay less attention to spelling and penmanship, more to the style and content of essays and reports. Math teachers may devote less time to drills in the multiplication tables, more to setting up problems and then checking and understanding the solutions. And in all this, there will be some significant problems. Plenty of today's teachers have large gaps in their knowledge of even the traditional three Rs. How will they cope in tomorrow's computerized schools, demand that they go beyond rote memorization, toward real education?

The average teacher's salary today is $17,644. Adjusted for inflation, that figure is 12 percent lower than in 1971. For many teachers the only way to pay their bills is to moonlight at gas stations or grocery stores. Thus the good ones often welcome the chance to take jobs in industry, where they can start with raises of several thousand dollars. The ones who stay behind are sometimes of doubtful competence. A typical teacher-competency exam may call for a new teacher, holding a B.A. degree, to read at the tenth-grade level and do eighth-grade-level math. Of the applicants taking such tests, 20 to 50 percent have flunked.

The schools themselves are too often hotbeds of bureaucracy and paperwork. As one New York City teacher recalls, "The administration failed to recognize negligence—except if you punched your time card a few minutes late." Still, red tape is often the least of teachers' problems. Some 100,000 of them are physically assaulted by students each year. Even worse, disruptive or violent students cannot be straightforwardly suspended or expelled. In a 1975 decision, the Supreme Court ruled that students accused of troublemaking have the right to due process. In other words, teachers who try to get rid of such students may face lawsuits.

Against this background, then, how will our school systems develop in this Computer Age? The question of education in the future is fascinating, but also elusive. Computers are methods of communication; they present messages. But that is not the same as education, which prepares the mind to respond to those messages. Today, such educators as McGill University's Glenn Cartwright and MIT's Seymour Papert hail the promise of the computer. But for decades, from the telephone and motion picture down through television to the video game, other new inventions in their time have been hailed as offering new means of teaching that would revolutionize education. Educators have shown recurrent bursts of enthusiasm for such novelties as the new math, the look-say method of teaching reading, "relevant" courses, and open classrooms. Yet between 1967 and 1982, the national average on the Scholastic Aptitude Test dropped from 953—out of a possible 1600—to 893.

So despite the claims of educators, it is hard to say that we have discovered all that much about education beyond what was known to Plato and Aristotle. There is still no substitute for an interested student and a knowledgeable teacher, and it is still true that "one must learn the thing by doing it." Since 1960 we have seen that it is all too easy to present students with distractions and call them new forms of education.

Far better than a freight-car load of computers would be a Supreme Court decision allowing teachers and principals to expel disruptive students and keep them out. Education, finally, is discipline. That is what is too often missing today, and what no advanced electronic systems can restore—even if the school district can afford computers and can protect them from theft or vandalism. Let us pay teachers decent salaries, kick out the troublemaking students, and foster an atmosphere where merit is the key. Then we will do much more for education than the best computer wizards. ∞

T. A. Heppenheimer, whose Man-Made Sun will be published by Little, Brown in 1984, is a frequent contributor to Omni.

CONTRIBUTORS

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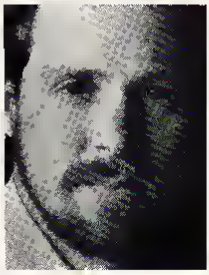

STARR


DAVIS


DOZOIS


CADIGAN


WISWELL

Receptor cells deep in the human nose translate the scents of perfume or freshly baked cookies into dense bundles of electrical signals. Then the data of roses or chocolate race directly through a neuronal network: from the nose to one of the most primitive sections of the brain. The system is sensitive enough in some people to detect one hundredth of a trillionth of a gram of a substance. Yet some people smell nothing. They are "smell blind" or anosmic.

Those are just a few of the fascinating facts picked up by freelance writer *Joel Davis* while researching "Smell Lab" (page 44), a profile of the Monell Chemical Senses Center in Philadelphia. Davis went nose-first into the center to see what the country's preeminent taste and smell scientists are discovering. Amid the aroma of guinea-pig pheromone (cheesy) and wild-boar sex pheromone (strong to some people, absent to others), Davis learned that the researchers are looking beyond their noses. Discoveries at Monell may have an impact on such fields as birth control and the war on cancer.

"The people at Monell were quite helpful and friendly," says Davis. "And even though it may be unprofessional to play favorites, I especially enjoyed my time with Chuck Wysocki. He is the first person I've ever met who could talk during lunch about urine-sniffing mice and not make me lose my appetite." Davis's first book, *Endorphins: New Waves in Brain Chemistry*, will be published by Doubleday in June.

"Video Worlds" is a wide-screen look at the fantastic world of computer video games. On page 54 freelance writer *Phil Wiswell* examines the newest breakthroughs in video-game design—laser-disc technology, three-dimensional TV effects, voice synthesis and recognition, and telecommunications. And he forecasts what we will be playing five years from now. Can we expect interactive movie theaters with joysticks for everyone? Or video games controlled by brain waves?

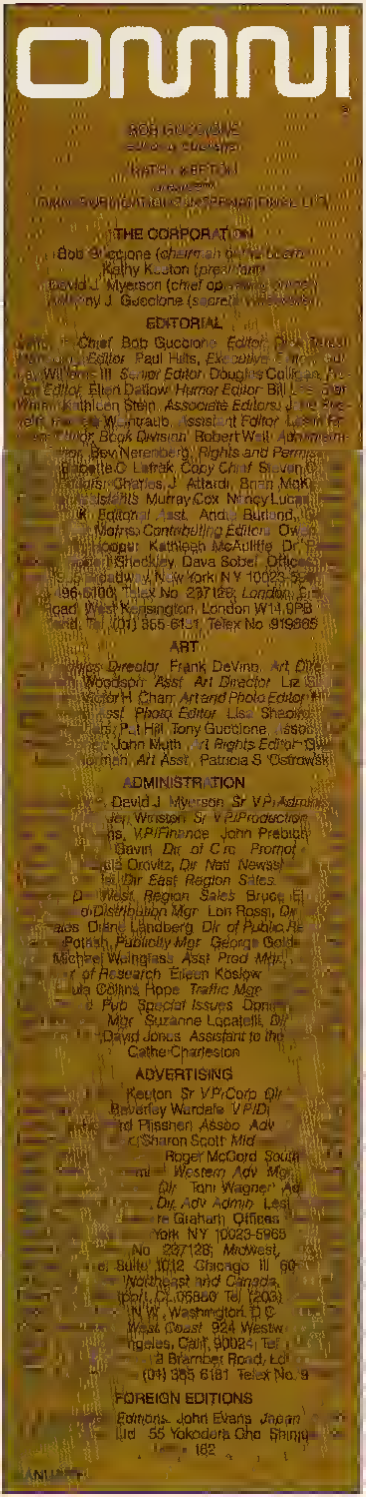
To explore such questions, Wiswell spends most of his time behind a computer screen critiquing new computer and video products. "I have a collection of one thousand computer video games," he says. "In a typical week, I receive fifty new products. Yesterday I got twenty-four packages, and the day before twenty-five. During holiday seasons UPS keeps pulling up outside my home."

While video games grow increasingly fanciful, medical technology is providing us with an increasingly realistic view of the body. The medical data appear on-screen in vivid splashes of color that rival the graphics of games. But what doctors are watching with growing interest is a Positron Emission Tomography scan, or PET. The scan is the product of a new computer-aided device that gives scientists a look at the human brain and other organs in action.

For years this combination of nuclear physics, computer science, and medicine has offered startling pictures. Yet only recently have scientists realized its enormous potential. Now they're using this doughnut-shaped machine to investigate aging, insanity, and a host of unexplained conditions, from Alzheimer's disease to Huntington's chorea. Many say there's no field of medicine that won't benefit from PET's probing. Writer *Douglas Starr* traveled to PET centers throughout the country, on page 84 he reports his findings in "A Window on the Living Brain."

Our fiction offerings this month include a story of a man and a young boy who face the aftermath of a worldwide conflagration together. In *Gardner Dozois*'s eerie story "Morning Child" (page 78), father and son are forced to adjust to far more than the destruction of their town. Dozois has written and edited 16 books, including the annual anthology *The Year's Best Science Fiction*, published by Bluejay. He and Jack Dann recently coedited the anthology *Unicorns!*

"Variation on a Man" is *Pat Cadigan*'s third story in the "Deadpan Allie" series. Allie is a pathosfinder, a person who hooks into another person's mind to help work out psychological problems. In this selection, which begins on page 68, Cadigan asks the haunting question: Who might I be if I were someone else? Cadigan writes and edits for Hallmark. She has just completed a novel, *Captives*.



LETTERS

COMMUNICATIONS

Illusive Coeds

As you may well imagine, when the May 1983 issues of *Omni* appeared here in Fayetteville, they disappeared quite quickly. As a result, we have heard about William Stuckey's article "Ozark Mountain High" only from subsequent letters to you and from secondhand reports.

It was with great dismay, however, that we, the fraternity that sponsors the "Go to Hell" party, read the disparaging and deleterious comments made by Jennifer Raich [Communications, August 1983]. If the coeds in question exist only in Stuckey's mind, then most of the people we know here are suffering from some mass delusion. That's fine with us, and may the good Lord preserve us from a cure (as well as "representative coeds" from Minnesota).

May "incredible numbers of attractive young women in GO TO HELL T-shirts and spray-on jeans" infest every college campus in North America, especially in Minnesota, where they are evidently in short supply.

Barney Clark
Secretary
Alpha Kappa Lambda
Fayetteville, AR

Not Sleeping on the Job

After enjoying several issues of *Omni* and relying on its consistent quality and its factual articles, I was appalled to read Arielle Emmett's article "Death by Anesthesia" [The Body, July 1983]. Unfortunately, Emmett's lack of knowledge and understanding of anesthesia is probably commensurate with that of the general public. My CRNA [Certified Registered Nurse Anesthetist] colleagues and I appraised the facts presented and found them to be outdated and sloppily researched.

We are aware that much of the information presented is from Canadian sources, where only doctors and not nurse anesthetists administer anesthesia. The United States, however, recognizes that human beings other than doctors can assimilate information and has given registered nurses the legal right to become CRNAs after completion of an accredited course of specific anesthesia study and a board examination.

We are also aware that not every individual, even if he or she is properly trained, is capable of handling even the smallest technical problems, such as detecting improper placement of a breathing tube. Regardless of the fine training available in numerous medical centers across the country, not everyone who completes the full training course is an acceptable choice to administer anesthesia to me, or to anyone else. Much to our disappointment, not every person who completes *any* advanced course of training emerges as an expert automatically.

The bottom line is: people must be aware of the anesthesia and the surgery they and their insurance companies buy. Most important, they must decide whether the procedures are necessary.

There are no guarantees with any anesthetic. No one knows how an individual's body will react to a foreign substance injected into it. We rely on an aggregate of past experiences and then do our damnedest to give a safe and effective anesthetic.

Mona Early
El Paso, TX

Arielle Emmett replies: *I stand by my story. Statistics and incidents of mortality or morbidity related to anesthesia administration were taken from cases documented in the medical literature and in court cases cited in* The Globe & Mail *(Toronto), Canada's newspaper of record. Information concerning the training of anesthetists was taken from interviews with leading American anesthesiologists, including the chairman of the anesthesiology department of a major New York medical center. By no means did I intend to suggest that trained nurse-anesthetists in the United States are ill-prepared to perform anesthetic procedures. But shortages of well-trained professionals may indeed be a hazard—in the United States, Canada, or anywhere else in the world.*

DIALOGUE

FORUM

Omni 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.

Versions of Kahn

There are many cutting remarks that I could make about James Reston, Jr.'s article "The Wrath of Kahn" [September 1983]. I choose, however, not to stoop to Reston's level of innuendo and snide commentary. Still, there are several things that should be said in order to set the record straight.

1. Herman Kahn never espoused Republican positions. Reston's contention that Kahn adopted a partisan view of the future is related to Reston's own prejudices and his misunderstanding of the project. Our goal has always been a balanced presentation of issues.

2. There were 45 teachers involved in the Phoenix project. Reston interviewed 15 of them. Why did he choose to report the findings of only one interview? Did the others not reflect his predisposition? Why didn't Reston use the information provided to him about the attitudes of teachers and students?

3. Reston writes: "When a 400-pound man looms over you in a rage, you listen." I suspect the article reflected Reston's revenge. Since he didn't have the courage to stand up to Kahn, he delivered a cheap shot in his article.

Herbert London
Director
Visions of the Future
Hudson Institute
Crofon-on-Hudson, NY

James Reston, Jr., replies: *As the architect and now executor of Herman Kahn's bequest of optimism to American youth, London has much at stake in a nationwide propagation of the Visions program. His response to my article was predictable.*

I couldn't help wishing that Herman Kahn had lived well into the twenty-first century, if only to be confronted by the adult versions of the high-school students he so destructively misled in the Eighties. He taught them to be "insensitive" and, worse, not to believe that there are vast problems confronting our species. Kahn scoffed at the threat of population growth, the explosive nature of which can be confirmed by any kid with a calculator and a reference book. He pooh-poohed environmental concerns, although the Cousteau Society has estimated that 40 percent of all life in the sea has perished in the last few decades. Rather than teach the young to doubt the reality of the global crisis, we should teach them that our problems can be solved if we face the dangers squarely and roll up our sleeves.

David Smith
New York City

I agreed with Herman Kahn completely until I read the last part of the article. In the next to the last paragraph, the Metro Center, a large Phoenix shopping mall, was idolized as illustrating the intersection of "ancient human yearnings and the bright promise of the future." This "mini-city" is 160 acres of totally artificial environment. Steel, concrete, and glass dominate the decor. The mall's whole reason for being is consumerism, not to provide a positive environment in which to learn and grow.

Nevertheless, I applaud Kahn for his optimism and for trying to affect change through positive means.

Daniel Huff
Phoenix

Your article on Herman Kahn was a joke. Practically every line was directly or indirectly critical. That level of criticism would be acceptable if it were also fair, accurate, and reasonable. But instead you turned Reston and his arrogant liberal ideology loose on Kahn, a man way beyond Reston's intellectual horizons.

Those of us who were fortunate enough to know Kahn personally were well aware of his frailties and excesses. But introduce me to a man with more conscience, show me someone as tolerant or as cosmopolitan as he. Let me meet someone from whom I could learn even one tenth as much as I did from Kahn.

Patrick Gunkel
Cambridge, MA

It came as a shock to me to learn that, according to Kahn, I am not an optimist. I've always considered myself one, but maybe I am actually a realist. In Kahn's Visions course, "students learn to dismiss environmental concerns and to disregard the possibility of nuclear war. And Kahn's students are taught to read all the other bad news in the papers as a mere swirl in the Great Transition." This sounds more like sticking your head in the sand than like optimism.

The solutions to our problems will come through hard work, not by ignoring the issues and wearing rose-colored glasses.

Teri Heckenmueller
Cincinnati

The apocalypse is not inevitable. Okay, I follow Herman Kahn that far. But when students are advised not to "overconcern themselves with any of these fashionable preoccupations" (world hunger, overpopulation, greedy waste of natural resources), my inner alarm goes off. I gladly add my wrath to Kahn's in humbugging the doomsayers who would have us throw science and technology to the wind and sit shivering in our lead-lined basements waiting for the "big flash." On the other hand, I am not going to be a "good little citizen" and assume that the powers that be will handle all our problems without me. I find little reason to believe that their methods would be compatible with mine.

The optimism that is needed to solve our problems will not come from our high-tech bureaucracies. It must come from each and every one of us taking responsibility for our lives and welfare.

R. C. Henderson
Monterey, CA

THE METEORITE MAN

EARTH

By Bill Lawren

Robert Haag is talking fast. "When a meteor comes in," he says, "there's a big tantare. It whistles, it hisses. It spins. It leaves a trail of smoke. When it breaks up in the atmosphere, each piece makes a sonic boom so that it sounds like a machine gun going off or a train coming."

"If you can hear all that," Haag says, "you're within thirty miles."

Haag heard "all that" one night as a teenager, when he was camping on a beach in Mexico. Although his search for remnants of the meteorite proved fruitless, he was hooked from that day on. Now some 15 years later, Haag—whose long, curly hair and muscle T-shirts make him look more like a rock musician than a rock hound—is one of the world's leading meteorite merchants. He has globe-trotted to Brazil, Mexico, Australia, and all over the United States in search of what he calls "visitors from outer space," and he has sold, traded, or donated meteorite specimens to the British Museum, the Smithsonian Institution, the Goddard Space Center, and a long list of universities, museums, and private collectors around the world.

He calls himself, predictably enough, the meteorite man.

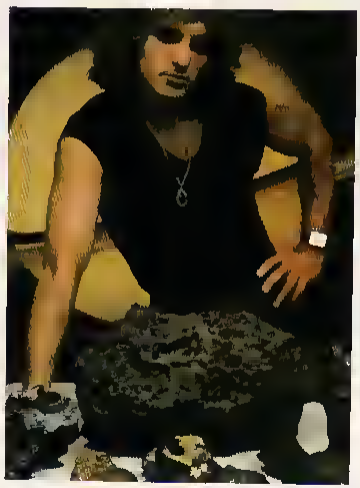
Ever since hearing that sonic boom on the beach in Mexico, Haag has thought of little else. Leaving the University of Arizona after two years as a geology student—"In geology classes, I never heard one word about meteorites," he says—he struck out as a surveyor and mine driller. But his first love was never far from his mind. Three years ago, when precious-metal prices started to fall, rendering his full-time job less lucrative, Haag moved into meteorites. "There are only about fourteen new falls a year in inhabited places," he reasons, "so I knew the demand would always outweigh the supply."

Haag's serious pursuit of the extraterrestrial visitors began in 1978 with an arduous trip to Mexico's remote Valle de Allende. The biggest stony meteorite in history—a two-ton, 4.6 billion-year-old carbonaceous chondrite (a carbon-rich meteorite)—had fallen there in 1969.

After combing the area and questioning hundreds of locals, he finally managed to find a man who still had ten specimens. "I was ecstatic," Haag says. "I really couldn't believe it. I bought them all."

Using the Allende stones for sale and trade bait, Haag began to build his collection, and as time went on, his expertise grew. He had to learn to make positive identifications of meteorite candidates. "There's a lot of mythology about meteorites," he cautions. "For one thing, they are *not* full of holes. For another, they're not glowing hot when they hit the ground. They've been cold-soaked in space at minus two hundred degrees Celsius for millions of years, so the heating they get when they pass through the atmosphere is just superficial. Actually, when you find them they're often so cold to the touch you can't even pick them up."

To identify a meteorite, Haag says, "I look for a heavy, smooth rock with a black fusion crust [formed when the meteor passes through the earth's atmosphere] on the outside. If a magnet sticks to the specimen and I can see metal flakes, then I have it tested for nickel. If it has seven percent nickel or more, then I know that it's a meteorite."



Robert Haag with some of his prize specimens.

Haag has also developed a method of *finding* meteorites in the first place. In 1978, when a large meteor fell in Nuevo Mercurio, Mexico, for instance, he determined the coordinates of the landing and took the train to the nearest junction. Then he walked four days to what the maps told him was the nearest town. "Nobody there knew what I was talking about," he says. Finally he found a village of four houses where people had actually been hit by the falling stones. He told the villagers he'd buy anything they found. "I've been down there five times since," he says. "I'd say I've got seventy to eighty percent of the entire fall."

Haag's itinerant expeditions are not without their risks. On one trip to Sinaloa, Mexico, he was trapped for three days when monsoon rains washed out dirt roads that had been barely passable before. "It was the closest I've ever come to being killed on an expedition," Haag recalls. "At one point I almost stepped out of my truck and right over a three-hundred-foot cliff."

Physical risk is by no means the only problem Haag faces. Since he himself finances what is always a speculative venture, every trip is something of a gamble, and many go entirely unrewarded. Moreover, well-meaning but ill-informed amateurs continually send him samples of rocks they think are meteorites but aren't. "I get three to four samples a week," he says, "and in two years only one of them has turned out to be a meteorite." In one case Haag almost became the victim of an outright fraud when a man from New Mexico took a hunk of iron, smelted nickel into it, used a blowtorch to blast it into a meteorite shape, and tried to sell it to Haag for $2,500. "The only way I could tell that it wasn't a meteorite," Haag says, "was that it didn't have any Widmanstaetten figures—tiny crystals that can form only under the special conditions found in outer space."

CONTINUED ON PAGE 117

ROPE TRICKS

SPACE

By James E. Oberg

A hot-air balloon floated peacefully between the dark-blue sky and the thick, yellow-tinged cloud bank below. Underneath the inflated sphere a small gondola dangled motionless over Venus.

The gondola was packed with samples of the surface and subsurface rock snatched by a computerized scooper from the hellish planet below. Now a small unmanned vehicle plunged from the sky to retrieve the samples.

Trailing behind the arrow-shaped vehicle was a nearly invisible but sinewy filament, a line connected to the mother ship orbiting above.

The arrowhead angled directly toward the balloon and was preceded by a sharp sonic boom. Tension on the line increased, slowing the plummeting vehicle. Small fins guided it toward its target with the help of an on-board computer designed originally for precision reentries of thermonuclear warheads. The arrowhead homed in on the balloon and tore through it amidships. As the balloon collapsed, hooks extended from the arrowhead, converting it instantly into a grappling iron. The spiky probe reversed its motion and began moving upward under the force of the line. The hooks caught onto the skin of the balloon and pulled it along with the still attached gondola, higher and higher.

Standard scenarios of twenty-first-century spaceflight generally depict bigger, faster, and more efficient spaceships—extensions of the technologies already familiar today. Too many spaceflight prophets fail to take into account the likely advent and radical effect of completely new ideas.

One such idea, slowly gaining recognition, may revolutionize space-station architecture, Earth-space-Earth transportation techniques, space propulsion and power systems, and—as in this imaginative vignette—interplanetary probes. The idea is space tethers.

As applied to space missions, *tether* means simply a long line connecting two or more space vehicles. The line can be tens or hundreds of kilometers in length. Current materials—such as Kevlar—can be applied to building tethers with potentially revolutionary applications to space operations in the near future.

Last year NASA and Italy's space agency signed an agreement to fly a joint mission in 1987 involving an Italian spacecraft and an American tether system. The spacecraft is to be reeled out 100 kilometers from the shuttle, like bait at the end of a fishing line. The "bait" will be cast upward to investigate ionospheric physics and downward to make long-term measurements of the earth's upper atmosphere.

The TSS, or tethered-satellite system, consists of the deployed payload, a boom extending upward like a fishing rod out of the shuttle's payload bay, and a reel assembly with tens of kilometers of cable. During the initial deployment from the mother ship and during the final minutes of retrieval, small jets on the payload keep it in the proper position.

Suppose the payload now hangs beneath the shuttle, closer to the earth. The tether in this case does not bear the subsatellite's entire weight. In fact, the line provides only a small fraction of the force keeping the subsatellite up. The reason is that the payload is "almost" in orbit—that is, it is going only a little bit more slowly than a tree-flying satellite would be going at that same altitude. The tension on the space tether provides only enough force to compensate for this small energy deficit.

Tethered vehicles "fishing" in outer space

In general, two tethered objects may be in a stable orbit, but the lower object is flying slightly more slowly than a stable free-flying satellite would, and the upper object is flying slightly more rapidly. The center of mass of the tethered system, located somewhere along the cable between them, is flying at precisely the correct velocity for a satellite at that altitude, whether it's a point mass or an extended structure.

Now imagine that the tether is suddenly cut. In an instant the lower satellite becomes a free-flying object without sufficient speed to maintain its orbit. So it falls into an orbit closer to Earth. But the upper object has an excess of energy over that needed merely to maintain a circular orbit at its altitude. So its orbit rises somewhat. The physics of the situation make possible an amazing array of applications for space tethers.

Here is one. A space shuttle today burns substantial amounts of rocket propellants to perform its "de-orbit burn" at the end of a mission. A decade from now an American space station will need to carry a significant amount of rocket propellant to boost its altitude against the slow orbital decay caused by aerodynamic drag. If a space station were tethered to a shuttle, both loads of propellant would be unnecessary. In orbit, the station would unreel the shuttle toward Earth. The winged vehicle would hang there until the end of the mission. Then, unlatching the tether would drop the shuttle toward home. At the same time, the space station would rise to higher orbit—all for free.

From a physicist's perspective, this spectacular payoff is the result of a simple trade. While momentum of the entire

CONTINUED ON PAGE 120

PLUMMETING PRINTERS

ARTIFICIAL INTELLIGENCE

By Owen Davies

It seems like only yesterday that computer-driven printers—the buzzing or clattering machines that convert delicate electronic data into "hard copy" on paper—cost more than the computers themselves.

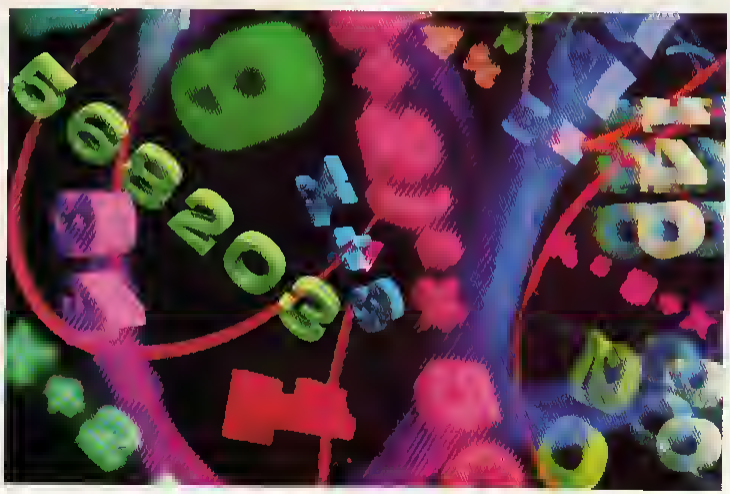
Yet the price of putting your data on paper is dropping as quickly as anything in the tab-slashing micro market. The cheapest machines so far are dot-matrix printers, which form printed letters from sets of dots. One printer capable of putting 80 characters across normal-width tractor-feed paper cost $1,000 or more only three years ago. Today more than a dozen dot-matrix units are list-priced at $600 or less. Daisy wheel printers—which punch out typewriter-quality characters using a daisylike "print wheel"—sell for barely more than that. And more costly dot-matrix printers are achieving speed, reliability, and quality far beyond those of earlier models.

Behind this trend is a combination of careful engineering and new technologies that promise to bring even lower prices for inexpensive printers, and more speed, reliability, and print quality for medium-range models. Among them:

- Dot-matrix-printer refinements. Three years ago most dot-matrix units picked out their lettering in a fairly crude rectangular pattern, five dots wide and seven high. Today it's difficult to find a printer that retails for more than $500 but uses a matrix smaller than nine by seven. The $699 Okidata 92, for example, has a 13-by-17 matrix. Two models from Diablo Systems, the 11/A and 31/A ($750 and $1,050, respectively), use a 16-by-35-matrix to produce nearly typewriter-quality print.

  In the upper price ranges, multiple typefaces and print speeds are increasingly common. The Anadex Silentscribe, with a list price of $1,845, tops out at a startling 200 characters per second.
- Simpler circuits driving daisy wheels. Fairly standard, if slow, daisy-wheel printers have already fallen well below $1,000. But the real revolution comes bundled with Coleco's Adam computer system. Slow—the company claims their daisy-wheel device turns out about 20 characters per second—the Adam printer is also extraordinarily cheap. It's included with the computer for a total cost of $600. Most of the savings spring from the substitution of an inexpensive "stepper" motor for the precision motor that usually turns a printer's daisy wheel. The stepper motor spins the print wheel exactly where it's needed, without complicated control electronics. Other makers are sure to adopt the idea, and when they do—later this year—the $300 daisy wheel printer could become a reality.
- Inexpensive ink-jet printers. These models use a miniature squirt gun—sometimes several of them—to shoot dot-matrix letters quietly onto the paper. Capable of printing 40 characters per second, Olivetti's PR-2300 lists for only $599. Several ink-jet printers offer seven-color printing. Diablo's entry costs $1,250. Canon's A-1210 offers 40 characters per second for only $795. And PrintaColor's TC1040, at $5,495, prints an amazing 4,913 different colors.
- Somewhere over the horizon waits the affordable laser printer. These superfast superquiet wonders work like plain-paper photocopiers. A laser beam scribes your message onto the surface of a semiconductive cylinder. Then inklike toner is deposited on the cylinder, adhering where the letters were written, and is pressed onto the paper. The result is nearly silent printing with quality that approaches that of a typeset page—at up to 7,000 pages per hour. Unfortunately, these magical devices cost $5,000 and up. But that may change. "We are now seeing a battle between the ink-jet and laser technologies," says Jeff Stenehjem, product-planning manager at Diablo Systems. "At the moment ink-jet printers seem to be ahead because they offer high performance for much less money. But as the technologies mature, laser printers could well catch up. There is no doubt their price will soon plummet."

Whichever technology wins, the home user is sure to come out ahead.



New generations of printers rapidly convert ephemeral electronic data into hard copy

THE ARTS

By Janet Bladow

From her castle the princess cries for help. A tail-flapping dragon holds three not-so-brave Lancelots at bay. As the drawbridge raises and lowers over the castle moat, forest creatures scurry in the grass. Meanwhile down the street, an oversize tricorner, a hard hat, a nurse's cap, an astronaut's helmet, and a fireman's hat lead an enormous eagle. As the hats spin and weave around the big bird, the feathered beast lowers its massive tail, raises its wings 44 feet into the air, and rotates 180°. Then it stretches its wings out to a full 88-foot span, opens its beak, and emits a bloodcurdling screech as "Stars and Stripes Forever" fills the air.

Such are two major floats entered in the Thirty-Sixth Annual Tournament of Roses Parade, in Pasadena, California. But as millions sit before their televisions with beer and chips and wait for the big game to start on January 2, they will also witness a kind of floating history of mechanical ingenuity, from the simplicity of a bell crank to the complexity of a Rockwell System 65 computer. High tech has come to the Rose Bowl, but fiberoptics haven't completely surpassed pulleys and levers when it comes to animating leviathan superstructures.

The computerized Rose Bowl parade isn't here yet, and it doesn't have to be, states Rick Chapman, president of Festive Arts, Inc., builder of the parade's biggest float. His company built the American eagle, and he is a staunch defender of the old-style float design. "Our main objective is limited to building physical armatures to puf flowers on," he says. "That's what this parade is all about. You can get only so fancy. Now the Cal Poly kids use computers that are donated to them, and I think that's terrific. But they've found a one hundred-thousand dollar solution to something we can do for one hundred and fifty bucks."

The Cal Poly kids Chapman is referring to are students from two campuses of the California State Polytechnic University—at Pomona and San Luis Obispo—who have jointly been building computerized floats for the parade since 1977. This year's offering, "A Knight to Remember," is an animated castle that looks medieval but is technologically light-years ahead of the other floats. Whereas Chapman relies on humans to man switches that start and stop the eagle's wings, the Cal Poly float uses a computerized command system that sends orders to various moving parts.

A Knight is the design of a 40-person committee, and more than 400 student volunteers devoted about 25,000 hours of labor to it. By Thanksgiving the San Luis Obispo students had built their half of the float (the rear section of the castle and the moat) and transported it to the Pomona campus. Then animation construction began. The animation is powered by a modified Rockwell System 65 eight-bit microcomputer. Two Pertec 5.25-inch, 35-track, single-sided, single-density disk drives store 80K of float data each. The System 65 is connected to a new animation control panel (ACP) by custom-designed, 64-bit serial fiber-optic cables. Light is used to transmit information to the ACP, which then transmits a command to electronically controlled solenoids. They in turn regulate the amount of hydraulic fluid passed to each cylinder. "We always try to introduce to the float something that represents the state of the art. This year it's fiberoptic cables," says Ron Simons, director of public affairs at Cal Poly, Pomona.

The computer is programmed to store the commands—the sequence in which things will move—one action at a time, although several movements may occur simultaneously. That is, the ACP is capable of handling 32 hydraulic movements. But by doubling up, some 45 separate motions are programmed, allowing several elements to move at once. Action is clocked by two 6532 RAM-I/O-Timers (RIOTs). Backing up the computer is a hardwired Master Animation Controller (MAC) and a series of manually operated switches. Since the computer has never failed, neither MAC nor the manual switches have ever been employed.

In addition to hydraulic controls, Cal Poly students utilize electric circuits powered by heavy-duty 12-volt industrial

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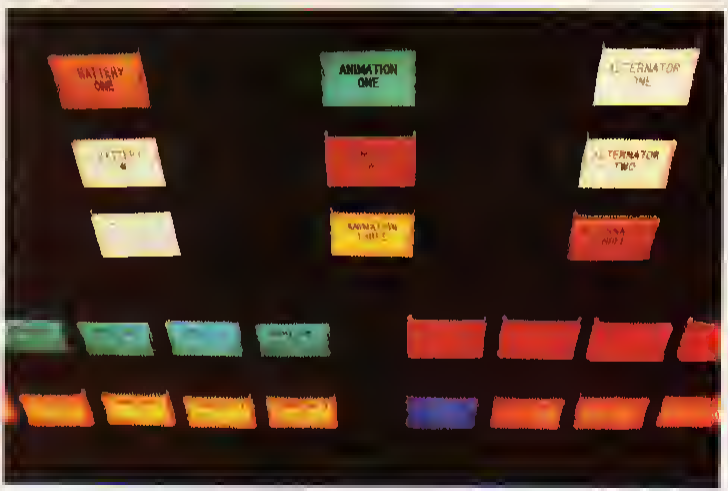

Computerized command systems are the behind the scenes event at the Rose Bowl parade

TECHNO-ERROR

MIND

By Richard Wolkomir

To err may be human, but in our High-Tech Age the consequences can be disastrous. The bullet train leaves the track at 150 mph. The chemical plant erupts. The robot runs amok. Sorry, folks.

Minimizing the chances for such slipups is the aim of a team of engineers and psychologists at Brookhaven National Laboratory on New York's Long Island. By studying how the human mind interacts with complicated machinery, these researchers are reducing human performance to a series of algebraic equations. Given a set of appropriate data—a particular piece of equipment, a given set of circumstances, a typical set of workers—these equations predict what the chances are for a blunder.

It was perhaps the most notorious potential technological calamity, the near-meltdown of Pennsylvania's Three Mile Island nuclear-power plant, that got the Brookhaven project started four years ago. "Once we began to study what happened there, human error kept popping up," says engineer Robert Hall, who heads the Brookhaven group. He notes that many technologies, from aviation to energy, are vulnerable to worker error. Although the outcome of the Brookhaven study should affect many industries, the team is focusing its efforts on the country's 80 nuclear-power plants, where the smallest error could snowball into a major mishap, like a meltdown.

Unlike traditional ergonomics or human factors research, which asks such questions as Is this light too dim or too bright? or Should these dials be in red or blue? Hall's group assesses the way the human mind functions. The group wants to know how people make decisions, or make mistakes, especially under pressure.

"The time it takes to make a decision is critical," says Hall. "If time is tight because you're stuck on a freeway with a stalled car and you're late for an appointment, you might keep trying the same adjustment over and over, even though you know deep down that it's wrong. But if you have the whole afternoon to think, with the car in your driveway, you might come up with the right move."

The Brookhaven group is trying to see how workers perform, as Hall puts it, "when all bets are off, when there are no normal operating procedures to follow because what has happened is out of the ordinary." The group is also developing equations to predict the chances that a worker will follow up one mistake with a second mistake, and then a third, and so on. This is especially important in nuclear-plant safety because of the designed-in redundancy that is generally employed.

"You might have not one but three pumps for the cooling water," explains Hall. "One will be a diesel, one will be electric, and one will be steam driven, to avoid a factory defect [that might] appear in all three. But what are the chances that a worker who has flipped the wrong toggle switch on the first pump will also flip the wrong switch on pumps two and three?"

The Brookhaven research has identified several ways in which the human mind trips itself up when involved in operating high-tech equipment.

- *Perseveration.* Having made a decision, you stick to it without wavering and do not reconsider even when new evidence suggests you are wrong.
- *Task fixation.* You become so preoccupied with one task, probably trivial, that you overlook more important tasks. Hall cites the Eastern Airlines flight that crashed in the Florida Everglades in 1972. The crew were so concerned about a faulty landing-gear indicator light that they forgot to check their altitude.
- *Alternation.* You keep changing your decision, even though the information on which it is based remains constant.
- *Short-term memory overload.* In the middle of an accident, with so much information of all kinds coming in, you run out of room in your short-term memory and don't retain important data, such as meter readings.
- *Internal models.* As an experienced nuclear-plant operator, you have stored in your brain a model of how the plant behaves. But you have probably never

Nuclear power plant. Can new decision-making equations prevent a Three Mile Island II?

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CONTINUUM

PLAYING DICE WITH THE UNIVERSE

To the casual observer, it was just another arcane scientific experiment. Physicists Alain Aspect, Jean Dalibard, and Gérard Roger energized some calcium atoms with a laser beam, waited for each atom to emit a pair of photons, and then carefully measured how these bits of light flew off in opposite directions.

But this enigmatic exercise was more than pure physics. The three researchers, working from the Institute of Theoretical and Applied Optics, in Orsay, France, were actually on a philosophical quest, seeking the rules by which the universe plays. Is it a game of chance, they were asking, or does nature perform like a well-oiled machine, steady and predictable?

In the closing years of the nineteenth century, smug Victorian scientists would have opted for the latter assertion, believing that all processes in the universe were precisely calculable. Sir Isaac Newton himself ushered in this Age of Determinism two centuries earlier, when he successfully calculated the motions of the far-flung planets with his law of gravitation.

But something went amiss when man attempted to apply these classical laws to the workings of the atom, an entity 1 billion times smaller than a golf ball. In fashioning the laws of this submicroscopic world (laws later dubbed quantum mechanics), scientists came to see that atomic particles behaved with less predictability than such ordinary objects as pencils or desks. Light, for one, could behave like either a particle or a wave, depending on the experiment. And one could never know both the position and the velocity of an atomic particle at the same time. The reason: The measuring instrument was so large and the particle so small, the physicists said, that the very act of measuring one parameter was bound to change the other.

Physicists as notable as Einstein railed against this uncertainty. They conjectured that quantum mechanics was merely an approximation and that if science delved a little further, it would find other variables—variables now hidden to us—that would enable man to describe atomic processes exactly.

To make his point, Einstein even posed a thought experiment. He proposed a situation in which two closely connected particles were suddenly flung miles apart. Physical law says that two such particles should possess equal but opposite properties. Yet according to quantum mechanics, the properties will remain unspecified until one of the particles is measured.

As far as Einstein was concerned, this presented a problem. If the two particles were always equal but opposite, and neither had any properties until one was measured, then the mere act of measuring one would bestow specific characteristics on the other, even if the two were separated by thousands of miles. This, said Einstein, would violate the principle of local causality, which holds that events cannot be instantaneously or directly influenced by distant objects. Taken to the extreme, this might mean that a fire in Los Angeles could instantaneously affect a schoolhouse in Peking. Incredibly, communication would be faster than the speed of light.

The philosophical debate over Einstein's thought experiment raged for years. Then, in 1965, physicist John Bell suggested that certain laboratory experiments could decide which scheme, chaos or order, governed the universe. For more than ten years, now, scientists around the globe have avidly conducted such tests, the French experiment is the latest.

Motivated by their desire to see how nature operates, Aspect and his colleagues measured the polarization (the angle of vibration) of pairs of photons racing away from the calcium source in different directions. The experiment would work, they reasoned, because the correlation between photon pairs would be statistically higher if the theory behind quantum mechanics were correct. The earlier tests all seemed to support the mathematical predictions of quantum mechanics, but they had a gaping loophole. What if the first photon being measured could 'send a message' back to the calcium source, telling all subsequent photons what properties they were being tested for? The French avoided this pitfall by switching the settings on their instruments every ten billionths of a second, too little time for the photon to report back to the source.

The result: As in past experiments, quantum mechanics was the overwhelming winner. The implication was that Einstein's hope for a comprehensible universe might never be fulfilled. But although Aspect accepts the experimental evidence for quantum mechanics, he still has his doubts. "Quantum mechanics is a good set of recipes for making predictions," he says, "but I still don't think it provides an adequate picture of how nature works."—*MARCIA BARTUSIAK*

CONTINUUM

AURORA BOREALIS HAVOC

What do power blackouts in Wisconsin and leaks in the Alaska oil pipeline have in common? According to a University of Washington scientist, both are part of the mischief of aurora borealis, better known as the northern lights.

The spectacular northern sky show is created by electrical-storm activity some 60 miles up in the ionosphere, geophysicist George Parks explains. The several-million-amp currents—'enough to light up New York City'—in turn induce electrical-potential changes down on the ground. Such a ground current in regions near the Alaska pipeline can speed corrosion at the joints of two metals, he claims, and that may be one reason why so many small leaks have been reported in parts of the pipeline.

What's bad for the pipeline is also bad for power lines in northern regions. The strong ground currents induced by ionospheric storms, Parks adds, have a way of overloading power-station transformers, causing blackouts. Consider August 1972, a hotbed of auroral activity. During the first week of that month a massive polar-cap blackout wiped out regional radio communications, the researcher notes. Power failures were reported as far away as Minneapolis, Deer Lake, Newfoundland, and northern Wisconsin.

There's no quick fix for such problems as the pipeline leaks. But Parks points out that solutions may be found in the late Eighties, when a NASA project called OPEN (for Origin of Plasma in the Earth's Atmosphere) starts to investigate the northern lights.

—Frank Catalano

For all their enchantment, the northern lights cause a heap of trouble—including small leaks in the Alaska pipeline.

COLD-HOUSE ORCHIDS

Orchids have long been prized for their exotic, luxuriant beauty. But because of their high-temperature requirements, the lush flowers have been almost impossible to grow except in near-tropical conditions or in strictly regulated hothouse environments. Researchers in Florida, however, have recently developed cold-resistant orchids that could change all that. In fact, orchids may one day be as easy to grow in the average home as common rubber trees are now.

Now the orchid's tropical beauty has been mated to the ability to endure the cold, but the new hybrid won't be cheap at first.

Genetic researchers Laymond Hardy and Don Blake produced the new hybrids, dubbed 'Enduracolds,' by crossing tiny wild Georgia orchids of the *Epidendrum* genus with colorful tropical cattleya orchids. Their experimental breedings resulted in 35 hybrid varieties that can withstand cold temperatures for varying lengths of time.

The flowers are being tested at the University of Florida to determine the extent of their hardiness, and some have withstood temperatures as low as 45°F for up to eight days. Other varieties are expected to survive in temperatures well below freezing.

There are some other differences between the Enduracold and tropical orchids. It takes approximately three years for the new plants to bloom, compared with a four- to seven-year wait for the tropical orchids to flower. Tropical and hybrid orchids come in the same colors (lavender, red, white, and yellow), but the new varieties produce flowers that are half the size of their tropical counterparts.

'Ultimately, we will breed these plants for bigger flowers,' notes Andy Reasoner, of Bradenton, Florida, who markets the new orchids. 'And they will probably sell for thirty to fifty percent less than the imported variety.'

By early 1984 Enduracolds will cost from $30 to $50 each. But the first hybrid cold-resistant orchids are selling for $1,000 apiece.

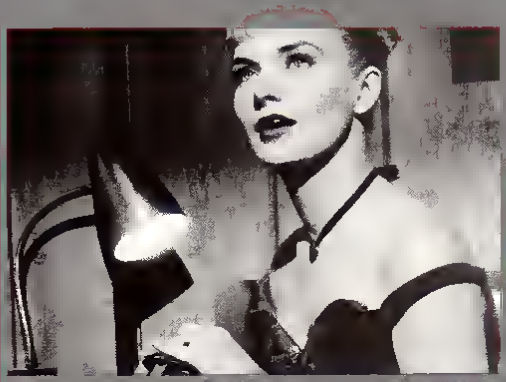
—Sherry Baker

MULTIPLE PERSONALITIES

It is so bizarre that many psychiatrists have pooh poohed it as a rococo hoax But in 1979 researcher Frank Putnam came across his first real-life *Three Faces of Eve* case, misdiagnosed and languishing in a ward for depressives at the National Institute of Mental Health in Bethesda Maryland Since then, the psychiatrist has turned up some 150 victims of 'multiple personality disorder' who according to hard psychophysiological evidence do indeed have many minds many voices and many separate memory circuits

At St Elizabeths Hospital in Washington DC Putnam and his co-workers looked for shifts in the brain activity of ten 'multiples each of whom had four or five alternate personalities capable of cooperating with the tests Eerily the various Sybils Joes Harriets, or Marys inhabiting each patient looked like different individuals when their 'evoked potentials' or brain-wave responses to light flashes were compared In contrast the EEGs (electroencephalograms) of normal volunteers who merely imagined being different characters varied little from personality to personality

Then just recently neurologist Christie Ludlow of the National Institute of Neurological and Communicative Disorders and Stroke (NINCDS), also in Bethesda, used a computer to analyze the 'voiceprint" of each alternate personality The result The frequencies that composed these voices were startlingly different from one identity to the next



Joanne Woodward in The Three Faces of Eve *Real-life multiple-personality cases are a genuine menagerie of selves*

What causes a personality to split? The clear and chilling answer is child abuse, the vast majority of such patients were physically or sexually abused as children 'The child compartmentalizes his or her pain so as not to have to deal with it all the time ' Putnam explains A form of self-hypnosis is probably involved The child goes into trances and the trance-state consciousness grows more and more autonomous and differentiated '

Lurking somewhere behind all the personas says Putnam, is the "original personality " which may take years to unearth Meanwhile, the 'host" the facade personality that the patient uses to simulate unity, presides Despite their myriad identities though these patients aren't psychotic and may function quite well, often delegating different tasks to different personalities

'The multiple personality is a fascinating model for studying the impact of the environment on biology," notes Putnam "Here is a case where experience alters the mind which then goes on to alter brain physiology '—Judith Hooper

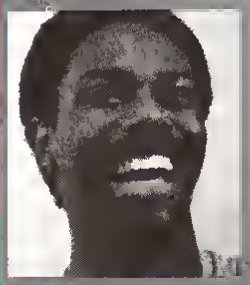
SMILE POWER

Could it be that primal-smile therapy will soon be as effective as the primal scream? Yes according to Clark University psychologist James Laird, who has recently quantified such homey adages as 'put on a happy face' and "let a smile be your umbrella' in his lab

Laird first asked students to read distressing newspaper editorials and comic stories by Woody Allen Later he asked them to recall the material while smiling and then while frowning Half of the subjects effortlessly spewed back the humor when grinning but faltered in the frown mode And the grim editorials were better recalled with a grimace

Students were also asked for memories associated with neutral words like car while making sad and happy faces "When they smiled they remembered pleasant incidents,' Laird reports, 'but when they scowled they recalled things like 'the time that I totaled Dad's car '

Facial expressions don't just reflect moods and memories the psychologist concludes they can actually trigger them And a smile might even be a clinically useful antidepressant Depressed people typically remember only negative things—which just depress them more Perhaps, notes Laird, consciously changing a pout to a grin could break the cycle —Kathrine Jason



Rx for neurotic depressions Smile-and-chortle therapy

CONTINUUM

SHARKPROOF SUIT

Yes it s finally safe to go back in the water A San Diego marine biologist has designed an armor-plated skin-diving suit to protect against shark bites

Inspired by the armor of medieval knights the 15-pound underwater outfit consists of an epoxy resin shield sandwiched between a heavy-gauge mesh of 150,000 stainless-steel rings, says twenty-nine-year-old inventor Jeremiah S Sullivan of the Scripps Institute

He claims the suit makes divers "invulnerable to attacks from all the shark species studied to date including the blue brown bull mako, white tip reef, gray reef ragged tooth and hammerhead sharks Tests on larger sharks such as the tiger oceanic white tip and great white are still pending

Sullivan first tested the special mesh on a prosthetic limb dropped into the ocean Though the armor seemed adequate Sullivan wasn t really satisfied and decided to test the suit by wearing it himself After baiting sharks into frenzied hunger with ground-up fish, he jumped into the water and eventually emerged unharmed with pieces of shark teeth embedded in the mesh

Scheduled to go on sale later this year for more than $3 000, the suit has attracted interest not only from cameramen photographers and marine scientists who specialize in the study of shark behavior but also from commercial fishermen and NASA officials concerned about rescuing astronauts from the ocean

Says Sullivan "I guarantee that the person with the suit on will fare far better in dangerous waters than anyone without it

—Robert Brody

If you swim in shark-infested waters you ll be interested in the new Jaws-resistant stainless-steel mesh skin diving suit

By wire and wireless in a score of bad translations / They give their simple message to the world of men '

—W H Auden

ELECTRIC BAND-AIDS

Electricity speeds up the rate at which broken bones knit But what would happen if you electrified a skin wound? That s the question biochemist Oscar M Alvarez and colleagues at the University of Pittsburgh Medical School asked themselves recently The answer a 30 percent reduction in healing time

The new procedure involves dipping a nylon cloth in silver which acts as an electrical conductant The cloth is then connected to a battery energized with a tiny electric current and placed on the wound

The Pittsburgh group treated minor surface abrasions on the skin of several domestic pigs and the results showed that the electrified wounds healed in an average of 2 9 days This compared with 4 1 days for wounds treated with the silver cloth but without electricity and 4 6 days for those wounds left open to the air

According to Alvarez tests indicate that both the silver and the electricity are responsible for the rapid healing It is fairly apparent he explains that the electrical-silver complex stimulates cells from surrounding tissue to aggregate at the wound site, increasing protein production and enhancing the healing process

Manufactured by the Sybron Corporation the silver-coated bandage has recently been classified as a drug Approval by the Food and Drug Administration should follow on the heels of human tests now being conducted by Dr James Albright chief of orthopedic surgery for the St Louis Medical Center in Shreveport Louisiana If all goes well, you ll find the bandages on your pharmacy shelf in a few years

—Rick Boling

"The tragedy of life is what dies inside a man while he lives '

—Albert Schweitzer

'It is far harder to kill a phantom than a reality

—Virginia Woolf

The electric Band-Aid a silver glazed cloth connected to a battery can heal wounds twice as fast as Mother Nature

REBIRTH OF THE MISSISSIPPI

Acting as the drainpipe for nearly half the continental United States the Mississippi River was the recipient of enormous pollution before the days of environmental regulation

In the mid-Seventies, for example nearly 8 000 metric tons of lead and some 200 metric tons of cadmium were introduced into the river each year As new laws emerged the amount of dumping along the famous muddy banks was reduced and the restrictions on lead in gasoline began to lower the levels of lead entering the huge snaking waterway

Even with these positive steps, many environmentalists were concerned that it might take several decades to reduce pollution significantly in the Mississippi Some even feared that the damage already done might prove nearly permanent

Well the good news is that the Mississippi appears to be cleaning itself up at an unexpectedly rapid rate According to John Trefry, a chemical oceanographer at the Florida Institute of Technology, in Melbourne lead and cadmium levels are down significantly, and much of the remaining metals are binding to sediments that are then carried out into the Gulf of Mexico for permanent storage

The water is incredibly clean in terms of pollutants says Trefry who recently headed a team of researchers on the first of two planned fact-finding tours 'The river is displaying an unprecedented ability to recover from human use, and this suggests that changes in natural systems are reversible in shorter time periods than we had earlier believed '

How is the gulf affected by the polluted sediment it receives from the river? ' There is no evidence that there has been any major environmental problem in the gulf from the emptying of the Mississippi ' says Tretry As a matter of fact, the area at the mouth of the river is considerably healthier than similar areas around the Houston ship channel or Biloxi and Galveston bays —Rick Boling

The years have made the Mississippi less picturesque and more squalid Fortunately cleanup measures are undoing the damage

'Mathematics may be defined as the subject in which we never know what we are talking about nor whether what we are saying is true'

—Bertrand Russell

ROBOT FOR THE HANDICAPPED

Even though paralyzed from the neck down a wheelchair-confined artist is able to create a beautiful painting With simple verbal commands— 'Left Stop Down '—he directs a robot to move a paintbrush, applying each successive splash of color to canvas

The scene is the Robotics Project at Veterans Administration Medical Center in Palo Alto California, where engineer Larry Leiter has customized an industrial robot to be an electronic servant to the handicapped This computerized innovation, project scientist K G Englehardt explains is actually a three-foot-long robotic arm with a slender mechanical grasper and an omnidirectional base to serve as its feet It speaks and understands 53 words Among its abilities Englehardt adds, are cooking and serving a simple meal, jiggling shaker salt onto food and typing Soon it will be equipped with a more sensitive sense of touch enabling it to brush someone's teeth safely

Already 20 quadriplegics have been trained to command the robot and within a decade a mass-produced version should be available for the price of an average car These electronic servants adds Englehardt may soon do many tasks now performed by nurses and therapists

'This robot is an evolving prototype' Englehardt explains 'We ask each disabled person What do you want it to do for you?'

'So far,' she says, 'We haven't reached its limits '

—Eric Mishara

The amazingly dexterous Palo Alto robot It can cook, clean, type and paint and soon it may learn to brush a patient's teeth

CONTINUUM

THE ATOM OF VISION

Spots, stripes rectangles, and disks waxed and waned on the television screen as researchers at England's Cambridge University fiddled with the contrast knob Their object- to pinpoint the basic unit of sight the image that the human eye sees best The winner was a round patch with fuzzy bars

suspect that you understand any given image only after your brain converts it into a set of different-size patches with bars

Yet the case for the patch as the atom of vision still isn't proved An even more readily detectable pattern could be found or the underlying theory of how images are processed might be wrong

—Tom R Kovach

The dots that make up the images on your television set have a counterpart in your brain The elementary grating patch

The 'grating patch as it's known may be to human vision what the dot is to television speculates NASA psychologist Andrew Watson, who also worked on the project Just as the pictures on your TV screen are made of thousands of minute dots he says so must our brains make sense of the seen world by breaking it up into simple patterns Watson and Cambridge physiologists Horace B Barlow and John Robson thus

NOSE AID

Hay fever sufferers may eventually be able to sniff their way to relief from spring-summer allergy problems by using "local nasal immunotherapy' (LNIT)

LNIT patients inhale gradually increasing doses of pollen extracts starting eight weeks before the onset of the hay-fever season In trials since 1979 various forms and strengths of extracted pollen have proved effective in desensitizing patients according to a research team at the State University of New York at Buffalo An extract that chemically binds the allergens is most promising

'The treatment could provide a convenient effective relatively inexpensive alternative to the conventional series of injections now used ' says immunologist Robert Reisman Its primary benefits would be ease of use—the patient could administer the treatment to himself—and lower cost 'We expect to come up with final thoughts regarding its effectiveness in a year or so " Reisman says

—Allan Maurer

'I am going to record the facts for the information of God He knows the facts but he does not know this version of the facts '

—Leo Szilard

FAT BLOOM

One of a candy maker's biggest enemies is fat bloom Fat bloom strikes when cocoa-butter crystals undergo temperature changes and migrate to the surface of chocolate giving it a dull-white appearance It s what happens to chocolate Easter bunnies when they sit around too long

Confectioners battle the problem by 'tempering chocolate—stirring it vigorously during heating and cooling In the past this technique relied more on tradition and guesswork than science Now two University of Pennsylvania food scientists Paul Dimmick and Doug Manning have used polarized light and scanning electron microscopy to identify numerous forms of cocoa butter s polymorphic crystals Their findings? One form in particular, called a feather crystal is the culprit most responsible for fat bloom And another crystal the 'bow tie may lead to a stable chocolate configuration thus eliminating fat bloom

Chocolate manufacturers who paid for the study hope this research will eventually result in a process that keeps chocolate crisp rich and brown for a much longer time

—Allan Maurer

'Then beauty is nothing but the start of a terror that we re still able to bear And the reason we love it so is that it blithely disdains to destroy us '

—Rainer Maria Rilke

Beware the notorious feather crystal au chocolat

It may be bad for teeth, but it's great for open wounds

SWEET TREATMENT

Putting sugar or honey on a wound is an old folk remedy, but the first time Dr Richard Knutson tried it in a modern operating room, nurses thought he was 'pure, blind crazy '

After seven years of research however, Knutson's slightly revised version of the folk treatment has proved effective on 2 000 patients Initially Knutson tried the remedy on an elderly patient's bedsore at the suggestion of a nurse ' The ulcer went clear to the bone and wouldn t respond to conventional treatment, ' Knutson recalls 'I knew I couldn t make it any worse, so I tried sugar and a day and a half later we had clean tissue and no infection This primitive medicine beat the hell out of everything we knew to use '

Knutson's experiments show that ordinary granulated table sugar combined with iodine works best In addition to helping sugar adhere to the wound, iodine has antibacterial and antifungal properties that speed the pace of healing Powdered and brown sugars all contain starches that interfere with iodine s normal effectiveness

The treatment provides low-cost healing for deep wounds burns and bed sores says Knutson, who works out of the Delta Medical Center in Greenville, Mississippi ' It has an enormous impact on the cost of treating wounds and it allows skin to cover even large wounds, such as those made by a shotgun blast Since we've discovered the sugar treatment our use of antibiotics is ten percent of normal '

Knutson suspects the sugar treatment works because it provides nutrients to surface cells, promoting rapid tissue growth in the wounds

'I can tell you this ' Knutson says, "it instead of being common, this substance were extracted from the testicles of an endangered species, the species would be extinct by now '

—Allan Maurer

' Fantasy is revealing it is a method of cognition Everything that is imagined is true, nothing is true if it is not imagined "

—Eugène Ionesco

"All men are fools, and he that does not wish to see them must remain in his chamber and break his looking glass '

—François Rabelais

COMPUTERIZED SKI

Computers will be making their debut on the ski slopes this winter in the form of a boot binding designed by engineers at the University of California. "It is the first digitally controlled ski binding in the world " boasts project coordinator Maury L Hull an associate professor of mechanical engineering at the universi-

The digital ski binding A computer, strapped to the skier's back, signals the bindings to snap open at the right moment

ty's Davis campus

The binding, which was successfully tested at the Boreal Ski Area in Northern California, features a dynamometer to measure pressure, a release mechanism and a computer In the event of a drastic change in pressure against the ski or of a sudden shift in the position of the leg, the dynamometer s electrical signals alert the computer With lightning speed and precision the computer calculates the potential danger to the skier and if the situation warrants it orders the binding to release the ski from the boot

Mechanical bindings are designed to perform much the same task, but Hull claims that 90 percent of skiing injuries can be attributed to malfunctions in the traditional systems The computer-controlled binding, on the other hand, is far more accurate he says The computer contains a mathematical model of the skier's leg and is programmed to monitor delicate movements—such as twisting and bending—that the mechanical system is not sensitive enough to gauge —Pablo Fenjves

"I tell you that I can trace my ancestry back to a protoplasmal primordial atomic globule "

—Gilbert and Sullivan

CONTINUUM

COMPUTER AGE ROBIN HOOD

After work each day, computer specialist Stanley Slyngsted of Olympia Washington, frequented a local tavern While he quenched his thirst on cold beer, Slyngsted says out-of-work patrons would complain of their economic hardships Soon Slyngsted claims he began doling out his own money to help them And when his funds ran out he stole more at work

Slyngsted a self-styled Robin Hood was supervisor of a Washington State computer system that annually disburses millions of dollars in benefits to disabled persons During a 15-month period he finagled the computers to issue $17 000 in illegal checks One check went to an unemployed carpenter so he could buy a truck another to a woman who was supposedly broke but most of the checks were issued directly to Slyngsted He claims all this embezzled money ended up with the needy but state police say much of it went to purchase rounds of drinks at the local tavern

After the computer scam was uncovered Slyngsted pleaded guilty to theft Judge Hewitt Henry of Thurston County Superior Court recently set the maximum sentence of ten years imprisonment He noted that Slyngsted couldn't possibly be a Robin Hood since this case has no latter-day equivalent to the evil sheriff of Nottingham

'I'll figure out some other way to help people in the future' Slyngsted says 'The bureaucracy is a total flop when it comes to helping those truly in need

—Eric Mishara

Stanley Slyngsted Computer crimes for the truly needy

CONQUERING PHOBIA

Late at night a California woman would lie awake tearful her house was about to collapse on her Whenever a truck rumbled past she imagined the earth was shaking wildly The woman suffered from seismophobia—an irrational fear of earthquakes

To conquer her phobia she learned a simple self-cure technique from psychologist Donald Dossey director of the Phobia Institute of Beverly Hills First she focused on a pleasant memory—in this instance her marriage ceremony While still dwelling on this serene mental image she squeezed her wrist for an instant Soon whenever a phobia attack began the woman squeezed her wrist which triggered memories of her marriage ceremony—and calm feelings Now once-frightening stimuli (such as creaky houses or rumbling trucks) don't provoke panic but pleasant wedding memories instead

Squeezing the wrist is a physiological key that turns on good feelings psychologist Dossey says 'It overrides the phobia

It's similar to getting a speeding ticket he explains Months later memories of that ticket automatically cause you to slow down at the same spot'

Dossey who claims an 85 percent success rate with more than 100 phobic patients says his Pavlovian technique cures any phobia including fear of flying A six-hour $75 cassette course teaches the method

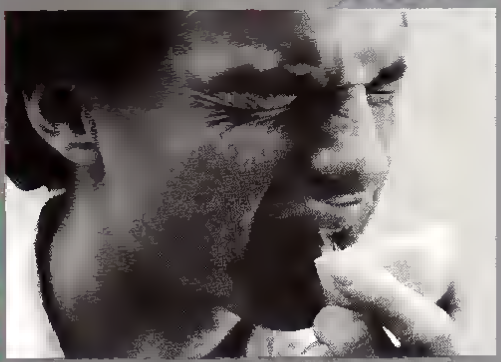
—Eric Mishara

HICCUP REMEDY

Drinkers who imbibe too much alcohol often pay a much-lampooned penalty—they get unstoppable hiccups Now a Johns Hopkins University pediatrician thinks he has a solution rapidly eating a lemon wedge soaked in angostura bitters, rind and all

Dr Jay H Herman began studying the treatment on the advice of his bartender friend David Nolan Trying the method on those who did not respond to conventional treatment (eating granulated sugar) Herman achieved at least a two-hour cessation with 14 of 16 subjects, or 88 percent Some people, he added needed a double dose

Angostura bitters can usually be purchased in a liquor store (they're used in Manhattans and other drinks) The lemon wedge should be the size used in bars —Allan Maurer



For serious drinking without the heartache of hiccups try a wedge of lemon flavored with a soupcon of angostura bitters

SMELL LAB

How do the nose and tongue transmit the data of wine and roses?

BY JOEL DAVIS

Here," said Judith Wellington, "smell this." And she thrust into my face the extreme posterior of a guinea pig. Right before my very nose was the wriggling creature's pheromone-secreting organ. I reared back involuntarily—and, at the same time, sniffed. "Er, uh, kind of cheesy," I replied weakly. "Yep, you're right, it is."

PHOTOGRAPH BY PETE TURNER

she said, obviously pleased with my foray into the science of olfactory perception.

The Monell Chemical Senses Center occupies four floors and 80,000 square feet of a building across the Schuylkill River from downtown Philadelphia. In front of the center sits an enormous sculpture of a mouth and nose, seemingly plucked off the face of some unfortunate specimen of *Homo sapiens gigantus*.

Three of the four occupied floors house offices and laboratories for research in more than half a dozen different fields of scientific curiosity. The fourth floor is the animal floor. I knew it as soon as I stepped out of the elevator: the odors, of course. This is home to colonies of mice, wild and domestic guinea pigs, and marmosets. The basement holds huge tanks of water teeming with catfish, trout, lampreys, and some small alligators to which Wellington has become greatly attached.

Researchers in residence number more than 40, though that figure fluctuates constantly. Some people are visitors for a year or more; others are postdoctoral fellows who move on. At any particular time, some of the researchers will be off doing field work or giving a workshop for interested businesses. The permanent staff has hardly changed, though.

"A basic question of our research," Robert Cagan says, "is: How is the initial recognition made? How do our senses distinguish the smell and taste of a chemical molecule?" Cagan has been at Monell since its founding in 1968. He is also one of the few people who work on the biochemical basis of smell and taste.

Cagan was the first to show that the oral and nasal cavities of mammals and fish are lined with cells that have special receptors, or chemical-attachment sites, jutting up from their surfaces. As the molecules in food and air come wafting by, they bind to these receptors in a highly selective fashion. For example, Cagan discovered that "sweet" molecules have a chemical configuration that permits them to plug in to only one type of receptor, in much the way a key fits a lock.

Cagan's finding has put an end to the rampant speculation that once surrounded the field. For instance, one popular theory of the last few decades did not even take into account the role of receptors. This theory postulated that sensory organs in the nose and mouth distinguish between molecules by their infrared spectrum—that is, the frequency at which chemical bonds in the molecule vibrate. By identifying the olfactory receptors with radioactively labeled molecules, Cagan has convincingly overturned this earlier hypothesis. It's very basic work, but so little research has been done in the field that Cagan's finding was a major advance.

Taste and smell are the chemical senses. They detect different kinds of chemicals and pass on data about the outer reality to the brain. None of the other senses depend on chemicals as the primary source of information. For sight, it's photons; for hearing, vibrations; and for touch, it's temperature changes and physical contact of various kinds.

Taste (or gustation) seems to have neuronal wiring much like the other senses. Somehow a molecule activates a receptor site on a specialized taste cell. It fires off an electrical impulse, which is passed on to a nerve cell, which in turn passes it down the line to other neurons, into a major nerve bundle, and finally up to the brain's taste centers. Sight, hearing, and touch all work in much the same way.

So does smell (olfaction), but for one strange difference. The other four senses pass their electrochemical impulses through an intermediate neuronal gateway before reaching higher levels of the brain. The olfactory nerves in the nose, however, are wired *directly into the brain*, specifically into a region called the olfactory bulb.

> *"Evidence suggests that women produce a specific kind of odor before they ovulate. Further research on this could lead to an easy-to-use form of rhythm birth control."*

If we look closely at this region in any vertebrate, we see something rather striking. The brain's cerebral hemispheres seem to swell directly up and out of the olfactory bulb. Paul G. Seybold of Wright State University in Ohio has pointed out that some scientists believe our frontal lobes—devoted to higher-thought processes, memory, and the integration of all sensory inputs—evolved from the smell-processing regions of more primitive brains. This is both interesting and ironic: interesting because of the incredibly intense memories that smells can evoke; ironic because we have devoted so little of our higher-thought processes to understanding our sense of smell.

Why do the raw data of odors take a shortcut into the brain? That's one of many unanswered questions about taste and smell. And here is another: Does deprivation make the appetite grow fonder? Common sense says yes. But when it comes to salt in the diet, Monell's Mary Bertino says no. "We've clearly determined that the *amount* of salt in one's diet does affect one's *perceptions* of salt in the diet," reports Bertino, a small woman with dark hair and sparkling eyes. "People generally come to prefer less salt on their food if it is reduced in their diets for a prolonged period." The change probably occurs within two months of cutting back, she says, "but we're not sure about that yet."

Bertino thinks that a change occurred in the *context* within which people rated salty taste. Before our study on this began, the subjects consumed large amounts of salt in their diets. So foods that were really quite salty tasted okay. But after being on a low-sodium diet for a while, they underwent a shift in their internal pleasure or "hedonic" scale. Concentrations in the test substances didn't change, but what they compared it to in their own heads may have. What once tasted perfectly seasoned to these subjects, now tasted too salty. So the people naturally preferred less salt in their everyday diets.

Though there is now some degree of controversy over how much of a role excess salt in the diet plays in high blood pressure, there's no doubt that it can be a contributing factor.

Dietary regulation of salt intake has long been a way of controlling high blood pressure. Bertino's work highlights the need to stick to a low-salt diet for at least two months. If people can hang in that long, they may well find themselves wanting to decrease dietary salt just to keep their foods from tasting too salty.

There aren't too many places in the world like the Monell Chemical Senses Center. Compared with research in sight and hearing, the study of the chemical senses is still in its infancy. But things are changing. Fifteen years after the Ambrose Monell Foundation provided the initial funding for the center, the study of the chemical senses is on the verge of several major breakthroughs. More than 100 papers are published each year, and some young scientists actually specialize in the field of the chemical senses. Many of them do their postdoctorate work at Monell. The center is a hotbed of research in the fields of taste and smell.

More than 80 percent of the center's funding comes from foundations and government agencies, but the food industry is also interested in what goes on at Monell and has proved a generous patron. A partial list of industrial sponsors includes American Cyanamid, Campbell's Soup, Colgate-Palmolive, General Foods, General Mills, Heineken, Hershey Foods, Kellogg, Kraft, McCormick, Procter & Gamble, Quaker Oats, R. J. Reynolds, Joseph E. Seagram & Sons, SmithKline-Beckman, and William Wrigley Jr. Monell takes these patrons' money happily (it makes up some 17 percent of their budget) and without embarrassment—also without strings.

"All the grants we get from industry are unrestricted," says Morley R. Kare, Monell's director and himself a pioneer researcher in the chemical-senses field. "We won't have it any other way. If industry were

CONTINUED ON PAGE 96

To cast our limelight where the Nobel's sun don't shine, we award Omni's third annual

LAURELS (AND HARDYS)

Should auld acquaintance be forgot? We occasionally think so, especially when viewing the obscure and sometimes misdirected efforts of a few scientists and the too many administrators who govern the uses of their work. Yet far from the cutting edge of research, the duller blades of science cleave to their humble labor with a tenacity that should not go entirely unrewarded.

Thus each year we send our judges into the field, asking them to separate the chaff from the—well, the even less noteworthy chaff, and deliver to us those who have most clearly earned the prize we give for distinguished silliness: nothing. This year the task fell on Eric Mishara and Owen Davies and they produced even less than expected, except for a huge expense account.

So once again we fill the cup and offer a New Year's piece of toast to the mad and merry—and occasionally just bizarre—science stories that made 1983 the last year in its field. We salute the author who wrote a psychohistory of Mickey Mouse. We applaud the compassionate researchers who discovered that snails apparently do not like to be fried, and that rats need their beauty rest. And we bow to the Australian government bureaucrats who shot themselves in their foot-in-mouth lab.

So here it is: the only compendium that dares to delve beneath the headlines and get right to the very headaches of 1983.

FROGGER FIGHTERS Today they're blasting *Space Invaders*, but tomorrow their target could be the Soviet air force, or at least this is the future that President Reagan envisions for teenage video wizards. Touring Disney World's Epcot Center, in Orlando, Florida, the President surprised a group of students by announcing that he had learned something. It was about video games, he went on. "Many young people have developed incredible hand, eye, and brain coordination in playing those games," the President said. "The Air Force believes these kids will be our outstanding pilots, should they fly our jets."

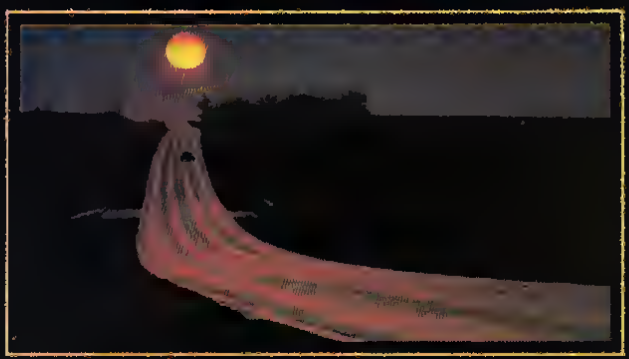
If that seems good news for military planners, it must have come as a shock to Reagan appointee C. Everett Koop, surgeon general of the United States. It was little more than a year ago that he declared video games a menace to the health of young people. The pediatric surgeon admitted that he had no hard-core clinical evidence to back his charge. Instead, he deferred to commonsense wisdom, declaring that more and more people are beginning to understand the mental and physical dangers of habitual alien-zapping.

Maybe both Reagan and Koop are right. Maybe the future fighter pilot will have microsecond-fast trigger fingers, conditioned by American software, combined with a pathological tendency to try to push a RESET button whenever the enemy artillery gets too heavy.

CAR CZAR To Americans worried about highway safety, Raymond Peck offered a soft shoulder to cry on. During his two years as head of the National Highway Traffic Safety Administration, Peck put roadblocks in the way of lifesaving technology. He deflated an air-bag rule that would have saved 10,000 lives a year, and he sideswiped a plan to require more side-impact protection for cars.

He also lowered the 5-mph impact standard for bumpers to 2.5 mph. This latest blow could cost automobile owners more than $500 million annually in accident repairs.

After he was forced to resign under crushing criticism last year, the king of safety demolition in effect said you could take the job and rear-end it. "Anybody who wants that job," he said, "either is a masochist, dumb, or has a sacred mission."



MEGATON MISOEMEANOR First, speed traps. Next thing you know, the local fuzz will be after your cruise missiles. Chico, California, recently considered an ordinance mandating six months in jail, a $500 fine, or both, for producing or deploying nuclear weapons within city limits. Folks in Cambridge, Massachusetts, are also up in arms over arms. They drew up a similar "nuclear-free" law. In both cities, proposed laws were drafted to outlaw atomic-weapon disposal as well, meaning you couldn't set off your bomb or throw it away, either.

DOCTORS DELUGED If you think that you're overdosing on junk mail, consider the involuntary binge of Dr. Roger A. Breslow, of Utica, New York.

"Most physicians have probably noticed that when they received their M.D. degree, they wound up on many mailing lists," observes internist Breslow. "I saw piles of junk mail lying around and thought, *My God—how much of this stuff do I receive in the course of a year?*" So he decided to save it all and see. His mail was heavy enough to cause a severe case of letter-opener's finger or brochured eyeball. Here's some of what he got:

- advertising brochures from 55 drug companies—Roche Laboratories alone sent 89 separate mailings. "Most are about drugs like Valium and Librium," Dr. Breslow comments. "How often do I have to hear about them?"
- 281 brochures hawking medical courses and seminars.

"It's a waste," the internist grouses. "Nobody has time to read all this stuff."

Breslow did find the time, however, to carry his complaint to the august pages of the technical journal *Science*.

Some of the material was interesting, he acknowledged. But he added: "When one considers the number of physicians in this country, all of whom wind up on many mailing lists, it is apparent that pharmaceutical advertising probably makes a large contribution to the gross national product."

By year's end, his office had developed a stuffy ZIP code, and his desk had gained a staggering 503 pounds from junk mail.

SEAT FLAP See, while flying to Burbank, California, writer Howard Abramson was ordered to belt up his son in the usual fashion and put his son's seat under the seat, but Abramson refused to take the order sitting down.

Abramson argues that cabin arrangements on airliners are unsafe, particularly for infants and toddlers. So during the journey, he strapped his son Nelson, two, into a car seat he had brought along specially for the trip. When a flight attendant demanded that Abramson stow the seat, he refused.

The Federal Aviation Administration has since given its seal of approval to one type of safety seat for use in airliners—the very seat Abramson used. But as a punishment for breaking the rules, the agency is still demanding that he pay a fine of $1,000, the most the law allows. "We have regulations," an FAA spokesman says, "and if we don't enforce them, they're useless." Or even if they do.

LAURELS (AND HARDYS)

SOFTWAR Amid tough competition, many producers of computer games last year were making the musical death noises Pac-Man emits after running afoul of Inky, Blinky, Pinky, or Clyde. Against such a somber backdrop, the computer program designed by Bob Karcher seemed to fit right in.

He calls it the Apple Fallout Prediction and Shelter Sizing program. But it isn't about falling apples. See, kids, it's designed for the Apple computer to tell you how you'll fare if a nuclear bomb happens to be detonated near you. You get to punch in wind speed and estimates of megatonnage and how far home is from ground zero. (During a real attack, you could try to pick up these data from the radio, or make it a family game. Ask your mom and dad for their best guesses, if they're still around.) Then the fun really begins.

The computer, calling on a lot of genuine Department of Defense research, crunches the numbers and lets you know how thick your walls should have been and what radiation dosage you'll get if you venture out into the open. It tells you how long the nuclear cloud will be looming over your head. It's all there for just $13, including the enlightening news that if you receive 1,000 rems of radiation, you'll be as dead as a floppy disk.

Karcher, who spends his days at Rockwell International studying ways to toughen space hardware against atomic attack, doesn't sound quite as upbeat about his product as most computer salesmen do.

"When you're talking nuclear-war survival," he says, "then you're talking to a pretty damn small audience. The American people would prefer to die in large numbers rather than survive nuclear war." But his sales pitch warms up a little. "When the time comes to do the dying, I'm sure many will change their minds."

"Of course, it'll be too late by that time," Karcher adds.

MIRACLE MACHINE Italian inventor Giuseppe Valenti follows in the footsteps of venerable visionaries who think they can square the circle, trap the unicorn, or pay off the national debt. He has invented a perpetual-motion machine. He calls it "a self-working device for the production of costless electric energy." An electric motor drives an electric generator, which supplies power to the motor, which turns the generator, and so on. The inventor explains: "The motor requires less power than the power coming from the generator."

As most schoolchildren know, the motor will keep spinning without stopping, just as long as there is a child or trained animal there to keep turning it.

The United States Patent Office has long since banned applications for such devices. Valenti's invention, the plans for which have been sent to patent offices in ten European countries, may generate enough static to spark a similar ban abroad.

But the concept is so ingeniously simple that it's certain to endure perpetually.

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MICKEY ON THE COUCH Sigmund Freud met Mickey Mouse at the convention of the American Psychological Association, held in September near Disneyland. There, John P. Murray, of Nebraska's Boys Town Center, earned his Laurel (and Hardy) for a lecture titled "Mickey Mouse: A Brief Psychohistory."

Mickey started life as "a plucky, scrappy youngster out for a good time and willing to take chances," Murray said. As Mickey's career flowered, however, he shunned "the youthful peccadillos and lustful pursuit of Minnie Mouse" and matured into "a more sober, staid, and suburban mouse."

"Mickey Mouse was all things to Walt Disney," Murray concluded. "It is hard to separate these two lives."

Tell us, Dr. Murray, what does Bonzo the chimp reveal about the actor who worked with him?

OSHA-HA Faced with evidence that the federal standard for ethylene oxide exposure—50 parts per million—endangered lives, the Occupational Safety and Health Administration (OSHA) acted promptly. It immediately put off any change in the standard until 1984. That angered Judge Barrington Parker, of the Washington, DC, Federal District Court of Appeals. Ethylene oxide, a fumigant and pesticide, may cause leukemia, miscarriages, and abdominal cancer, even at levels far below those OSHA allowed. Judge Parker gave the agency three weeks to set tighter rules to protect workers in vulnerable jobs.

For its part, the government watchdog agency seemed determined to protect its own personnel from overwork. An OSHA staff document circulating in Washington proposed abandoning all direct regulation of 116 toxic substances.

SENSITIVE SNAILS Compassionate researchers at the University of Western Ontario suggest that despite the placid appearance of escargots in restaurants, snails do not enjoy being cooked. Martin Kavaliers and fellow researchers discovered that snails lift their little feet as if in pain when they are put on a hot plate. When injected with morphine, though, they are slow to respond to the heat.

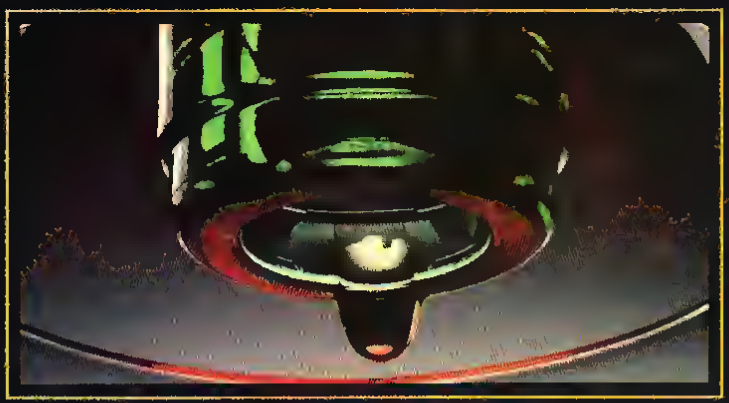
In other animal research, psychologist Allan Rechschaffen discovered that rats aren't worth much without sleep. He and several colleagues developed an experimental procedure similar to the technique teenagers use to deprive their parents of rest. As soon as a rat began to drop off, a turntable was turned on. But in Rechschaffen's work, the rats were riding the turntable and forced to walk when they wanted to sleep. Test animals developed stomach ulcers and fluid in the lungs, and lost all interest in testing artificial sweeteners, coffee, and cigars.

LAURELS (AND HARDYS)

DOWN-AND-OUT UNDER The Australian government last year managed to shoot itself in its own foot-in-mouth laboratory. The lab, in Geelong, was designed and built to study foot-and-mouth disease. Although the country is currently free from the affliction, scientists fear that if the virus ever took hold in Australia, it would quickly ravage the Aussies' 150 million sheep. That's why farmers initially supported construction of the lab. But they had second thoughts when it was pointed out to them that the lab couldn't study the virus without importing some. The government bowed to their pressure to ban importation of any of the virus. Result: Australia's valuable livestock population has been increased by one white elephant.

BAR GRAPHS Timothy Perper's job, under a $30,000 Guggenheim grant, was to study what goes on at 80 East Coast singles bars. A biologist and animal behaviorist, Perper reports, "In the absence of social norms and cultural mores, we are forced to rely on our innate behavioral abilities in bars"—a professorial way of saying it's a jungle out there.

Perper divides a typical pickup into four parts: the approach, verbalization ("Didn't I see you at the Cannes Film Festival?"); the touch, similar to the technique animals employ when groping for each other; and synchronization, in which the partners move in unison. Perper plans next to study what happens after a couple leaves the bar. Hypothesis: It has something to do with innate behavioral abilities.



GOLFERS' ACE OBSERVATORY The third-largest radio telescope in the United States, the Ohio State University Radio Observatory, continuously monitors the far reaches of space for intelligent signals from extraterrestrials. Lately, astronomers at the three-acre facility have also been hoping for some intelligent signals from the Earthlings around their observatory.

Last spring, Ohio Wesleyan University, which owns the land where the observatory stands, sold out to a country club that wants to tear the facility down and replace it with a golf course. The observatory, which is run jointly by Ohio State and Ohio Wesleyan, has discovered some of the most distant objects in the universe (including quasar OH471). But if the country club's plans go ahead as scheduled, aliens who went to contact Ohio are now going to have to submit an application form to the Admissions Committee.

LAYAWAY SPECIAL The manager of the National Aeronautics and Space Administration's Get Away Special program reports turning down 20 requests from people who want to have their ashes scattered from an orbiting shuttle. Donna Miller, Get Away's manager, says that right now the program is set up to fly only scientific experiments into space, at a cost of $3,000 to $10,000 to the shipper. But Miller suggests that in 1985, when shuttle flights start taking off on a regular basis, NASA might be open to applications for space burials. "These people are very sincere," Miller says. "Some of them have told me, 'I've always had a desire to have my ashes scattered among the stars.'" When the time comes, NASA will probably have to let applicants know that there aren't a lot of stars in low-Earth orbit, although by then Walter Cronkite and Carl Sagan may have wangled a seat on a shuttle.

POLITICAL POLLUTION For production of solid waste last year, hardly any industry could compete with the prodigious output of James Watt, the former Interior secretary. His tossed-off comments littered the political landscape: the comparison of environmentalists with Nazis, the crack about how Indian reservations represented the "failure of socialism," and his infamous introduction of a new coal-lease commission: "We have every kind of mix you could have . . . a black . . . a woman, two Jews, and a cripple." To clean up the mess, President Reagan decided to replace Watt with his foreign-affairs aide, William Clark, who probably knows a lot about the domestic environment since he proved to know so little about what was happening abroad.

CELL GUARDS Leaders of religious groups including the Moral Majority and the liberal United Church of Christ signed a resolution last year opposing efforts to engineer specific genetic traits into human reproductive cells. A major concern was that such tampering could lead to the creation of new species as different from man as "we are from the higher apes."

The clerical call for a ban resulted from the zealous one-man campaign of author Jeremy Rifkin, who wrote the apocalyptic letter accompanying the resolution based on his latest book, *Algeny*. The book presents the case against any manipulation of human sex cells.

Rifkin later denied manipulating the genetic issue to sell his $14.75 book, pointing out that royalties go into the coffers of a public foundation he heads, and from which he draws a "minimal" salary.

If the resolution were to become law, scientists would have to stop trying to correct such genetic disorders as Tay-Sachs disease, sickle-cell anemia, and Huntington's chorea. They might also be prohibited from pursuing some of their work in fighting such leading killers as cancer, heart disease, and diabetes. But at least victims of these afflictions could rest easier knowing that their diseases were still safely locked in their cells according to divine plan.

You no longer just play the game. You are part of it in these brave new

VIDEO WORLDS

BY PHIL WISWELL

With a thundering explosion of booster power, your assault jet screams in low over the desert sand, then climbs to an altitude of one mile. From here you can look out to the horizon, over the mesas, canyons, and mountains that break up the rolling desert floor. Your attention is drawn to the navigator's voice, piped into the cockpit. "Target number one approaching," he tells you. "Let's get it, Captain."

And there it is. Several miles ahead, at eleven o'clock, a military installation appears. Seconds later you can make out some individual buildings, towers, and radar-tracking devices. Suddenly the airspace around you fills with anti-aircraft flak explosions and enemy jet fighters. Zigzagging through the flak, you fire at the fighters with air-to-air missiles and blast a path over the installation. As you swoop over, you hit the button marked BOMBS, and there is a thundering explosion. One direct hit.

In the excitement of battle, you forget your supersonic speed, and now you are rapidly closing on the face of a mesa cliff. Just in time you pull up and skim the top of the ridge. More enemy jets appear. You aim and dispatch more air-to-air missiles at the closest ones and swoop down into a narrow canyon to avoid the others. Then you send your jet into another screaming climb. For a moment you are lost in a dense cloud bank, but a split second later you burst through into the clear atmosphere above. A helicopter gunship appears out of the cloud and fires at you, and in a frantic series of maneuvers, you start to evade

its heat-seeking missiles. You bank hard to the right, and the whole world tilts away. Then you dive, leaving your stomach near your Adam's apple as your altitude drops. Finally, your plane swings back smoothly, parallel to the ground. Below is a wide river, snaking to the sea in the distance.

'Target number two approaching,' announces the navigator. 'Take out that bridge.' Below you is a bridge across the river, but the speed of your dive threatens to carry you past before you can drop your bombs. Flak explodes everywhere, and again planes swoop in. You ignore one enemy jet and take a chance on hitting the strategic bridge. You press BOMBS, but before the bomb-bay doors can open, you hear a terrifying explosion, and your windshield is engulfed in surreal, fiery patterns of red, yellow, and orange. You are dead. It will cost you another 50 cents to take off and play the game again.

Welcome to the awesome world of *M A C H III*, where the real and the fantastic are brought together in a video game so realistic that it should come with its own airsickness bag.

This is just one of a new generation of video games that are using technologies so advanced they promise to transform the video game industry this year and in the years to come. *M A C H III*, for example, uses a technology called interactive laser discs. Not only does it show sharper video images, but it can change entire game scenes in an instant, reacting to the player's moves. Other advanced technologies are also coming into more common use. Last year games began using special sound chips to talk. This year they can listen and respond to the spoken word. Visual effects are advancing rapidly as graphics designers begin to introduce games in which images appear in three dimensions. And AT&T and others are getting ready to send entertainment software over telephone lines to game players. Video games are about to undergo one of their biggest ever technological leaps forward.

John O'Neill, a partner in the software firm Flyghts of Fancie, is optimistic about the direction of the industry. "We're headed into interactive laser discs, holography, and the exploration of various aspects of downloading software through satellite cable-television systems. It's like a bubbling sea. You've got to be talking to everybody about everything right now."

This may sound confusing, but it is good news for the folks in the video-game industry. And good news is what they need. For much of 1983 the major business news headlines read something like this: WARNER'S PROFIT FALLS BY 56.6 PERCENT; MILTON BRADLEY ANNOUNCES LOSS IN VECTREX SALES; MATTEL REPORTS LOSING $156.1 MILLION IN QUARTER; WARNER POSTS $283.4 MILLION LOSS. But if you read between the headlines, it becomes clear that we are seeing not the death of home video games at all, but a transition to new, more sophisticated games that offer the gamer considerably more imaginative and realistic play.

Most people in the industry think that in the near future all video games will be played on home computers, and the game machines—like Mattel's Intellivision or North American Phillips's Odyssey 2—will be gathering dust in the basement. But the machines are not dead yet, largely because manufacturers have been bringing out new machines and/or new technologies for them at a phenomenal rate. And while the technology for home machines once lagged behind arcade technology by a matter of years, that time has now been shortened to a few months.

'As the coin-ops go, so go the home games.' That maxim has been true since the first *Pong* machine was installed in a bar in Sunnyvale, California, ten years ago. New technologies and new ideas get tryouts in the game arcade before going into home games. The arcade operators and even the manufacturers now admit that the games have needed to make a quantum leap technologically to rekindle the public's flagging interest. (For the first time in ten years, revenue from coin-operated arcade games slipped—by 25 percent—in 1983.) So, although they won't admit it publicly, companies have dropped many of the games originally scheduled for 1984 release and have been working furiously on new game designs. They want to take advantage of the newest technology, the laser disc.

"There was a time when talking to your television set was a sure sign of a troubled mind. But what if your television could understand you?"

A laser disc is a silvery-looking platter that is shaped like a long-playing record. It can store 54,000 video frames, or roughly 30 minutes of video, on each side. The disc is played on a turntable-like device that spins at a more rapid rate than a conventional audio turntable, and a laser beam is reflected onto its surface. This laser stylus "reads" the images stored on the disc, and these in turn are displayed on the screen.

Videodisc games can generate sophisticated animation or display film footage. They don't rely on the stiff, blocky computer graphics typically used in games. But more important, the laser-disc format is interactive, that is, the machine will quickly scan the disc and, in response to a player's moves, display a new scene on the screen. (It is a technology heavily researched by MIT computer scientist Nicholas Negroponte [see "Magic Mirrors," February 1982].)

The interactive element is what adds realism to *M A C H III*. Once the player is seated in the 'cockpit,' the game machine shows real video footage shot from the nose cone of a fast-moving jet. When you see a bridge spanning a river, it is the same view you would get from a high-speed jet. Superimposed on the video are computer graphics that comprise the action elements of the game: the image of your jet on the screen, flak bursts, helicopters, and missiles. Stereo speakers enhance the game sounds. The total effect is one of uncanny realism.

At first videodisc games did not attract much attention, mostly because they were not designed imaginatively enough, but then came *Dragon's Lair*, an adventure game from a company called Cinematronics. In it, you make decisions that lead you from one beautifully animated scene to another. Your on-screen persona is Dirk the Daring. You direct his actions until he makes a fatal mistake or until he completes his mission: to rescue the princess held captive within the castle.

The rules of *Dragon's Lair* are elementary. You choose whether to go right or left, or whether to drink a potion labeled DRINK ME, for instance. All this is done with a simple two-way joystick. Your only other control is a SWORD button that will cause Dirk to swing his weapon against whatever he faces. The problem is, you have no way of knowing just what a potion will do, or exactly *when* to press the SWORD button to keep Dirk from being killed by his foes. If you succeed in passing through numerous rooms, passageways, tunnels, and other scenes, you reach the beautiful woman that Dirk must rescue from the dragon guarding her. You have three chances, or lives, to lose before coughing up another 50 cents.

The graphics of this 50-cents-a-shot game are as sophisticated as those of an animated Disney film, which is no surprise since one of the game's cocreators, Don Bluth, is a former Disney animator. Unlike the action in *M A C H III*, action changes in *Dragon's Lair* do not proceed seamlessly from one scene to another. Between scenarios, the screen goes blank while the player chooses the next scene.

Dragon's Lair has turned out to be one of the hit games of 1983, and companies are counting on laser-disc games to boost interest and sales. The technology is particularly appealing to owners because the games lend themselves so well to interchangeability. All the arcade operator has to do is slip a new disc into the player, redecorate the outside of the game cabinet, and presto—a new game.

And what do you think happened to the home-video-game rights to *Dragon's Lair*? The Connecticut-based company Coleco

bought them for $2 million. So far the firm has said little about the rights other than that it will release a home version of *Dragon's Lair* sometime in 1984. One rumor has it that the company will also introduce a laser-disc player that can be connected to its new Adam computer.

In the meantime interactive laser disc games are already available for the home. The first, *Murder, Anyone?* from Vidmax of New York City, was released during the 1982 Christmas season. This videodisc of a movie features real actors and is made in a campy soap opera style, with 16 different endings. This past Christmas a new Vidmax game, *Many Roads to Murder*, reached the stores. It again features detective Stew Cavanaugh, who will help or hinder your efforts to solve the mystery, depending on what choices you make.

Many Roads to Murder is complex. There is more than one murder to solve—hence the title. Depending on your decisions in a game, one of three possible murders will be committed. Detective Cavanaugh interrogates the suspects as you listen and watch for clues. You can call up the files on a suspect. If, for example, you think a high-society woman named Lenore Krieger is the murderer, you can call up a video interview just with her.

Right now, the home interactive-laser-disc games are not as challenging as their arcade counterparts. The problem is, while the laser-disc players now available have the capacity to play video games and can access scenes randomly, their microprocessors are not as sophisticated as those of an Apple or an Atari. Consequently, the home games tend to be slow and cumbersome to play.

Adding a third dimension to video-game images is another area that game companies are exploring. True 3-D television is a few years off because it requires a special method of transmission and reception. But in the meantime there is one home game system that lets you play some pretty exciting 3-D software. That's Vectrex, from GCE, a subsidiary of Milton Bradley. This game machine is the only one to come with its own monitor or TV screen. The beauty of this system is that it can produce sharply drawn video images. That's because it uses a vector-graphics monitor like those used for arcade games. This system can also display three-dimensional images.

And with GCE's new 3-D Imager, that's just what Vectrex will be able to do. The Imager, a sleekly designed pair of goggles that plug directly into the machine, resembles high-tech electronic sunglasses. When playing any of four new game cartridges, the wearer sees true three-dimensional, full-color objects. In one Vectrex game, *Mine Storm*, asteroids loom larger and larger and seem to burst through the screen if you fail to blow them up.

Although another technology, synthetic speech, has been available for large computers for years, it had been prohibitively expensive for home machines. In 1983, however, about half a dozen speech-synthesis modules were introduced for home computers and game systems. Two of the big game companies, Mattel and North American Phillips, both introduced speech modules for their respective game-playing machines, Intellivision and Odyssey 2, so far, the best talking game comes from Mattel. It is called *B-17 Bomber*, a game in which you must pilot your plane by reading an array of gauges and instruments on one screen, use another screen and a map to check your plane's position as you fly across the English Channel into enemy territory in Europe, and use yet another screen to monitor the bomb-bay view of the ground as your targets appear. In all, the player can call up one of nine different screens by pressing a corresponding number on a pad. How do you know which screen to look at? Your flight crew tells you.

The crew consists of voices that warn you of various dangers. If you slow below stalling speed, a voice will cry out "Mayday! Mayday!" If enemy planes begin sneaking up on you, the voice may warn, 'Bandits at six o'clock!'

> *"With special electronic 3-D glasses, the wearer truly sees three dimensions. In one game,* Mine Storm, *asteroids seem to burst through the screen."*

There was a time when talking to your television set was a sure sign of a troubled mind. But if your television could understand you, that would be a different story. Now it is starting to do just that. Late last winter the General Instrument Corporation and Milton Bradley unveiled a computer chip that can not only synthesize speech but can also recognize it.

This new technology is first being used in ten video-game cartridges and an expansion module called the MBX (for Milton Bradley Expander). Milton Bradley originally developed the chip for Texas Instruments' 99/4A home computer. The unit consists of a 64-key membrane laid out in an eight-by-eight grid, a special joystick, and a headset-microphone combination that the player wears.

The easiest way to explain the module is to describe what it has done with our national sport. *Championship Baseball*, one of the first ten cartridges for the MBX, has added a new dimension to video ball playing. Before a game can begin, each player programs the computer module to recognize his voice and the names he has chosen for each player on his defensive team. For example, you could use the word *right* to indicate the right fielder, or you could use the word *Reggie*—it's up to you. During play, you say the word *Reggie* when you want to activate that player. Then you control his moves with the joystick. When he picks up the ball, you say *First* or *Home* and Reggie will peg it there. Two actions can even be combined: you can say *Second First*, for example, to speed up double plays or pickoffs. This lets the player concentrate on the game, eliminating the need to look for the proper button, and it lessens the lag time between actions.

Michael Lanier, Jr., director of development for Milton Bradley's Video Products Group, nursed the MBX from a general concept to final production copies of the unit and game cartridges. "I think the electronics industry right now is seeing a lot of high-tech gimmickry," he admits, "but I don't think the MBX is a gimmick, because it's useful in a game. For instance, where you would have to use your hands on a joystick control and you want to access another control, it acts as a device that you don't have to touch."

Speech may be the most dazzling new form of video-game control, but this year also saw several alternatives. One of the areas game designers are bound to explore next will be kinesthetic effects—games that either evoke or are controlled by body sensations. One such device, called the Aerobics Joystick, from Suncom, lets you play games as you exercise. It's not so much an invention as a clever combination of two existing recreational items—the video game and the exercise bicycle. If you have an exercycle stashed in a closet because you got bored with pedaling and going nowhere, this might be the time to get it out. The Aerobics Joystick consists of two elements. One is a conventional game joystick that can be attached to the handlebars of your exercise bicycle; the other is a special switching device that attaches to the wheel of your bike and to the video game itself.

The way it works is very simple. In one game, called *Enduro*, which Activision designed for the Joystick, you are in a fast-paced, twisting road race. You use the joystick to steer from one lane to another. To gain speed, you must pedal: the faster you pedal, the faster your car moves down the road. The Aerobics Joystick works with the Atari and Commodore computers and is compatible with any system using an Atari VCS (Video Cassette System) cartridge adapter.

The joystick was the invention of Stephen Kiesling, a former Olympic rower (1980). After he moved to New York, Kiesling found he couldn't make himself work out at anything more physically taxing than video games. Then the magazine *American Health* sent him to the University of Nebraska to do a story on a stress re-

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With his Nobel Prize 20 years behind him, the father of cellular immunology works toward a vaccine that may prevent half of all cancers

INTERVIEW

SIR PETER MEDAWAR

One afternoon during World War II, young Oxford zoologist Peter Medawar, his wife, and child were having tea on their small lawn when they heard the sound of a plane and looked up to see a low-flying bomber coming straight at them over the walls of nearby gardens. Frantically gathering up their son, the Medawars barely made it to shelter before a dark shape swept past overhead. Seconds later, with what Lady Medawar recalls as an "appalling *whump*," the two-engine RAF Whitley bomber buried itself and most of its crew in a neighbor's yard two houses away. In the aftermath of the crash, Medawar, in his role as experimental biologist, was called in as a consultant to help one of the few survivors, the pilot, who had suffered severe burns across two thirds of his body. Such hideous injuries were a new kind of clinical problem then, for the simple reason that in the prewar years the victims had always died. Now blood transfusions and sulfa drugs, which kill bacteria, were keeping them alive. But the problem of repairing the raw skin remained. Could badly burned victims somehow be enabled to accept grafts of skin from other bodies? If not, they were condemned to disfiguring scars, painful shrinking, and even gangrene, the lot of those who didn't have enough of their own good skin to transfer to the burned areas.

As it happened, Medawar failed to solve that particular puzzle. Even today, medicine hasn't been able to transplant skin very successfully, and victims of bad burns must usually be patched slowly with little islands of their own skin. But the challenge led Medawar to explore the field, and soon afterward he made a momentous discovery, one that initiated modern cellular immunology and heralded all the heart, kidney, lung, and liver transplants that are rapidly becoming routine.

PHOTOGRAPH BY MALCOLM KIRK

The rejection phenomenon of the body, Medawar explains, is a very ancient one. It's present, for example, in bony fish, which have an evolutionary history of hundreds of millions of years. The substances that stimulate a rejection reaction—the antigens—are genetically programmed and not modifiable. These two reasons gave rise to the widely accepted view that the graft-rejection process was too deep-seated to be modified and that the grafting of tissues between different human beings could never be achieved.

The discovery of *tolerance* revolutionized the way medical researchers thought about the immune system. It showed for the first time that the problem could be solved—that the barriers preventing transplantation could be surmounted. By investigating what actually happens in the wombs of cows and mice, Medawar came up with startling evidence that the embryo's immune system begins with a clean slate, and only in the womb does its recognition system learn to differentiate between self and nonself.

Medawar was able to show this in a classic experiment. He injected pregnant mice with tissue from another animal, pointing the needle blindly into the womb in hope of injecting the cells into at least one or two fetuses without damaging them. After the mice were born, he tried grafting the skin of the donor animal onto the young ones. If the test worked, it would show that the immune system was not formed in prehistory and, more important, that it could potentially be manipulated in a living patient to facilitate transplants or enhance disease resistance.

It did work, and the finding opened a shining new vista in medicine—one that includes current transplanting triumphs and offers the hope that humans may be able to control their immune systems and prolong life far beyond current limits. In 1960 Medawar and Macfarlane Burnet, the Australian biologist who had first suggested the idea of tolerance, shared the Nobel Prize for physiology or medicine for the discovery of "immunological tolerance."

Having continued to work along this line of inquiry as well as a variety of others in immunology, Medawar now threatens to make another breakthrough of almost equal significance. His current research into an unexpected phenomenon that links cancer and the immune system may explain why teenage mothers ultimately have a lower incidence of breast cancer than mothers who bear their first child later in life. Just possibly, his work may one day enable us to prevent many cancers by the simple expedient of vaccination.

But Medawar's fame is not limited to his role as the acknowledged "father of cellular immunology." He is also widely known as an intellectual gadfly, a literary critic whose relentlessly clear head and merciless wit entertain the readers of *TLS: The Times Literary Supplement* and *The New York Review of Books*. Medawar expertly deflates woolly thinking and unscientific theorizing wherever he thinks he finds them. His targets are not small. They include the works of such prominent thinkers as Arthur Koestler ("very clever" but "amateurish") Teilhard de Chardin ("feeble argument abominably expressed") and Freud ("psychoanalysis is the most stupendous intellectual confidence trick of the twentieth century").

Though born in Rio de Janeiro in 1915, Peter Brian Medawar was instantly registered at the British consulate by his parents, an English mother and British father of Lebanese origin. The family soon returned to England, where Medawar spent most of his childhood, passing through Marlborough, a fashionable prep school, and Magdalen College, Oxford, where he earned a highly prized first-class degree in zoology.

So it's not surprising that Sir Peter (he was knighted in 1965) is a leading exemplar of one of his nation's most cherished

> *"I have played a part in exposing card-carrying cheats who weren't under economic pressure but were fired by ambition, the lure of being regarded as distinguished scientists."*

virtues—common sense, or as he defines it, "empiricism and pragmatism." His writing is characterized by sardonic wit and a meticulous honesty. Medawar is, as one colleague puts it, "a man of absolute integrity in all his dealings." Unlike many scientists today, Medawar never signs his name to a research paper unless he has made a substantial contribution to the work. Still, his list of papers is long. He has also written many articles and lectures, as well as a string of books on the philosophy of science, including *The Future of Man*, *The Art of the Soluble*, *Induction and Intuition*, *Hope of Progress*, *The Life Science*, *Advice to a Young Scientist* and *Aristotle to Zoos: A Philosophical Dictionary of Biology*, which he cowrote with his wife.

In his youth Medawar was tall and so handsome that, a friend recalls, Oxford coeds gazed "with bovine longing" at his photograph in a shop window. Medawar has unfortunately suffered two slightly crippling strokes in the last ten years, but he is still vigorously distinguished in appearance; his intellect shines as sharp as ever, and his comments seem even more succinctly biting than they were before.

Medawar finds lengthy interviews tiring now, but he graciously made an exception for *Omni* at the urging of Oxford University Press, the publisher of his latest collection of critical pieces, *Pluto's Republic*, which *The New York Times* reviewer described as being "excellent company of the uncommonest sense."

Science writer Anthony Liversidge talked to him one sunny June afternoon in Medawar's room in the tree-shaded Abby Aldrich Hall at Rockefeller University, on Manhattan's East Side, where he was staying on one of his frequent visits to the United States. Biologist Lady Jean Medawar, his gently elegant wife, was with him and entered into the conversation. Medawar himself was bright-eyed, rosy-cheeked, well-tailored and cheerful.

Omni: Could you explain what you meant when you wrote in your 1977 book *The Life Science*, that "the cause of cancer is never going to be found"?

Medawar: What's important there is the definite article—*the* cause. We already know a great many things that cause cancer—ionizing radiations, a fairly large number of condensed-ring polycyclic hydrocarbons, viruses certainly in experimental animals and almost certainly, though not yet conclusively demonstrated, in human beings.

Omni: And you hope to show that the immune system is capable of combating some of these causes?

Medawar: Yes. The underlying principle is that some cancers in experimental animals, particularly those cancers caused by various chemicals and viruses, are antigenic. That is, they evoke a reaction from the immune system. A tumor is to some degree a nonself entity, it is recognized as alien by the body and can be reacted upon immunologically. In principle this opens the possibility of vaccination.

Omni: In other words, you may be able to prime the body's immune system to defeat cancer. What would you envision vaccinating with?

Medawar: This is the crucial question. The body's immune system identifies cells as friendly or alien, self or nonself, by "reading" molecules known as antigens, on their surfaces. The antigen then arouses the immune response. The antigens of cancers, when they can be demonstrated to exist, are generally sui generis, that is, unique to each cancer. Each cancer tends to have its own antigen. There is, however, one large group that is an exception to the rule: those cancers that present fetal antigens. These tumors once again manufacture embryonic substances that appeared very early in the womb and were then phased out in later development.

Omni: Some cancers, you are saying, are a kind of reversion to tissues the body hasn't incorporated since its embryonic stage? And the immune system attacks these tumors because it reads their embryonic antigens as alien?

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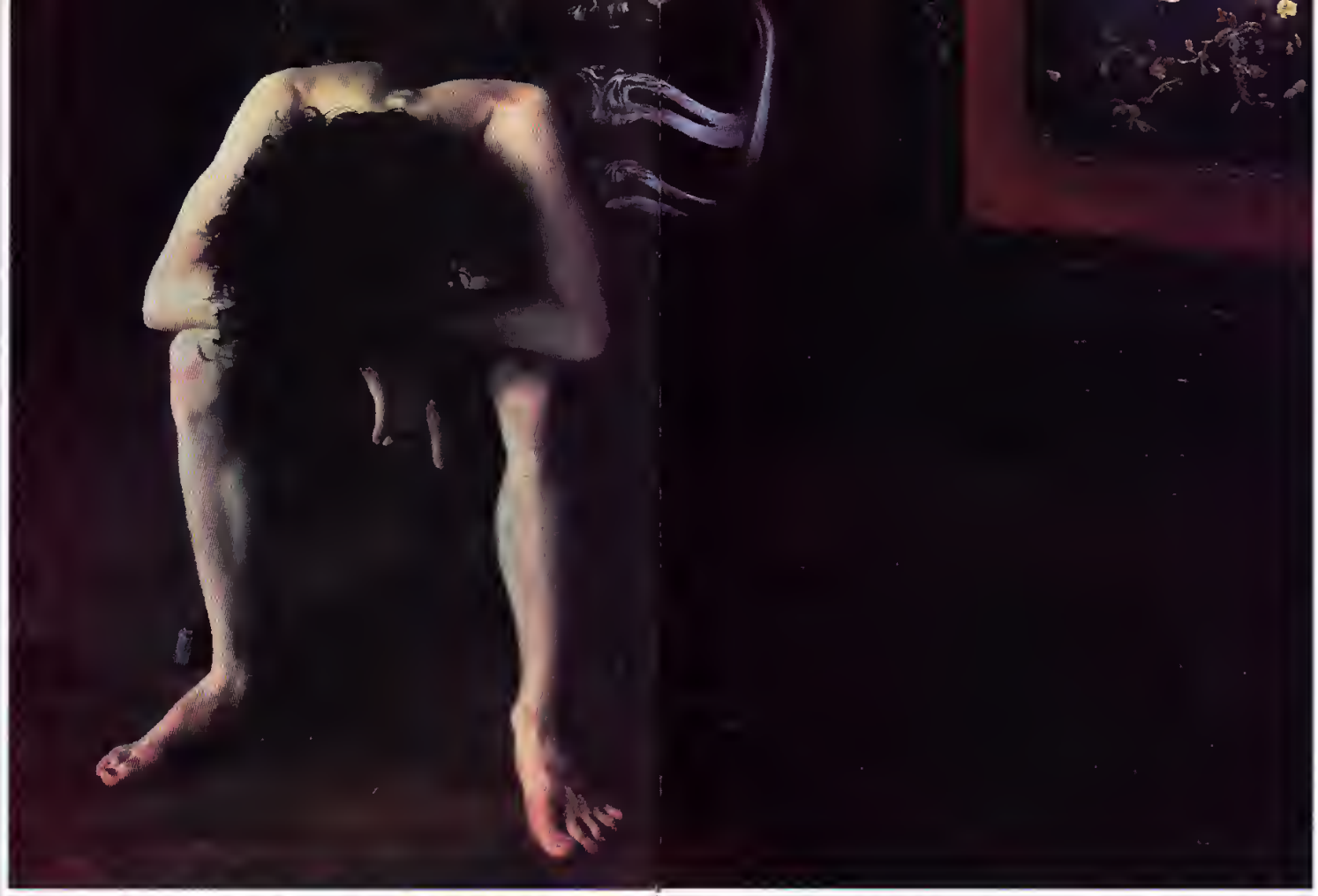

FICTION

VARIATION ON A MAN

BY PAT CADIGAN

When you probe someone else's mind, just be damned sure you know your own

PAINTING BY CHARLES PFAHL

I was convinced (still am) that it was the pearl-necklace episode that caused Nelson Nelson to give me the Gladney case.

All mindplayers can pretty much count on getting pearl necklaced sooner or later, but it's a far more vivid experience for pathosfinders than it is for neurosis-peddlers, say or belljarrers, who don't spend as much time in direct mind-to-mind contact with their clients as we do.

It seems the more time you spend working as a disembodied mind, the more intensely you get pearl necklaced.

My pearl necklace came during a routine reality affixing. Reality affixing is mandatory for mindplayers by federal law, though I don't really believe we're more prone to delusional thinking than anyone else. And there's something about having to have my perceptions stamped ACCEPTABLE PER GOVERNMENT REGULATORY STANDARDS that makes me a touch uneasy. On the other hand—or lobe, if you will—a mindplayer who is convinced everybody must accept the water buffalo as a personal totem is not someone you'd want fooling around in people's minds.

Still, I didn't look forward to having my reality affixed, in spite of Nelson Nelson's reassurance that government standards were broad enough to encompass all the varieties of normal. I always wanted to ask him what made him so sure about that. But there was no room for argument—either I had my reality affixed or I lost my job at the mindplay agency and my license to practice pathosfinding.

All I had to do was go headfirst into the agency's system and let it probe me for perhaps ten minutes, if that. Of course, it can seem like days when you're lying on the slab with your eyes out and the system hooked into your mind via the optic nerves, body awareness blocked off so that you're completely alone with yourself. NN was always telling me that I should look at it as a particularly intense kind of meditation and that as long as I was myself, I certainly had nothing to feel uneasy about.

As long as I was myself. And who else would I be? The system had apparently stimulated this particular question, and out came the pearl necklace. That was exactly how it appeared to my inner eye: as a long, long line of pearls, each one holding a moment in the life of Alexandra Victoria Haas, a.k.a. Deadpan Allie, separate, self-contained, unrelated to those on either side of it. The connecting thread running through them was suddenly gone, and I was looking at a series of strangers who shared my face but nothing more, as though I had popped in and out of being every moment. I had been alive instead of existing continuously. The realization flared like sudden pain: *I have not always been as I am now.*

I couldn't remember being any different. Nor could I conceive of what I would be like in the next moments—the future me was as much a stranger as the past one.

The pearls began moving away from one another, the sequence going from ordered to random. I lunged to gather them up, and panic sent them flying apart as I fell toward disintegration.

The next thing I knew, I was fine again, and the pearl necklace was gone. The foundation of everything I'd lived was under me again. I was no longer a stranger to myself. The system ran through the rest of the affixing procedure and then disengaged. I put my eyes back in and went off to have a nap.

Naturally the crisis was reported to Nelson Nelson. I knew it would be, but he never mentioned it. Instead he called me into his office to give me an assignment.

"In your work with artists," he said while I lay on the gold-lame interview couch and tried not to be obvious about the rash the tacky upholstery was giving me, "what would you say your primary objective as a pathosfinder is?"

I rested my cheek on my left hand and thought it over. "To assist them in reaching a level where inward and outward perceptions balance well enough against each other so that—"

"*Allie.*" He gave me a look. "This is *me* you're talking to."

"Help them move past irrelevant and superficial mental trash."

NN raised himself up on one elbow, his own couch creaking and groaning, and actually shook his finger at me. "Never, never, *never* essay-answer me."

"Sorry."

His eyes narrowed. He had brand-new pink-jade biogem eyes, and they made him look like a geriatric rabbit. "Don't be sorry. In spite of your initial choice of words, you're right." The wrinkled old face took on a thoughtful expression. "Would you say that in many cases the pathosfinder is responsible for helping an artist locate the creative generator's ON button as well as helping to enhance the soul in the work?"

For someone who didn't like essay answers, he was pretty fond of essay questions. "In many cases, sure."

Now he looked satisfied. "That's why I'd like to put you on the Gladney case."

"Rand Gladney? The composer? I thought he'd been sucked."

> *"I was looking at a series of strangers who shared my face but nothing more, as though I had popped in and out of being instead of existing continuously."*

"He was. But he's out of full quarantine now, and his new personality's grown into mature form. He's lucky his old recording company had regeneration insurance on him. Of course, he's not really Gladney anymore and never will be again."

"Have they told him who he used to be?"

"Oh, yah. Every detail. He wanted to know. Most victims of involuntary mindsuck do. They're all intensely curious about their former lives, and the doctors figure honesty is the best policy. Better for them to hear about it in a sheltered environment where they can learn to deal with it. Anyway, I thought this would be a good opportunity for a pathosfinder to work with an adult who has no history whatsoever and help him become an artist."

For the millionth time, I thought about the career in neurosis-peddling I'd given up. NN had promised (sort of) that someday he'd let me go back to it.

I'd never thought peddling things like compulsive cleanliness to wealthy people who enjoyed feeling a little more unstable than usual was easy work until NN had made a pathosfinder out of me.

But I didn't have to tell him I'd take the job. He knew I would.

I ran through the bare minimum of information on Gladney that NN had dumped into the data-keep in my apartment while the portable system I used for mind-to-mind contact with clients was being overhauled. Prior to having his mind stolen, Rand Gladney had been a composer of middle-high talent with a fair number of works that had settled into the cultural mainstream. At the time of his erasure he'd been approaching a turning point in his career where he would have either ascended to greater ability and prominence or settled slowly into repetition and, eventually, semioblivion. In seven years he had peaked twice after his breakthrough. And that was just about all NN wanted me to know about the Gladney-that-had-been. I could have easily found out more, but I trusted NN's judgment as to how much information on Gladney's previous incarnation I should bring with me to the job.

The Gladney-that-was-now had been out of full quarantine for a month, though he was still hospitalized and his movements were restricted. Rehabilitating mindwipes is a precarious business, like trying to stand with your hands both on and off someone's shoulders. Personality regrowth begins with the restoration of language, first by machine, then by humans. If humans don't replace the machine at precisely the right moment, you end up with a person unable to think in anything but a machine-type mode. People like that may be great logicians, but they're lousy on theory. Most often they resolve the conflict between the definite and the gray in their lives by suicide or voluntary mindwipe, which is pretty much the same thing. There are very few brains hardy enough to redevelop a mind after a second erasure, the myelin sheath-

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THE DANCE OF DEATH

BY JUDITH HOOPER

An
ancient horseman rides a
bronze horse
into the walled city of a dream
The dream is
foretold by French artist
Michel Henricot
in the images you see Can
you name the
faceless patient, the mortal fear
under surgical gauze?

Cocoon
or sarcophagus. It is the last trance. You are in the Realm of
Second Sight, where sad, fleshless hounds graze
in fields of Oriental jade. You see that all desiring carnivores look
alike under the skin. You notice the vaults of
the rib cage and the planktonlike glow of carbon molecules in the
conscious organs. Beyond the jackal-laced doorkeeper
is another world, called the Mirror City, but you do not go there

Your
voyage casts no shadow on the turquoise sea. It displaces
none of the surrounding water. You are shocked
by the flagrant disregard for the laws of nature, but after a time
this serene, painless infinity seems less improbable
than the crude physics of gravity, entropy, and mass. Like a larval
worm in the thrall of metamorphosis, you forget
your old skin and lapse into a newborn's pure, timeless dream.
∞

FICTION

A man and a boy make an eerie journey through a deserted town devastated by war

MORNING CHILD

BY GARDNER DOZOIS

The old house had been hit by something sometime during the war and mashed nearly flat. The front was caved in as though crushed by a giant fist; wood pulped and splintered, beams protruding at odd angles like broken fingers; the second floor collapsed onto the remnants of the first. The rubble of a chimney covered everything with a red mortar blanket. On the right a gaping hole cross-sectioned the ruins, laying bare all the strata of fused stone and plaster and charred wood—everything curling back on itself like the lips of a gangrenous wound. Weeds had swarmed up the low hillside from the road and swept over the house, wrapping the ruins in wildflowers and grapevines, softening the edges of destruction with green.

Williams brought John here almost every day. They had lived here once, in this house, many years ago, and although John's memory of that time was dim, the place seemed to have pleasant associations for him, in spite of its ruined condition. John was at his happiest here and would play contentedly with sticks and pebbles on the shattered stone steps, or go whooping through the tangled weeds that had turned the lawn into a jungle, or play-stalk in ominous circles around Williams while Williams worked at filling his bags with blueberries, daylilies, Indian potatoes, dandelions, and other edible plants and roots.

Even Williams took a bittersweet pleasure in visiting the ruins, although coming here stirred memories that he would rather have left undisturbed. There was a pleasant melancholy to the spot, and something oddly soothing about the mixture of mossy old stone and tender new green, a reminder of the inevitability of cycles—life-in-death, death-in-life.

John erupted out of the tall weeds and ran laughing to where Williams stood with the foraging bags. "I been fighting dinosaurs!" John said. "Great *big* ones!" Williams smiled crookedly and said, "That's good." He reached down and

PAINTING BY BIRNEY LETTICK

rumpled John's hair. They stood there for a second, John panting like a dog from all the running he'd been doing, his eyes bright, Williams letting his touch linger on the small, tousled head. At this time of the morning, John seemed always in motion, motion so continuous that it gave nearly the illusion of rest, like a stream of water that looks solid until something makes it momentarily sputter and stop.

This early in the day John rarely stopped. When he did, as now, he seemed to freeze solid, his face startled and intent, as though he were listening to sounds that no one else could hear. At such times Williams would study him with painful intensity, trying to see himself in him, sometimes succeeding, sometimes failing, and wondering which hurt more, and why.

Sighing, Williams took his hand away. The sun was getting high, and they'd better be heading back to camp if they wanted to be there at the right time for the heavier chores. Slowly, Williams bent over and picked up the foraging bags, grunting a little at their weight as he settled them across his shoulder—they had done very well for themselves this morning.

"Come on now, John," Williams said, "time to go," and started off, limping a bit more than usual under the extra weight. John, trotting alongside, his short legs pumping, seemed to notice. "Can I help you carry the bags?" John said eagerly. "Can I? I'm big enough!" Williams smiled at him and shook his head. "Not yet, John," he said. "A little bit later, maybe."

They passed out of the cool shadow of the ruined house and began to hike back to camp along the deserted highway.

The sun was baking down now from out of a cloudless sky, and heat-bugs began to chirrup somewhere, producing a harsh and metallic stridulation that sounded amazingly like a buzz saw. There were no other sounds besides the soughing of wind through tall grass and wild wheat, the tossing and whispering of trees, and the shrill piping of John's voice. Weeds had thrust up through the macadam—tiny green fingers that had cracked and buckled the road's surface, chopped it up into lopsided blocks. Another few years and there would be no road here, only a faint track in the undergrowth—and then not even that. Time would erase everything, burying it beneath new trees, gradually building new hills, laying down a fresh landscape to cover the old. Already grass and vetch had nibbled away the corners of the sharper curves, and the wind had drifted topsoil onto the road. There were saplings now in some places, growing green and shivering in the middle of the highway, negating the faded signs that pointed to distances and towns.

John ran ahead, found a rock to throw, ran back, circling around Williams as though on an invisible tether. They walked in the middle of the road, John pretending that the faded white line was a tightrope, waving his arms for balance, shouting warnings to himself about the abyss creatures who would gobble him up if he should misstep and fall.

Williams maintained a steady pace, not hurrying, the epitome of the ramrod-straight old man, his snow-white hair gleaming in the sunlight, a bush knife at his belt, an old Winchester 30-30 slung across his back—although he no longer believed that they'd need it. They weren't the only people left in the world, he knew—however much it felt like it sometimes—but this region had been emptied of its population years ago, and since he and John had returned this way on their long journey up from the south, they had seen no one else at all. No one would find them here.

There were traces of buildings along the way now, all that was left of a small country town: the burnt-out spine of a roof ridge, meshed with weeds; gaping stone foundations like battlements for dwarfs; a ruined water faucet clogged with spiderwebs; a shattered gas pump inhabited by

"This early in the day, John rarely stopped. When he did, he seemed to freeze solid, his face intent, as if he were listening to sounds that no one else could hear."

birds and rodents. They turned off onto a gravel secondary road, past the burnt-out shell of another filling station and a dilapidated roadside stand full of windblown trash. Overhead a rusty traffic light swayed on a sagging wire. Someone had tied a big orange-and-black hex sign to one side of the light, and on the other side, the side facing away from town and out into the hostile world, was the evil eye, painted against a white background in vivid, shocking red. Things had gotten very strange during the Last Days.

Williams was having trouble now keeping up with John's ever-lengthening stride, and he decided that it was time to let him carry the bags. John hefted the bags easily, flashing his strong white teeth at Williams in a grin, and set off up the last long slope to camp, his long legs carrying him up the hill at a pace Williams couldn't hope to match. Williams swore good-naturedly, and John laughed and stopped to wait for him at the top of the rise.

Their camp was set well back from the road, on top of a bluff just above a small river. There had been a restaurant here once, and a corner of the building still stood, two walls and part of the roof, needing only the tarpaulin stretched across the open end to make it into a reasonably snug shelter. They'd have to find something better by winter, of course, but this was good enough for July, reasonably well hidden and close to a supply of water.

Rolling, wooded hills were around them to the north and east. To the south, across the river, the hills dwindled away into flat land, and the world opened up into a vista that stretched to the horizon.

They grabbed a quick lunch and then set to work: chopping wood, hauling in the nets that Williams had set across the river to catch fish, carrying water for cooking up the steep slope to camp. Williams let John do most of the heavy work. John sang and whistled happily while he worked, and once, on his way back from carrying some firewood to the shelter, he laughed, grabbed Williams under the arms, boosted him into the air, and danced him around in a little circle before setting him back down on his feet again.

"Feeling your oats, eh?" Williams said with mock severity, looking up into the sweaty face that smiled down at him.

"*Somebody* has to do the work around here," John said cheerfully, and they both laughed. "I can't wait to get back to my outfit," John said eagerly. "I feel much better now. I feel *terrific*. Are we going to stay out here much longer?" His eyes pleaded with Williams. "We can go back soon, can't we?"

"Yeah," Williams lied, "we can go back real soon."

But already John was tiring. By dusk his footsteps were beginning to drag, and his breathing was becoming heavy and labored. He paused in the middle of what he was doing, put down the woodchopping ax, and stood silently for a moment, staring blankly at nothing.

His face was suddenly intent and withdrawn, and his eyes were dull. He swayed unsteadily and wiped the back of his hand across his forehead. Williams got him to sit down on a stump near the improvised fireplace. He sat there silently, staring at the ground in abstraction while Williams bustled around, lighting a fire, cleaning and filleting the fish, cutting up dandelion roots and chicory crowns, boiling water. The sun was down now, and fireflies began to float above the river, winking like fairy lanterns through the velvet darkness.

Williams did his best to interest John in supper, hoping that he'd eat something while he still had some of his teeth, but John would eat little. After a few moments he put his tin plate down and sat staring dully to the south, out over the darkened lands beyond the river, just barely visible in the dim light of a crescent moon. His face was preoccupied and glum and beginning to get jowly. His hairline had retreated in a wide arc from his forehead, creating a large bald spot. He worked his

mouth indecisively several times and at last said. "Have I been . . . ill?"

"Yes, John," Williams said gently. "You have been ill."

"I can't . . . I can't *remember*," John complained. His voice was cracked and husky, querulous. "Everything's so confused. I can't keep things *straight*."

Somewhere on the invisible horizon, perhaps a hundred miles away, a pillar of fire leapt up from the edge of the world.

As they watched, startled, it climbed higher and higher, towering miles into the air, until it was a slender column of brilliant flame that divided the sullen black sky in two from ground to stratosphere. The pillar of fire blazed steadily on the horizon for a minute or two, and then it began to coruscate, burning green and blue and silver and orange, the colors flaring and flickering fitfully as they merged into one another. Slowly, with a kind of stately and awful symmetry, the pillar broadened out to become a flattened diamond shape of blue-white fire. The diamond began to rotate slowly on its axis, and as it rotated it grew eye-searingly bright. Gargantuan, unseen shapes floated around the blazing diamond, like moths beating around a candle flame, throwing huge, tangled shadows across the world.

Something with a huge, melancholy voice hooted, and hooted again, a forlorn and terrible sound that beat back and forth between the hills until it rumbled slowly away into silence.

The blazing diamond winked out. Hot white stars danced where it had been. The stars faded to sullenly glowing orange dots that flickered away down the spectrum and were gone.

It was dark again.

The night had been shocked silent. For a while that silence was complete, and then slowly, tentatively, one by one, the crickets and tree frogs began to make their night sounds again.

"The war—" John whispered. His voice was reedy and thin and weary now, and there was pain in it. "It still goes on?"

"The war got . . . strange," Williams said quietly. "The longer it lasted, the stranger it got. New allies, new weapons—" He stared off into the darkness in the direction where the fire had danced; there was still an uneasy shimmer to the night air on the horizon, not quite a glow. "You were hurt by such a weapon, I guess. Something like *that*, maybe." He nodded toward the horizon, and his face hardened. "I don't know. I don't even know what *that* was. I don't understand much that happens in the world anymore. . . . Maybe it wasn't even a weapon that hurt you. Maybe they were experimenting on you biologically before you got away. Who knows why? Maybe it was done deliberately—as a punishment or a reward. Who knows how they think? Maybe it was a side effect of some device designed to do something else entirely. Maybe it was an accident, maybe you just got too close to something like *that* when it was doing whatever it is it does." Williams was silent for a moment, and then he sighed. "Whatever happened, you got to me afterward somehow, and I took care of you. We've been hiding out ever since, moving from place to place."

They had both been nearly blind while their eyes readjusted to the night, but now, squinting in the dim glow of the low-burning cooking fire, Williams could see John again. John was now totally bald; his cheeks had caved in, and his dulled and yellowing eyes were sunken deeply into his ravaged face. He struggled to get to his feet, then sank back down onto the stump again. "I can't—" he whispered. Weak tears began to run down his cheeks. He started to shiver.

Sighing, Williams got up and threw a double handful of pine needles into boiling water to make white-pine-needle tea. He helped John limp over to his pallet, supporting most of his weight, almost carrying him—it was easy. John had become shrunken and frail and amazingly light, as if he were now made out of cloth and cotton and dry sticks instead of flesh and bone. He got John to lie down, tucked a blanket around him in spite of the heat of the evening, and concentrated on getting some of the tea into him.

He drank two full cups before his fingers became too weak to hold the cup, before even the effort of holding up his head became too great for him. John's eyes had become blank and shiny and unseeing, and his face was like a skull, earth-brown and blotched, with the skin drawn tightly over the bones.

His hands plucked aimlessly at the blanket; they looked mummified now, the skin as translucent as parchment, the blue veins showing through beneath.

As the evening wore on, John began to fret and whine incoherently, turning his face blindly back and forth, muttering random fragments of words and sentences, sometimes raising his voice in a strangled, gurgling shout that had no words at all in it, only bewilderment and outrage and pain. Williams sat patiently beside him, stroking his shriveled hands, wiping sweat from his hot forehead.

"Sleep now," Williams said soothingly. John moaned and whined in the back of his throat. "Sleep. Tomorrow we'll go to the house again. You'll like that, won't you? But sleep now, sleep—"

At last John quieted, his eyes slowly closed, and his breathing grew deeper and more regular.

Williams sat patiently by his side, keeping a calming hand on his shoulder. Already John's hair was beginning to grow back, and the lines were smoothing out of his face as he melted toward childhood.

When Williams was sure that John was asleep, he tucked the blanket closer around him and said, "Sleep well, Father," and then slowly, passionately, soundlessly, he started to weep. ☒

GAMES

ANSWERS TO GAMES (PAGE 128)

HEADLINE: Dr. Jaks didn't reveal the newspaper trick, and neither will we. If you want to know, you'll have to study magic. Good places to start for a variety of such effects are *13 Steps to Mentalism* by Corinda, and *Practical Mental Magic*, by Theodore Annemann.

CREDIT: The extra digits on credit cards are a security device that allows, among other things, credit purchases to be made over the phone. If you make a mistake in reading off your number, or if the clerk at the other end makes a mistake in writing it down, or if you don't even have a credit card and are making the number up, the chances are overwhelming that the false number won't correspond to anyone's actual account number. There are 10 trillion possible 13-digit Visa numbers, but only about 65 million of them correspond to actual account numbers. The odds that an incorrect number will correspond to a real one are about 1 in 150,000. American Express has a 15-digit number for about 11 million members. The odds of a random number corresponding to an account are about 1 in 9 million.

The number given is the one American Express uses in all advertisements for its credit cards. The company doesn't want you copying a number from the TV screen and charging things to Roy Jacuzzi, Ed Schwinn, or Jim Henson!

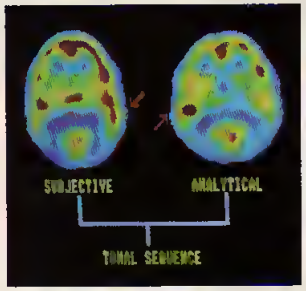
CLIP: The Klipette nose-hair clipper is sold through mail-order ads in the backs of magazines. It retails for about $3, and the company's 6 percent profit on that is about 18 cents. The company makes a great deal of its profits by renting out its mailing list for anywhere from 3 cents to 75 cents per name—and the list can be rented over and over. The Klipette list is one of the most valued in the mail-order business. Why? It is guessed that people responding to Klipette ads are concerned about appearances but too embarrassed to face a drugstore clerk and ask for a nose-hair clipper. "For whatever reason, that mentality is just right for some mail pitches," Poundstone says. Consumer's Union reports that the other firms listed also sell mailing lists that have an extremely high response rate. The Kozak Drywash list has been rented by the Republican party to solicit contributions.

MANTRAS: The spellings are phonetic and may vary according to different sources (*Iem* for *Aem*, for example). Also, the orderings may be slightly different on different lists. The list has been published in short-lived booklets entitled *Transcendental Meditation Secret Manuscript* (New Thought Educational Society, Akron, Ohio) and *Transcendental Misconception* (New Age Ministries, Kent, Ohio). Amateur magician Marcello Truzzi has used the list in a mind-reading act in which he divines a person's mantra "psychically." ☒

Senility, strokes, insanity—the mind's hidden torments are being exposed by a machine called PET

A WINDOW ON THE LIVING BRAIN

BY DOUGLAS STARR



The brightly lit left hemisphere (on the right in the above PET scan) shows that musicians may process tones in an analytical fashion

Glowing white numbers flashed across his visual field. As if seeking them, the man's eyes and head swiveled toward the left. Then he blacked out. When he awoke he was blind in precisely the same place where the numbers had been.

Intrigued by the symptoms, doctors at the UCLA Medical Center positioned the patient's head in a metal doughnut-shaped device (right). Soon a picture emerged on the video display. A glance told it all. Something had gone drastically wrong in the vision centers of the patient's brain. On the screen the region resembled an exploding nebula of red and white light. Moments later the scan showed that the same area had now been engulfed in darkness, as if the nebula had suddenly gone cold. The images explained both the visions and the temporary blindness.

"He had a tumor that was treated ten to twelve years ago," says Dr. Jerome Engel, neurology professor at UCLA. "The damage it left became an epileptic focus." That healed-over scar had triggered the seizures that periodically short-circuited the brain.

Only positron emission tomography, or PET, could have produced such an image. Unlike most diagnostic technologies, PET does not present a static picture of anatomical structures. This combination of nuclear physics, computer science and medicine depicts function, not form.

Is one part of the brain more active than another? PET shows it in red or bright white. What about aging, strokes, insanity? PET reveals the metabolic activity that could someday help researchers to understand and deal with them all. "We've always been separated from our brains by hair, skin and bone," says Dr. Thomas Chase, chief of experimental therapeutics at the National Institute of Neurological and Communicative Disorders and Stroke (NINCDS) in Bethesda, Maryland. "Now we have a window."

Beyond the brain, PET is opening new vistas on the chemical workings of the heart, lungs and liver. Some say there's no field of medicine that won't benefit from the technology. "It's the future," says UCLA PET expert Mike Phelps. "It's the only way to observe the dynamic processes of the living body."

A PET room is a peaceful place, with subdued lighting and the muffled hum of computers at work. The patient lies on a padded, stainless-steel tray. His head is inserted into the "doughnut hole" of the bulky machine. About a half-hour earlier, doctors injected into the patient's arm a radioactively labeled liquid, usually a solution of the sugar glucose. The most active regions of the brain consume the highest amounts of

PHOTOGRAPHS BY DAN McCOY

sugar, concentrating the telltale radioisotope in the process. Inside the machine hundreds of detectors absorb the radiation and signal a computer. The computer combines thousands of such messages into a video image. Bright spots show where the isotope has accumulated and yield a chemical map of the patient's brain. Afterward, having received little more radiation than with a chest X ray, he walks away, leaving behind in a computer memory a full three-dimensional representation of his cerebral processes.

PET differs substantially from CAT (computerized axial tomography), its better-known cousin. CAT is a fancy X-ray machine. It shoots a series of X rays through the body, and a computer combines them into an exquisitely clear image. But it's basically a photograph. It has nothing to do with chemical activity. Like X rays, CAT can show only what body parts look like; PET shows what they do.

To illustrate, Phelps holds up a slide that shows two images of a man's brain. One, taken with a CAT scan, portrays the brain's normal creases and folds. The other, a PET scan, is black. "What was the matter with him?" I ask. Replies Phelps, "He had been dead for eight months." The CAT scan indicates that structurally the man was fine, even though biochemically he was, as Phelps puts it, "at an all-time low."

The first true PET was built ten years ago by a team that included Phelps and Dr. Michel Ter-Pogossian, then both at Washington University in St. Louis. The prototype—a crude device—was produced by fastening radiation detectors around a hole sawed in the center of an old, wooden table. A dog was the contraption's first living subject; they strapped him to a platform and pushed him up through the opening. "The image was a funny, squiggly blur," recalls a team member.

A few months later, with an improved machine, they made the first scans of a living human brain. It belonged to Dr. Ter-Pogossian. "It was the custom," he says, "that a team member went first."

The early machines may have seemed clumsy, but they were based on sophisticated nuclear physics. PET uses an unusual class of isotopes that give off positively charged particles, or positrons. Injected into the body, the positrons collide with the negatively charged electrons in the surrounding tissue. The particles annihilate one another, leaving a brief burst of radioactive rays. It's those fleeting rays that the PET detectors pick up.

Soon other teams built more PET machines, adding detectors to enhance the accuracy of the image. They also began experimenting. One scientist watched the pleasure centers of his brain light up on the PET screen as he listened to his favorite music and ate his favorite food. Phelps, an ex-boxer, has had his head scanned 20 times. "It's just a normal brain," he says nonchalantly. Early results were so promising that NINCDS gave $29 million to boost the fledgling technology. Research took off. The dramatic detail and clarity of the images constructed by the computer surpassed the scientists' expectations.

The first target of investigation was the brain. For centuries scientists have puzzled over this three-pound lump of tissue. With at least 10 billion nerve cells and many times more connections, the organ of intellect has eluded their probes. "At best," scientists could study such brain-damaged individuals as victims of stroke or injury to get a rough picture of the brain's inner workings. They would record electrical impulses from the patient's scalp or insert electrodes directly into the brain during surgery. Other researchers tried to gather clues by monitoring chemicals in the blood vessels leading to and from the brain. Some investigators destroyed portions of animal brains, then monitored behavioral changes to try to map sites for memory or desire. But the various approaches were painfully indirect. The quest was like studying a gas pump and exhaust pipe to understand the role of spark plugs in your car.

"One scientist watched the pleasure centers of his brain light up on the PET screen as he listened to his favorite music and ate his favorite food."

PET opened the hood. Suddenly scientists could watch the entire brain in action, literally seeing where thought processes occurred. And their investigation could extend to healthy individuals with no prior history of neurological disorders. "We no longer had to depend on accidents of nature," says Dr. Martin Reivich, a PET pioneer at the University of Pennsylvania. "We got clearer information than ever on the normal functioning of the brain."

In one of Dr. Reivich's first PET studies of healthy volunteers, he shined light patterns into their right visual fields. Later he played tones into their right ears while running a brush across the back of their right hands. The results were graphic. Bands of light in his PET images showed pathways crossing from the subject's right sensory organs to the left side of the brain. When Reivich stimulated sensory pathways on the left side of the body, he found the exact reverse. This time the right hemisphere was activated. In days he confirmed the crisscrossed, or contralateral, wiring of the body's nervous system. Researchers earlier in this century had spent years amassing convincing evidence of the phenomenon.

At UCLA Phelps and neurologist John Mazziotta filled in other complicated paths. Dr. Mazziotta played a tape of a Sherlock Holmes story to volunteers through headphones. Parts of the left hemisphere, which processes information in an analytical fashion, were found to light up. When he played musical tones, the emotional right hemisphere brightened. "It was the content," says Mazziotta, "that determined where the information was processed." Then he asked subjects to match two different tones. Most listeners processed the information in the right side of the brain. But a trained musician used the left side more. He apparently thought about music in a more analytical way.

Finally Mazziotta scanned several volunteers with their eyes closed and ears stopped. These sensory-deprived brains generally "cooled" from hot white to blue-green. But still the left hemisphere remained more active than the right. Mazziotta theorizes that the right side may act as a "sentinel" for information. Shut off the sensors and the sentinel shuts down.

All this describes an organ that's remarkably complex. Yes, there are cross-overs, and yes, the left and right hemispheres do different things. But PET studies have provided scientists with far more precise maps of brain function and with a better idea of how the organ works than ever before. Mazziotta's tone tests, for example, suggest that some people process the same information in entirely different areas. In other words, the brain changes its circuitry with experience or learning. It's infinitely more flexible than the most advanced computer. Indeed, some scientists say that if the brain were a computer, it would cover Texas with a building ten stories tall. Programming the cerebrum would take hundreds of years.

Given the staggering complexity of the brain, it is no easy challenge to unravel how a breakdown in the system gives rise to mental illness. Yet, in this area too, PET is offering fresh insights. At Brookhaven National Laboratory in New York, scientists scanned a schizophrenic man who had been institutionalized for years. He had been hearing voices telling him he was God, and he regularly got into fights with another patient whose voices insisted *he* was the devil.

When Alfred Wolf and his colleagues scanned the patient, they saw a startling image. While most of the man's brain glowed in bright yellows and blues, the frontal areas showed a far dimmer color. (The frontal areas control foresight, emotions and abstract ideas—functions over which schizophrenics lose control.) "We knew right away that we'd hit upon something exciting," says Wolf. The team scanned another dozen and then two dozen more schizophrenic patients. In each case the same striking pattern

emerged. The frontal areas burned sugar far more slowly than the rest of the brain. The pattern remained even after the patients were treated with drugs. In other words, schizophrenia may be a physical—even genetic—disease.

'No one had looked at what the schizophrenic brain was *doing*,' says Wolf. 'For the first time, we saw its ability to use glucose was altered.'

Soon other conditions revealed their secrets to PET. Scans of manic-depressives showed chemical changes although none as consistent as those of schizophrenics. Severely depressed patients seemed to have their entire brains burning on low. One study found significant chemical changes in the memory centers of people with mild amnesia.

We'll never replace psychiatrists with PET; mental illness is too complex for the scan to explain. But PET studies add weight to the growing notion that upbringing may have less to do with mental illness than previously believed. "There's something physically wrong with these people," concludes Dr. Mark Raichle, a Washington University neurologist. Adds Wolf: 'The big question is: Will we be able to do anything about their conditions?'

In the meantime, other researchers are focusing their PET cameras on victims of Alzheimer's disease, the most common form of senility. At the National Institute on Aging, in Maryland, Dr. Ranjin Duara scans a graying, wrinkled woman who has arrived from the Midwest. For months she has been forgetting things: the names of objects or whom she had meant to telephone just a moment before. When an image of her brain appears on the screen an hour later, a small, dark crescent shows up in a memory area. The ominous crescent fits a recognizable pattern for Alzheimer's.

Dr. Duara scanned his first Alzheimer's patient less than two years ago, when the disease was a mystery from beginning to end. You could guess that someone had Alzheimer's when the symptoms began; you were certain when he died. Autopsies show an atrophied brain laced with microscopic tangles of dead nerves. But the progression of the disease that afflicts some 2 million to 3 million Americans was a medical enigma—until PET.

The scans indicate that Alzheimer's disease begins in the roof of the brain, dimming centers of memory and orientation. Then it spreads forward, leaving the patient increasingly confused. Eventually it dims the entire brain. Nerve cells degenerate. The victim becomes bedridden and, in a few years, dies.

'PET really hasn't told us anything about the cause,' says Duara, "but by highlighting the specific areas affected by the disease, it should aid us in finding a cure." Duara says researchers will soon test dozens of drugs, using PET to see how they modify the chemistry of the disease. Running regular scans is quicker than waiting for symptoms to change.

The technology may also help doctors distinguish Alzheimer's from other forms of senility. Depressed patients become senile but have strikingly different brain patterns from victims of Alzheimer's. Seeing this, doctors can prescribe counseling and antidepressants rather than custodial care, which some patients find restrictive.

For some diseases, there's no hope—only the chance to save future generations. At UCLA, scientists are stalking a killer called Huntington's chorea. Victims suffer bizarre writhing, slurred speech, insanity and—always—death. It killed folksinger Woody Guthrie. His doctors mistook it for alcoholism and shunted him in and out of mental hospitals for years. 'There's nothing that can stop it,' says Phelps. 'It's genetic, clear and pure.'

Huntington's destroys parts of the brain; the damage shows up in CAT scans five to ten years after the symptoms begin. Yet PET scans show chemical changes in the brain almost immediately. That's good news. Scientists might someday treat the chemical process before the physical damage begins.

And if carriers could be prevented from passing Huntington's on to their offspring, the disease might be eradicated altogether. Children of an afflicted parent have a frightening 50 percent chance of becoming victims themselves. But symptoms don't generally appear until mid-life, so many people reproduce before they are aware that they are sick.

It's devastating for a parent to realize that his or her baby may suffer the same tragedy," says Phelps.

Here's where the UCLA research may someday help. Phelps and co-worker David E. Kuhl scanned a group of young people whose parents had Huntington's. Although no subjects were yet afflicted, about half the subjects showed the telltale chemical of the disease. Two have since developed the disease. Could PET predict who will get Huntington's?

Phelps insists that's still just a distant possibility. Yet already he worries about the ethics involved. "Do you know what it does to someone to say 'You're definitely going to get Huntington's?' Yet the drive to reproduce is so strong in humans that without this kind of information, you can't frighten people away.

While medical researchers work toward a long-term solution to the problem, PET is helping other victims today. Surgeons at UCLA and other centers around the country have used PET scans to guide them in treating dozens of epileptics.

In a brightly lit operating room, a surgeon examines a little girl's brain. Peering through the hole in her skull, he sees the gray tissue glisten in the fluid that cushions it. He inserts a cutting tool and twists. Then, using something that looks like a long, thin metal spoon, he scoops out some tissue. The half-dollar-size chunk does not differ in appearance from normal brain tissue, yet it is the cause of the epilepsy that has

CONTINUED ON PAGE 118

"A pathologist at a major hospital postulated that early man had been hybridized with an alien of superior intelligence."

ANTI MATTER

UFO UPDATE

E L a carpenter s mete for the Navy was looking for shells on a beach in Hawaii when he claims he saw a strange object about 50 feet in diameter When he went to investigate he found a craft surrounded by four-foot-tall humanoids in tight green uniforms Suddenly one of the creatures lunged at E L with a swordlike weapon and a life-and-death struggle ensued To E L s amezement the others jumped into the fray and slew their own comrade Then they told him of the wondrous world they came from 21 light yeers away

Though E L thought he was alone he says het his dealings with the grounded aliens had been observed and reported to Naval Intelligence He insists he was threatened by a plainclothes agent who looked l ke President Johnson And then efter a lengthy interrogation he was forced to teke an oath of secrecy

Like E L meny witnesses citad in *FO Crash Retrieval Stetus Report III* recount fantestic teles of crashed seucers humanoids end government suppression R T for instance elleges thel he was present when lhe Marines recovered a crashed UFO Afier R T wen public with his story, he wes purportedly heressed by secret agents and forced to leeve the stale f rielly his fiancée was killed in e mysterious hit-and-run auto accident Then theres the cese of C M e Los Angeles-based freelence writer who seid she could procure the film ot a crashed allen craft Just before tha film was to chenge hends, though C M s source was 'silenced' by unknown means

The person col ecting these incred ible anecdotes is Leonard Stringfield a recently retired public-relations di-rector ot an Ohio chemical firm and author ot *Situation Red The UFO Siege* When asked for the most convincing evidence of what he calls the rash/re-trieval syndrome Stringfield cites the testimony of two medical sources who say that under the auspices of government Intelligence i the Fifties, they studled an allen corpse Stringfield says he knows the researchers names and where they work but respecting their wishes he won t reveal the particulars

Stringfield can however reveal theories A pathologist who allegedly performed an autopsy on an allen body he says postulated that early man had been genetically altered by or hybridized with en allen of superior intelligence to form *Homo sapiens* In essence pr meval Earth had become an experimental test tube for a new race whose development required periodic watching

Even Str ngfield admits that this theory can t help him ump the mein hurdle to credibility the enonymity of his sources UFO expert and skeptic James Oberg agrees 'The evidence in these cases has been selective and changed to tit circumstances Oberg says, end the idea of a fesciatic government coverup is absurd

To make his point Oberg hes pledged $1 000 to the defense tund of anyone facing prosecution for reveeling elien corpses hidden saucers or UFO secrets in eny shepe or form —*CASEY McCABE*

DOG HERO

Man's best friend may be the dog, but sometimes a dog is better off with another dog. Take the case of Percy the Chihuahua and Mick the terrier.

In Barnsley, England, recently, Percy accompanied his owner, Christine Harrison, on a visit to her parents' home. But the tiny canine refused to stay in the yard, he darted into the street, where he was hit by a car.

'We couldn't detect a heartbeat, and his eyes were fixed and staring. We were all sure he was dead,' says Christine. Distraught, she asked her father to bury her pet. Percy was put in a heavy paper sack and entombed in a two-foot-deep grave in the garden.

But Mick, Christine's parents' dog, refused to leave the grave. Finally he dug up Percy and dragged him, still in the burial sack, to the house. 'I had already returned home and it was a shock to have my parents call with the news that my dog had come back from the dead,' explains Christine.

Unconscious but with a faint heartbeat, Percy was rushed to a veterinarian who surmised that the animal had survived because of air trapped in the burial sack. And not only had Mick saved the Chihuahua by digging him up, the vet pointed out, he had also stimulated the little dog's circulation by giving Percy a lick massage.

Percy has recovered, and Mick was recently nominated for an animal lifesaving award by the Royal Society for the Prevention of Cruelty to Animals.

'The strangest thing about all this was that Mick saved Percy at all,' Christine points out. 'Those two dogs hate each other. They always have, and they still do.' —Sherry Baker

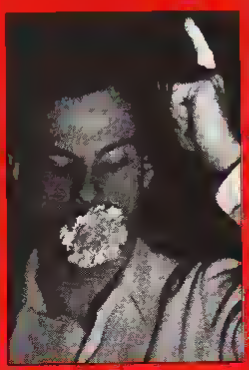
"Description is totally incompatible with what we want to say."

—David Bohm

SCANDAL IN THE SPIRIT WORLD

At thirty-five, Paul McElhoney was well on his way to psychic superstardom. Wildly enthusiastic crowds in Britain and Australia flocked to his demonstrations and listened in wonder as the spirit guide Ceros, speaking through McElhoney, uttered words of cosmic wisdom. Selected followers were privileged to sit in a dark room with McElhoney, from whose mouth dropped live goldfish, flowers, and other small objects (simulated picture below). And McElhoney also directed United World, a 40,000-member organization dedicated to the dissemination of Ceross's spirit truths.

Along the way McElhoney accumulated a lot of money—and enough resentment to inspire some fellow Spiritualists to put their suspicions about the young medium to the test. Thus, when McElhoney appeared at Spiritualist minister Ronald Baker's home last year, he walked into a trap.



Shortly after his arrival, McElhoney put his tape recorder, which he always used to record his seances, in the darkened séance room. When he went out to mingle with the other guests, though, *News of the World* reporter Alan Whittaker and three Spiritualists entered the room, where they discovered six carnations crammed into the battery compartment of the tape recorder. Later, during the séance, when the flowers miraculously dropped from the medium's mouth, the sitters, unimpressed, switched on the lights and found one carnation still inside the machine.

Angrily refusing to be searched, McElhoney fled into the night and left the telltale tape recorder behind. A picture of it, complete with carnation, was featured in a front-page story in *News of the World*.

In the wake of Britain's biggest psychic scandal in years, McElhoney went into seclusion. A spokesman, claiming the medium was very ill, announced the cancellation of a big United World fest scheduled for last August in London. There is now talk in Spiritualist circles of a 'test séance'—one last chance for McElhoney to prove himself—but so far nothing has come of it.

According to one source close to McElhoney, the psychic "is no longer active in mediumship."

—Jerome Clark

ANTI MATTER

MERMAIDS IN THE MORNING

The phone rang before the alarm clock did. "Hello Owen?" a voice began. "Look, I thought you'd want to know. There aren't any mermaids in New Guinea."

It wasn't the kind of news that justifies waking someone. "What?" I asked.

That story in *Omni*. The August 1983 issue. About Roy Wagner. He says the natives have seen mermaids—*ri*. I've been there and there aren't any.

It came back slowly. Wagner was an anthropologist from the University of Virginia. He claimed that dozens of New Guinea natives had seen *ri*, sea-dwelling creatures seemingly humanoid from the waist up. Skeptics conceded that there might be something there, maybe a strange mammal related to dugongs and manatees.

"Who is this?" I asked. The answer explained everything.

It's Jon Beckjord. I'm in London now, but I was in New Guinea a couple of months ago. I talked to the same natives Wagner did. I found that *ri* means different things from one village to the next. In most it means dugong. When I showed them pictures of a dugong, all but two agreed it was what they saw.

Beckjord—the ace Bigfoot hunter from Seattle. When last heard from, he'd been looking for the Loch Ness monster. Before that he'd "confirmed" a Bigfoot sighting that Washington-area forest rangers said had been faked.

I looked into a couple of other things in New Guinea, he continued. You might want to write about them. There was a UFO crash near Namatani Airport. Well, maybe it was a meteorite. But there were several sightings of a sea serpent, and they seemed pretty firm. And there was a tamboran, a sort of leprechaun, reported caught in a pig trap last year. They sent it to a government lab for analysis. I'm checking it now.

Checking things seemed like a good idea. During normal business hours, I called a respected cryptozoologist. "If you use my name," he said, "I'll never talk to you again." The last time you quoted me about Beckjord, I couldn't get rid of him for months.

There were no mermaids, the cryptozoologist agreed, but an unusual animal *does* swim the waters of Rammat Bay. I was in New Guinea with a team shortly after Beckjord," he said, "and found something, but we're not sure what."

When asked about the UFO crash and the sea serpent, my source just laughed. But he did confirm that something had been caught in a pig trap. It was a dog.

—Owen Davies

May you live in interesting times

—*Chinese curse*

ANIMAL SACRIFICE

There were goats, sheep, roosters, chickens, guinea hens, pigeons, and a duck. And they weren't on old MacDonald's farm.

The animals, 52 in all, were crowded into a Manhattan apartment, most of them in one room, waiting to be the main event in a religious sacrifice last September. That was the report of James Hill, a deputy director of law enforcement for the ASPCA, who took a look at the urban abattoir at the request of local police.

Hill was not surprised by what he found. Animal sacrifice may sound like an ancient ritual, but it's an everyday affair in twentieth century New York City. The sacrifices play a part in the Santeria cult, which had its birth among black slaves brought to Cuba in the eighteenth century. The cult is still healthy in places like New York and Dade County, Florida, where a retired Miami detective reported witnessing a woman rub her naked body with a chicken, kill it, and throw it in the Miami River as two other women in robes chanted an accompaniment.

Hill said he was "not trying to interfere with anybody's religion," but farm animals were not even *allowed* in Manhattan. In addition, some of the prospective sacrifices—the goats—were found, tussled up in very heavy plastic bags. The only thing sticking out was their heads. That said Hill, constituted cruelty to animals, as would the sacrifice itself.

The ASPCA actually conducted some discussions with representatives of the religious sects a few years ago, but there was little to talk about. Either the law had to change, said Hill, or the practitioners had to find a substitute for animals, such as wine.

In the recent case, Hill issued two summonses to Maria Castro, who lives on Manhattan's Lower East Side. She was charged with harboring farm animals and with cruelty to animals. The sacrifices themselves were saved for a secular future. Said Hill, "All have been adopted out to farms and will be kept as pets."

—James Gorman

"Where does one go from a world of insanity?/ Somewhere on the other side of despair"

T. S. Eliot

CODES FROM BEYOND

When the magician Harry Houdini (above) died on Halloween 1926 it was widely rumored that he had prepared a coded message and that he would communicate the key to that code 'from the other side' if it was possible. Even today mediums and psychics hold séances on Halloween and regularly announce that they have received the Houdini message. But reports are so muddled it is agreed that Houdini's message if it ever existed has never been received.

Now Arthur Berger president of Survivel Research Foundation has started a mass test to see whether the dead can send messages after all. All a prospective participant has to do is write to the Survivel Research Foundation P.O. Box 8565 Pembroke Pines FL 33024. He will then receive a three-page questionnaire and instructions for preparing a coded message of his own.

Here's how it works. Go to the dictionary preferably a large unabridged dictionary—and pick a word at random. Consecutively number each letter in the word and in the definition that follows it. Then pick a short phrase or message and substitute numbers for the letters in the phrase.

The key word should then be committed to memory not written down or told to anyone else. Finally the questionnaire a photograph of yourself and the encoded message—along with some personal object or a tape recording of your voice—are sent to the foundation's headquarters. When the foundation has been notified of your death, it sends the photograph or one of the other items to one of a group of psychics.

We don't identify the subject and we try to use European psychics with American subjects and vice versa to cut down the possibility of contact between psychic and subject while the subject is still alive says Berger. The psychic tries to receive the key word that will break the code. And if you're out there you try to send it.

Berger concedes that it would be possible to break the code by normal means but he considers this highly improbable. Besides he says we will need more than a couple of successes before we can claim strong evidence for survival.

Any luck yet? Of course the subject has to die before the experiment really gets started. Berger explains. Only one of our hundred or so participants has died so far and we still haven't gotten the key word from her.

—Daniel Cohen

Nature owes another form of existence when the present one collapses.'
—Johann Wolfgang von Goethe

[illegible]

Englishwoman Toni Channing had been working in Hong Kong for a while when her employers decided to move their corporate offices atop a skyscraper. She was shocked though when the company hired a witch doctor to mollify demons and spirits in the new digs.

The witch doctor—known as the geomancer—moved all the furniture around, recalls Channing. He ordered workers to tear a doorway down and build another one three feet away. One vice-president even has to crawl over his desk to get to his chair. The geomancer decided the modern teakwood design belongs wedged into a corner lest ancient spirits be disturbed.

The belief throughout China and Vietnam,' explains historian Ngo Vinh Long of Boston, "is that ancestral spirits coexist with the corporeal world. Geomancers are needed especially in overcrowded Hong Kong to make sure rooms and buildings don't arouse the hostility or vengeance of the dead. The witch doctors scare evil spirits away with fire for instance by facing the kitchen or fireplace toward the legendary demon home in the west. And they order changes in color so that blue (symbolic of water) won't clash with red (for fire), perturbing the spirits and causing a business to collapse.

Channing herself managed to accept the geomancer's rearrangements after acclimating to Oriental culture. But she adds she drew the line at another custom—letting goldfish starve to death as an offering to the office ghosts. Despite the chagrin of coworkers she rescued the hungry fish from atop the filing cabinets and took them home. —Ben Barber

"Above us only sky."
—John Lennon

SMELL LAB

CONTINUED FROM PAGE 46

permitted to dictate the course of research, it would compromise our position in the field. So none of the money is earmarked for any specific project, and no company has any exclusive claim on anything we come up with here."

But they do come to visit. Several top executives from S. C. Johnson and Sons cross my path as I wander down a hall on the first floor and look for the men's room. Later I walk back through the library and find them sniffing something from a small, transparent vial.

Off to one side is a blond, bearded man, Gary Beauchamp, scientist and bearer of the scent. "My God," one of the execs exclaims. "That's just ... just ... amazing!" He passes it to someone else who takes a whiff. The second man's jaw drops. "Pretty wild, huh?" Beauchamp says. A small smile plays across his features.

Some research at Monell in smell and taste is of the basic variety, and some deals with very practical and sometimes desperate human situations. Example:

Several times a year Beauchamp visits the Centro de Recuperación Nutricional, near Guadalajara, Mexico. It's a "renutrition center," where infants suffering from severe malnutrition are treated in an attempt to bring them back to some semblance of health.

Along with Martha Vasquez and Paul B. Pearson, both of the Universidad Autonoma de Guadalajara, Beauchamp is trying to find out how chronic malnutrition affects food preferences. The researchers are particularly interested in learning whether malnourished children develop a craving for foods that would quickly bring their nourishment up to par.

The field trips for this project are "pretty depressing," Beauchamp admits. But what he and his colleagues are learning is intriguing. Compared with a well-fed control group, the malnourished children were found to have a reduced appetite for sweet-tasting foods. "This surprised us," Beauchamp concedes. "We had predicted the exact opposite, since the rich caloric content of sweet substances would presumably help them gain weight."

On the other hand, he continues, the children admitted to the center had an elevated response to soup containing casein hydrolysate, the major protein in milk. The malnourished youngsters also preferred soup containing monosodium glutamate, or MSG, a vital amino acid that serves as a building block for proteins. (Findings from some studies suggest that the Oriental palate actually perceives MSG as a fifth basic taste, separate and distinct from the four "classic" ones—sour, bitter, salty, and sweet.)

The results so far support the notion that taste in humans can control the intake of needed amino acids and proteins. The same kind of mechanism has been proved to exist in rats. It might exist in humans, more research is needed. But if Beauchamp's hunch is borne out, his work could conceivably lead to better nutrition for millions of starving children in the Third World.

Monell is not the only place in the country studying taste and smell. Other centers are found at the Pierce Foundation, at Yale, Florida State, Northwestern, the University of Michigan, the food science department at the University of California at Davis, and the University of Colorado.

Then there are the "chemosensory clinics" which specialize in the treatment of dysfunctions of smell (anosmias) and of taste (ageusias). These centers are located at the University of Pennsylvania, the University of Connecticut's Chemosensory Clinical Research Center, the Medical College of Wisconsin, in Milwaukee, and the Center for Molecular Nutrition and Sensory Disorders, at Georgetown University in Washington, DC.

The rise of these centers for study and treatment of chemosensory perception is "a good sign," says one Monell researcher. "While it means more competition for us, it also indicates the field is finally coming into its own." Adds director Kare: "For every one scientist in the field today there's room for ten more. I wish the other centers good luck."

Famed scientist and physician Lewis Thomas (who is also the current chairman of the Monell Chemical Senses Center) has long speculated on the relationship between olfaction and the immune system. The sense of smell, he has said, is the body's way of detecting chemical compounds that are *external* to the body. The immune system is essentially doing the same thing with chemical compounds *internal* to the body.

With that comparison in mind, Gary Beauchamp has been working on a project in collaboration with Kunio Yamazaki, of Monell, and Edward A. Boyse, of the Memorial Sloan-Kettering Cancer Center in New York. The three researchers have learned that the genes that give a mouse its unique odor are next door to genes coding for the immune system.

In mice the code for immune-system functioning lies on chromosome 17. Beauchamp, Yamazaki, and Boyse, along with other researchers including Thomas, determined that a portion of that chromosome, called the H-2 region, also seems to govern the ability of mice to recognize one another as individuals, a recognition based on individual odors. Then the scientists narrowed the location down still further, to two areas within the H-2 complex: the H-2K and Oa-T1a regions.

Now things have gotten even more specific. In a recently published paper, Beau-

champ and his colleagues report that they've narrowed one of the sites coding for chemosensory individuality down to *several specific regions in the DNA within a single gene*. Thus they are close to breaking a genetic code that governs the production of individual specific mousy odors. It has taken more than eight years of work to accomplish this breakthrough at the frontiers of chemosensory reception, immunology, and genetics.

The work of Boyse, Yamazaki, and Beauchamp on the immune-system/olfaction genetic connection illustrates a fact of scientific life: A study is an investment of months and often years of time. And most of the time is not spent 'doing science.' Such research is an application of Sturgeon's Law: "Ninety percent of everything" declares the renowned science-fiction writer, "is crap." That's an unfortunate fact of life at Monell, as it is anywhere.

Bertino and her colleagues spent seven months gathering data for the sodium study. "I'm not talking about recruiting subjects," she says, "or about writing up the protocols and getting them approved by the Human Subjects Committee. I'm not talking about writing the paper, dealing with the journal, and going back and meeting with my collaborators. Just gathering data." The data collection began in September 1980, "and we began planning the study way before that." The data collection ended in April 1981. Bertino and her co-workers then analyzed the data, wrote the paper, and submitted it for publication. The journal received the paper in March 1982, accepted it three months later, and published it in December. The process, from conception to final publication, took more than three years. Only about 20 percent of that time was actually spent doing what Bertino calls real science.

For researchers who work with animals the situation is even worse. Gisela Epple studies chemical communication in her colony of 200 marmosets. "More than fifty percent of my time is devoted to keeping my animals alive. These monkeys are incredibly difficult to maintain in captivity. You spend a lot of time just shoveling shit."

Some of the other research currently going on at Monell:

- Harry Lawless is examining the relationship between aversion to bitter tastes and accidental poisoning among preschool children. He's also studying the abilities of expert (and not-so-expert) wine tasters. "I'm also looking for the perfect wine to go with spicy foods," he says with a laugh. "That's my Holy Grail."
- Richard Mattes is examining how different cancers and cancer therapies affect olfaction and gustation. "Chemotherapy has been reported to induce food aversions in patients," Mattes says, "and these may adversely influence dietary habits." If such treatment-related losses of appetite can be verified, Mattes and his colleagues hope to characterize them, evaluate their

impact on the patients diets nutritional status and prognosis and develop ways to keep any loss of appetite from happening Other related work includes the evaluation of volatile compounds in the breath to help predict or diagnose the occurrence of certain kinds of cancers

• Russell Reidinger who comes to Monell from the U S Fish and Wildlife Service, has studied animals' chemosensory perception to develop appetizing poisons for controlling rat depredation of rice crops His work could result in more food for Asia's impoverished masses

• Several researchers, including John Labows and George Preti, are examining the relationship between human odors and the female reproductive cycle There is evidence that a woman produces a specific kind of odor shortly before she ovulates Further work on this could lead to an extremely reliable—and easy-to-use—method of rhythm birth control (Does the Vatican know about this? It isn't listed as a Monell contributor)

A pheromone is a substance that provides a chemical means of communication for insects and certain other animals It is analogous to a hormone which provides a chemical means of communication between organs within the body

There's a men's cologne on the market that claims to contain male pheromones John Labows smiles when I mention it 'None of those products contain human male sex pheromones,' he says 'What they contain is androstenol It's a male sex pheromone all right For boars'

No one's really sure whether there are such things as human pheromones The evidence for them is still somewhat shaky The most dramatic indication of their existence comes from an experiment that was performed several years ago with women living together in a college dormitory The researcher took the sweat from a woman—a stranger to the others—who was having her period, and then regularly dabbed a small amount of it below the noses of the subjects After a few months, nearly all the women's menstrual periods had shifted to coincide with the woman whose sweat had been used in the test This synchronizing effect is well-known to most women living in groups, but this was the first attempt to deliberately induce it

Monell has its strengths and its weaknesses Its greatest strength is its interdisciplinary character Zoologists work side by side with psychologists who collaborate with organic chemists Psychobiologists hang out with biopsychologists, nutritionists trot down the hall to consult with physiologists The arrangement of offices deliberately fosters such cross-fertilization There is no chemists' floor or zoological enclave (except for the animals on the fourth floor and the fish tanks in the basement) Everyone is assigned office space pretty much randomly Psychologist Lawless is next to nutritionist Mattes, who is next to biochemist Cagan Says Sharon Greeley (a biochemist specializing in nutrition) 'Science is a lot more fun when it's interdisciplinary'

A major weakness is the center's inability to recruit good people in certain fields, particularly in biophysics neuroanatomy electrophysiology, and membrane physiology Kare explains, 'It takes guts to stay here and do this kind of work Smell and taste are not considered 'hot' areas of science' Kare also points out that Monell does not have programs devoted to insect-pheromone research or other "popular areas" of this otherwise unpopular field

"On top of that," he continues, 'we can't offer people tenure' which scientists formally affiliated with a university would have It adds up to what Kare delicately calls a recruitment problem

Monell has another nagging problem—one of image Although there are no strings attached to industry contributions Monell sometimes suffers from guilt by association That in turn might make it more difficult to rustle up other funding sources

When I questioned Labows about the colognes claiming to contain male pheromones, a wry smile spread across his face He said they contained a male sex hormone all right—but for boars

Not that the center is financially hanging by its fingernails 'Over the last ten years, we've grown about fifteen percent a year,' Kare notes The recruitment problem might be partly alleviated however, if Monell could do something about increasing its guaranteed annual income 'We have a modest endowment,' Kare says 'but we could certainly use a substantial one It would be helpful in recruiting Having the stability of a major university when we're out there competing with them for young scientists would be nice

Charles Wysocki is a stocky man with blond hair and a mischievous smile He has his fingers in a great number of chemosensory pies Over lunch at Monell one afternoon, he talks about one of them the vomeronasal organ

'It's called Jacobson's organ by some people because that's the guy who described it' says Wysocki, as he digs into his salad "It's a chemical sensory organ that is functionally and anatomically distinct from the olfactory organ It exists in all mammals with the possible exception of whales dolphins, and other members of the cetacean order

'Now here's one curious thing about the history of the vomeronasal organ Up until the late Thirties the scientific community accepted that some humans had it too Then a series of papers asserted that humans didn't have it And everyone bought that even though no specifics about the conclusions were ever offered So today you won't find the vomeronasal system mentioned in any of the medical textbooks In general physicians don't know anything about it at all

"But," Wysocki continues, leaning over the table, 'I think it's worth the time to look for it in people" He's now in the process of conducting such a search It's still in progress and not yet ready for formal publication so Wysocki prefers not to talk about it Once the study is done, however, "I'll let *Omni* know the results"

Whether humans have a functional vomeronasal organ is open to debate, but it is certainly quite functional in other mammals Mice and guinea pigs for example, seem to use it to detect the olfactory cues in urine for reproductive activity In her tour of the guinea-pig room Judy Wellington had mentioned that the animals get their noses so close to deposited urine that they practically snort it Other animals seem to do the same kind of thing when they are nuzzling and smelling each other during mating rituals

Wysocki smirks 'It makes you wonder about the origins of kissing" he says 'I happen to think it's left over from a time when humans had functioning vomeronasal organs, and we used 'em in our reproductive behavior"

I stop and ponder my veggieburger I think about vomeronasal organs and guinea pigs that snort urine I wonder how I'll feel tonight when I get home and my wife greets me with a kiss

After lunch Wysocki leads me through the halls and shows me some poster papers Poster papers are exactly what their name implies scientific papers in large poster form, tacked onto the walls for people to stop and read as they go about their business The last one we come to is about human olfactory blindness or specific anosmia, for the odor of androstenone a form of the boar sex pheromone Some people can smell it—'and believe me," Wysocki says, "if you can smell it you know it'—and some people can't

Just to the right of the poster, a small plastic squeeze bottle is taped to the brick wall Above it is a little note

CAN YOU SMELL IT? GIVE THE BOTTLE A SQUEEZE AND SNIFF!

Wysocki gives me a merry elf grin 'Go on, try it'

I remember Wellington and the guinea pig Then I squeeze the bottle I sniff

I smell nothing Thank you God

VIDEO

CONTINUED FROM PAGE 58

search project using video games

"I met some people who had been trying to figure out how people reacted to different types of mental stress," recalls Kiesling. "They had published a lot of learned papers about this, but they never bothered to tell anybody that the way they produced stress in their lab was to have people play video games. They were finding rather dramatic increases in blood pressure and heart rate from people playing the games. And that indicates video games contain the mental component of sport." While researching the article, he began to think that unless there was a physical counterpart to the stress response, video gaming wasn't particularly healthy. He mentioned that observation in his magazine article. "Then I said 'wait a second. I'm giving away a great idea here!' So I teamed up with David Potter, a roommate from Yale with a degree in electrical engineering, and we went to work." The Aerobics Joystick was born.

But there is a limit to how much of a difference all this new hardware and imaging technology will make. The truly dramatic transformations won't come until there is a change in the heart of the home video game: the game cartridge. With the price ranging from $20 to $40 and up, the typical player will spend more money on the software (the cartridges) than on the hardware (the game-playing machine). While the cost of the machines has dropped drastically over the years, the cost of the software has not, because the memory chips in the game cartridges are still expensive. Now a company called Romox, a manufacturer of home computer games, has developed a new kind of cartridge chip called the ECPC (for edge connector programmable cartridge). Unlike other game chips, the ECPC can be erased and reprogrammed with an entirely different game.

The idea for the ECPC came from Paul Terrell, president of Romox. Terrell had started a computer-games store called The Software Emporium, and the more involved he became in his enterprise, the more he realized his big problem would be inventory. Given the number of different machines on the market, it is difficult to stock a wide selection of software and relatively easy to get stuck with too many games. Terrell decided first to solve the problem of how to stock a large inventory of computer software, then to establish the store in a big way.

To do this, he teamed up with Dan Izumi, an expert in telecommunications. It soon became apparent to them that the solution was to send games to retailers' terminals over the telephone. So they went to work on a programming terminal that would receive the games. But there was another problem: Who would be the customers? Terrell and Izumi decided to prime their own pump by designing a line of Romox game titles on ECPC cartridges.

Here's how the system works. Retail stores lease a Romox programming terminal, which has enough memory on its hard-disk storage system to contain up to 500 different game programs. A customer with either a blank ECPC or a used Romox cartridge walks into the store, inserts his cartridge into the terminal and within minutes has a new game.

The beauty of the service is that once a game manufacturer puts his game on-line (sends it over phone lines to a Romox terminal), his production headaches disappear. The customer provides the cartridge, and the game, technically speaking, is manufactured right in the store. Thus the game manufacturer doesn't have to worry about overproduction or returns. For his part, the dealer no longer has to worry about maintaining shelf space for different games; he needs only blank ECPC cartridges. Five hundred titles could be stored on one hard disk—a large-memory, fast-retrieval computer device.

At the moment there are nearly 90 Romox titles on the erasable ECPC cartridges (especially appropriate since the Romox creations are not really very good as video games go), and the terminal itself is now in use in several stores. If the idea catches on, fewer games would go out of print for lack of dealer shelf space, and more publishers could afford to bring their games to market. This would stimulate competition and create better games. An unknown game designer could place his game alongside those of the larger companies and let the games speak for themselves, without any packaging or elaborate advertising gimmicks.

Soon game players won't even have to walk to the store to buy their games. In fact, they won't have to buy them at all. They'll be able to rent them—at least some of them—over the telephone from Control Video Corporation (CVC).

CVC was started by William F. von Meister, who also founded the Source Telecomputing Corporation, one of the nation's most popular subscription data banks. He established CVC to offer Atari VCS owners (or those with VCS adapters) a video-game subscription service, called Gameline. For about $60, you'll get a special Master Module which is simply a high-speed modem, automatic phone dialer and computer memory all in one unit. When the player plugs it into a telephone jack and connects it to a VCS, the device dials CVC's central computer by means of a toll-free number, keeping the phone charge down to the cost of a local call.

Once the connection is made, a menu of games is displayed. The user selects one with a joystick, and the game loads into the Master Module's memory. The user will get about 40 minutes of play for $1, which is billed automatically to his credit card. (And yes, parents can set a weekly or daily limit for the kids!)

For some people, this will be an excel-

lent way to sample games before buying Von Meister sums up the appeal of Gameline nicely: 'A buck a shot is really expensive if you like the game. If you're really going to play it a lot, you'll have to go out and buy it. But if it's a dog, you'll have to play it only once or twice.'

Not all VCS cartridge manufacturers, however, have agreed to go with CVC. The big three—Atari, Mattel, and Coleco—have said no so far. But other software companies will be represented in an initial offering of about 35 games in 1984.

For a few years, CompuServe, a competitor of The Source, has been offering games as just another category of software that can be loaded into your computer. After paying an initial subscription fee, the customer pays by the hour for the service. While licensed arcade hits like *Donkey Kong* and *Pac-Man* are not available through this system, multiplayer games like *Megawars* are. *Megawars*, as you might expect, is space-war combat. It simultaneously accommodates up to ten players, who can be sitting at their computers anywhere in the world, each looking at the galaxy of play through his game ship's windshield. Players, known to one another only by their nicknames, may form alliances, stab one another in the back, or battle with everyone in their sectors. How popular is *Megawars*? It is one of CompuServe's biggest money-makers—about 2,000 players a week drop at least $5 an hour to play—generating more revenue than the network's news and stock-market services.

On the horizon are two other options for phoning home your video games. One is Atarítel, from Atari, and right now it's very hush-hush. This project involves a device that would allow your telephone to communicate with central data banks through, or perhaps instead of, your game/computer system. AT&T and Coleco have also announced a joint venture into an interactive game and entertainment service available by subscription. It will use existing phone lines and an AT&T/Coleco modem that will connect to as-yet-unspecified game systems and computers.

The popularity of the home computer is also bound to change the game industry in the future. Sales of the machine have continued to grow exponentially as home-computer prices have dropped drastically over the past year. This has led many software companies to design a greater number of games for the most popular models. And these powerful home computers, with their capacities to display dazzling video games as well as perform computing tasks, could spawn a golden age of computer-game design.

Design firms are understandably reluctant to give specifics about their game products now being readied for release in the next few years, but some of the general ideas that have been bouncing around computer labs in Silicon Valley are known.

Most companies are exploring the option of videodiscs for use in home games by 1986. There are still a few problems that have to be solved first, however. Both Pioneer and RCA have a new interactive videodisc player that has random-access capability—that is, the machines can jump from one section of the disc to another. But they are still not fast enough to give designers the flexibility needed for interactive videodisc games. The solution: Give the machines more brains.

There are two ways that could be accomplished: by adding microcomputers inside the players or by developing a standard device to couple the player with any home computer. This would still present some problems. Not only would you need different versions of a game for the various home computers but different versions to accommodate random-access speeds of the different videodisc players.

Several companies claim to be preparing products for sale within the year. Once the images from a videodisc can be manipulated with the sophistication and speed of a good computer, we can expect software with unparalleled visual quality. For example, NFL Films is compiling video images from its files for an interactive football game in which two players could change the outcome of such classic gridiron struggles as Super Bowl III.

> *"One game-playing device, Aerobics Joystick, is not so much an invention as a clever combination of two existing recreational items: the video game and the exercise bicycle."*

With so much research in the areas of videodiscs, computer graphics animation, and artificial intelligence, people are beginning to talk about creating interactive movies for multiple players. Just as ten players can now sit in their homes and play CompuServe's *Megawars* simultaneously, each member of an audience of a special game/movie, each able to control his own character on screen, could decide the outcome as part of a group. To offer a crude example, each audience member might be assigned a ship on the screen, with control over where it flies and when and at whom it shoots. Friends could gang up on strangers and pull off power plays. Although the technology for such a game exists, it is still very expensive, and no one is working on the idea—yet.

Further in the future, a player will be able to involve himself physically in a game, with almost total realism. In his book *Artificial Reality*, University of Connecticut computer scientist Myron W. Krueger describes an interactive room he calls Videoplace. His fantasy involves using a large computer-controlled screen in a room that would detect your presence with a sonar system and could sense the movement of your body and reproduce it graphically. To play, you might wear a special interactive play suit with a series of small lights attached to your arms and legs. Special sensors could follow your changing body position by scanning the lights' motions, putting a computer-generated shadow image of you on the screens.

It is even possible, he suggests, to design a special body harness, part of a sensory feedback system called GROPE, developed at the University of North Carolina. The harness would give you the sensation of handling and touching real objects whose images are displayed. 'With such feedback, the person could climb nonexistent mountains, swing from illusory trees, and grapple with graphic phantasms,' speculates Krueger. In a game like *Dragon's Lair*, the player could run, jump, and swing an imaginary sword to get the on-screen figure to do the same.

Whole-body controls of a different sort are already being tried out by some game designers. Bioteedback devices may soon be used to manipulate computer games. Freelancer Jaron Lanier is working with other designers on a device that registers subtle changes in the body and interprets them as joystick commands. This apparatus, worn by the video gamer, can measure as many as seven different body changes. With it, Lanier and his fellow researchers have been able to synchronize players' pulses and respiration rates with different movements on a video screen.

One early experiment used the device with *Moondust*, a game that Lanier designed for the Commodore 64. It is as much a piece of interactive art and music as it is a game. The player controls seven different screen objects: six spaceships and one spacewalker. Every move of the joystick changes the computer-generated theme music, which plays throughout the game. Push the joystick up, and the music rises in pitch; move it down, and the pitch drops. Move right, and the chord structure of the music changes from a minor to a major; move left, and individual notes change.

Lanier's bioteedback version of *Moondust* gives us some idea of what it would be like to play video games with a complexity and subtlety of control never available before. Instead of moving the joystick, a wired-up *Moondust* player can now manipulate the music with his rate of breathing. And at the center of the game screen there is a glowing, throbbing design. The player controls this with every beat of his heart. 'For someone with advanced yoga or meditation training,' says Krueger, such a game 'would be interesting.' ∞

INTERVIEW

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Medawar. I believe so yes The embryonic antigens excite immunity You see, a fetus is something very foreign to an adult Even—and this is crucial—if both have the same genetic makeup. Embryonic cells, just because they are embryonic cells, are sufficiently different from the adult cells to arouse a rejection reaction in the same body when it is fully adult The tetus is a very specialized organism, with all kinds of adaptations peculiar to itself A fetus goes through stages in which it has substances that are no longer present in the adult and therefore act as antigens when they are presented to the adult This, I believe, is why some tumors are attacked by the immune system They are recognized as foreign to the body because of the reappearance in them of fetal substances, which are themselves so unlike those of the adult as to be virtually foreign

Omni. Why doesn't the immune system conquer such a tumor when it attacks it?

Medawar We don t know how often it does The pathologists say we almost certainly have very many more tumors than ever become clinically apparent They may come up and then be rejected successfully

Omni. And if your theory is correct, the body s immune system can be primed to react against those that it now overlooks is that right?

Medawar. I hope it can be In mice it can be If you were a mouse, Anthony, I could do something for you. Even before you had a tumor I could treat you in a way that would reduce the likelihood of your getting one

Omni. Well, thank you But aren t there millions of antigens involved? How would you know in advance which ones to treat for?

Medawar. I am talking only of the embryonic antigens There may be a fairly limited number of them

Omni. So we might be able to vaccinate against a certain number of cancers How wide a slice might be involved—twenty percent of all cancer patients?

Medawar: I think one might be able to immunize against virally aroused tumors and many chemically induced tumors. I would be surprised if the proportion were less than half of all cancers

Omni. Have you actually been able to prove that the antigens that certain tumors bear are fetal antigens?

Medawar. In mice, yes The same antigens that occur in the fetus reappear in the tumor. And the inoculation into mice of fetal antigens or of some adult tissues that present fetal antigens will protect against some kinds of tumors That's been shown very clearly in mice. I've injected a mouse with embryonic or quasi-embryonic antigens and then given the mouse a dose of carcinogen, such as 3-methylcholanthrene. Such an inoculation diminishes the risk—the frequency and rate of formation—of tumors The hypothesis has been tested and confirmed repeatedly in this way

Omni. You've spent ten years on this particular problem. Do you think you are close to a breakthrough?

Medawar. I believe that our results so far are very promising We have demonstrated the validity of the principle on rats and mice in the laboratory We have shown that antibodies are formed in response to the injection of fetal substances -that I should emphasize are syngeneic—from mice of exactly the same genetic makeup That s very important Antibodies against genetically foreign embryos are already well-known It would not have been an interesting phenomenon if the tetus had induced antibodies by reason of being genetically different That s a commonplace finding The antibodies I have been working with are all aroused in syngeneic systems, where the mother and the tetus are genetically identical, so far as they can be made so The fetus is being attacked or reacted upon, because of its unlikeness as a tetus, to the adult, the mother

"The psychoanalyst has a definite role as a professional boree, to sit there dutifully, listen, and be bored And this process itself may be beneficial"

Omni. What kind of tumors might you be able to inoculate against?

Medawar. Mammary tumors are among those whose incidence I would expect to reduce That's what we can do in experimental animals with the inoculation of tetal cells. And there is evidence that human mothers are often naturally inoculated against breast cancer in a similar way It is a well-known truth, established by Brian McMahon of the Harvard School of Public Health, that women who become mothers while they are teenagers are much less susceptible to breast cancers than women who have their first children later in life Having a baby, we know, itself produces antiembryo antibodies, and one can tell on an epidemiological scale that this has a protective effect When you're dealing with populations of tens of thousands or hundreds of thousands, you can pick up such very weak effects

Omni The antibodies excited by the embryo in the mother turn out to help protect her against such tumors as breast cancer?

Medawar. Exactly It is also true that ovarian cancers are much more frequent in childless women than in women who have had children And their frequency is inversely proportional to the number of children they have Now, that doesn t prove that this immunity is due to embryonic antigens, but I believe it may be It's a hypothesis that is borne out by our experiments and by epidemiological studies, that is, demographic studies of disease occurrence in the population

Omni. You once noted that probably eighty percent of cancers were caused by external agents Now there are reports that even ordinary gasoline has been found to cause tumors in rats Do you think a large number of modern cancers are in fact caused by industrial pollution of one kind or another?

Medawar. A disgracefully high proportion, I should say We are all exposed to risk as much in Britain and Europe as in the United States But there have been some very important advances in cancer prophylaxis [protective remedies], which are not generally known, which we are also working on. Epidemiology is the source of all the really hard, substantial evidence about cancer prophylaxis, for example about smoking and cancer Epidemiological studies by Oxford professor Sir Richard Doll the great smoking-and-cancer man have recently shown that levels of vitamin A in the bloodstream are correlated in the most strikingly significant way with diminishing the cancer risk Bjolke performed an important experiment in Norway In his study two large groups of age- and sex-matched human beings were exposed to a powerful carcinogen Each group received different diets so that one part of the population at risk had blood levels of vitamin A of not less than one hundred international units per deciliter Bjölke demonstrated that part of the population had a decidedly lower risk of contracting cancer than the other, which had lower blood levels of vitamin A.

You're probably wondering how this dangerous experiment was done. The people involved were all volunteers They all ran the risk of giving themselves cancer by smoking Great experiment that Bjölke deserves great credit for it The point is that adequate intakes of vitamin A are associated with diminished risks of cancer And not only vitamin A but beta carotene also My wife and I take about ten thousand units of vitamin A in the form of halibut-liver oil every day, and it s a bore It tastes disgusting if one inadvertently bites the capsule

Omni. Are you taking anything else? Might vitamin C be involved, too?

Medawar. I would be very surprised if it were not involved I take three grams of vitamin C a day, not because I don't want to get scurvy but to derive the benefits that are believed to follow from a medically adequate intake No I don't take as much as Linus Pauling. I don t take so much that it comes out of my ears! But I don t want to sound disrespectful to a very brilliant, very nice man I think he may have something

I used to jeer the way many people jeer now because there is not much evidence for what he says, except for vitamin C. But I believe the epidemiological evidence for vitamin A is very much stronger than for vitamin C.

Omni: You have said that you look forward to the day when a kidney-donor card will be accepted by the banks as surety for cashing checks up to thirty pounds.

Medawar: I hope one day a kidney donor card will be as good as a Visa card. I made that remark at the opening of a transplant unit simply to emphasize to the general public the need for donors, who should have some compensation. That would be a rather good one, I think. The public ought to be made aware of the urgent need for donors. I am talking about donation after death, of course. That requires one only to fill in a form in return for which you're given a card that says you'd be willing to have your parts used.

Omni: What would you say about a society of the future where, perhaps, a rich man could buy an organ from a poor man?

Medawar: Providing the thing is legal and on a strictly contractual basis, then I don't have any objection. People sell blood now. Medical students often sell blood. Everybody's got a spare kidney. But I wouldn't think it was the ushering in of the millennium if some needy medical student paid his way through medical college by selling a kidney. I think he'd be a mug because his one kidney might fail later. I'd certainly be interested in propaganda to clarify the nature of the risks that voluntary donors run. Statistics indicate that the frequency of kidney disease is quite high.

Omni: You don't see anything immoral in a rich man's being able to buy an organ from a poor man?

Medawar: That injustice extends throughout life. The rich have all kinds of privileges the poor don't have. It's been possible to buy organs ever since kidney transplants were first done, but it hasn't happened yet as far as I know. I know of an identical twin who voluntarily gave up one of his kidneys to rescue his brother.

Omni: People are afraid that if they become donors, their organs might be plundered before they are dead.

Medawar: Yes, that's what they fear. One can invent Grand Guignol situations, but one shouldn't take them too seriously.

Omni: What perspective do you have on AIDS [Acquired Immune Deficiency Syndrome], which has just been declared the number-one concern of the U.S. Department of Health?

Medawar: I have no ideas at all. Quite frankly, immunology pervades so many areas of medicine that one has to ration oneself. I would be interested in helping to discover what's up with AIDS, but I do not know at the moment. I'm not doing research on it.

Omni: There has been a rash of recent episodes of scientific cheats in this country—at Yale, Cornell, Harvard, and other institutions. Is this kind of thing epidemic in Europe too?

Medawar: I don't regard it as a great threat. But there have been notable frauds among European scientists. I think we can produce as lurid a record in Europe as you can in the United States.

Omni: Is this caused by competitive pressure to produce results?

Medawar: Yes. I think that might have something to do with it. But I have met and played some part in exposing one or two real card-carrying cheats who weren't under any economic pressure at all. They were fired simply by ambition—a rootless ambition. To people of certain temperaments, just the lure of being looked upon as a distinguished scientist is very great. So ambition plus vanity are just as rife in Europe as America. Economic pressure, I should say, a bit less.

I think character has a lot to do with success in science—such homely virtues as persistence, not being downcast when things go wrong, as they so often do, and drive. Nothing unexpected about this. Just common moralizing sentiments.

> *"There is no evidence that intelligence has declined, much to the disappointment of racists. But I don't believe intelligence will increase, either."*

Omni: Dr. Rupert Billingham, of the University of Texas, once your graduate student, said that he was warned before he chose to work with you that he would be "taking a great risk if he worked under your supervision, because there were rumors that you had rather wild ideas."

Medawar: There is a widespread impression that scientists are people who deal only in facts, who don't exercise their imaginations. That, of course, is a quite mistaken view, because the generative act in science is an imaginative act. People who are nonconformists and who are right win a tremendous prize, of course. And people are frowned upon sometimes if they do something outside the paradigm. You see, Jonas Salk is a very interesting example. When Salk was working on polio vaccine, the paradigm was that only living viruses could cause immunity. Salk turned this ass over tip, as you know, by showing that inactivated polio virus can produce immunity. And many virologists never forgave him for that. He has not received anything like enough honor for devising his vaccine. When I last looked into the matter, he was not even a member of the National Academy of Sciences. Did you know that? And did you know he's not a Nobel laureate? He's probably done more good in the prevention of disease than any other man in this century.

Omni: You say in *Pluto's Republic* that psychoanalysis is "the biggest confidence trick of the twentieth century." How far do you go in challenging the efficacy of such treatment?

Medawar: I do not believe there is the same kind of evidence for the efficacy of psychoanalysis that we expect—and demand—before say a new drug is allowed to be introduced on the market. And analysts do not make enough effort to secure such evidence. Freudian psychoanalysis in particular inflames me because of its unsupported pretensions. I love science. I love science dearly. I hate it to be diminished and smeared over by pretentious and sloppy thinking.

Omni: Is it the theoretical structure that annoys you, or the whole attempt?

Medawar: It's the theoretical basis—or the lack of it. The pretense that it has sound biological foundations. It has nothing of the kind. I do not believe there is evidence that these treatments do any good. They treat complaints that tend to get better of their own accord.

Omni: But is it feasible to look for an objective measure of cure in this field?

Medawar: It's very difficult and should be the subject of deep thought and trial. There should be a much more urgent sense of, "My God, how are we to demonstrate that what we're doing is efficacious?" There are methods by which it could be done. Of course psychoanalysts will always say that everybody's different, so one can't match cases, but that's not true. You can make an attempt to match them; you get roughly comparable neuroses of a roughly comparable degree of severity and of roughly similar prognoses. And some subjects could be treated by analytic methods, others by some other kind of mumbo jumbo, doesn't matter what, and see whether there's any difference between the two.

Omni: You're probably aware that when such studies have been performed, researchers have generally been unable to prove an effect?

Medawar: One sees such reports from time to time. They don't surprise me. In *Pluto*, I report a true story of children suffering from DMD [dystonia musculorum deformans], a rare and dreadful neurological disease that locks the limbs into grotesque attitudes and gives rise to mad-looking tremors. Some of these unlucky children fell into the hands of psychoanalysts and were culpably, criminally misdiagnosed and treated for an organic disease by psychotherapeutic methods, whereupon they got much worse.

Omni: But would you object if a friend said, "I'm going to a psychoanalyst"?

Medawar: Privately, yes. I do think so. I'd

feel sorry that he should need this kind of support I doubt he would get it I think the psychoanalyst has a definite role as a professional boree, put it that way Sit there dutifully, listen and be bored And this process itself may be beneficial A very distinguished psychoanalyst used that expression to me She had no pretensions at all "I am a boree," she said

Omni Don't you believe that dreams are significant experiences?

Medawar I don't believe that dreams convey information

Omni Don't they echo what has run through the brain recently?

Medawar Even when we're awake we tend to think about the things that worry us

Omni Might not a dream image reveal a feeling that we hadn't noticed fully when we were conscious—that we had unconsciously repressed?

Medawar That is possible One might get some clue It could be helpful, yes But knowing the cause of a physical disease is in no way therapeutic If you get flu and somebody tells you you have flu virus type B, you don't feel any better for it Nor are you put in the way of getting better With mental ailments or departures from normality, it's assumed that if your condition was due to having seen something nasty taking place in the woodshed, to take the standard example, then you'll feel better about it if you recognize the cause I don't see why you should

Lady Medawar I think I do I think you feel much much better first of all because you're not frightened that you've got something much worse You've identified what it is I remember when I was very upset about something and got a rash You diagnosed it as having been brought about by the death of a friend, and the rash went away I've never forgotten that And you were quite impressed yourself

Medawar Was I? Have I psychic powers my love?

Lady Medawar No you simply told me what I was worried about, and I had not realized it Of course it may all be coincidence and it happened only once But it did happen, though I never get rashes

Omni: So what would your prescription be for those who go to a psychoanalyst in an attempt to alleviate anxiety or excessive nervousness of unknown origin?

Medawar I would recommend only that they not go to any psychoanalysts and that's all I would say

Lady Medawar No Peter You do not say that Our own daughter went to a psychotherapist when she was tied up in knots and he understood her very well and made various suggestions She said it was a revelation and she felt much better All you're saying is, you don't want her to have a Freudian analysis

Medawar There are wise and knowledgeable psychiatrists who aren't psychoanalysts In America the terms are used interchangeably A clear distinction should be drawn between psychiatry in the general sense and the teachings of Freud

Omni Would you include Jung on your list of enemies?

Medawar I think Jung is even worse than Freud as a mystigogue—a mysteriarch

Omni How much psychic suffering do you believe is probably biological or physiological in origin?

Medawar In neurosis more than is commonly allowed I should say One can't put a figure on it

Omni Researchers have just discovered that patients suffering from anorexia nervosa have elevated levels of the hormone vasopressin Is that the kind of finding that you would expect more of in the future?

Medawar I would expect this to be a quite common kind of finding, yes

Omni Recent research indicates that the emotions affect immunological response In fact, in the wake of studies showing that the emotions, acting through the brain, can affect nervous-system function, hormone levels and immunological response a whole new branch of science psychoneuroimmunology seems to have sprung up Do you think this will be a fruitful area?

Medawar I do believe the psyche and soma interact yes States of mind affect states of health, and vice versa I possibly wouldn't be alive if I didn't have a healthful state of mind as well as good medical care I suspect depression has a physical origin and I do hope that physical causes will be found for certain psychoses This would provide a point of attack that might lead to therapeutics

Omni Are you temperamentally hostile to the mystical view of life?

Medawar Mysticism means nothing to me I don't believe it means anything anyway but certainly not to me I would feel it an apostasy for a scientist to believe in anything for which there was no good reason to believe I do believe in many immaterial things I believe in ideas I believe in the influence of ideas on history and of history on ideas I am not a materialist in that sense But I don't believe in a God I am not saying there isn't a God It's not part of my constitution to believe in a God I would however like to behave in such a way that people took me for a religious man "That Medawar," I'd like them to say "he's clearly a man of high principle"

I don't think it's a bad thing that some people believe in a God If it produces a measure of contentment and peace of mind and reconciliation to all the nasty things in life then religious belief is a good thing I am writing a book *The Limits of Science* on this subject right now I've just gotten to the chapter that deals with this Innumerable satisfied customers provide evidence that religion brings peace of mind

Omni You've been critical of I.Q. scientists for invoking a very narrow idea of intelligence What criteria do you think constitute true intelligence?

Medawar It is such a multifaceted thing, so very complex that one cannot measure it It's a complex quantity, an *n*-dimen-

sional quantity It cannot be measured by applying to it a scalar or single, figure as if one were taking a patient's temperature

Omni: Do you think average intelligence will rise or decline?

Medawar: There is no evidence that it has declined Whenever the hypothesis that the intelligence level is declining has been tested, it has been shown not to be Such findings are much to the disappointment of various kinds of racists who believe that the lower classes are less intelligent and more prolific than the brighter and better are But I don't believe intelligence will increase either

Omni: You once said that Teilhard de Chardin was popular only because wider education had developed people's literary tastes "far beyond their capacity for analytical thought"!

Medawar: That's a bit snobbish, I admit People do have a taste for the mysterious and unsolved

Omni: You denounce as "wrongheaded" the argument against abortion that points out that Beethoven, who had a syphilitic father and a mother with tuberculosis and ten children, would in all probability have been lost to the world if abortion had been an available option in those days Why is that argument misleading?

Medawar: The point is abortion would be offensive only if there were a causal connection between having a syphilitic father and a tubercular mother and giving birth to a musical genius If there were such a causal connection, then it would be heinous to conduct abortions But otherwise there's no more harm in it than having a menstrual period Every time a woman has a menstrual period, you don't worry that it could have been Beethoven Abortion might deprive us of Beethoven But it might also deprive the world of a homicidal maniac, for all we know The meeting of sperm and egg is a random event

Omni: It seems you're kindly disposed toward animals You wrote that "the sound of a thousand mice all eating cornflakes falls gratefully on the ears of those who are fond of mice and wish them well."

Medawar: Some of my best friends are mice Anthony! Any success I may have had has been achieved standing on the shoulders of mice I have never carried out any experiments that were inhumane I just wrote a strong article for the *Encyclopaedia Britannica Medical Health Annual* about experiments on animals which I think is a very important topic indeed It was very much in defense of such research

Omni: What do you think is the worst mistake you have made?

Medawar: I have made two or three serious mistakes, but it would be too boring, I think, to describe them in detail I believed at one time that the antigens that aroused the rejection of grafts were DNA protein And they're not. I don't believe I have made many serious errors of fact I have put forward wrong hypotheses I've wasted too much time on what turned out to be dead ends. I have been too enamored of hypotheses Stopping a line of research is always a very difficult thing to do because you've invested hours, weeks, months, even years sometimes, therefore you don't want to give it up

Anyone can propound a wrong hypothesis, that doesn't matter It's just part of the hurly-burly of science What one must not do is make mistakes over matters of fact, which I have done though they weren't very serious Nothing must be said or written that diminishes the likelihood that someone else will get at the truth That's crucial

Omni: Since it's clear that you are an unusually positive man, may I ask if you were ever discouraged and pessimistic about your progress at any point?

Medawar. I get browned-off from time to time I sometimes say to Jean that it's about time I had a break But I've gotten over bad bits, I've bulldozed my way through them by attrition I worked harder and harder in order to surmount the stone wall I usually

> *"Every time a woman has a menstrual period, we don't worry that it could have been Beethoven Abortion might deprive the world of Beethoven or of a homicidal maniac"*

expect things to go very well And this has been of great importance to me in my life, since I've had two very serious illnesses, both cerebral-vascular accidents I have a very strong constitution and a sanguine temperament to go with it I never believed I was going to croak, as we say in the English vernacular

Omni: You have said that "secretiveness in a scientist is a disfigurement." Recently we read that AIDS researchers were refusing to share their latest findings in a meeting because they hadn't published them yet Can your ideal survive modern pressures in science?

Medawar: Science can survive it Scientists aren't basically secretive If they do something good, they publish it all right Secretiveness is a sign of littleness of mind

Omni: But can scientists afford to tell all before they officially publish? Isn't there a justified fear that someone might steal it?

Medawar: That is their fear But scientists are naive about that Most people do their own research, they don't want to pinch anybody else's But I think they should pick their company before they tell all There are a few scientists in front of whom I never tell all because they're sharp—sharp as hell I have known such people

Omni: You are fond of debunking myths such as the story of Alexander Fleming discovering penicillin after it floated in the window of a building in which the windows don't, in fact, open You also skewered the idea that salty blood is an echo of the sea origin of vertebrates

Medawar: Well, there is of course a tiny element of truth in that Life began in the sea and therefore adjusted to the existence of ions the same as one finds them in the sea But the original story was that blood was in effect the descendant of seawater And that is absurd I chose that merely as a very good example of the intrusion of literary things, or what I call poeticism into science—propounding or clinging to an idea because it produces a nice, warm mystical feeling inside I call that a visceral as opposed to an intellectual appeal Seawater and blood is a flagrant example of sheer nonsensicality

Omni: Do you believe that people should be discouraged from genetically dangerous pairings?

Medawar: Let me put it this way There are certain eugenic situations in which considerable circumspection before deciding upon a mate would be very well justified

Omni: Do you think people should be informed as a matter of course of their genetic inheritance?

Medawar: Only where there is evidence that would put one on one's guard. Phenylketonuria, the disease called PKU, is a genetically determined error of metabolism The incidence of it could be reduced very dramatically if the carriers of this gene were dissuaded from marrying one another

Omni: Are you what feminists might call a sexist? In the introduction to your book *Pluto's Republic*, you explain the title is the gushing malapropism of "a neighbor who sex chivalry forbids me to disclose."

Medawar: She said that, and I thought it was funny! She was a very nice, very sweet Texan girl who married an English neighbor And she gushed about philosophy

Omni: But you are, of course, naming her sex You don't believe that women make a lesser contribution, do you?

Medawar: Of course I don't I really thought it was just so funny, that's all I wanted to say it was a woman but without being too obvious about it

Omni: Why did you want to say it was a woman, though?

Medawar: Because in my memory she's so vivid—that sweet, silly face of hers I still see it before me! "Don't you just *adore* Pluto's *Republic*?" she said

Omni: But isn't that something Americans would react against as a sexist remark?

Medawar: I think they would! Yes I can bear it though

Omni: But judging from your books, you agree that women can make the same contribution as men

Medawar: I don't merely think they can. They actually do

VARIATION

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ing on the axons just won t stand up fo that kind of abuse

In any case, Gladney (who was apparently still going by that name for fhe sake of convenience) had passed all fhe critical points in redevelopment and had become a person again or for the first time de pending on your point of view He was certainly nof the same person—the man who had emerged from the blank brain was reminiscent of his former self but no more that self than he was anyone else

The extreme convolutedness of such a situation was one reason why I chose not to go into rehabing mindwipes as a profession when I'd had the chance Still, it was a fascinating field, easier to succeed in if you have a bit of a mysfic bent, or so I've been told I'd never thought of myself as particularly mystical, but I suppose all mindplayers are to a certain extent, if you accept the mind as the ghost in fhe biological machine or something like that

I filed the idea away for later meditation and went over Gladney's aptitude tests His new personality had grown in with a definite talent for music and more—I was startled to find thaf he now had perfect pitch The previous man did not. It made me wonder Was the perfect pitch something that had shown up due to some alteration in Gladney's brain chemistry broughf about by the mindsuck? Or was it jusf due fo a different brain organization? Possibly it was a combination of both

Whatever it was I didn t really have to worry about it I was supposed fo treat Gladney as I would any other client, which is to say as though he had never been any one else but who he was now

'Trufh to tell ' said the woman wifh the carnelian eyes and the too-shorf appled hair 'we ended up selecting you for your business name Anyone operating as Deadpan Allie must have quite a lot of control over herself ' She smiled brightly Her name was Lind Jesl and she looked less like fhe chief doctor on fhe Gladney case than she did someone finishing up her own recovery Except for the carnelian eyes and the hair she was as plain as possible her stouf body concealed in a loose gray sacksuit The office we were sifting in was even more austere a cream-colored box with no decorations Even the compufer desk was all folded into a stark, bare block The whole thing reminded me of the infamous whife room image I'd come across in certain clienfs minds

"Of course ' she went on "your self-control will be vital when you delve our boy An involuntary wipe is supremely sensitive and impressionable, even at such an advanced stage of regeneration Just fhe experience of you probing his mind is going to make quite a mark on him Your flavor, as 'twere, will leave a bif of an aftertaste

' I'm very careful '

' Yes certainly you are ' Her gaze snagged briefly on my equipment piled up beside me before she gave me her five-hundred waft smile again 'And we wouldn f have hired you if we weren't as confident of his ability to think independently as we are of *your* abilify fo refrain from exerting too much psychic influence '

She was putting a lot of emphasis on the very thing guaranteed by the fact that I was licensed to pathosfind in the first place "Whaf kind of results are you looking for?"

"Ah " Five hundred watfs went to six hundred She folded her pudgy hands and plunked them on her stomach "We're hoping you'll help him learn how to combine the various elements that make up a composer into a whole that will be greater than fhe sum of the parts '

I blinked.

"We know that he has a musical *bent*, as twere A definite leaning toward music, an affinity for playing instruments that fends to accompany perfect pitch But as yet

He got up for Jesl's brief introduction, touching hands with me gingerly as though I might be hot iron. Something like bewildered panic crossed his face

these fhings are fragmented in him He's having difficulty achieving a sfate where fhey all work together In fact, he has yet to achieve it even for a few moments "

"Isn't that just a matter of —I shrugged— ' practice and experience?"

"Usually But I know Gladney *This* Gladney There are signs of a definite barrier of some kind that he just can't or won't find his way around We don t know for certain because we haven't delved him since the very early part of the regeneration, which he does not remember Delicate Planf Syndrome you see—if you keep digging up a delicate planf to see how well the roofs are taking, it dies " She sat foward her hands disappearing into the voluminous cloth of the sacksuit "We feel he's ready for mind-to-mind contact now but with a pathosfinder rather than a doctor We wanf him to feel less like our patient and more like a person '

"How long *has* it been since you delved him therapeufically? '

"About nine or ten months It's been a year since the mindsuckers gof him We're hoping to release him complefely in another six months at fhe most Depending on how much progress he makes with you "

"Have you let him listen to any of his old compositions? The previous Gladney's music, I mean?"

' Yes and no Which is to say he's heard it, but he doesn't know who composed it We removed all identification from all the recordings we've given him, not just Gladney s to foil whatever deductions he might have tried to make '

"Does he react any differenfly to the Gladney compositions than he does to any of the others?"

' He reacts to all music somewhat guardedly He puts it through some kind of mental sorting procedure, and he *can* fell wifh an accuracy of close to ninefy percent sometimes more whether different pieces of music were composed by the same person I suspect he could also arrange a composer's works in the correct chronological order as well He's *extremely* bright But—' Jesl spread her hands "Somefhing inside isn t meshing "

' Has he tried to compose? '

' Oh yes Some short things he won f let us hear We had to bug the synthesizer we gave him His work shows potential There are moments when if a*lmost* breaks fhrough, but it always stops short of achieving—well, fullness, as 'twere You'll hear that for yourself, I'm sure " She looked at my equipment again

She was awfully sure about a lof of things it seemed to me I considered the possibilify that her evaluation of his music might be faulty Perhaps the musical direction he was taking was just different from fhe old Gladney's, and what he wasn't achieving were her expectations But a sight reading of her Emotional Index didn't indicate any smugness Her certainfy seemed to come from the facf that she'd been with him at every step of his regrowfh She smiled again this fime somewhat reservedly and I realized she knew I'd been taking her Emotional Index

"When can I see him?" I asked

"Righf now, if you like We've fixed up a room for you not far from his so you'll be within easy reach of each other I'll take you down there, and fhen we'll visit our boy "

The room fhey'd given me was an improvised efficiency with a freestanding lavabo unit and jury-rigged meal dial My apartmenf af NN's agency had spoiled me for any other kind of accommodations, no mafter how temporary The bed was a hospital bed disguised as a civilian—not very wide but, to my greaf relief, hard as a rock

I'd brought only a few personal fhings with me, which I didn't bother to unpack I debated taking my equipment with me to Gladney's room and decided against it He might feel too pressured to begin work if I appeared wheeling my system with me I wanted some extra time myself, just to see whaf an eighteen-monfh-old adult was like on the outside before I went inside

The man lying on the bed had once had the pampered good looks found in most

people of celebrity status. Over the months, he'd lost a good deal of them: the way an athlete or dancer will lose a certain amount of strength after a long period of inactivity. He was still attractive, but his appearance was changing, veering off in another direction. Typical of a regrown mindwipe. In a few months it was possible he would be so changed that no one from his previous life would recognize him.

He got up for Jesl's brief introduction, touching hands with me gingerly, as though I might be a hot iron. Something like bewildered panic crossed his face as Jesl made a quick but unhurried exit, leaving us on our own.

"So, you're my pathosfinder." He gestured at a small area arranged around an entertainment center with a few chairs and a beverage table. He'd probably set it up himself, but I could tell he wasn't completely at home with it.

"Anything you'd like to ask me in particular?" I said, sitting down. The chair I selected gave like soft clay under me, and I realized it was one of those damned contour things that will adapt a shape to complement your position. It was made of living fiber, supposedly the most comfortable kind of furniture there was, though how anyone could be comfortable with a chair that needed to be fed, watered, and cleaned up after was not within my understanding. Occasionally you'd hear horror stories about people who had sat down on one of those things and then needed to be surgically removed later. I wondered why they'd given Gladney a contour and then remembered it was also supposed to be a boon to the lonely. I was going to have a rough time being deadpan if it started any funny stuff with me. Fortunately, it seemed disposed to let me sit in peace, so I decided to tough it out rather than change seats. Gladney appeared to be watching me closely.

"I hardly ever use that one," he said, as it molded itself to support my elbows. "I can't get used to it. But it's fascinating to watch when someone else is in it." He turned his attention to my face. "What kind of eyes are those?"

"Cat's-eye biogem."

"Cat's-eye." He sounded slightly envious. "Everyone here at the hospital has biogems. Even some of the other wipes. Dr. Jesl says that I can order some whenever I want to, but I don't feel like I can yet. *He* had biogems."

"Who?"

"Gladney. The original one, not me. After he was sucked, the hospital replaced them with these, which I guess are reproductions of the eyes he was born with." He smiled. "I remember how surprised I was when they told me almost everyone has his eyes replaced with artificial ones. It still amazes me a little. I mean, my eyes don't feel artificial—but then, I guess I wouldn't know the difference, would I? His smile shrank. "It's strange to think of you going into my brain that way. Through my eyes.

It's strange to think of anyone else in there except me." He put his hand on his chest and absently began rubbing himself. "And yet there have been a whole lot of people in there. Mindplayers. For *him*. And then the suckers. The doctors. And now you."

"Direct contact with the mind is a way of life. Not just the mindplay but many forms of higher education. People buy and sell things, too. Neuroses, memories, or—"

Nice rolling. Deadpan. I thought. *You had to bring* that *up.*

"Yah. I know. People buy and sell. They steal, too." He lifted his chin with just a trace of defiance. "I made them tell me about that, and what they wouldn't tell me, I looked up. How Gladney's mind got stolen because there was some guy who admired him so much that he wanted to *be* Gladney. So he had Gladney overlaid on his own self. He went crazy. Trying to be two people at once." He slouched in his chair and rested his head on his right hand, digging his fingers into his thick, brown hair. "I didn't make a move. I asked them why they didn't just take Gladney out of him and put him back, but they said they couldn't do that after he'd already been implanted. Even if they'd found the suckers before that, it would have been impossible because this brain—he pointed at his head and then resumed rubbing his chest—had already begun developing a new mind. Me. There would have been too much conflict. Doesn't seem fair."

"Fair to whom?"

"Gladney." Beneath the thin material of his shirt, I could see his flesh reddening. "He just disintegrated. Evaporated when they cleaned him out of the other man. And here I am. Variation on a theme." His gaze drifted away from me to something over my left shoulder. I turned to look. He was staring at the synthesizer near the bed. It was a small one as synthesizers go, taking up about twice as much space as my portable system did when assembled. There was a very light coating of dust on the keyboard cover.

"Use it much?" I asked.

"From time to time."

"I'd really like to hear something you've composed."

He looked mildly shocked. "Ah, you would. Why?"

"Get acquainted with your music."

"So that after you get into my brain and find my music box, you'll know whether it's mine or not, huh?" He waved away his words. "Never mind. I've done nothing but short pieces, and I don't think of any of them as complete. Not when I compare them to other things I've heard."

"I would still like to hear something."

He hesitated. "Would a recording be all right? I don't like to play in front of anyone. I'm not an entertainer. Or at least not that kind of entertainer."

"A recording would be fine."

He got up and puttered around with the entertainment center for a minute, keeping his back to me.

Generally it's difficult if not impossible to sight-read the Emotional Index of someone who isn't facing you, but it was easy to tell that Gladney was dry-mouthed at the idea of my hearing one of his compositions. It was far more than stagefright or shyness. His shoulders were stiffened as though he expected someone to hit him.

Abruptly music blared out of the speakers, and he jumped to adjust the volume.

"Set it to repeat once," I told him.

He turned to me, ready to object, and then shrugged and thumbed a shiny green square on the console before sitting down again. "Just a musical doodle, really," he muttered, apologizing for it before it could offend me.

In fact, it was a bit more than that: a dialogue between piano and clarinet, admirably synthesized but too tentative. And he'd been right—it wasn't complete at all. It was more like an excerpt from a longer piece that he'd heard only a portion of in his mind. I was no musical authority, but

> *"It was easy to tell that Gladney was dry-mouthed at the idea of my hearing one of his compositions. His shoulders stiffened as though he expected someone to hit him."*

the second time through, I could pick out spots where a surer composer would have punched up the counterpoint and let the two instruments answer each other more quickly. There might even have been the makings of a canon in it, though I couldn't be certain. Perhaps he'd been mistaking Bach for Gladney. Whatever he'd been doing or trying to do, something was definitely missing.

"How did you compose it?" I asked after the music finished.

He frowned.

"Did you just sit down at the synthesizer and fool around until you found a sequence or—"

"Oh." He laughed nervously. "That's a funny thing. I heard it in a dream, and when I woke up I went to the synthesizer to play it out so I wouldn't forget it. First I just played all the notes as I'd heard them. Then I put them with the appropriate instruments."

"Was that how it was in the dream—piano and clarinet?"

"I don't remember. I just remember the music itself. Piano and clarinet seemed right."

I had a feeling I knew what the answer to my next question would be, but asked anyway. "What was the dream about?"

He was rubbing again. "Gladney."

I managed to talk him into playing a few more of his incomplete compositions. When his discomfort went from acute to excruciating, I gave him a reprieve and told him I was going to get some rest. His relief was so tangible I could have ridden it out of the room and halfway down the hall.

There was a message in my phone, an invitation from Dr. Jesl to have dinner with her and the other medicos working on Gladney's habilitation. I begged off and asked her if she could supply me, without his knowing it, with dupe recordings of Gladney's recent attempts at composition, and also some of the previous Gladney's work. She could and did, and I spent most of the rest of the day and a good part of the evening in an audio-hood.

Maybe if I'd known more about music—the real hard-core stuff, mathematics of progressions and so forth—I'd have been able to pick out more similarities (or differences) between the two Gladneys' work. I called for recordings by other composers he'd listened to, and I played those as well. Our boy, as Jesl had called him, hadn't been trying to crib from Bach or anyone else. He had avoided being derivative as much as possible, admirable in a beginning talent and also evident of already well-developed control, which is a good sign only as long as it doesn't become inhibition. What he had borrowed from other composers was mostly technique—my ear was good enough to pick that up, if I listened to everything several times. The composer he seemed to have borrowed from least was, oddly enough, Gladney. Or perhaps that wasn't so odd. Perhaps the compositions sounded too familiar.

I listened to the piano-clarinet piece over and over, trying to hear some similarity between it and any of the other Gladney's music—a sequence of notes, rhythm, something. He'd been unable to tell me exactly what had happened in the dream where he'd heard it—just that he'd known the dream was about Gladney. That was somewhat unsettling and would have been more so if he had composed all his music after dreaming about that former persona. But he hadn't, and I would have found it reassuring if the piano-clarinet piece hadn't been so obviously superior to all of his other attempts. Variation on a theme, he'd called himself. It nagged at me.

I waited until Gladney had been escorted off to some kind of day-to-day culture workshop early the next afternoon and had Jesl let me into his room so I could set up for our first session. That way he wouldn't have to receive me as a guest with all the attendant awkwardness again.

The bed, I decided, would be the best place to put him. It was obviously what he gravitated to when left to himself, so he'd probably be more receptive lying down. I

rolled my equipment over and assembled the eight odd-sized components. They still reminded me of a giant set of cub's blocks. With me as the giant cub, I supposed, building some kind of surreal structure a little like a cubist idea of a skyscraper. It looked ready to topple over as most of the smaller pieces were clustered on one side of the largest one, a four-foot rectangle. In reality it would have been more trouble than it was worth to knock it over. By the time Gladney returned I had the compartmented tank for our eyes set out on the stand by the bed, the optic-nerve connections to the system primed, and a relaxation program ready to run the moment he was hooked in.

He didn't seem surprised to see me, only a little resigned and nervous. "You're not going to want to hear any more music, are you?" he asked with an attempt at a smile.

"No more recordings, no." I patted the bed. "Come get comfortable. We don't have to start immediately."

Now he did smile, stripped off his overshirt and chaps (it never fails to amaze me what will come back into style), and flopped down on the bed in his secondskins.

Rather than play one of the usual preparatory games like *What Would You Do?* or *What Do You Hear?* with him, I eased him into chatting about his habilitation. I thought I'd learn more about his state of mind from simple conversation than from games. After all, what past experience could he draw on for a game? It would only oblige him to be inventive and pull his concentration from the situation at hand. Chitter-chat was the right approach. He had some rather astute observations on modern life, as any outsider would, and I hoped he wouldn't lose them when he became an insider. He wasn't really opening up to me—I hadn't expected that—but watching him try to hide in his own talk was enlightening. He wasn't going to give a single thing away, not even in mind-to-mind contact, and if I didn't figure out a different approach I'd end up chasing him all over his own mind.

Eventually he began winding down. I let him get away with some delaying tactics: going to the bathroom, taking his vitamins—delaying tactics can be important personal-preparation rituals if they don't go on for too long. When he began talking about having a snack, I made him lie down again and start breathing exercises.

He was a good breather, reaching a state of physical receptiveness more quickly than a lot of more experienced clients I'd had. When the time came I removed his eyes for him, just pressed my thumbs on his closed lids and out they popped into my palms, as smoothly as melon seeds. Gladney didn't even twitch. The connections to his optic nerves disengaged with an audible *kar-chunk*. Hospital eyes are always a little more mechanical than they have to be. After I placed them in the left side of the holding tank, I slipped the system connections under his flaccid eyelids. A tiny jump in the wires told me when he was hooked in to the mental fingerpainting exercise I'd selected for him. Mental fingerpainting was about the right amount of effort for someone on his level. The system supplied the colors; all he had to do was stir them around.

I breathed myself into a relaxed state in a matter of moments, but I waited a full minute before popping my own eyes out and joining him in the system. I wanted to give him time to get acclimated. Some people experience a sense of continuous drifting when they first enter the system, a disorientation not unlike weightlessness, and they need a minute alone to right themselves before they have to get used to another presence.

My materialization was even more gradual than usual, to spare him any trauma. His perception of my entry was as another color oozing in greenly and then transforming itself into a second consciousness. Bright lights flashed as he recognized me; some of them nightmare purple.

> *When the time came I removed his eyes for him, just pressed my thumbs on his closed lids and out they popped into my hands, as smooth as melon seeds.*

but it wasn't me he was afraid of. There was a little fear from not having a body to feel, but he was becoming accustomed to that. He was edgy about something else entirely—quick images of traps snapping shut, closet doors slamming. But there was exhilaration, too, at being in a realm where almost nothing is impossible.

The images began to flow more continuously from him, rolling over us in a tumbling series: gargantuan confetti. Most of them were portions of dreams, scenes from books he'd read; some were strange scenes he was making up in the heat of the moment, just to see if he could do it. I stabilized myself and moved with his attention, reminding him that I was still there. The image of my own face came followed by a series of others that gradually became more bizarre. The undertones running out of him indicated this was how he imagined everyone else in the world to be—somewhat exotic, different, mysterious aliens, existing on a plane he had only the haziest conception of.

I emphasized my presence before he could become caught up enough in his grotesquely ornamented faces to get hysterical. He steadied his energy level decreasing. I felt him adjust something, and there was a sense of balance being established, as though two large masses floating in space were settling into orbit around each other. *Space* was a good word for it. The feeling of emptiness surrounding us was enormous and almost vivid enough to induce vertigo.

This is me. So much nothingness to be filled. He was unaware that he'd said anything. It simply came out of him as everything else had. There was a brief image of Gladney—the previous Gladney—and he tensed at the thought. *Somewhere. In this big emptiness—*

The Gladney-that-had-been drifted away from us and disintegrated. The thought remained incomplete. He seemed to be at a total loss now, drifting nowhere, so I gave him a new image, a simple one: the synthesizer. As soon as I was sure he saw it, I added the music, the clarinet-piano piece.

Suspicion bristled on him for a moment, and then he was rerunning the music with me. I could hear little extra things: notes and embellishments absent from the recording. He was on the verge of rolling with it, letting it come the way it had been meant to, when hard negation chopped down like a guillotine blade. We were left in silence. If he could have withdrawn from me, he would have, but he didn't know how to.

I waited, making my presence as nonthreatening as possible, while I took his Emotional Index. He registered in peculiar fragmented sensations of movement rather than visuals, because everything was movement for him. I could see that now. The universe was movement, the movement of vibration. Like a tuning fork. He was a tuning fork, and right now he was vibrating in the key of tear-sharp. One octave up I could hear a whiny echo of guilt.

The intensity of it ebbed, and I turned the music on again. This time he didn't shut it down. He just pulled back from it as far as possible and allowed it to replay as the original recording without changes. I slowed down my time sense and concentrated, tightening myself until I was small enough to slip in between the notes. At that level they thundered, no longer recognizable as music; my consciousness vibrated in sympathy. I concentrated a little more, and the thundering rumble of the notes became more ponderous. Now I could detect something else within the vibrations of the music, faint but present. I would have to concentrate even harder to find out what it was, and I was nearly to the limit of my endurance. To concentrate that forcefully is to alter the state of consciousness in such a way that one is not actually conscious in the true sense of the word—I would not be able to monitor Gladney. From his perspective it would seem as though I'd vanished into some part of his mind inaccessible to him, or gone from being real to being imaginary.

I strained, achieving it slowly. The notes swelled until I could perceive only one at

a time, and I let the nearest one swallow me up. If was a piano note, G, perfectly formed in perfect pitch, a universe created by the oscillation of a string in the air (that was how he saw it, not as synthesized piano but the real thing). Each sweep of the string through space created the universe of the note anew, the string reaching the limit of its swing before the ghost of itself opposite had disappeared. And within—

He looked up with a smile of mild interest. The face was unmistakable in spite of all the changes he'd been through in the last year and a half.

Come closer, he said.

Gladney?

The same. The smile broadened. *Well, not quite the same.* Those pampered good looks in full flower, the well-tended skin, the sculptured jawline, the hair brushed straight back and falling nearly to his shoulders. His face was the most solid thing about him. The rest had been sketched in vaguely. I could get no undertones from him, no feelings, no images.

He locked me in here, he said. *So I won't get out and take—*

The note passed away, and we were in another. Gladney was standing on a high hill in the middle of the day.

—what used to be mine. He looked around. In the distance the horizon ran wetly, melting into the sky. *I live in the music now. He can't come in unless I get out.*

It wasn't possible. If anything had been left of the old Gladney's mind after the suckers had finished cleaning out his brain, it would have shown up while he was still in quarantine. This had to be a delusion of the present Gladney, some kind of survivor guilt. Until he ceased to think of music as being a simultaneously convex and concave prison, he would never be able to compose more than a few incomplete snatches of melody.

The outdoor scene disappeared as the note went on, now we were in a vague representation of the old Gladney's recording studio. He looked up from the piano he was sitting at.

Can you prove who you are? I asked him.

You can see me as I was. Isn't that enough for you?

No. The Gladney that is has perfect pitch—that could easily translate to his being able to reproduce his old appearance. If you are really the Gladney that was, you can tell me something about yourself that the Gladney-that-is has no knowledge of.

The delusion spread his hands. *He's studied up on me thoroughly. They gave him access to vid-magazines, newstapes.*

There's still plenty he doesn't know. I said. *The private things. Certain memories. Feelings. Tell me something your family could confirm as true.*

His face took on a defiant look, but there was no more feeling from him than there would have been from a holo transmission. That in itself indicated he was a fabrication, but my merely telling Gladney that wasn't going to help. Even if I could get his intellect to believe me, his emotions probably wouldn't.

Tell me something. I prodded again.

He rose and leaned on the top of the piano. *Don't you think a man with perfect pitch would be able to interpolate the private feelings of another man who had grown from the same brain?*

The studio was gone. He was leaning on a small table in a quick-eat while I stood just outside the entrance. I could hear the drumming of his fingers on the table.

Tell me a fact, then. Just one fact he couldn't possibly know.

He straightened up abruptly. *The mind-suckers damaged me. I remember only what he knows.*

I'd expected him to hide behind that, but I was unsure what to do next. Arguing with the delusion was only going to strengthen its sense of presence. Even acknowledging it was giving it something to feed on. Confronting it was Gladney's job, not mine. I was going to have to get him down in the music with me.

The note passed and was replaced by a bedroom. Gladney lay crosswise on a bed with his arms folded behind his head. He was looking at me upside down.

I'm residue, he said happily. His reversed smile was grotesque. *I'm a myelin ghost. You can't get rid of me without physically damaging his brain.*

I hooked my feet under the bed and willed myself upward. His bizarre upside-down face rushed away from me as I grew through the ceiling of the phantom room up into the emptiness to the limit of the note. The piano string swung across a sky made of the present Gladney's face. My abrupt appearance gave him a surge of alarm that nearly dislodged me.

Where were you?

You know. The piano string moved between us. I stretched out my arms. *Take my hand before that string comes back.*

No.

Why not? It's your music.

No!

From the corner of my eye I saw the piano string return to view, slicing through space. *Please, Gladney. Don't let that string put another barrier between you and your own work.*

Panic at the idea of being cut off from his music made him grab my hands. Half a moment later panic at the idea of meeting his delusion head-on made him sorry he'd done it.

We were pitching and bucking in the throes of his fear, but still the piano string approached. Shortly it would pass through my wrists and fragment my concentration.

I can't pull you in, Gladney. You have to come on your own.

I'm afraid!

Why? Say it!

I'm afraid because—

Say it!

He'll get me!

Who?

Gladney!

You are Gladney

No!

Then who are you?

There was no answer. The piano string was almost on us.

Are you a composer?

His affirmation ducked him under the string just before it would have severed my hands. He stared after it with a horrified elation, and then we were rushing down into the music together in the momentum of his admission.

The delusional image of Gladney watched us descend. The real one made a soft landing on the bed beside it, still gripping my hands. Without thinking, he tried to pull me onto the bed between himself and the other.

The bedroom vanished. We were on an underground tube, the only three in the coach. I moved around behind Gladney and he had to let go of me. As soon as he did, the delusional image vanished. Gladney was startled, but not half as much as I was. He moved forward with his hands out in front of him, feeling the air.

He's not here, Allie. Is he?

I didn't answer. I was still trying to figure out what had happened. Delusions didn't just go away that quickly.

Allie? He half-turned toward me, and I saw that his eyes were closed. He swung his arms back and forth awkwardly, fingers clutching at nothing. Either he was making use of a fairly sophisticated mental maneuver, a sort of sneaking up on his own blind side, or he was faking same to stay blinded to the situation. I couldn't tell which, his undertones showed only confusion.

Suddenly his hands seized on something invisible. The delusion snapped into existence again, caught in Gladney's grasp. The air around them crackled with sparks from Gladney's terror.

Allie! I can't let go!

We went from the tube to a raft in the middle of the ocean, bright sun beating down on the water. Gladney still had hold of the delusion. His eyes were open now. A shadow passed over us—a high-flying piano string.

High A sharp, Gladney said automatically, identifying the note. *We're getting close to the end of the melody. What do I do with him then?*

You're asking me? It's yours. What do you do when the music's over?

We were in the lower branches of a large tree, then back to the tube very briefly (*B flat grace note,* Gladney said), in the bedroom, on a windy rooftop several thousand feet above the ground. Gladney was plunging us to the end of the song. The images began to blend into one another, flickering and flapping. Gladney and his delusion flashed on and off in a variety of positions. Gladney still holding on, as though they were wrestling or dancing. The music went from slow-motion subsonic to recognizable melody. The background imagery faded away completely, leaving the two Gladneys in their dance/struggle. The delusion offered no resistance, but Gladney was too occupied to notice. The struggle became a tumbling, end over end over end over end. I saw Gladney's hospital room, the synthesizer, Gladney himself standing before it, staring it down as though it were an enemy. Dr. Jesl appeared briefly, carnelian eyes blind to the two figures tumbling past her through the entertainment center where Gladney sat studying a newstape of the Gladney-that-had-been on the holo screen. The fumblers rolled on to the vision of a dimly remembered dream, that dream of Gladney, the old Gladney, lifting his head to the sight of three people visible only from neck to thigh, rushing forward at him.

The dream Gladney cried out, fell back and vanished, and then the tumblers were beyond the end of the melody. But still they went on, and the music went on with them, the piano and clarinet finally making contact, playing together and opposite each other in complement.

> *"I emphasized my presence before he could become caught up enough in his grotesquely ornamental faces to get hysterical. He steadied, his energy level decreasing."*

After some unmeasurable time, the tumbling began to slow. When the music stopped, there was only one figure, not two, that stopped with it. He drifted in emptiness, excited and drained all at once. That was enough, I decided. Before he could think of doing anything else, I cued another relaxation exercise and wrapped it around him. As soon as he was completely absorbed in mental fingerpainting, I broke the contact between us and withdrew.

It took a minute or so for his vitals to calm down. I changed the exercise from fingerpainting to simple abstract visuals. He was overstimulated, in need of a passive mode. After his pulse went down below eighty, I disconnected him from the system and put his eyes back in.

As soon as he saw me, he broke into a sweat. "Don't try to talk." I told him, covering the connections and slipping them into the drawer in the largest component.

"I can talk."

"Sure. I just didn't want you to feel like you had to."

He turned his face away while I dismantled the system. His breathing was extremely loud in the room. Rhythmic. I let him be. The inexperienced are often overcome by an intense feeling of embarrassment after mindplay, particularly pathos-finding. It takes some getting over.

"Listen," he said after a bit, still not looking at me. "You don't know what it's like. What it *was* like." He rubbed his forehead tiredly. "I was almost him. I wanted him, and I didn't want him." He paused and I knew he was staring at the synthesizer. "If I'd been him, I would have been someone I just came out of nowhere, out of his brain. But I'm not him. Now I'm a figment of my own imagination."

I opened my mouth to say something conciliatory but neutral when the image of the pearl necklace popped into my mind. *I have not always been as I am now.* And neither was anybody else. I wanted to tell him so. I wanted to tell him he'd get over that, too, that he wasn't the only person who'd ever met the stranger in himself. Granted, his experience had been more extreme, but it was pretty much the same. I could no more tell him something like that than I could map out his life for him.

"You can't have somebody else's past," I said as gently as I could. "And there's no such thing as a ghost, myelin or otherwise. It's always just you."

"I could buy memories. People do that." His face was hard. "They even buy whole minds, remember?"

"And it drives them mad, trying to be two people at once. Remember?"

That gave him pause. "God. I'm tired," he said after a moment.

"Take a nap. I'm just down the hall if you want to talk later."

"Allie—"

I waited while he tried to settle on what it was he wanted to say. The words never came. He waved one hand, dismissing me. I let myself out, wondering how long he was going to sulk. If we prize our illusions, we are even that much more jealous of our delusions because they're so patently untrue. I was sure, though, that in a few more sessions he'd adjust to being exactly what he was, no more and no less, and he would accept his music as his music only, to make without the fear or the desire that it came from him at the behest of something beyond his control.

Dr. Jesl phoned me sometime later, rousing me from a doze. "Our boy has a supreme mad on for you," she said. "Thing is, I can't tell just what it's all about. I don't think he knows, either." She sounded more amused than worried.

I was still too exhausted to explain about mindplay embarrassment compounded by the loss of a self-imposed handicap. "He'll get over it," I told her.

Which he did. And I was only a little bit spooked later on when he correctly distinguished all of the old Gladney's music as having been composed by him without anyone's identifying it for him. Great minds, I told myself, think alike. ∞

EARTH

CONTINUED FROM PAGE 18

Fraud and misadventures aside when things go right Haag ends up with a harvest of meteorites he can haul to his home in Tucson. There he slices the stones into sections with a superhard diamond saw cutting at the excruciatingly slow rate of 0.25 inch per hour. 'Meteorites, especially metallic meteorites, are so hard," Haag explains, "that you can hit them with a twenty-pound sledge and they'll just go ping. They can tear the teeth right off my saw." The sections are then prepared for market by hand polishing and etching with Nitrol.

Then they're ready either for trading or for admission to Haag's catalog, which sells for $1 and is read by museums, universities and private collectors.

Samples can sell for $5 for a small piece of common tektite to $6,500 for a pyramid-shaped Mundrabilla from Australia. In addition to the conventional clients, his customers include the U.S. Department of Defense, which uses the meteorites to test lasers, and the American Buddhist League, which smelts the meteorites down to make ceremonial knives.

Even with a well-organized business and a list of steady customers, traveling and purchasing costs keep Haag at the break-even level. But his collection—which is stored in a strong room guarded by dogs and alarms—is now worth over $100,000. "All I really want," he says, "is to have a fantastic collection of meteorites."

But Haag has other, more cosmic, axes to grind. He owns a number of pieces of the famous Murchison meteorite, the carbonaceous chondrite that fell in Australia and was found to contain amino acids. Along with some experts in chemical evolution, Haag believes that life on Earth is a result of amino-acid "seeding" by meteorites, and he is eagerly awaiting the next breakthrough. "I know there's life out there," he says. "Can you imagine if they found a spore in a meteorite? A piece of coral? A fossil? That's why I keep looking—to find something that's never been seen. You could call it a form of faith." ∞

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LIVING BRAIN

CONTINUED FROM PAGE 89

plagued the girl for years. Now she'll be free of her strange, recurrent trances.

The operation is performed regularly on patients whose epilepsy is the result of erratic impulses that begin at certain points in the brain. Like dominoes knocking down others beside them, the impulses spread to other sections of brain tissue, causing them to send out impulses of their own. Within minutes whole sections are firing spastically. The electrical overload sends the victim into a seizure or hypnotic trance.

Scientists don't know what triggers the seizures, but they have learned that sometimes it helps to remove the spot where the anarchy starts. In the pre-PET days, finding the trouble spots was a little like hunting for an enemy submarine. For days the patient would wear a crown bristling with half a dozen wires sunk several centimeters into his brain. A machine recorded the electrical waves that each wire picked up. During a seizure, doctors would monitor the impulses. By comparing how strongly each wire detected them, the seizure's point of origin could usually be located. It was risky and uncomfortable; on rare occasions, surgeons removed the wrong part of the brain. Yet frequently the epileptic was cured by the operation.

Now there's an easier, safer alternative. Doctors can watch a PET screen. Between seizures, trouble spots glow as greenish-blue regions of very low metabolism. During seizures they glow white, using several times more energy. PET provides surgeons with a map that guides them to their target with extraordinary accuracy.

Dozens of these operations have been performed by doctors at UCLA and the National Institutes of Health. "In those cases in which we've removed tissue," says Phelps, "diagnoses based on PET scans have been correct nearly one hundred percent of the time."

UCLA's Mazziotta recalls a particularly bizarre case in which a woman came to the emergency room with inexplicable seizures. "She'd smell horrible things she'd never smelled before. She suffered from continuous nausea and vomiting. Then she'd go into a seizure. Yet all her tests showed nothing was wrong.

"I was a resident then and asked her permission to do a PET scan," he recalls. "The scan showed hyperactivity in a small, kidney-shaped brain area associated with smell. Doctors did a biopsy and discovered a tumor. The woman's seizures and the mysterious smells stopped when the tumor was removed."

If all this makes you think you'll soon find a PET at your hospital, critics say you'd better think again. PET's good for research, they argue, but far too expensive for clinical use. The doughnut-shaped "camera" costs $1 million. Furthermore, because positrons—the radioactive tags—have half-lives of only a few minutes or hours, there must be a cyclotron to produce them. Add several million dollars. For hospitals straining to reduce costs, it seems like an impossible expense.

This argument, however, may not hold true in the future. PET will become cheaper as more people use it, points out Washington University's Ter-Pogossian. And even if PET scans are estimated at $2,000 each (they're free now because they're still experimental), the procedure is worth it. A correct PET diagnosis could save you thousands for the time you don't spend in the hospital. "Doctors waste millions of dollars on unnecessary X rays," says Ter-Pogossian. "It's what you get out of the treatment that counts."

Still other critics charge that PET is a dinosaur, destined to extinction by an upstart called NMR (for nuclear magnetic resonance). This diagnostic technology uses a powerful magnet to rattle chemical bonds in the human body. The energy the NMR units emit is converted into an image by a computer. It's radiation-free—an advantage, some say, over PET.

Ter-Pogossian, who routinely uses both diagnostic techniques, emphasizes that PET occupies a different niche from that of NMR. He notes that certain laws of nuclear physics enable NMR to look at only a few chemicals, including hydrogen and phosphorus. "That's great for examining structure but poor for examining chemistry. PET, on the other hand, uses a class of isotopes that bond to almost anything the body uses. It can image anything taken up by the body; radiation exposure is minimal. NMR will replace the CAT scan," says Ter-Pogossian, "but new insights into disease will all come from PET."

As PET centers start producing ground-breaking results, experts predict that the technology will come to be applied widely in medical diagnostics. At Washington University researchers are scanning the brains of premature infants to learn why so many suffer mysterious, fatal strokes. Researchers at Johns Hopkins are using PET to study the chemical messengers that regulate the brain's thoughts and moods. A team at the University of Texas, in Houston, hopes its PET will someday predict—and help avoid—heart attacks up to ten years in advance.

Already 43 PET centers exist around the world, with 20 in the United States and 7 in Japan. NINCDS and other agencies say they'll support the American effort with millions more dollars. That researchers say makes PET less an experimental technology than an unstoppable trend—and vindication for visionaries who once predicted that computers could save lives.

"There's a tremendous force that has been building up very quietly," says Phelps. "The applications will increase. PET will change all of medicine." ∞

SPACE

CONTINUED FROM PAGE 22

system is conserved the tether allows some momentum to be transferred from the space shuttle (which then falls out of orbit without needing rocket fuel) to the space station (which then receives a routine orbital boost without using any fuel either). There is a cost, of course: the weight and complexity of the tether system. But recent studies have clearly demonstrated the cost-effectiveness of this strategy.

Another interesting possibility arises if a long tether is made of an electrical conductor. It then becomes a wire moving through a magnetic field (Earth's). The movement makes it an electrical generator. If a closed circuit can be established. As described by NASA futurist Ivan Bekey, "If electrons are collected by a metallized film balloon at the upper end and ejected at the lower end by an electron gun, a current will flow downward through the wire." For a 100-kilometer cable, the current will be about 15 000 volts at 5 amps, producing a net power to the payload of 70 kilowatts.

But such concepts pale to insignificance next to the notion of dropping a tether from a satellite to Earth's surface. If the anchor in space were in a synchronous 24-hour orbit, 40 000 kilometers above the equator, the cable could be attached to a spot on the surface near the equator—perhaps Mount Kilimanjaro, or somewhere in Sri Lanka (à la Arthur C. Clarke's novel *Fountains of Paradise*), or in the city limits of Quito, Ecuador or Singapore. Since the cable would have to support its own weight, it would have to be tapered, thin at the bottom and thick at the top. The required material strength is far beyond anything yet available.

The idea for such a skyhook has been around for decades. Yuri Artsutanov first mentioned it in print, in a Soviet magazine in 1960, and it has subsequently been independently reinvented several times. It's also been called a space elevator (transportation would be by "funicular railway" up the line) or, more in keeping with the semilegendary nature of the structure, a beanstalk. And for the foreseeable future, it cannot be built on Earth. (See "High Wire Act," July 1981.)

There are still other variations on the idea. Amazingly, they are entirely feasible with such modern materials as Kevlar.

Many military pilots owe their lives to a simple skyhook device that plucked them out of enemy territory when their planes had been shot down. Downed fliers released a helium balloon attached to a long cable that was hooked at the other end to a harness around their bodies. A rescue aircraft with a pronged fork extending below and ahead of it made passes at the balloon, and once the aircraft caught hold of the balloon, the pilots were pulled off the ground and to safety.

In the Arctic, bush pilots have perfected a trick for dropping off and picking up mail, supplies and other cargoes for isolated settlements. The aircraft lets out a bucket on a long line, then begins flying a tight circle around the bucket, which drops to a target area. While the bucket bounces around, ground personnel grab it, retrieve its contents, and load any return cargo. The exchange complete, the aircraft flies off straight and reels in the bucket.

These operations are feasible with space-based tethers. Some are difficult on Earth, with its deep gravity well—the deepest of any world in the solar system on whose surface humans will ever walk. But such techniques are extremely attractive for smaller worlds such as Mars.

For bigger worlds a "rolling skyhook" may be one answer. This approach, originated by John McCarthy of Stanford, and elaborated by Hans Moravec, involves a long, free-flying tether orbiting the earth (or any planet) while also tumbling end over end. Its motion resembles that of a diameter on a rolling wheel: its center point remaining a fixed distance from the surface while each end arcs through a full circle. Whenever the tether is aligned exactly vertically, one end is touching the surface of the planet. The tumble rate is adjusted so that the tip of the tether appears to descend from the sky nearly vertically, come to a stop, and then accelerate back up into the sky. But the skyhook doesn't have to go all the way to the surface. It could pick up an airborne vehicle in midflight, whip it up into space, then release it.

A similar pickup-and-delivery system could help future planetary explorers retrieve soil samples from other planets. An interplanetary probe orbiting a target world reels out a long tether with a weighted sample tube at the far end. The tethered sampler device—perhaps containing a small, expendable guidance computer to guarantee a precise impact point—descends to the planet's surface, scoops up material, and is pulled back into space.

The sampler's descent and ascent must occur rapidly, as the mother ship holding the end of the tether passes overhead. For target planets with thick atmospheres, this presents a serious problem, because the atmosphere will slow the sampler or burn it up before it can reach the surface.

One solution is balloons. A short-lived robot dropped untethered to the surface grabs the samples and loads them into a balloon gondola that is quickly dispatched to the upper levels of the atmosphere. There the package is snared by the descending skyhook and yanked out into space.

For target worlds such as Venus, the technological challenge of recovering surface samples has been awesome and intimidating, as long as mere rocket propulsion was considered. But as space engineers are learning, rockets aren't the only way to move mass through the solar system and to and from planetary surfaces. The success of future missions may hang by a tether.

mind

CONTINUED FROM PAGE 30

experienced an accident a situation in which the plant behaves differently Thus, when an accident starts you try to act on the model in your memory which no longer applies to reality While closing valve x for example may be the normal procedure any other time it could be the wrong procedure in this abnormal situation

Having identified these mental patterns that can bedevil high-tech workers the Brookhaven team is using the information to make nuclear plants safer 'Take task fixation, says Hall "We're now trying to design emergency procedures that force workers to pay attention to anomalies—maybe screens suddenly flash red instead of green That way they would act as flags that pop up and attract operators' attention to what is happening"

Under new procedures for handling emergencies Hall continues, operators could concentrate on function—on what should happen to prevent a calamity—instead of trying to diagnose exactly what went wrong The reason for the change in focus is that trying to uncover the source of a problem can lead to task fixation—getting so distracted by the burned out light bulb or the persistent buzzer in the warning signal that you let the plane crash

In a malfunctioning power plant where the coolant water has stopped flowing for instance, operators using these new procedures would not stop to ask why the water had stopped flowing Instead they would concentrate on ways to get water in to cool the core After the plant has stabilized they will then have time enough to diagnose the cause of the mishap One advantage of the new type of emergency procedures is that in directing the operators' minds away from diagnosis the chances of task fixation are reduced

According to Hall the less time a worker has to think the more apt he is to fall into error prone habits of thinking Thus in designing its error-prediction equations the Brookhaven group factors in time available for action' as the key variable in determining the odds for error In current tests on college students in simulated situations the team hopes to refine its equations, which it devised from studies of nuclear plant mishaps The Brookhaven group hopes the experiments will lead to error predictions that are even more accurate than the ones they now make

"Right now, I'd guess that we're hitting about seventy-five percent which is pretty good but we have a long way to go' says Hall The process is slow, he observes because data on human performance with high-tech equipment are scant Eventually the equations predictions are apt to have an impact on the design of power plants, on the type of people hired to operate them, and on the kind of training the workers should receive

The Artist

TECHNOLOGY

CONTINUED FROM PAGE 28

batteries. A direct-current panel is connected to a 12-volt windshield wiper motor to power some of the smaller movements in a tiny forest animal. These movements are sent through a console equipped with animation channels that provide the power to the solenoids that control the actuators. Also on the board is a panel that supplies alternating current to the computer.

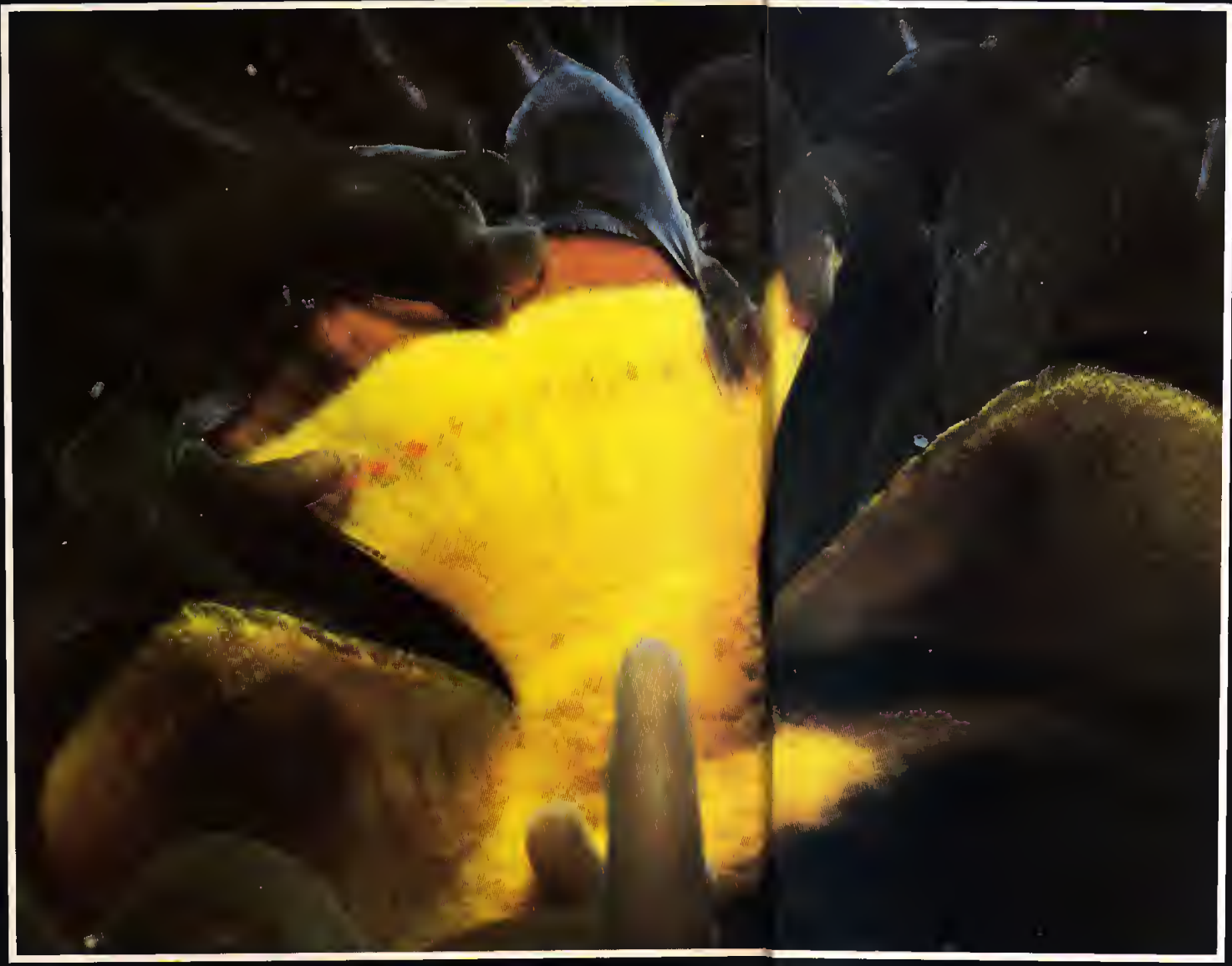
In 1979 the original animation program was written in 6502 assembly language by Dennis Brown, of the Pomona campus, and it is now maintained by Jeff Knight, assistant float chairman. Collisions are avoided by linear-position transducers in an analog-to-digital board. A data file of possible collision zones is updated annually. Should an animated object enter a collision zone, the program checks itself and overrides the sequence until the warning ends. Although they are working on a self-monitoring system, until they have one, the Cal Poly students on board observe the whole float on closed-circuit television. Two monitors are positioned to give operators a panoramic view of the float. Two people are in the castle with the computer, making sure all systems function properly. Should the driver, located in the front of the float, cut a turn too close, the observer in the castle will alert him by walkie-talkie. If it is necessary to override a computer command, an on-board dot-matrix printer logs all functions for future study. This equipment is stored in the castle on a rack mount no bigger than a cigarette machine.

"Yes, certain people are messing with electronics," counters Festive Arts Chapman, "but something like the American eagle will probably be the most impressive thing in the parade. A computer would get in the way." The eagle has about 30 functions, all run by switches and valves. "We don't need a computer to do fifty million things. Fifty million things do not communicate best on TV," Chapman continues.

Besides the giant raptor itself, the Chapman design sports those independently twirling hats. They are built on bicycle units powered and steered by the humans underneath them. Closest to the eagle is the astronaut's helmet, built over a trailer that contains a sound unit and speaker system broadcasting patriotic music. The eagle is constructed on top of a four-wheel-drive vehicle with two steering wheels and a Dodge slant-6 engine that powers a drive pump—and two hydraulic pumps to flap the wings and tilt the bird's head and tail. Oil lines travel through the bird's legs (its only means of support), and inside its body a massive valve bank controls its torso movements. A human operator initiates the animation by activating an automatic sequence that controls every function.

Midway between the eagle and the castle, technologically speaking, is the remote-controlled International House of Pancakes float. It stands out in parade history because last year this innovative design caught fire, causing many to overlook the animated little girl riding a tricycle that was running independent circles around her friends and their dog. This year they're all back to parody the accident. The little girl is still on her tricycle, but this time she's rescuing the dog. And again, she's powered by a remote-controlled device.

"We thought, if you can run a model airplane or boat with remote-controlled devices, why not do the same with a float?" remembers Donald Bent, founder of C. E. Bent & Son, the most prolific builder of floats. Bent admits he had some problems with the remote-controlled design, the biggest being "weight versus power." The more power he needed, the more batteries he had to add; the more batteries, the greater the weight. The solution was found, however. Two 12-volt golf-cart batteries and the remote receiver are housed under the girl's skirt. The steering is a self-centering mechanism so that the tricycle always returns to the center of the float. This year the little girl, dressed as a nurse, will carry the ailing pup while running circles around her friends. Her controller will be riding on the float next to hers. ∞

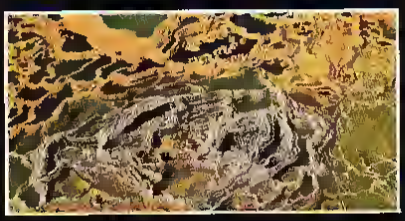


PHENOMENA

Six fathoms below the surface of the Red Sea, a teeming cluster of tentacles enfolds a butterfly fish in a lethal embrace. The fingerlike appendages are poisonous and belong to a sea anemone, a harmless-looking, flowerlike creature that stuns its prey with paralyzing toxins. It lures its victims to their death with the help of the unusual clownfish, which dwells in the anemone's deadly branches. This little fish is immune to its host's tentacles and, in exchange for acting as live bait, gets protection and an occasional share in the anemone's kills. The fish serves to attract would-be predators to within striking distance of the tentacles, which can inject their poisons with an explosive suddenness. Once the kill is made, the carcass of the victim is slowly forced by the anemone toward its mouth, in the center of its plantlike structure. Jeff Rotman used a Nikonos camera, Kodachrome 64 film, and a flash to catch this close-up of undersea violence DC

OMNI ON SALE JANUARY 24

EYE IN THE SKY

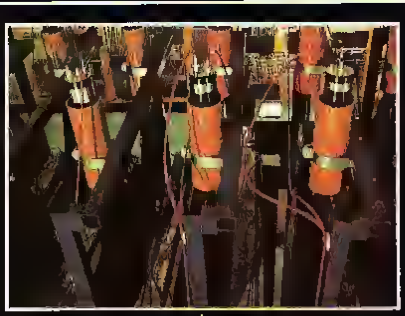


"The bird's-eye view is nonhuman," an artist friend once complained to photographer Georg Gerster. But that suits Gerster fine. From the perspective of several thousand feet in the air, Gerster has taken a remarkable gallery of portraits of Earth and us Earthlings who populate it. From the elegant abstracts of natural shapes to the rigid geometric constructs of man, his work shows what he calls a "second face" of our environment. Look for it in the February issue of *Omni*.

HUMAN HIBERNATION

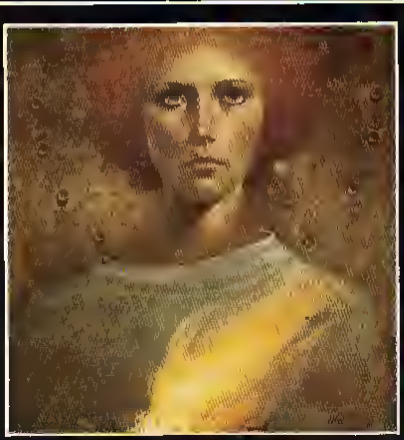
His name is Spock, and his shaved head makes him look disturbingly alien. Yet the physical appearance of this rhesus monkey *is* appropriate, for soon he will boldly go where none of his kind have gone before—into hibernation, previously the province of bears and some squirrels. Scientists speculate that once monkeys and other primates, including humans, make this journey, we'll see revolutionary changes in areas from weight control to the treatment of sleep disorders. We may even be able to send astronauts slumbering agelessly on interplanetary voyages.

SUPER SMASHER



FermiLab is outrageously large, a 6,000-acre swath of open plain 30 miles west of Chicago. Its core is a doughnut-shaped tunnel, four miles in circumference, covered with prairie land. Here in the tunnel, particles are whipped to the speed of light and forced into spectacular collisions so that scientists can sift through the debris. But the size of the equipment and its immense power match the magnitude of the quest. Researchers here and at other similar facilities are looking for nothing less than the secrets of matter. Or, as one scientist involved in the search puts it, "I think we're on the threshold of finding God." Join us this month, when *Omni* looks over the threshold.

FICTION



Omni's February fiction appears courtesy of two members of the "Texas Mafia," a group of hot young SF writers living in Austin. Bruce Sterling's "Sunken Gardens" takes place in the far future, when humans have been so altered in form that they are barely recognizable. The Regal faction has devised an ambitious scheme to "terraform" Mars. Have the lower factions compete for power and wealth by attempting to create the most beautiful and useful environments. The protagonist, Mirasol, fights for the future of her people in the bioengineering free-for-all that ensues. "Deserted Cities of the Heart," by Sterling's fellow Texan Lewis Shiner, takes place in a very different environment. Ryker, an American archaeologist, is disillusioned with the material world and seeks knowledge, enlightenment, and change. On a dig in a future, more prosperous Mexico, Ryker stumbles across something that could be the unsettling answer to his dreams.

Secrets what they don't want you to know

GAMES

By Scot Morris

Here is how the headline-prediction trick looks The magician calls to the stage some trusted local official—the chief of police or the head of the Rotary Club say—who is carrying a sealed envelope In response to the magician's questions the official assures the audience that this is the same envelope given to him or her a week before and that it has been kept in a secure place where the magician couldn't get to it or make a switch of any kind Inside the envelope the magician says he sealed his prediction of the headline on the local paper that day—the day of the performance A newspaper is brought out the envelope is opened and—magic!—the prediction matches the headline

Many years ago Stanley Jaks who performed under the name Dr Jaks did the headline-predictron trick in Las Vegas On the day of the show the big local story was of a fatal shooting Jaks had predicted the tragedy

When the show was over Jaks was placed under arrest The police figured that if he knew about a killing a week before it happened he was a prime suspect and ought to be questioned

The affair ended with the magicians code intact The conjurer had to do some fast talking to convince the police but he refused to tell the secret It took three hours of questioning before the police finally decided to let Dr Jaks go free

Secrets are a precious commodity We all want to know them as long as we are among the few If you tell a lot of secrets you are sure to get many listeners and make many enemies That's the situation William Poundstone is in with his new book *Big Secrets* (William Morrow)

Poundstone writes about things that some people don't want you to know the Coca-Cola formula Masonic initiation rites secret recipes, and so on Sometimes he blabs too much as when he reveals tricks of Harry Blackstone Jr David Copperfield Doug Henning and others who have never claimed to produce anything more than good illusions This is like giving away the endings to all the Agatha Christie novels

Other chapters analyze rumored secrets' that turn out to be nonsense such as the devil-worshiping messages supposedly recorded backwards on such rock-and-roll records as Snowblind by Styx and Another One Bites the Dust by Queen

THIS IS YOUR OFFSTAGE ANNOUNCER

The most interesting secret of all is the one that *isn't* revealed because Pound stone doesn't know what it is and neither—officially—does anyone else That is the question of secret radio frequencies and numbers stations Why at 3060 kilohertz (kHz) on the short wave radio dial is there a regular transmission of a female voice reading numbers in Spanish? Where is the broadcast coming from and what do the numbers mean? No one seems to know

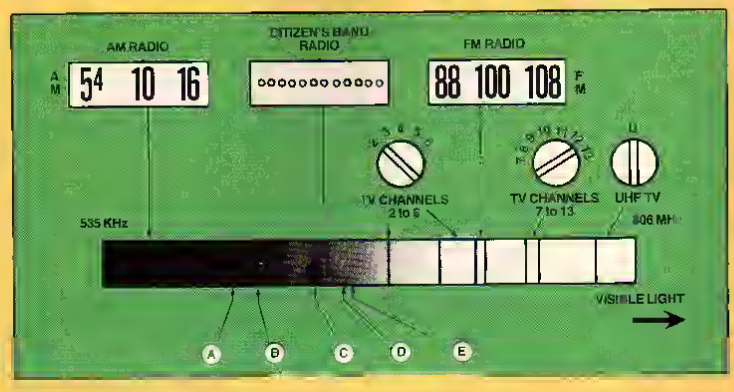
Most of us are familiar with only parts of the broadcast spectrum—AM FM and TV (when you switch a TV from channel 6 to 7 you skip over the entire FM band it is often possible to pick up the sound of a local channel 6 at the left end of an FM-radio dial) Between the AM and FM bands shortwave hobbyists have found hundreds of numbers stations that no one will own up to (A few are shown below Exact frequencies vary these are only approximations)

Because shortwave signals travel all around the world it is difficult to tell which *hemisphere* they are coming from, much less which country or city Current theories argue for Cuba Central America or somewhere in the South Pacific

Transmissions usually start just after the hour and generally during night hours in the Western Hemisphere The Federal Communications Commission (FCC) and the International Telecommunications Union (ITU) say they don't know where the signals are coming from who is sending them or why but they would *like* to know because the unlicensed broadcasters are violating international law

Dozens of stations transmit only a single letter of Morse code over and over *K* (dash-dot-dash) is repeated endlessly at 4005 kHz 5795 kHz and several other frequencies *U* at 4466 *F* at 5307 *Q* at 6806 and so on What information is transmitted in a single letter?

This is a supergame It arouses the puzzle solving instinct It makes you want to *know* either to solve it yourself or turn to the answer page Unfortunately there is no answer page for this one



Female voices read numbers in Spanish at 3060 kHz (A) French at 4642 (B) German at 10500 (C) and English at 14970 (E) A male reads numbers in Russian at 13320 (D) Why?

We don't know The FCC and ITU don t know Even the guy who wrote *Big Secrets* doesn't know If any reader does please share it with us We won t tell

Other answers are on page 82

CREDIT REFERENCE Some entries aren t so much secrets as little-known facts A credit card chapter raises the question Why do account numbers have so many digits? There are nine digits in a Social Security number and each of us has a different one Since the U S population is about 226 million it will be a long time before we need a tenth digit The new two part postal codes have nine digits, enough to give each of us our own ZIP code A telephone number with the area code is ten digits long

So why do credit-card numbers have so many digits? MasterCard has 16 (20 if you include the bank number) American Express 15 Diners Club 14 and Visa 13 The biggest companies MasterCard and Visa, have about 65 million accounts each—8 digits Even allowing for excessive corporate optimism surely 9 digits will be enough for all foreseeable membership rolls

Why all the numbers? (In this connection what is the significance of the number 3712 3456 78-95006?)

CLIP Another interesting disclosure concerns the unpublicized ways that some corporations make profits For example can you guess what Klipette has in common with the G I Joe Fan Club, Kozak Drywash (a car-buffing cloth) and Halbert s Inc an Ohio firm that sells family coats of arms?

Poundstone misses the boat on a few secrets He spends a whole chapter on whether Neil Armstrong misspoke his first lunar line, 'That s one small step for (a) man citing various third-party opinions As *Omni* readers know we asked Armstrong about this and reported his answer in June 1982 (Competition page 126) 'There isn t any way of knowing [whether I misspoke],' he told us When I listen to the tape I can t hear the *a* but that doesn t mean it wasn t there

Why is this guru grinning? Mantras revealed

because that was the fastest VOX [voice-operated microphone key] ever built *The a* is implied so I m happy if they just put it in parentheses '

TRANSCENDENTAL TRUTH

In the spirit of giving away secrets we ll add one that Poundstone doesn t mention and we have never seen mentioned in any mass-circulation magazine—the truth about those secret mantras given to graduates of transcendental meditation (TM), a discipline headed by Maharishi Mahesh Yogi and derived from Hinduism

When a person completes a TM course he is given a secret word that he is told is 'individually matched with an initiate s personality'—a personalized set of syllables that he should repeat to himself during meditation and never share with anyone, including other TM-ers

One of the most impressive things about this is that if you study TM under a second teacher you will likely be given the same mantra as before The effect is quite astounding Apparently there is something transcendent about your personality that determines the particular syllables that apply to you

Some researchers say that the calming effects of meditation can be had by repeating any word over and over—*mudpie horselaugh vootie* or any other—but the maharishi disagrees strenuously 'We know that each man is a different individual ' he says 'Similarly each man has his own type of energy impulses that constitute his personality Therefore if the qualities of the energy impulses created by the sound of the mantra rightly correspond to the energy impulses of the man, only then will it be of real value Any wrong choice of the mantra is sure to create unbalance in the harmony of the man s life

How many different mantras does TM use? There are thousands of mantras " the maharishi says and all have their specific values specific qualities and are suitable for specific types of people 'Thousands' is an overestimate It turns out there are just 16 and they are assigned not according to your energy impulses' but according to your age This was first revealed by some disaffected former TM trainers

Here are the secret mantras

ENG	0–11 years
EM	12–13 years
ENGA	14–15 years
EMA	16–17 years
AENG	18–19 years
AEM	20–21 years
AENGA	22–23 years
AEMA	24–25 years
SHIRING	26–29 years
SHIRIM	30–34 years
HIRING	35–39 years
HIRIM	40–44 years
KIRING	45–49 years
KIRIM	50–54 years
SHAM	55–59 years
SHAMA	60 years and over

What is all this secrecy for? Any fifty-five to fifty-nine-year-old who took TM got a very good hint

LAST WORD

By Randy Cohen

If you don't want to host the Kafka party, perhaps you'd be more inclined to go for a big 1984-athon! Yes?

With 1984 coming right up, it's a good time to check in with the CIA, which by happy coincidence I have done. [*Editors' note: Randy Cohen is a compulsive letter writer and a whimsical seeker of truth. These are actual letters he has written and received.*]

Office of Public Affairs
Central Intelligence Agency
Washington, DC

To the Director:
What's with you folks? Just when tempers were cooling down over the agency's Southeast Asian escapades, your Chilean horrors, your Castro-and-the-exploding-cigar travesty, what do you do? You try to topple the government of Nicaragua. Some people just never learn. However, I've come up with a way for you spies to buff up your image.

This coming July first is the hundredth birthday of Franz Kafka, even though he's dead (of course, with all your secret sources, I'm sure you knew he'd passed on). I urge you spies to promote a huge national Kafka festival. The agency could undertake all sorts of grotesque, Kafkaesque, devious, complex activities. You could befuddle your foes, impress your friends, and lead innocent, unsuspecting people through mazes within mazes for no apparent reason. Sound like fun? You bet.

I'd be happy to work with you on the plans for such an exciting celebration. Are you intrigued? Can we start soon? I'd very much appreciate hearing from you soon, because if the CIA is not interested I plan to approach the FBI. They must be really depressed over there since their TV series got canceled.

So I look forward to hearing from you on this thing. Oh, one further thought: If you don't want to host the Kafka party, perhaps you'd be more inclined to go for a big 1984-athon! Yes? There's only a short time left until the big day.

Thank you in advance for your consideration of these proposals.

Randy Cohen
Manhattan Applied Research Division
(but you probably knew that already)

Dear Mr. Cohen:
The Central Intelligence Agency respectfully declines your humorous invitation to a Kafka day or 1984-athon.

Just in case you are seriously concerned over what you term the agency's "escapades," we want to assure you that the Congressional Oversights Committees are fully informed about our activities. They are your elected representatives and you may want to make your opinions known to them. We are also sending you two pamphlets that will explain the story, organization, and functions of our agency.

If you go ahead with your celebration plans, we wish you luck. We know "The Big Apple" is famous for the ingenuity and diversity of its inhabitants.

Katherine J. Hall
Public Affairs
Central Intelligence Agency

(Accompanying the letter were two booklets, *The Central Intelligence Agency Fact Book* and a recruiting booklet, *Intelligence: The Acme of Skill*. Among the sights shown in the first booklet is the south wall of the foyer in the agency's headquarters building. It is a display of stars, each honoring an agent who was killed in the line of duty. These agents' names, however, are a secret; the agency can't tell you who is being memorialized. The *Acme of Skill* booklet shows color photographs of people at work in the CIA. In one picture a roomful of people are sitting at computer terminals; and in another a woman is leaning over a large sandbox and making a topographical map out of white sand.)

Katherine J. Hall
Central Intelligence Agency
Washington, DC

Dear Ms. Hall:
I read in *USA Today* that the agency refuses to allow anyone to photograph the duck and her brood of six, now nesting in a courtyard in your Langley HQ, for "national-security reasons."

Is this true? Is the duck an American agent? Is she an agent of a foreign power now serving our side? Is there perhaps a chance that the duck was improperly classified? And when do we get a chance to hear the duck's side of the story?

I'd quite appreciate some clarification of this matter, and if it is at all possible, it would be nice to see a snapshot of duck and ducklings.

Randy Cohen
Manhattan Applied Research Division

Dear Mr. Cohen:
You will be happy to know that our duck and ducklings have been "reassigned" to a bird sanctuary under the auspices of the National Wildlife Federation.

Unfortunately we do not have any pictures of our star visitors. Photographers from the press were not allowed into our buildings for obvious reasons unrelated to the "clearances" of our aquatic guests. The ducks had impeccable character references.

Katherine J. Hall
Public Affairs
Central Intelligence Agency