MAMMOTH MACHINES FOR 2001
HERMAN KAHN'S FINAL VISION
THE SECRET SOVIET SPACE SHUTTLE
CASPAR WEINBERGER ON WAR IN SPACE
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Michel Tcherenkov, one of New York's leading advertising photographers, is a technical wizard in his field. He designs and photographs all his sets within the confines of his Manhattan studio. In this picture a sphere is bisected by the transcendental number π.
Food is the single most important requirement for life. The need for food is universal in the entire biosphere and the success with which each individual obtains the elements and compounds essential for an adequate diet determines ultimate survival. With the explosive growth of world population, food has become a global priority number one.

Although American dietary patterns might suggest otherwise, the moment of decision is upon us. A sense of urgency pervades acrimonious talk. At a recent address to the American Chemical Society, Nobel Laureate Norman Borlaug, father of the Green Revolution, commented that "expanding food production fast enough to meet the increasing needs of a large and growing population over the next four decades will be vital to the survival of civilization.

In the sphere of foreign policy, the need to confront world hunger problems has also come to the fore. The Presidential Commission on World Hunger, which concluded its studies under the Carter Administration, recommended that beginning in the Eighties, the United States should make the elimination of hunger the primary focus of its relationship with the developing countries. The prospect of disaster is at hand. It is closer than most people realize or are prepared to admit.

By 2015 our planet will be home of almost 8 billion people, double today's population. It will not suffice, however, to double our food production. We must at least triple it. Two-thirds of humanity are already suffering from inadequate nutritional balance, as the experts would say in statistiandance, they are starving. The gap between the billions of hungry people and the amount of food needed to feed them is constantly widening.

Population reduction is the obvious answer. But the numerical stabilization of the human race will not be achieved in a decade, nor in two, perhaps in half a century it will. For at least another generation we must turn to science and technology to provide food for humanity. This is a formidable project. In the next 40 years alone, world food production must be increased by at least as much as it was increased during the entire 12,000-year period from the beginning of agriculture to the present day.

The choices are bewildering. On one hand, there is dire pessimism, on the other, a certain scientific optimism. After the World Food Conference, sponsored by the United Nations, there were even some scientists who advocated the totally unthinkable and absolutely inhuman solution of triage. Let the hungry die of starvation, they said, while the strong conserve available supplies of food for themselves and their families.

Then there are those who profess a certain exuberant hope that science can solve all problems. Francis Bacon gave us his idea of utopia. The modern proponents of this utopian ideology quote the significant developments in science—from the conquest of space to the harnessing of the atom, to the decoding of DNA. The Apollo program was without question a supreme triumph of science and technology. The casting off of the shackles that bound us to Earth gave us the exhilarating freedom to explore the universe will be recorded as one of man's greatest achievements. But perhaps there is a fallacy in the line of sunland reasoning that suggests science can be a global elixir. The truth may lie somewhere between the poles of dismal pessimism and undue optimism.

How can the world food supply be increased? Is it possible for man to produce some food independent of climate? The chemical synthesis of food is a tantalizing area of exploration. If we can make material for our shirts, can we not make the substance of our lunches? Carbohydrates arise from the fixation of carbon, hydrogen and oxygen. Proteins result from the same three elements, with nitrogen thrown into the bargain. The laboratory of nature achieves this result through the complex processes of plant photosynthesis and animal metabolism. In the laboratory of modern chemistry, the shortcut from molecules to meal is within scientific reach. There is an intriguing science-fiction story about a gourmet restaurant, where the only raw material that enters the building is coal. Such a concept may not be a mere technological fantasy.

It is commonly believed that nature knows best. Molecular biology has given us ample evidence that in many instances the ways of nature may be wasteful and wasteful. In the breeding of plants, the reduction of respiration and the improved efficiency of photosynthesis might double the yield of our crops. Enhanced biological nitrogen fixation, accomplished by exploiting the symbiotic relationship of certain algae with the roots of cereals—the Azolla with rice, for example, a circumboreal understand by the ancient Thai and Vietnamese and rediscovered today—is a potential area for active research. Epoch-making discoveries of recombinant DNA pave opened horizons of wondrous proportions. We are on the threshold of major new advancements. The Green Revolution will yield to the Gene Revolution.
Engineers who plan and execute massive, superhuman-scale projects are a breed unto themselves. Macroengineers, as they are called, are big dreamers with rich planetary fantasies. Consider a transoceanic tunnel linking Europe and North America; a single building metropolis rising one mile high; a transcontinental bullet train linking Tokyo and Paris; with a connection under the English Channel to London and Edinburgh and a subsea tube to Dublin. Our article, "Macroengineering" (page 80), adapted from Macro—a book to be published by William Morrow and Company and coauthored by Frank P. Davidson and John Stuart Cox—reveals plans for fantastic engineering feats that are technologically feasible today. Davidson, a scientist at MIT and one of the founding fathers of modern macroengineering, has an eye for what history can teach us about the future. He says: "We have neglected achievements in the past that might solve current puzzles. No modern government has been able to equal or even come near the achievement of the ancient Romans in thrusting back the Sahara. I really believe that the United States now needs a Roman approach to such vital matters as water supply and transportation."

In this month's exclusive interview, Caspar Weinberger, America's secretary of defense, candidly discusses the future of America's military presence in space with Richard Halloran, military correspondent for The New York Times. Weinberger is Reagan's most influential adviser and Cabinet official and has complete responsibility for the actions of the Pentagon. Weinberger elaborates on Reagan's new famous "star wars" speech and on the President's policies as they refer to the military development of space, the deployment of weapons that use laser beams, particle beams, and other directed energy weapons that can track and destroy Soviet missiles. He proposes to utilize artificial intelligence for defense and he predicts high-tech, milliseconds-long battles fought with new weapons, all of them computer-aided in design. For a top-level prediction of the American way of war, see page 103.

Herman Kahn was our country's most distinguished futurist, known for his controversial books on thermonuclear war and his development of a "trickle-down" theory of economics. Twenty-two years ago he founded the Hudson Institute, America's most renowned and prestigious think tank. He was chairman and director of research until his recent death. One of Kahn's great concerns was the "cloud of pessimism" hanging over this nation, especially over high-school students. To counter the malaise he perceived, he designed an ambitious program known as "Visions of the Future," a crash course in thinking optimistically about environmental, population, and resource concerns. Kahn foretold a fabulously green future. Too green, according to his critics as journalist James Reston Jr. reports in "The Wrath of Kahn" (page 68).

Reston was shocked and saddened by Kahn's death. "For all our disagreements, it was clear that he was an extraordinary and vital human being. He loved intellectual engagement, and I think he was looking forward to the product of our many hours of sometimes-heated discussion. He was an important man who thought about important things."

It has been a productive year for Reston. His first film, 88 Seconds in Greensboro, was offered in the new PBS Frontline series and his second play, Kaituma Sunset, will open in October.

This month we present four new science-fiction stories. Dan Simmons's "Conor Collins" (page 132) is a powerful horror tale set in contemporary Charleston, South Carolina. On page 62, award-winning novelist Howard Waldrop goes Eastern in "Man Mountain Gentian," which combines two Oriental traditions—Zen and sumo wrestling. In John M. Ford's "Boundary Echoes" (page 86), a famous musician meets a neurologist and is forced to face her own irrational fears. Ford's latest novel, The Dragon Waiting, will be published in November by Timescape. Our fourth selection is by Robert Hastly, a semiconductor-research scientist whose first love is science fiction. Two travelers meet unexpectedly and one finds the other's plans in "Seventh Sense" on page 100.
LETTERS

COMMUNICATIONS

Comsat
Richard Wolkomir and Omni are to be applauded for the excellent article on the Communications Satellite Corporation (Comsat) and its advances in satellite communications technology [Satellinks, June 1983]. Wolkomir succeeded in taking a highly technical subject and writing it in such an interesting and informative manner that thousands of your readers now have a better understanding of the intricacies and benefits of satellite communications.

Recognition should be given also to Malcolm Kirk for the striking photos that accompanied the story.

Fine writing should not come as a surprise to your readers; excellence is what they have come to expect from Omni, an outstanding publication that gets better with every issue.

Allan Galt
Manager, External Affairs
Comsat
Clarksburg, MD

Controlling Man's Aggression
Douglas Starr's discussion of the theories expressed by philosopher Paul Shepard was extremely interesting [Earth, May 1983]. I feel, however, that Shepard's concept of secondary bonding is a romanticized and ornate attempt to explain a much simpler psychological reality.

Man's ascent from the lower primates was governed by evolutionary processes favoring traits of aggression; cunning and a high degree of intelligence. Over the ages, these traits were reinforced in primitive man, enabling him to survive in a hostile environment.

As man progressed, he gradually developed the tools and knowledge of a hunter to secure his dominion over other animals. He controlled his environment by building shelter and providing himself with food and warmth. As his development continued, man extended his control by domesticating plants and animals. Through his intelligence, he established a stable supply of food, and that enabled him to further improve his condition. This led to the formation of social groups and the beginning of civilization.

Throughout this process, man aggressively sought to extend his control over the environment. The process has continued unabated, man now attempts to exercise dominion over other men, geographically, economically, socially, and ideologically.

I would not attempt to describe man's contempt for his environment as a backlash against the land that bound him. Man has always shown contempt toward that which he has conquered.

I believe the time has come for man to develop the intellectual maturity necessary to restrain his aggressive and hostile nature. We have the wonderful gift of intelligence and the ability to understand the universe that gave us life. Our advances in science have been profound, but they have given us the awesome power to destroy ourselves. We have the necessary intellectual resources to control the darker side of our nature, and we must do so in our generation. The alternative is unthinkable.

H. Scott Ireland
North Miami, FL

Glorious Flight
Joseph P. Allen's article 'Joe's Odyssey' in the June 1983 issue was one of the most awe inspiring, poetic descriptions of orbital spaceflight I have yet encountered. My only regret is that at forty one, I may never be able to experience the phenomenon of spaceflight or actively participate in the exploration of the new frontier.

The goal of the world's nations should be a cooperative effort to fund space research, not arm racing that will lead only to a dead end. Age-old, culture oriented vendettas and dogmas must be minimized, if not eliminated, so that the human family can be free to work toward achieving its greatest potential, instead of engaging in dangerous backing.

We are entering an era of great promise for our young in the realm of space exploration. Let these new opportunities be our gift to the future generations.

I would like to congratulate you for
In which the readers, editors, and correspondents discuss theories and speculation arising out of Omni. Readers are encouraged to debate views and pose questions to Omni, the scientific community, and the science fiction establishment. The opinions published are not necessarily those of the editors.

**Give Nukes a Chance**

As an occasional newspaper purchaser of Omni, I am perplexed by the antinuclear themes that I seem to encounter regularly in your magazine. Certainly a healthy respect for the dangers, as well as the potential benefits, of nuclear power is appropriate. However, the irrational and patently antinuclear tone of Hans Fantel's review of *The Cult of the Atom* (Books, April 1983) is clearly out of place in a magazine that purports to have some association with science.

Particularly offensive to me were statements made by Fantel that seemed to portray the entire nuclear industry as "villains," and his citation of a few well-known and well-reported accidents as an indictment of the industry as a whole. The worst sin of all was using an illustration of a nuclear-bomb explosion to accompany the article.

Such crude sensationalism may impress those who had problems with their high-school physics, but it certainly betrays your lack of sensitivity for those who have taken the trouble to assess nuclear power from a reasoned and scientific perspective.

Gregory Schuler
Seattle

Everyone, it seems, loves a mystery—even Hans Fantel, whose review of *The Cult of the Atom* indicates that he revels in the prospect of an upper level conspiracy of silence.

Sadly for Fantel and his readers, such cloak-and-dagger potboilers as Daniel Ford's egregious tome are the product of the hyperactive imaginations and lust for hyperbole of antinuclear authors.

I am amazed that Ford needed the Freedom of Information Act to obtain all those items he treats as great revelations. All he needed to do was to look through any newspaper or magazine or read one or more pro-nuclear books and pamphlets. The Brown's Ferry incident did not discredit the nuclear industry. Rather, it demonstrated a principle unique to nuclear power known as "defense in depth." In this incident, two operating reactors shared a common control station duct with a third plant under construction. A typhoon with a candle set some control and instrumentation wiring on fire, incapacitating 2 of the 11 separate cooling systems in one of the reactors. Of the remaining nine cooling systems, four required special procedures, and five remained in operation. The reactors were shut down and cooled with no danger whatever to personnel or environment, and the end result was plant equipment damage. The outcome of this incident was that plants now have their cabling in more secure areas, away from such dangers.

Also what justification is there to condemn plant design because of the stupidity of an individual who used a candle to inspect the ductwork? Are cars unsafe because drunk drivers drive them?

Fantel seems to expect nuclear power to be categorically safe before it is used. He'll never see this happen, because such an achievement is impossible. No reputable nuclear expert would make a statement to the contrary. Nukes are not 100 percent safe, but then neither is any other energy source. Given equivalent and properly operating coal and nuclear plants, the coal plant can emit up to 75 times as much radiation as the nuke. Most coal plants if put under Nuclear Regulatory Commission control would be shut down for exceeding radiation limits.

It can be easily proved through statistical analysis that more people have died in traffic accidents while driving to antinuclear rallies than have ever died because of nuclear energy.

Do not raise the issue of Hiroshima and Nagasaki as examples of death by nuclear energy, as the rabid antinuke activists eager to associate N-war with N-power do. This comparison is as asinine as someone demanding that we abolish lawn mowers because petroleum is used for both gasoline and napalm.

Far from being a faded dream, nuclear power is a gigantic resource awaiting America's decision to stop taking scientific direction from assorted Hollywood idols, rock stars, organic farmers, and self-styled environmentalists.

Bob Renaud
Massachusetts Voice of Energy
Pittsfield, MA

**The Day We Bombed Utah**

John C. Fuller's article, "The Day We Bombed Utah" (May 1983) was excellent. I found it very interesting to read that there was a rainout in Troy, New York, in April 1953. While I was attending medical school in the Sixties, there was an outbreak of Hodgkin's disease in the Albany area, which is near Troy. I recall that the Albany Medical School was involved in extensive epidemiologic studies to try to ascertain why there was a sudden and abnormally high statistical level of this malignancy cropping up in that one corner of the state.

These facts would certainly make one wonder whether Fuller hadn't stumbled onto the answer. Keep up the fine work.

Sherry Rogers
Syracuse, NY

I want to thank Omni for publishing the article, "The Day We Bombed Utah." Although these nuclear tests were not news to me, reading the article left me quite upset to put it mildly. Articles such as this one are needed so that the public can see what lengths some people and some governments will go to in order to cover up their terrible mistakes.

We sometimes forget that we are all on the earth together and that we share the same atmosphere. I hope articles like the one you printed will make people consider the consequences of their actions. I pray that I will live to see the day when nuclear testing, weapons and power plants are relics of the past.

Susan Meeker-Lowry
Worcester, VT
by Dian Fossey

Editors' note. It was in 1967 that primatologist Dian Fossey traveled to the Congo (now Zaire) to launch the first long term field study of mountain gorillas. After her work was interrupted by a rebel uprising, she founded the Karisoke Research Center in Rwanda; there, in the rain forest of the Paro des Volcans, her research continues today. The following story comes from Fossey's new book, Gorillas in the Mist. The section below describes the plight of Coco and Pucker—baby gorillas destined for Germany's Cologne Zoo. The narrative picks up in March of 1968, right after Fossey has learned of Coco's violent capture, ordered by the Conservator in charge of the region at the time.

Immediately I went down the mountain and drove to the rambling old barrack buildings that served as offices for officials connected with the park in those days. In the small open square behind the ramshackle buildings were a series of sheds, the largest of which now served as a garage for the Conservator's new Land Rover. Nestled between the Land Rover and a stack of wood was a coffinlike box surrounded by swarms of laughing people mainly children. A discarded wire cage lay nearby. Pushing away joking children I slowly released the door bolt of the wooden box in an attempt to see the captive who had retreated as far in the back of the dark interior as it could get. Instantly the little black furry form hurled toward me, shrieking in fear and rage. I slammed the door as people crowded around, laughing loudly at an injustice they did not understand.

I had the box carried into the Conservator's room, where relative quiet prevailed. Against his wishes I opened the coffin door this time to let the baby out. Once more the small ball of fluff came hurtling forward. Before the Conservator could move she sank her teeth into his leg. She next ran to the windows, where the people had gathered to cheer the action noisily. The frightened gorilla baby beat on the panes with such force that I was convinced the glass was going to shatter. She shed pools of diarrhetic dung as she ran back and forth between windows and, because of her state of dehydration, stopped to lick it up. With an ashtray filled with water I was able to lure her back into the box.

I only briefly questioned the Conservator about the manner in which he had acquired the young gorilla, being desperately anxious to get the baby to camp as soon as possible. Every minute spent talking seemed to be a minute less of her life. If the captive could survive at all. Without any blasphemy, the Conservator admitted to having asked the leading poacher of the park, Munyantaruko, to organize a group of poachers to make the capture. The men climbed Mount Kansimbi and selected a group containing a young gorilla. Later I learned that ten members of the gorilla group were killed in the capture.

The young animal was wired onto bamboo poles by her arms and legs and carried to a small village near the park boundary. Kept for two weeks in the specially made wire cage the park guards had ready for her, allowed neither standing nor turning space; she was fed corn, bananas, and bread until brought to Ruthergen. There she was transferred to the coffinlike wooden box.

I shall never understand how the orphaned infant managed to survive the confines of the cage, her meager diet or the infected wounds caused by the wire bindings. Somehow she had found the will to live an additional two weeks in Ruthergen before I heard about her. Not wanting to waste more time in the Conservator's office I informed him that I would be taking the baby back to camp with me. He showed no remorse in letting her go. He seemed more than happy to let me bear the responsibility of the captive's fate—probable death.

That night I firmly made up my mind that provided she lived I would release her to the wild rather than allow her to be put into another wire cage at the Cologne Zoo. I estimated her age as three-and-a-half to four years—old enough to be able to survive in the wilderness under the protection and care of adult gorillas and I named her Coco.

The Karisoke staff had prepared the second room of my cabin for the captive's arrival, transforming it into a miniature facsimile of a gorilla habitat. With many screams and orders in Kinyarwanda the porters had managed to squeeze her pen through the doors of the cabin and deposit it amid the trees that now sprouted between the floorboards. Suddenly the baby and I were left alone together in blissful quiet.

Cautiously I prodded off the cover of the pen, unsure of the reaction to expect. Would the infant be timid, aggressive, or lethargic? I was thrilled when Coco straightaway left the pen and disdainfully walked over the vegetation, patting the leaves and stalks as if to reassure herself they were real. Because of her weakened condition she made only one feeble attempt to strut by my side to indicate that she intended to be in charge of this new situation. She then stood and stared at me intently for nearly a minute before very hesitantly crawling onto my lap.
Searing a high, fine arc over the steamy jungles of Kourou French Guiana, last September the Ariane rocket carried far more than just a two-satellite payload. On the ascent of this first fully operational mission of the European Space Agency's (ESA) new launcher rode Western Europe's official bid for a share of outer space. Perhaps even more important to the 11 nations of ESA, the flight was to act as confirmation that they could cooperate setting aside parochial interests. That confirmation proved to be the only part of her mission that Ariane would complete.

At 12 minutes into the flight Ariane burned well into the second of her three booster stages and champagne corks were popping at the ESA's Space Operations Center (ESOC) in Darmstadt, West Germany. As soon as the launcher released her $100 million worth of satellites into geostationary orbit, the ESOC team would take over full operational control. But somewhere between the Aleutian Island and Kenyan tracking stations Ariane disappeared from the screens.

The last words a control operator wants to hear at zero plus fifteen minutes were those that came over the audio loop. "The launch has failed to achieve required orbit. Repeat. Gravity being what it is, everyone at ESOC knew the verdict was final. Within a matter of minutes, the mission which was to have catapulted Western Europe into full space capability, had aborted and frustrations were as hard to cork as the premature champagne.

Officially the Ariane is not a French launcher but a European launcher. But of course nationalistic rumblings couldn't be heard-. says K. G. Lenhardt, research head at ESOC. The British newspapers said that it was a French launcher that failed. On the other hand, when the early tests were successful the French newspapers claimed it as a French launcher. But in the ESA, we tend to say just that it's European."

The official show of unity that followed the ESAs greatest setback no doubt helped to reduce potential strains in the young alliance. When members of special project teams and research groups devote up to four years to a mission only to watch it disappear from a computer screen, stress reaches a critical stage. "Officially there was never any pointing of fingers, but internally you can bet there was some grumbling," admits a British systems-control operator at ESOC.

"When a launch goes sour we're all concerned, because that's our job. If we can't launch satellites we're out of work, and some of us felt there was a question of poor quality control on the part of the French. Yet at the rank and-file level the grumbling has the appearance of a friendly fight, not an international conflict."

"If I tell one of the French guys I work with, 'Hey Froggie, not much of a launcher,' he'll just come back with, 'Well, Roastbeef at least we have one.' says the Britisher at ESOC. Under the charter that officially founded the ESA in 1975, each member nation contributes to optional projects according to its interest. The French pushed for rocket development from the beginning, assuming nearly two thirds of the budget for Ariane's development. The British preferred to focus on the projected boom in communications satellites and the West Germans turned their attention to NASA's development of Spacelab, due to be launched soon with the shuttle.

In the face of these diverse interests, the ESA experiment depends on interfacing highly technical hardware from different countries. ESA's quest for a piece of space also requires unifying groups of people who are, initially, foreign to one another. The laboratories are ESA installations in France, Germany, Holland, and Italy. Where bad English is the official language, and participants go by such names as 'Frog, Oog, Kraut, Wop, Beefer,' and Scandinavian.

"At the worker level the international cooperation works very well," says a computer operator at ESOC. "We work with one another, we drink with one another, we date one another. We have the same lovers. We spend more time with our colleagues than we do with our wives or girlfriends. So once in a..."
When California psychologist Bruce Ogilvie was invited to the San Diego Padres spring-training camp in the early Seventies, he was asked to keep a low profile. Around baseball clubhouses he explains psychologists were people asked to sneak up the back stairs in the dead of night. Nonetheless, the Padres thought he might be able to help improve the performance of their rookies, so they asked him to talk to the players.

After administering a series of psychological tests to a twenty year-old rookie—a spectacularly talented catcher named Mike Ivey—Ogilvie gave Padres management some advice. Ivey he told them had a fierce competitive drive, but he was also extremely sensitive and could easily be upset by harsh criticism. "Be careful," Ogilvie warned, "or you might mishandle this kid."

Ogilvie's warning was ignored. The very next day, however, Ivey made an errant throw to the pitcher and missed hitting a coach by inches. The coach turned on Ivey. "You goddamned stupid busher!" he yelled. "You stink! You'll never make it in the Big Leagues!" The abuse continued in that vein with the entire veteran team listening. For the rest of the workout, the humiliated Ivey rolled the ball back to the mound. That evening, he called the team office from a bus station to announce he was going home. He was through with baseball.

At that point, Ogilvie's intervention saved matters. He persuaded Ivey to return and spend some time with him in not only for his own peace of mind. He then isolated himself with Ivey for two days, finally coaxing him back onto the team. Ivey switched from being a catcher to an outfielder. His powerful hitting ensured him a successful career in baseball. Thanks to the Ivey episode and others like it, professional baseball teams have begun to realize that psychologists can be as valuable as trainers and physicians. After years of struggling for acceptance, psychologists are now working with players on most Major League teams. They give private psychotherapy to certain troubled players and use techniques ranging from relaxation exercises to hypnosis to enhance the performance of well-adjusted players.

All of these techniques, of course, would have been anathema in the grand old game's early days. When your nickname was Big Train, Iron Man or the Duke, you were supposed to be a hero and you didn't rave on about emotional pain. You were paid for flawless instinct and performance; not complaints.

But during the Sixties, this veneer of baseball machismo began to erode. First the leagues added more teams, and younger immature players were brought up from the minor leagues to fill the extra slots. Second, a rule known as the reserve clause was struck down. The rule had given teams the right to hold or trade players at will. When the clause was abolished by federal statute, baseball's peons—the players—were freed and began signing with teams offering the highest bids. Virtually overnight, pitchers and hitters just beyond their teams became millionaires. Coaches and managers, who now earned less than the players, grew angrier with their praise and their high-salaried young charges felt an ever-increasing obligation to perform like supermen. Their worries damaged their concentration, whittling away their batting averages and slowing them down their fastballs. Eventually fearing that the money they spent was about to be thrown out the window, the teams tried a tack that was being explored by many corporations. They recruited a few psychologists.

Ogilvie was one of the earliest of these consultants. He recalls that at first managers feared the intruders would undermine their leadership. whereas the players viewed the "shrinks" as spies of the management. And because few had ever worked with athletes, the psychologists themselves seemed hopelessly amateurish in the years that followed. Though they worked with a larger sampling of players, gradually developing a solid block of psychological theory.

By and large, Ogilvie insists he and his contemporaries have found that

A new type of psychologist is helping baseball players open doors to a level of mentalines.

CONTINUED ON PAGE 144
Literate Computers

Artificial Intelligence

By Phoebe Hoban

Instead of using artificial languages to communicate with their computers, some programmers are now teaching their machines to understand an old and complex language: everyday English.

Researchers in artificial intelligence are developing systems that may eventually make man-machine communication as natural a process as human conversation. "If computers are ever really going to become household appliances like the TV or radio, there's no question they will have to use natural language," says Kenneth Lim, of Dataquest, a California market-research firm. The average Joe Public is never going to want to learn BASIC. You have to program the computer to be people-literate.

BASIC is a programming language used in applications that range from calculating a return on an investment to playing games. Writing computer instructions in BASIC or other common artificial languages requires strict adherence to rules. Misplacing a quotation mark, for example, can cause a program to quit, blocking the flow of data. By contrast, people continue conversations in ordinary English even when a previous phrase is ungrammatical or ambiguous.

Cracking the human communication code and teaching it to computers, however, is a challenge. Which comes first—form or content? Is it possible to comprehend the meaning of a group of words without first defining that group's structure? These and other fundamental questions have kept researchers busy since the Sixties. Now their work is beginning to pay off. And within the next 8 to 18 months, several companies plan to introduce the first natural-language programs for personal computers.

Like people, these programs will differ in how they use language. For example, one program marketed by Artificial Intelligence Corporation approaches English armed with a rich knowledge of grammar. The Intellect program understands such normal English questions as "What is the average salary of unmarried managers in the Rochester division?'" and searches databases for answers.

AI researchers often use hypothetical examples such as "If tomorrow is a sunny day in San Francisco, what are the chances of an earthquake?" In response, they might print the conditions in California or the likelihood of an earthquake on October 18, 1989, 6.9 magnitude, occurring in the Hayward fault-zone.
The space tourists file a bit uncertainly into the briefing room. Five dozen seats line the circular walls of the room, where the travelers will receive instructions for their tour of the cosmos.

A robot in the center of the room. Logos, the space guide, gives them orders. They are to throw a ball at him, but when they do, it curves away crazily. Then they try to throw it without moving, and movement is difficult. Logos takes them through a preview of gravitational and motion effects they should expect on the trip.

Next, the tourists receive space physical, balance, and memory tests to ensure their fitness for space. And then they enter the space capsule. A huge door opens, and the launch tower to the right, a video screen shows the crew preparing for launch. To the left, a digital display flashes the countdown. The sound of preparation is all about. Finally, the descending numbers reach zero. Lift-off, and the travelers are pushed into their seats as the capsule vibrates.

It is quite a trip, and it's even more impressive because it takes place entirely in a Manhattan office building in late 1988. The 2010 space vacation is actually the SpaceWorks, a multimedia simulation scheduled to open in New York this December. Developed by Trans-Lux Corporation, the SpaceWorks is a pioneering step in the new art of computer simulation and amusement. Combining the flight simulators used to train astronauts and airplane pilots with the technology of video disc and microcomputer, these realistic displays can place us in any corner of the universe of the human imagination. Unlike past amusement scenarios, they provide the physical sensations of the genuine event.

The SpaceWorks uses computer controls and a huge centrifuge-room to create the effects of the spacecraft's breasting chamber. In the spacecraft itself, computers knit sound tapes, video disc images of the crew. and 35mm movies of the port views into a seamless whole. Hydraulic lifts are tied in as well, to sweep the "capsule" around and move the seats in ways that back up the images with authentic physical sensations.

Another similar simulation ride is the SR2, made by Doron Precision Systems in New York. The SR2 looks something like a van without wheels. Inside a dozen seats face a rear projection screen.

The SR2 can become a spaceship, a super roller coaster, a barnstorming biplane, a race car or a white water raft. The images flash on the screen are coordinated by microprocessor with a complex hydraulic system that moves the unit about in convincing twists.

Already, Doron has placed more than a dozen SR2s in Japan and sees an unlimited future for simulation amusements in the United States.

The future probably holds additional kinds of sensory stimulation, says David Trenchler, of Doron. "Wind" strobe lights, more sophisticated motion. The future of the amusement industry is in simulation—creating sensations in the mind rather than on real rides.

And not only sensations of space or adventure. In the movie Outland, the evil mine owner played simulated golf with a computer-controlled screen that showed him the fairway and traced his ball's path toward the hole. That device already exists. It is called the Golfomat and its developer, Arthur Angelos, has sold hundreds of them. Sensors behind the screen measure the angle and velocity of a ball hit by the player. The computer then calculates where the ball will land and selects the proper view of the course.

Ultimately the technology will lead to fully interactive scenarios in which the user has vast freedom of choice to interact with his environment—which will respond to whatever he does. Real-life Dungeons and Dragons? Tennis against Jimmy Connors? A mock auto race? All are possible through computer video simulation.

NEW PRODUCTS

The Spy Beam is a miniaturized system to mark and keep track of valuable cargo, vehicles, or people without attracting attention. A battery-powered transmitter attached to the moving cargo or person transmits a beam invisible to the naked eye to an infrared receiver where the beam penetrates smoke, fog, or fabric. It blinks every two to three seconds. But the unit can be set to transmit distinctive signal patterns. The system costs about $400; could be used to locate a shore point from sea, or to find a specific person in a crowd (CCS 633 Third Avenue New York NY 10017).

Microwave ovens are safe when they leave the factory, but according to Controlled Energy Systems of Texas, some become dangerous at home when spilled food breaks the tight seal of gaskets designed to trap radiation. To find such leaks, the company sells the Micro Snooper ($19.95), a hand-held detector. Microwave owners move a wand around the seam of the oven door while hearing the sound of radiation. A color-coded gauge warns of radiation (14200 Microway Road Dallas, TX 75234).
when the phone rings at Gametrics Ltd. in Sausalito, California, biologist-entrepreneur Ronald J. Ericsson often finds himself fielding some odd requests. "Is this where you order boys?" a recent caller asked the czar of scientific sex selection. She wasn't joking, either.

Catalog-order babies, whether swaddled in blue or pink aren't available naturally, from Gametrics or anywhere else. But Ericsson's operation comes close. Now that his pioneering "sperm separation" technique—the first and only documented means of choosing your future baby's gender—has been put to the test by some 200 couples desiring sons, its success rate of 76 percent has held steady.

Left to her own devices, Mother Nature deals an even 50-50, of course—and those are the odds to which would-be parents of girls have had to resign themselves. Until now, that is. For the first time, there is a way to make the Ericsson method favor female offspring. The only problem is that no one, including the inventor himself, can figure out why it works.

Ericsson hit upon his male-producing method by accident some years ago in the course of fertility research. It just happened to favor the speedier Y-bearing sperm that produce baby boys. The technique works by filtering sperm through several layers of human serum albumin. Because the Y sperm outswim their X-bearing counterparts, what ends up at the bottom of the vertical glass column is a sample composed of about 80 percent Y sperm. Conception is then accomplished by artificial insemination at one of 17 licensed centers around the globe from Rome to Philadelphia.

Recently Ericsson started wondering about the fertility drug Clomiphil—designed to stimulate ovulation in women who don't ovulate—and found journal reports that it shifted the sex ratio slightly (about 56 percent) in favor of female offspring. Since some of the women using his method might be taking the drug, he asked his sex-selection centers for statistics. The numbers made no sense. The combination of Clomiphil and the Ericsson technique seemed to begat a startling, and mysterious, preponderance of females. 15 out of 19 babies born.

"Remember," notes Ericsson, "that the control group in this case isn't fifty-fifty, but is skewed heavily toward males. and that Clomiphil was the only variable."

But how on earth could sperm samples consisting of 80 percent Y sperm be making 80 percent female babies?

Frankly, Ericsson doesn't know. Either the statistics are a fluke, or Clomiphil exerts a weird chemical influence on the filtered sperm. Despite the theory gap, at least three women are pregnant with what they hope are daughters following a Clomiphil/sperm-separation regimen. "I'm not giving anyone false hopes," says Ericsson, "We'll see what happens. I am telling the centers not to use Clomiphil for boys."

New methods are sure to follow. In Japan, for example, researchers report a promising technique that uses electricity to separate the Xs from the Ys. But it hasn't yet produced a baby.

What impels people to try to tamper with the gender game anyway? The very idea seems to stir dark presentiments of a bioengineered society full of made-to-order firstborn sons. From the mail Gametrics receives, though, Ericsson predicts that kind of scenario won't happen. "A sociologist, Nan Chico, is analyzing our letters—several thousand by now—as part of her Ph.D. thesis," he says, "Only about one percent of the people who want to preselect the sex of a first child. Most people in this country want a girl and a boy." At the East Bay Fertility OB/GYN Clinic in Berkeley, where the Ericsson technique has produced 44 children so far, Dr. Ferdinand Boernink concurs. "Almost all of our couples already have several daughters; often from former marriages and want a son."

"In Taiwan, where we have several centers, people do want sons," Ericsson notes. "Sons are their Social Security, they're expected to take care of the parents in their old age. But twenty years from now, when we're sure of topos, there will be a less sexist place."

Some parents prefer daughters to sons. Now there may be a method for begetting them.
TOKYO'S HIGH-TECH MECCA

EXPLORATIONS

By Doug Garr

It is a miasma of neon and a veritable electronic emporium extraordinaire. It is a dazzling array of calculators, stereos, and televisions as well as a supermarket of semiconductors and assorted electrical gadgets. Welcome to the proud center of the Japanese retail market for high technology, the inimitable Akihabara district of Tokyo. It is sometimes said that you haven’t been to the Far East if you haven’t spent at least a couple of hours perambulating the half-dozen square blocks along the Chuo Dori (central street) just off the Akihabara subway and train station.

In Akihabara there are some 530 stores and shops, ranging from the posh computer showroom of the Nippon Electric Company on the seventh floor of Tokyo’s Radio Building to the tiny stands in the cramped arcades featuring the raw inners of radios and computers. Last year the district sold $2 billion worth of goods, or 9 percent of Japan’s total high-tech gross national product. And most of those goods went for 15 to 40 percent below the manufacturer’s listed price. Nobody pays the suggested retail price in Akihabara. In fact, it would be considered impolite by Japanese standards if a buyer didn’t haggle over even the “discount” price.

There are basically two kinds of products available in Akihabara. First, such typical consumer appliances as refrigerators, electric heaters, and every imaginable variation of TV tape deck, videotape recorder, amplifier receiver and camera. Strange hybrids also abound, from FM radio digital watches to stereo tuners operated by remote control. Computerized tuning is very popular; as is computerized everything else. Almost every storefront has a flashy display with something whirring in the window.

The second category of Akihabara merchandise features kits, electronic parts, and gizmos that have marginal practical use but are nonetheless infatuations of the Japanese engineering mentality. Shoppers snatch up such exotic items as electric sesame-seed grinders, radish graters, ear picks, pencil erasers, miniature desk-top vacuum cleaners (for the really messy and busy executive, one imagines) battery-operated corkscrews, diaper alarms that beep when baby is wet, and an overflow-sensing device that automatically turns off the faucet when the bathtub is full.

Akihabara also attracts hobbyists of all kinds. You can buy electric trains, a scale-model remote-controlled Bell Jet Ranger helicopter (about $510 list), a lifesize robotic arm ($37), and kits to build everything from TV sets to home computers. Many of the customers frequenting the hobby shops are adults. Japanese men continue their hobbies far longer than American men do. School kids in their dark-blue uniforms can usually be found tinkering with music synthesizers or playing with computer keyboards. Sunday is the big sales day here with Chuo Dori cordoned off from traffic to allow the 100,000 shoppers a little more elbowroom. Among them are high-tech marketing executives scouting the competition’s products. As Akihabara sales are often the bellwether of an item’s performance. The activity on Sunday is fiercely aggressive. Quite possibly this is the only place on earth where computers are sold on the sidewalk.

Tokyo’s high-tech district actually has something of a vanished history. Before World War II, Akihabara was the place where the Japanese bought bicycles (much more common as a mode of transportation here than in the United States) after the war, black marketers who were driven out of the nearby Sudacho district congregated in Akihabara. Since the district had been ravaged by bombing, most of the peddlers sold their wares in open-air markets. Radio parts became the predominant staple. Remarkably there are still one or two shops in Akihabara that sell antiquated vacuum tubes. The most amusing anachronism, however, is the sight of an elderly shopkeeper adding up the price of a purchase of electronic goods with his abacus. If you shake your head in bewilderment he will probably reach into his coat pocket and produce a calculator.

One shop owner, Shuichi Take, sixty,
How to read faster

By Bill Cosby

I realize that reading is an important skill, but I also know that there are many people who struggle with reading at a comfortable pace. This article is not a replacement for professional help, but it might offer some tips that can help you improve your reading speed and comprehension.

1. Preview—It's short and simple

Previewing is a way to get a general idea of what you are about to read. You can do this by skimming the first paragraph, checking the headings, and reading the first sentence of each new paragraph. This will give you an overview of what the text is about and help you understand the context.

2. Skim—It's long and hard

Skimming is a technique that involves reading quickly to get the main ideas of a text. You can do this by reading every other sentence, skipping paragraphs, or reading the first and last sentence of each paragraph. This will help you get a sense of the overall content without getting stuck on details.

3. Cluster—Increase speed and comprehension

Clustering involves grouping ideas together to create a mental map of the text. This can help you understand the relationships between ideas and remember them better.

Today, the printed word is more vital than ever. With the rise of digital media, reading has become a more complex task. However, with the right techniques, you can improve your reading speed and comprehension, making it easier to absorb new information and stay informed about the world around you.

Bill Cosby

INTERNATIONAL PAPER COMPANY
ominous dark patches threatened to engulf the last vestiges of healthy skin on his legs. Under a microscope, the diseased tissue was seen to comprise hideously deformed cells—huge, lumpy blobs that clumped together in haphazard groups. To the pathologist on the case, all the signs clearly pointed to the vicious killer, melanoma. But the clinical picture seen by Dr. Mark Dahl, at the University of Wisconsin's dermatology clinic, told a different story.

The patient, a retired schoolteacher reported feeling fine at a stage in the disease's progression that should have left him at death's door. A battery of tests failed to uncover any evidence that the disease had spread. And when asked about some white blotches on his legs, the patient revealed that these were spots where other tumors had "gone away."

Regression atypical histiocytosis, or RAH, is a newly identified disease that may be subjecting hundreds of people throughout the world to unnecessary cancer therapies. Because its mimicry of such insidious cancers as melanoma, Hodgkin's disease, or lymphoma is uncanny, Dr. Kevin J. Flynn, an associate professor of pathology and dermatology at the University of Wisconsin at Madison, has been conducting studies to determine the course of RAH, how it looks to clinicians, its biopsy characteristics, and how it progresses and regresses. He hopes that his efforts will provide physicians with techniques designed to diagnose the imposter.

At a microscopic level, however, RAH's many faces share common features—these similarities appear to distinguish the disorder from lethal varieties of cancer. Once you know what to look for," says Flynn, "RAH can be diagnosed with great assurance most of the time.

The distinction is crucial for if doctors are fooled by the appearance of RAH, the treatment can prove worse than the disease. A Florida man, for instance, lost his leg to amputation before the deception was exposed. Because RAH disguises itself as a voracious killer, Flynn explains, doctors may feel compelled to adopt drastic measures when, in fact, the application of a hot compress to the body is probably the best course of action.

It is impossible to calculate just how many cases of RAH have been mislabeled in the past, but the number is probably in the hundreds. Flynn's search of the medical literature has uncovered many possible episodes of the disease. These reports typically mention numerous lesions that come and go while the general health of the patient remains good. Though not all RAH tumors regress completely, regression is one of the disease's indicators.

In the cases now documented, RAH is most commonly mistaken for malignant melanoma, which accounts for two thirds of all deaths from skin cancer. In diagnosing melanoma, the size of the tumor is a prime indicator of the patient's chances of survival. Because many an RAH tumor is as large as a melanoma tumor that would be fatal 50 percent of the time, doctors are faced with very difficult therapeutic choices.

"RAH looks as if it should be lethal," says Flynn, "but it's not. At worst, it may be a form of low grade malignancy, and it should be treated accordingly."

Dr. Dahl, an associate professor of dermatology at the University of Minnesota medical school, views the disorder as a mild type of cancer. "If my hunch is borne out," he says, "the key question becomes, How does the body ward off the assault?" The answer could have far reaching implications for treating cancer.

Dahl speculates that a specific reaction of the body's immune system could explain why RAH appears to regress spontaneously. He also believes it's possible that people get the disease only if they have a particular biological makeup that renders them susceptible.

Once we have an idea of who's likely to contract RAH, what it looks like at different stages, and what role the body's defenses play in controlling the disease, we may discover better ways to attack truly aggressive cancers in the bargain," Dahl says. As things stand now, though, we have a long row to hoe.
For a conceptual artist who is more often concerned with representation than with straight entertainment Canadian filmmaker Michael Snow can be a pretty jokey fellow. In fact, all the avant garde artists I know he may well be the one who laughs the most and the hardest. His longest and craziest movie—the 260-minute, encyclopedic "Rameau's Nephew" by Diderot (Thanx to Dennis Young) by Wim Hofman—contains a grab bag of assorted puns, puzzles and adages from lines like 'eating is believing' and 'hearing is deceiving' to a mad tea party where words and sentences recited backward are then reversed to sound vaguely intelligible. Even Wim Hofman in the title is an anagram for Snow's name. One of his shortest works, the eight minute two Sides to Every Story is projected on two back to back screens simultaneously showing the same events in the same room from opposite angles. Just as typical in the living room of Snow's house in Toronto where I recently interviewed him is a front door that isn't in use—of rather is in use, but not as a front door. Over the side facing inside the room is a life-size color photograph of a painting of the same door. A concept of a front door in place of a real one? A statement about representation instead of a portal to walk through? Perhaps a bit of both. But there's another detail in the photograph that makes the whole thing funnier and stranger: a gigantic hand in the foreground holding a lit match. This image is many times larger than life totally contradicting the supposed equivalence between real door and represented door.

Perceptual and conceptual gags of this kind abound in Snow's work. Sometimes they're amazingly literal. After making an epic film trilogy in the late Sixties and early Seventies about possible ways of moving the camera—zooming, panning back and forth, and rotating every which way—he built a set on rollers for a section of another film (Presents 1981). Then he used a couple of forklifts to jerk the whole film set to and fro so that the camera wouldn't have to budge an inch. In the ensuing slapstick mayhem (a needle on a Bach record skips wildly walls and furniture shake objects crash to the floor actors are buffeted about) something about the perception of movement—as well as the intimate relationship between creation and destruction—is being explored.

Just a few short subway stops away from Snow's house is the best known and most popular of all his works. Flight Stop. It isn't a movie; but it makes many people think of one. Located in the largest enclosed shopping mall on the continent Eaton Center, which reportedly attracts more visitors annually than Niagara Falls, this photographic sculpture consists of 60 fiberglass geese, each suspended from three wires and glued to a contoured photograph of a real goose. Extended over about six stories, the geese seem to be landing in formation, and there's something eerily cinematic about the overall spread; as if each bird were a separate stop-frame in a dispersed simulation of animated flight.

For epic visual breadth, perhaps the only Snow creation to rival Flight Stop is the three-hour film, La Region Centrale (The Central Region: 1971) in which a computer operated camera spins in endlessly changing configurations around an uninhabited mountain landscape in northern Quebec. It probably wouldn't be an exaggeration to call this film one of Snow's least popular works—it certainly has the fewest laughs. But that's largely because it's so scary. There's a direct assault on the senses, including one's center of gravity as the flip-flopping camera makes circular patterns at variable speeds that no human being could possibly duplicate, producing an experience roughly akin to riding a demonic Ferris wheel.

I wanted to make the film a condensed day," Snow explained. "It isn't, really; but it does start in daylight, then there's sunset and sunrise and it's over at something like eleven.

In order to make the film, Snow enlisted the help of Montreal technician Pierre Aebelos, who designed a machine that used audio tapes to program the camera's 360° movements without any direct human control. Then Snow went out looking for a wild location where nothing man made was visible, finally settling on an area near Sept-Îles on the Gulf of St. Lawrence. Renting a helicopter, he flew there with three crew members, installed Aebelos's machine on a remote mountain plateau, and fired from camera range with the others for five cold days in September while the film was being shot.

Why was it so vital to have nothing human either in front of the camera or behind it? "On the one hand, I wanted to have the machine make the film," Snow told me. "But on the other hand, I wanted to make what you see more yours than the cameraman's or the director's, in a way. Even though the height of the camera is the usual human standing height five feet or so; it makes for a kind of experience that's not anthropomorphic. It's an experience that comes explicitly from the machinery."

"Ultimately," Snow went on, "the director of the artist is removed just one step in
I f you want to look into the real soul of a new machine—look into the eyes of Laurie Anderson. Look through her silver eyeglasses that are wired for sound. Sit around her electronic campfire
Laurie Anderson wants to tell you a story "Good evening. This is your captain. We are about to attempt a crash landing. Put your hands on your head. Put your hands on your hips. Heh. Heh. Heh. And we are all going down together—" "From the Air" ©1982 Difficult Music/BMI

Echoes like this one—of our collective fear of flying—are scattered throughout Anderson's performance of United States, Parts I–IV. After nearly five years in development, this 78-part ode to America in the Eighties received its full-length premiere early in 1983 at New York City's Brooklyn Academy of Music. It took six hours divided into two evenings to experience the entire work. The premiere capped a previous year that saw Anderson move from the position of a relatively unknown avant-garde artist to that of a pop star and media celebrity. 'O Superman,' her single released on the independent One Ten Records label, reached the top of the British pop charts and the top of many American music critics' ten-best lists. Warner Brothers records then signed Anderson to a major recording contract and her first album for them, Big Science, sold 800,000 copies worldwide.

When you meet her, Laurie Anderson is soft-spoken and personable. A state-of-the-art recording studio in her lower Manhattan quarters offers the only clue that she is proficient technologically as well as aesthetically. An accomplished violinist and sculptor, she casts electronic spells within a discipline that's really no discipline at all:formed performance art. It can be part music, part film, part monologue, part anything. And it is Anderson's ability to engineer hundreds of bits of musical narrative and visual information into one seamless work that makes her important. "When I began to write United States," she tells us, "I thought of it as a portrait of a country. Gradually I realized it was a portrait of any technological society, and people's attempt to live in a technological world."

The dramatic big picture she develops in United States touches on everything from the space program to romantic love and captures the humor, confusion, and wonder that seem to coexist throughout contemporary life. Outer space satellites and extraterrestrial travel and particular fascination her, but she is critical of the direction of the space program today. "It seems everything we send up now is just for the purpose of looking back down," she comments. "It's such a huge change from the Apollo days. We just go up for a few miles now and it's basically for surveillance. That's not to say she adds. That she would not jump on the first shuttle flight available.

As instrumentation in this new American Gothic, Anderson uses a Synclavier, which looks like an organ but is actually a "sample-to-disk" digital keyboard in which voices and sounds are assigned to various keys on the board—a bizarre, high tech variant on the traditional keyboard arrangement. In the section of United States entitled "Example #22," the Synclavier allows her to recall programmed voices of so-called paranormals—those self-proclaimed conduits to the spiritual world—and to mix them with her own voice speaking in both English and German. Radio waves, satellite beams, and other precise electronic transmissions are juxtaposed with the "spiritualists" communiques throughout the performance. The summoning of these voices resonates with eerie associations reverberating between ancient concepts of mystical realities and new extraterrestrial visions.

In another segment, the other hand, Anderson indulges in a rather pedagogical ten-minute monologue on the importance of Nikola Tesla. Another of Anderson's tools, the Vocoder, a voice-activated synthesizer, alters the voice's character and tone. Through it Anderson speaks in rapid succession as a child, as herself and as a middle-aged man. The capability of machines to affect speech is a major theme of her work. "I think this issue will predominate as machines take over more of our modes of speech," she observes. "The question of what is human and what is fascimile arises with these disembodied voices that come to us over a PA system or through a phone line."

"I have a friend with a child," she continues, "and one of the hardest jobs she has is to teach this kid what's alive and what's not. For instance, the phone will ring and she'll say, 'It's Grandma and the kid says, 'That's a piece of plastic. Is it alive? Is the TV alive? And these things are confusing not only to the child, they're confusing to me.'"

Anderson turns the kind of instinctive confusion we all feel toward supermarket checkout terminals that talk back, or friends who are present in spirit if not in fact through their phone answering machines into incisive gestures and images. At one point in the performance she turns her own body into a musical instrument by winding her head for sound with those electronic eyeglasses. Knocking on her head and jaw,
CONTINUUM

POLITICS AT THE POLE

Antarctica comprises one tenth of the terrestrial world, yet there is no consensus as to who owns it. Does it belong to the seven nations that have asserted territorial claims to it, or to the nations, now 14 in number, that have conducted most of the research there? Is it as some lawyers maintain res nullius—belonging to no one—because sovereignty is impossible to establish in such a hostile environment? Or does Antarctica belong to everyone?

As long as this ice-encased continent was the preserve of explorers and scientists, such questions were academic. But now the prospect of finding valuable resources endows the matter with urgency. Though exploration for Antarctic oil and gas has not even begun, their existence is almost a certainty. Coal and iron are known to be present in large quantities. Trace amounts of copper, chromium, nickel, cobalt, manganese, molybdenum, gold, silver, platinum, and other minerals have been found, and evidence indicates that significant concentrations exist. Perhaps most important, the Southern Ocean surrounding Antarctica represents the world's last major undeveloped fishery, its prime food source—tiny shrimplike krill—could provide protein for millions of people throughout the Third World.

Just 25 years ago, the 12 countries most active in Antarctica agreed that the continent and its wealth should be used for peaceful purposes only. Antarctica would be preserved as a common heritage of science. But all military activity forbidden. To this end, the 12 nations negotiated the Antarctic Treaty, which came into effect in 1961. At the time it attracted a great deal of attention less perhaps for its specific provisions than for the fact that at the height of the Cold War, the United States and the Soviet Union were among those able to agree on nonmilitarization, unlimited right of inspection, and full exchange of information—at least in one corner of the world.

But an important matter was omitted from the treaty. The problem of claims to territory and the resources within. The seven nations claiming territory in Antarctica were and still are, Argentina, Australia, Chile, France, New Zealand, Norway, and the United Kingdom (the claims of the U.K., Argentina, and Chile overlap). Five remaining countries—Belgium, Japan, South Africa, the Soviet Union, and the United States—asserted no claims and recognized none, but retained the right to stake claims at some future time. Poland and West Germany have recently joined the treaty nations. Like the United States and the USSR, these countries claim no territory at the present time.

In an effort to establish ground rules for exploitation of Antarctic resources despite the confusion, this “Gang of 14” is now trying to negotiate what they call a “minerals regime.” As expected the parties are having difficulty. The claimant nations assert that minerals found in their sovereign territory belong to them alone, while the nonclaimant states want some system of sharing resources wherever they may be found. Although the nations involved have a strong interest in reaching agreement, it is possible that avance and virulent nationalism will destroy the consensus system developed during the last 26 years.

If agreement can be reached, however, it is likely that the Gang of 14 will be able to ignore the rest of the world and divide the spoils among themselves, the treaty powers already seem prepared to make some token payment to the poorest countries if and when mining becomes profitable. Nor will the developing countries allow the Gang of 14 to treat Antarctica as a private fiefdom where they alone make all the decisions. Some compromise will be needed between the common-heritage principle and the notion that Antarctica can be run as a private club.

My own hope is that the Antarctic Treaty system will be preserved and that the 14 consultative powers will administer the area as a commons in trust. The treaty nations have so far acted responsibly and have acknowledged the interest of all mankind in Antarctica. They have already adopted agreements for the protection of the environment and the preservation of Antarctica as a unique scientific laboratory. They are the nations with direct knowledge of Antarctica and with an understanding of the probable impact of their actions. Provided the treaty powers can now reach agreement among themselves, keeping decision making in the hands of the most experienced and concerned nations will best ensure the words of the treaty “that Antarctica shall continue forever to be used exclusively for peaceful purposes and shall not become the scene or object of international discord.”—Philip W. Quigg

Philip W. Quigg is the former managing editor of Foreign Affairs and the author of A Pole Apart: The Emerging Issue of Antarctica.
BIONIC BEAKS

Beachgoers strolling the southern California coast last fall were stunned to see mutilated pelicans floating offshore. The birds had their upper beaks hacked off, probably by fishermen defending their anchovy patches. Four of the animals succumbed to the injuries almost immediately. The rest, no longer capable of catching fish, would have starved to death soon after.

This horror story, however, may have a happy ending. Veterinarians and an aerospace engineer have joined forces to save the 15 remaining animals by fitting them with artificial beaks.

Dr. Robert Rooks and a team at the Crown Valley Animal Hospital, in nearby Laguna Niguel, south of Los Angeles, successfully attached an artificial beak to a pelican named Pinocchio. The new beak, made of epoxy resin, fiberglass threads, and carbon fibers, was connected to the remains of the old beak with glue, pins, and screws.

Robert Cross, director of advanced technology at PDA Engineering in Santa Ana, joined the team to develop a new and safer method of attaching the artificial beak instead of using pins, which may cause injury to the birds when they strike their beaks on hard surfaces. He secured the prosthesis with epoxy and ultrapowerful bone cement. Though Cross tried to make the attachment just as strong as it was in nature, two of these beaks have recently broken, and the scientists must go back to the drawing board.

Nevertheless, hopes remain high that a working beak will soon be perfected. The surgical team hopes to operate on pelicans throughout the year.

—Joel Schwarz

Surgeons attach an artificial beak made of epoxy resin, fiberglass, and carbon fibers to Parrotch, a wounded pelican.
THE TELESCOPE VS. THE GOLF COURSE

The observatory that created some of the most detailed maps of the sky and that listened attentively over the past decades for radio signals from intelligent life in space was nearly destroyed by developers who wanted to build a golf course on the site.

You may think that a radio telescope weighing nearly 500 tons and covering about 4 acres of ground is too large an item to fall between the cracks. But that is what almost happened to the Ohio State Ohio Wesleyan Radio Observatory. Through a series of misunderstandings and miscommunications, Ohio Wesleyan sold the land out from under the telescope, apparently to the great surprise of Ohio State even though the two universities had jointly operated the observatory since 1956. The site went along with the sale of some 250 acres to Green Highlands Ohio General Partnership, a private group hoping to build housing tracts and putting greens.

Early reports quoted the developers as saying that the telescope was right in the middle of the proposed golf course. In later news bulletins, the partners said the telescope constituted an eyesore.

But anguish turns to the telescope's defenders have recently been heard. According to George Foster, who founded the Committee to Save the Telescope, the developers just need a little consciousness-raising to put their priorities in order.

Not only were the members of the partnership grateful for the astronomy lessons, Foster said, but they saw how influential friends of the telescope could help them win zoning variances on the land—something they left the observatory alone.

"Instead of a lot of static, they'll get a lot of cooperation," Foster explained. "They're beginning to look at the telescope as an attraction instead of an abomination." — Dave Sobel

MANATEE TALK

The gentle, giant mammals known as manatees are fast becoming extinct. But if they could be warned against such man-made hazards as boat collisions perhaps their lives could be saved.

So thought Florida Institute of Technology biologist John Morris and his student Cathy Steel. But when the two began studying ways to communicate with these creatures, they hit upon a surprising discovery. Manatees have a rich vocabulary of over 1,000 sounds, including a series of interplay and distress calls.

Using underwater hydrophones, Steel and Morris used computers to identify the patterns of various tones, frequencies and amplitudes. They sorted the findings into 13 categories depending on age and sex. Adult females, for example, mimic the noise of a low-pitched "rusty pump" while manatee infants sounded like chirping birds. All tones intensified with imminent danger. Clearly, the manatees had developed their own warning signals. The Florida researchers, and all of this without human help.

"Innovators and creative geniuses cannot be reared in schools. They are precisely the men who defy what the school has taught them." — Ludwig von Mises

"Do not free a camel of the burden of his hump you may be freeing him from being a camel." — G.K. Chesterton

*Surprising manatee. Scientists have found that the sea creatures have a vocabulary of more than 1,000 sounds.*
PET ACUPUNCTURE

Does a visit to the vet send your pet into fits of jitters, mewing, barking, or clawing? If so, acupuncture may take the edge off its anxiety suggests H. Grady Young, a septuagenarian veterinarian from Thomasville, Georgia.

Taking his cues from ancient Chinese cavalrymen, Young first used veterinary acupuncture 38 years ago to calm an unruly horse. And he's been practicing it ever since to ease vet-phobia— as well as to anesthetize four-footed surgical patients and relieve emphysema symptoms.

He claims the needles have also improved the performance of racehorses and restored a prizelighting rooster's bum leg.

The American Veterinary Medical Association views acupuncture as an experimental treatment from which the public must be protected. Young, however, retorts that the AVMA with its financial ties to drug companies won't endorse a procedure that lessens the need for drugs.

—Eric Mishara

An age is called Dark not because the light fails to shine, but because people refuse to see it.

—James A. Michener

BLUE PEOPLE

Kentucky is best known as the Bluegrass State but it also has another, less publicized distinction: an inbred group of people with pale blue skin.

The first known blue person was born in France around 1600. An orphan, he came to the United States and settled in Perry County, Kentucky along the banks of Troublesome Creek. By sheer coincidence, he married a woman with similar traits, and the two of them set the pattern that has lasted to the present.

Before 1900 blood spe-

cialist Madison Cawein

explains, Troublesome Creek could be reached only by foot. Thus, the isolated inhabitants—all related—named one another and today have produced more than 200 blue offspring.

Cawein became aware of their plight in the mid-1960s and he set out to help. Working from his lab at the University of Kentucky, he traced their odd pigmentation to an enzyme deficiency. They were missing the enzyme that breaks down the blue brown blood chemical known as metahemoglobin. With an excess of this substance flowing through their veins, the folks at Troublesome Creek had turned as blue as Oxford shirts.

Finally, Cawein came up with a cure: daily administration of an inexpensive antisepctic called methylene blue, which activates an enzyme that replaces the missing one, turning blue skin to pink.

Because there are few doctors in the vicinity of Troublesome Creek, a daily treatment isn't feasible, says Cawein, who now directs Merrell National Labaratories in Cincinnati. On the other hand, although these people are embarrassed by their condition, most of them stay healthy and bright to a ripe old age.

—Tom Kovach

SWEDISH SATELLITE

In the fall of 1984, Sweden will launch its space program with a Boeing-designed satellite aptly named Viking. Its mission: to study the northern lights or aurora borealis which Swedish scientists have long pondered from the ground.

The magnificent lights created when solar wind interferes with the earth's magnetic field unfortunately hinder radio communications. Perhaps Viking's eight-month voyage will tell scientists why.

Down the road, Viking project scientist Kerstin Fredga envisions a row of Swedish telecommunications satellites and even a Nordic cooperative satellite for direct broadcasting. Swedes are likely to greet their Space Age enthusiastically, she says, especially when they can look at their own summer cottages via remote sensing. Viking is the Boeing Aerospace Company's first international satellite—Frank Catalano

My means are sane, my motive and my object mad.

—Captain Ahab, from Herman Melville's Moby Dick

Viking. At last, a close look at the northern lights.
VOLCANIC MUD

Three years after the cataclysmic eruption of Mount St. Helens, residents of southwest Washington are still looking over their shoulders. But nowadays people aren't as scared of lava as much as they are of the mud.

When the mountain blasted away its northern face in 1980, explains Ed Daugherty of the U.S. Army Corps of Engineers, it plugged the upper watershed of the Cowlitz and Toutle rivers. A natural dam of volcanic debris now holds back some 3 billion cubic yards of eruptive leftovers—and huge amounts of water and mud. Should the dam break, 70,000 downstream residents could be engulfed.

But for now, according to Daugherty the situation is under control. For two winters the corps has been operating a pumping station to relieve pressure on the dam. And corps engineers are studying potential tunnels and pipe systems that would drain the area should eruption occur.

Still, even Daugherty admits that internal weaknesses, an exceptionally rapid snow melt or another violent eruption could result in a flood during the spring or fall. For that reason many area residents want the government to buy out all the endangered property letting the mud flow where it may.

"Everybody worries no matter what," says Jerry Comstock of Castle Rock.

"It's a constant fear. We keep our van packed. We don't know what to do, so we stay prepared."

—Tom Gauntt

"Of allIars, the smoothest and most convincing is memory.

—Olin Miller

PRESCHOOL SUICIDE

One August morning in 1982, three-year-old Jenny Brandon climbed up to a kitchen cabinet and guzzled down half a bottle of window cleaner. Fortunately her mother, who found her doubled up on the floor rushed her to the emergency room in time. But nine months later Jenny munched a handful of allergy pills she found on her mother's dresser, this time she died.

Until recently most experts would have blamed these incidents on a mere twist of fate. But now, according to Dr. Perihan Rosenthal, director of child ambulatory services at University of Massachusetts Hospital, many doctors don't take such "accidents at face value. Children as young as two, Rosenthal has found, attempt suicide.

In nearly all cases, says Rosenthal, preschoolers in repeated accidents have been abused or have lost a parent. One two-and-a-half-year-old patient for instance, starved himself for two weeks, then tried to jump in front of onrushing traffic. He also bit himself violently. When asked why he was hurting himself, he answered, "because nobody loves me—Mommy and Daddy went away.

"Why did they go away?" Rosenthal probed.

"Because I'm bad. Now I have to get punished," the child explained.

The child felt rejected and guilty, Rosenthal explains, and tried to punish himself just as he believed his parents had.

The idea that a preadolescent could attempt suicide runs counter to the traditional Freudian view which holds that a youngster's superego, or conscience, is not yet developed enough to conceptualize such a self-destructive act. But today says Rosenthal, most psychiatrists look beyond Freudian theory: "taking such factors as family situation and interpersonal relationships into account as well."

Rosenthal emphasizes that "children under the age of seven or eight really don't understand what they're doing. They don't think that death is irreversible." It's crucial, she adds, for those youngsters to receive some sort of therapy. By helping the child achieve self-love and self respect the psychologist or psychiatrist may prevent self-destructive patterns from flaring up later in life.

—Kathrine Jason
SHRINKING TUMORS

A benign tumor on the face and neck isn't really so benign. Left alone, it can crowd delicate anatomical structures causing serious damage. Yet surgery can also be dangerous and disfiguring.

Many such tumors—primarily those known as angiomata—are basically proliferating masses of blood vessels. If the tumor's blood supply can be cut off, the growth will shrink. But when physicians try to starve these blood-hungry tumors by clogging capillaries, the tumor attracts new blood vessels and keeps on growing.

Now the problem has been solved by New York University neuroradiologist Alex Berenstein, who has found a way to form a shield around the entire surface of the tumor. Instead of using gel or clotted blood to clog capillaries leading to the tumor, Berenstein injects the body with microscopic particles of polyvinyl alcohol foam. The particles are so small—250 to 600 microns in diameter—that they pass through the smallest capillaries to literally coat the body of the growth.

"In effect you get to the heart of the matter," says neuroradiologist IrA Braun now using the procedure successfully at Emory University Hospital in Atlanta. The tumor is no longer able to receive blood because the particles are blocking it off completely.

"For some people this is the only hope," and it offers them a complete nonsurgical cure. Braun says he adds that the technique can also be used to shrink operable tumors—including cancerous growths as tumors of the breast, thyroid, and kidney—prior to surgery—David Dreier

"We live in a Newtonian world of Einsteinian physics ruled by Frankensteinian logic." —David Russell

A potato... not what it appears to be. The scientist has built a spy spud whose mission is to warn of rough handling.

POTATO ESPIONAGE

Shuffled through processing equipment, potatoes often develop bruises and rot in storage. To help solve this problem two agricultural engineers created a spy spud.

Designed by Terry Morrow, of Pennsylvania State University, and tested by Neil Halley, of the University of Maine, the spy spud looks like a potato but un its authentic at it has a voice.

Listed from a real potato plant, the silicone-rubber spud contains electronic sensors designed to detect rough handling. When the spy spud is jostled and bumped, it yells, relaying an FM signal. The greater the force of the bump, the higher the frequency of the signal.

Although a prototype has been dismantled for improvements, "Mostly we want greater range," the scientist said. Morrow.

Eventually he said, the device may be adapted to sneak on apples and egg processing as well. Computerized data from the device would allow produce handlers to redesign equipment to avoid rough handling. —Allan Mauer

We must not wait for favors from nature; our task is to wrest them from her.
—Mikhail Lomonosov

The dead live only with the exact intensity and quality imparted to them by the living.
—Joseph Conrad
RUNNING AND ANOREXIA

Compulsive runners and women with anorexia nervosa suffer from different versions of the same destructive psychology according to researchers at the University of Arizona. Both versions of the disorder, they state, should be regarded as pathological.

Psychiatrists Alayne Yates and Kevin Lechey and psychologist Catherine M. McIntire reached this conclusion after finding striking similarities between 60 marathon runners and a group of female anorexics who starved themselves to be thin. Runners so consumed they ran even when sick or hurt, reports Yates, often set irrational goals for themselves. They kept upping the ante, adding more and more miles to get in better and better shape, but no goal was ever good enough for them. In fact, the compulsive runner felt out of shape even when he was overtrained.

Anorexics, by comparison, were compulsively driven to lose more and more weight. Even at dangerously low weights, anorexics continued to see themselves as too fat. Yates notes that both compulsive runners and anorexics tend to be introverted, self-effacing and unable to express anger. They are often high achievers from affluent families. The extreme examples of discipline seen in both groups she adds are actually efforts to forge a more stable identity.

Not all disciplined runners have pathological problems. Yates emphasizes. Moreover, the disorder may be found in a wide range of athletes, including weight lifters, javelin throwers, high jumpers, or anyone else who becomes obsessed with a sport.

—Marc McCutcheon

Unborn tomorrow, and dead yesterday! Why fret about them if today be sweet?

—Omar Khayyam

“History is unpainful, memory does not cloud it. You join the eminent lives of the long dead.”

—Elizabeth Bowen

PRENATAL SMOKING

Although no responsible physician would prescribe cigarette smoking, it may have one curious health benefit. A pregnant smoker apparently doubles her baby’s resistance to a fatal lung disease.

Some infants are born with immature lungs that don’t expand and contract normally—a condition called Respiratory Distress Syndrome (RDS). Among 600 women studied at the University of Wisconsin, nonsmokers proved twice as likely to have RDS-afflicted babies. One in every five “nonsmoking” newborns was stricken, according to researcher Luis B. Curet. But only one in ten of the smokers’ babies was so afflicted. And unsmoke children of mothers who smoked more than a pack a day had even better odds.

Nicotine restricts the blood flow to the uterus, Curet explains, and the long-term stress may actually prompt the unborn’s lungs to mature. Or perhaps the smoking mother’s faster metabolism somehow accounts for her baby’s difference. If researchers could isolate the crucial factor, more than 5,000 RDS deaths could be prevented every year.

But smoke in the womb is still unhealthy. Curet cautions. Smokers often give birth to underweight babies that don’t survive as well as their healthier peers.

—Sy Montgomery

I don’t care anything about reasons, but I know what I like.

—Henry James

Compulsive running may be similar to anorexia nervosa.
CARNIVOROUS BEES

David Roubik recently placed a nest of stingless bees in his yard. They seemed to behave like any of their stingless-bee cousins—until the day after Thanksgiving, when he put out a turkey carcass for his cats. Thousands of bees soon swarmed over the felines, some very stiff competition and convincing zoologist Roubik that he had discovered the only carnivorous bee species in the world.

The vulture bees, part of the species Trigone hypogaea, look like slender black flies and have a preference for soft-skinned lizards and amphibians. But reports Roubik of the Smithsonian Tropical Research Institute in Panama, "they can strip a dead monkey bird, or anteater down to the bare bones in days. A group stands in a circle and tears on the flesh until they've made a little hole; then they go down into the hole and tunnel right through, excavating viscera, internal organs everything."

Like other bees, T hypogaea suck nectar to make the honey that provides them with carbohydrates, but they've lost the leg structure used for carrying pollen, the source of protein for all their cousins. Instead, they suck flesh. Most bees have only two teeth; Roubik adds, but T hypogaea belongs to a small subgroup endowed with 16.

"I've been studying the ecology of the so-called killer bees for seven years," Roubik says. "And now I find a bee that will clean up after the killers. It's a little bizarre but it's a logical progression."

—Leah Wallach

"It's interesting to live when you are angry."
—Yevgeny Yevtushenko

SLOUCH FOR SUCCESS

Are you a failure? Has life dealt you the proverbial kick in the behind? As your old high-school coach might say after a crushing defeat, "Keep your chin up and your shoulders pinned back because things aren't all that bad."

Except Coach has it all wrong, according to a recent series of studies at Texas A&M University. More than 100 volunteers in those studies were given written tests consisting of purposely ambiguous impossible-to-answer problems of analysis. Each volunteer was told he'd failed the test, then psychologist John Riskind instructed half the subjects to sit in a slouched posture and the other half to sit erect.

Finally, he measured their moods through observation and questionnaires. The result: Those who had slumped were less depressed about their failure. Moreover, they were more self-confident and actually tried harder on a test taken shortly afterward.

"On a practical level," says Riskind, "the goal is to expand the domain in which we can control our own mood. Slouching promotes a kind of detachment: so if depression starts to set in, it might not be a bad idea to take on a slumped position and withdraw for a while.

—Eric Mishara

"Get place and wealth, if possible with grace, if not, by any means get wealth and place."

—Alexander Pope
QUEST FOR FLAME

BY KATHLEEN STEIN

There’s not a whole lot written about flames. Although one will find a few mushroom season items and烤串 and the like, the seeker will find almost no usable texts on the nature of fire. Instead, he will find passion and temptation (Flames of Desire, Flaming Hearts, Flames of Utterly, Flames and the Fury, war and combat (Flaming Heath, Flames and the Dagger) and the usual (Flame Sword, Flame of Dawn, Flaming Apocalypse), and any number of couplings suggesting something unusually hot (Flaming Tongue), something bizarre (Flaming Terrapin), or perhaps something redundant (Flame Touches Flame).

But if you’re interested in
Chigier offers us visions of engines that need no cooling devices, and fuels of water and coal.

something about flames as in "Flaming Fuel" or more specifically, Flame Stabilization in Recirculation Zones of Jets with Swirl, or "The Structure of Eddies in Turbulent Flames" or "Dynamics of Droplets in Burning and Isothermal Kerosene Sprays" (recent papers) you have to look up Norman Chigier. Norman Chigier wants to know everything there is to know about flames. And he's got books, papers, and his own journal to as he puts it "propagate my flames." Flames of the mind—from a wavy high-energy fifty-year-old whose professional formality dissolves into boyish glee when he gets hot on the subject. As William J. Brown, Professor of Mechanical Engineering at Carnegie-Mellon University (OMI) in Pittsburgh, he's in charge of a whole new laboratory devoted to flames and combustion. Chigier is a veritable Fellini of flame filmmaking. (See Chigier's photo, above, of a flame jet hitting a hard surface. His photos on the previous pages show a ring of fire and a propane flame.)

Fire is where it's at, declares this number one champion of the Combustion Age. A la Quest for Fire, hominids have been playing with flames for at least a million years. Fire has been at the center of the human sense of mystery and power; it's been the universal principle of explanation for cosmology and philosophy (Heraclean fire) and the nexus of science and industry. And yet as Chigier says, nobody knows much about fire at all. It exists as one of nature's greatest and most enduring paradoxes—chaos in order ignorance in knowledge. "The world was created by an act of combustion in one form or another," Chigier begins. "From the time humans acquired heat for cooking, fire has been the requirement for survival and the threat of destruction. Since the beginning of civilization men have been throwing fireballs at one another. The modern military machine—aircraft, missiles—is entirely dependent on burning fuels. Spaceships. The whole world seems huge quantities of fuel burning in seconds. Yet in a peculiar way," he goes on, "people seem to think all that's needed to be known about flames must be known. In fact, it's just the opposite."

Whether fire can be considered a human trait or a natural force, it has been the foremost medium that humankind has used to shape the environment, says Stephen Pyne in one of the rare books about conflagration, Fire in America. When early peoples grasped fire, they reversed the course of evolution. Fire is power; fire is the great transformer and its work is irrevocable. Bright-faced fire is the mediator between the raw and the cooked, between nature and culture. Fire may be one of the oldest words in any language. Studies of flame have been eclipsed, however, by sophisticated work in molecular chemistry and the physics of quantum mechanics.

We will not believe, discover anything about fire as dramatic as a black hole. Chigier says, but the uncovering of what is inside a candle flame inside a combustion engine—the complexity of the interaction of chemicals, fluid dynamics, the mathematical concepts—requires ingenuity and creativity the basic elements of scientific discovery.

Why is this so important? The volatile engineer offers us visions of engines that need no cooling devices, fuels made of water and coal, sprays of fuel so well controlled they burst into clouds of fire, each droplet a tiny explosion of energy. He promises us a laboratory where high-energy pulsed-continuous-wave lasers will be used to measure with impressive accuracy the velocity, temperature, particle size and concentration within the flame. He fixes off his view of the flame Zeitgeist like the staccato of machine-gun rounds. The burning of fossil fuels is the main source of energy now—95 percent of our energy to be exact. "And in my opinion it might have the same proportion well into the next century. This statement is extraordinary and against many scenarios prepared by energy and political departments, by economists who twenty years ago predicted that by now we would barely be burning fossil fuels at all."

There's been a great deal of talk about alternative energy systems. He warns to the subject: "A lot of money has been spent on them. Nuclear power has been waylaid by grass roots politics. Hydroelectric has already reached its potential. Solar is most suitable for heating the home and the swimming pool."

The main problem for combustion science, Mr. Flames insists, is how to get the maximum conservation of fuel with the minimum pollution. And to avoid the fire next time. "Future wars will be fought on the basis of energy resources," he warns, "The political factors are already enormous."

To achieve maximum conservation of energy with minimum pollution, Chigier calls for a radical reexamination of the combustion engine and its design. Although there are many varieties of engines that work, the combustion mechanisms are not fully understood. In the early years of the auto industry, for example, Detroit paid little attention to the physics of combustion. They put fuel in an engine and it turned over and the car rolled down the road. They had a problem with knock, they put lead in the gas and the knock stopped. They didn't know why. Ultimately it was the air-pollution crisis of the Seventies that aroused Detroit from its stupor. Chigier says, to achieve the contradictory goals...
of pollution reduction and fuel economy, the automotive engineer reluctantly began peering into the engine again. That was a red-letter day for scientists pursuing knowledge of the flame.

Most engines today are quite efficient from a combustion point of view. That is, the fuel put into them burns up. But in terms of thermodynamic efficiency, he continues, "that's another matter. Thermodynamic efficiency is the ratio of the heat gained by the system to the heat supplied by the fuel. A well-insulated boiler could achieve combustion efficiency close to one hundred percent and an ideal thermal efficiency of ninety percent. But heat loss by blue gases reduces thermal efficiency. The auto is only ten to fifteen percent efficient thermally. For boilers used in electricity generation today's heat exchangers transfer only forty to fifty percent of the available amount of heat.

"We know there's enormous scope for increasing total energy supply not only in the combustion process itself but in determining how the properties of the flame influence heat transfer and heat loss. The focus has turned from the single consideration of combustion efficiency to the recognition of the role flame structure can have on thermal and total energy efficiencies. In flames there's enough research to occupy me for the rest of my life and the lives of my children!"

Is there a physics of fire we wonder different from all the other physics? "Let us distinguish between the words combustion and fire," he says, "I am involved mainly with combustion, essentially a controlled reaction. The word fire is usually used for uncontrolled combustion. The two are obviously related, but much less is known about fire. There are many kinds of fires—forest fires, tunnel fires—and they are much more difficult to study.

"Most people get out of the way when there's a fire. There are scientists who study fires and probe and try to take measurements. But the study of fire is in a much more primitive state of development.

And what is a flame? 'It's a rapid gas-phase exothermic [heat-producing] combustion process characterized by self-propagation. Flame's definition is proving to be as elusive as the thing itself. So what is a combustion? An exothermic chemical reaction with the characteristic ability to propagate through a combustible medium usually a fuel and an oxidizer.' Both flames and combustion in general involve rapid oxidation (sometimes called burning) easily recognized by chemiluminescence and chemiluminescence.

Is a flame a fluid? Yes! It is not a solid or a liquid. A flame is essentially composed of gases. The luminous flame of a candle, the yellow section, has the presence of small carbon particles. The smoke is solid carbon particles.

"But the largest part of the flame is composed of hot gases. And there are a variety of them, they emit light at different wave-lengths. The colors represent different compositions and temperatures."

The hottest flame Chigier announces is about 3000° Kelvin (about 2700° Celsius), and at that point it is a question of definition whether to call it a flame or a plasma. Plasmas go up to 10000°K. A typical flame is around 1500° to 1800°K. The maximum temperature in a flame is achieved only in certain locations. Although the basic laws of thermodynamics apply to combustion, there are many aspects of thermodynamics that do not deal with the complexity of high temperature and the simultaneity of chemical reactions.

We want to enter the flame itself. Chigier plays Virgil, guiding us through the mini-inferno of a small flame jet's conflagration. He has made a movie of flames and he is justifiably proud of it, having filmed it with a photographic system he adapted. Flames are last incessantly moving. His camera can film up to 10 000 frames per second to show the structures of eddies and flow patterns to analyze the high-frequency changes and to catch the flame in the act.

Or the way to pick up the film: the internal-combustion engine we're driving misbehaves. So we get out and walk up the steep hills of Schenley Park. At the crest Chigier looks back over the three rivers of Pittsburgh at the cold lifeless steel mills that line the banks like burned-out ovens.

Later the flame flickers on the screen: a seething pulsating abstract zone of force. What is going on? Filmed at 3 000 frames per second and projected in slow motion, the gas pours from its nozzle in a smooth and continuous, or laminar flow. But as it reacts with the surrounding air, it begins to become unstable. Turbulent pulses of flame surge out like a breathing, unpredictable living thing. The pulses are the vortices Chigier knows them so well he has written about them at length in his book Energy, Combustion and Environment. He reports, "Neighboring pairs of vortices rotate around each other and amalgamate into a larger one in flows with large density differences. Individual vortices can be followed for their lifetimes."

The jet vortices wrap around the air taking it into the flame's core. This is entrainment, and combustion depends on the roll-up process in which air and fuel are surrounded by the flame's eddies and drawn inward. Chigier says that before his examination of eddies, vortices and turbulence through photography and lasers, the flame experts thought entrainment was a 'nibbling process. But Chigier has shown that it is a much more dramatic engulfing or gulping.

My work concentrates on fluid dynamics within the flame. He moves gracefully flame-like in front of the screen. I have seen the flame initially laminar, become unstable transformed into a ring vortex, a toroidal ring vortex! On the planet Jupiter there are concentric ring vortices. You can see them from the Voyager pictures. Those eddies, they are the same kind of rings..."
Similar fluid dynamic processes occur in the jet flame, a flow such as the Sacramento River and the bathtub vortex when you pull the plug. They are everywhere.

In another part of the story, a probe of gas emerges from a nozzle hits a steel plate—it could be a cooking pot's bottom—and spreads out like instant concentric tidal waves. Impinging on that's called. These particular rings of fire move outward and break up into eddies. The air is trapped between the rings, and the only area where the mixture can become flammable is on the ring surface.

Within the flame room, Chigier lectures in time with the oscillating colors behind him. Particles being formed, destroyed, regenerated. The flame begins with solid wax becomes fluid. Molecules are blown into atomic fragments having electrical properties. That's your run-of-the-mill candle flame. Even the combination of simple methane CH₄, with oxygen involves 100 intermediate chemical reactions. Chemical kinetics chemists deal with the rates at which things change are discovering still more chemical reactions.

In the combustion of more complex hydrocarbons there are hundreds of chemical reactions taking place within fractions of a second. Milton's whirlwinds of tempestuous fire at an atomic level.

Millennia ago humans knew that flames were complex and powerful. In Greek myth Zeus, the king of the gods, had fire from mankind. But Prometheus stole it from heaven and brought it back to earth. The punishment for this crime was severe. In one version of the story, Prometheus was chained to a rock where an eagle feasted on his liver. In another variation, Zeus sent Pandora and her jar of evils as retribution. But in Greek poetry, Prometheus—whose quest for flames brought disaster upon himself—is revered as the father of the arts and sciences. The Titan whose name means "forethinker".

A paradox. This creator of chaos, this consumer and swift destroyer of order. Life has been involved in virtually every scientific revolution. Since before the Greeks people have known about things and measuring what was. The proper explanation of combustion, perhaps the oldest chemical reaction, is usually said have been the first great step in the development of modern science. And when we will, double burn our way into the future.

That first hint of the true nature of combustion was set forth in 1774 by Antoine Laurent Lavoisier when he concluded that the fixed air that had combined with sulfur in burning was identical to a gas obtained by Joseph Priestley, the English chemist, when he heated the metallic ash of mercury. Lavoisier decided to call the gas oxygen. More studies of gases were made with fire and soon the first table of atomic weights was compiled. Generating a whole new system of chemistry based on reliable measurement.

In 1798 Sir Benjamin Thompson's experiments with burning revealed evidence of the theory of heat as a movement of particles. Energy. This heralded the kinetic theory of gases, the motion of atoms, and the laws of thermodynamics themselves. The theoretical underpinnings of the Industrial Revolution and its machines.

If the flame has brought order to the human condition, the flame itself is still considered a force of chaos. Uncharted, immeasurable. Chigier has done much to find the order within the flame. I was among the first fluid dynamicists to examine the close interactions between a flame's turbulence and its chemistry as claims of his years of research at Sheffield, England, with its renowned steel mills and long history of combustion research. But it was at NASA's Ames Research Center in Mountain View, California, in 1970 that Chigier encountered the laser. And in his one of those scientific epiphanies, he realized the capability of lasers for penetrating the flame to see and chart the patterns in the flow field. Turbulence. He imported the technology. Marco Polo-like back to Sheffield and began to find the symmetries within the flame front. "Now we can penetrate into the very high temperature regions to measure the flame's velocities and gaseous concentrations," he says. "We have seen the enormous changes that occur when air and fuel enter a combustion chamber—"from around three hundred degrees Kelvin about room temperature—to burn to two thousand degrees Kelvin in this case these are enormous changes in turbulence."

Turbulence is fire's personality. As it is the essence of weather and even perhaps of the cardiovascular system of the body. "There has been a change of attitude toward turbulence," Chigier announces. Conceptually, turbulence was always associated with chaos. But chaos may be an illusion. As the study of the subject matures, one sees the flow becoming less random. What we're finding in our measurements will serve as a basis for a new theory. Today, in one section of the turbulence community, there is a school of thought believing that there is order in turbulence and flames."

With lasers and high-speed photography Chigier documented the turbulence's orderly progression as the eddies danced their way through the flame's body. To a certain extent these eddy structures can be modeled mathematically, using complex calculations and supercomputers. Chigier shows us a computer-generated flame created in a government research lab from a mathematical model. Even though it is the product of an immensely sophisticated program executed on the fastest computers around it still looks like a high-quality cartoon after the fire dragon drama of the real thing. Flame has not been captured yet.

On another part of the flame frontier, Chigier is exploring the combustion of va
porated fuels. All fuels in diesel engines form droplets gas turbines and rockets are forced through nozzles that break up the bulk into smaller particles with more surface area in order to burn faster. Cigler has developed a 'hydrodynamic instability' that forms a ragged wave that is torn by shear and dragged into ligaments that are further torn into large drops and then into smaller droplets. Cigler can determine the size of these droplets and to a certain extent he can predict their ballistics and trajectories as they interact with the hot air and vaporize. He can penetrate the cloud combustion noninvasively without disturbing its life style, using dual-beam laser anemometers. And there he can measure particle size. Based on this research he discovered a weakness in previous explanations of the way clouds burn. When there are too many droplets in the cloud, there is oxygen starvation and the flame is forced toward the cloud's periphery. This is very inefficient. I came to this finding much to the consternation of the combustion establishment, he recalls. It has radically changed the concept, attitude and approach to spray combustion.

'it is a concept for which I had to fight bitterly. When I presented our first results at international conferences, there was great reluctance to accept our findings, particularly by people who have a vested interest in the status quo. All that has radically changed. But in a way I enjoyed it, the controversy was stimulating. The one episode that says more about Norman Cigler than many macho fire stories has nothing to do with the flame. He has climbed bodily into a fire yet, but he has physically entered into the vortex of a fluid. In 1977 Cigler was conducting research at NASA Ames on aerodynamic properties of turbulence in aircraft wakes. Aboard a Learjet he flew into the raging centers of two trailing vortices. These crystalized-water contrails persist as far as 20 miles behind jet engines. If you are in a small, light aircraft, he explains, trying to gain altitude and you run into one of these invisible vortices, the plane can be shoved down violently toward the ground. In the tests Cigler devised, he and a crack pilot flew in a Learjet following a Boeing 707. At 20 miles behind, they positioned themselves to move straight down into the vortex. When we entered it we were twisted about forty-five degrees. I thought the wings would rip off. At 10,000 feet they were ejected from one vortex and hurled into the other, which was streaming off to the other wing. It was terrible when we hit it, he shudders. They reentered the vortices at ten miles, then five miles and finally one mile behind. Cigler admits that he was sick. The pilot turned to me, he remembers, and laughed, 'Ya! Like vortices. Nom?'

And at that point he flew under the belly of the jet and came up in front of it and executed a complete roll. If fire put order into the human condition, it also gave structure to the life and times of Norman Cigler. He claims he was thrown into combustion at the deep end, but he was not a childhood pyromaniac. It did not chase fire engines to the blaze. Born in Frankfurt, South Africa, the son of a Zionist rabbi, he intended to spend his adult life on a kibbutz. He entered the university at fifteen and as a compromise to his parents took a practical degree in mechanical engineering. But I was more interested in enjoying myself. He was also involved in drama, music and as much antiauthoritarian politics as an exceptionally young, bright Jewish college boy dared to be involved in. He graduated at nineteen and went off on a quest to seek adventure in Europe. His twenties were rough-and-tumble, sweating and gripping giant construction sites with ex-jailbirds and dockworkers. His desire was to become a construction site barefoot man and then a writer. It was by chance that he ended up at Cambridge instead, teaching a Ph.D. in fluid dynamics under Sir William Hawthorne. Hawthorne fired his imagination for the most difficult branch of physical engineering and without telling him nominated Cigler as a representative to the International Flame Research Laboratory in Holland. The Flame Lab was located in the giant steel works of the Netherlands and there Cigler conducted experiments in hellishly hot furnaces. Teams of scientists from many countries opened up the furnace doors and thrust probes into the roaring infernos. Cigler spent three years in that vulcan's pit. 'It was the rough end of combustion.' And he was tempered to a fine edge.

I bring combustion with me,' he says today as he guides us through the embryonic combustion lab at CMU. The students are building a glass chamber in which to observe the flame. To measure its temperature they will use microthermocouples made of platinum/rhodium alloys—thin wires strung across the jet with diameters of .001 inch or less. The slender sensors will be hooked to microprocessors to feed information about temperature flux and variation of the flame front.

In the engine room are two formerly abandoned internal-combustion machines now outfitted for experimentation. There is a diesel and a spark-ignition engine which, Cigler says, 'they found in a box. It was like discovering Pompeii. In the past two decades teaching and research in internal combustion engines were abandoned in many leading universities.' he adds. 'They thought the engines were not elite enough.' And they continued the trend to graduate engineers who had no contact with engines. We're reversing that trend. We face sophisticated problems. We use exhaust analyzers and computers. We will be able to conduct tests.'
after the beginning of the present century, it was realized that some of the wrestlers were throwing their opponents from the ring without touching them.


It was the fourteenth day of the January Tokyo tournament. Seated with the other wrestlers, Man-Mountain Gentian watched as the next match began:

Ground Sloth Ikemoto was taking on Killer Kurzu. They entered the tamped-earth ring and began their shikiris. Ground Sloth, a sumotori of the old school, had changed over from traditional to Zen-sumo four years before. He weighed one hundred eighty kilograms in his mawashi. He entered at the white-tassie salt corner. He clapped his huge hands, raised his mouth, threw salt, rubbed his body with tissue paper, then began his high leg lifts. Clamping his feet, his hands gripping far down his calves, the ring shook with each stamp. All the muscles rippled on his big frame. His face was a flesh-colored boulder, smooth and vibrated.

DRAWING BY TAKAHIKO
Killer Kudzu was small and thin, weighing barely over ninety kilos. On his fore head was the tattoo of his homeland, the People's Republic of China, one large star and four smaller stars blazing in a constellation. He also went into his ritual shikiri but as he clapped he held in one hand a small box, ten centimeters on a side, showing his intention to bring it into the match. Sometimes these were objects for meditation, sometimes favors from male or female lovers, sometimes no one knew what. The only rule was that they could not be used as weapons.

The wrestlers were separated from the onlookers by four clear walls and a roof of plastic. Over this hung the traditional canopy and tassels symbolizing heaven and the four winds.

Through the plastic walls ran a mesh of fine wiring connected to a six-volt battery next to the north-side judge. This small charge was used to contain the pushers of the wrestlers and to frustrate help from outside.

A large number of 600 X slow-motion video cameras were strategically placed around the auditorium to be used by the judges to replay the action if necessary.

Killer Kudzu had placed the box on his side of the line. He returned to his corner and threw more salt onto the ground part of the ritual purification ceremony.

Ground Sloth Ikimoto stamped once more twice went to his line, and settled into position like a football lineman. Legs apart, knuckles to the ground, his nearly bare buttocks looked like giant rocks. Killer Kudzu finished his shiki and squatted at his line where he settled his hand near his votive box and glared at his opponent.

The referee in his ceremonial robe had been standing to one side during the preliminaries. Now he came to a position halfway between the wrestlers his war fan down. He leaned away from the two men left leg back to one side as if ready to run. He stared at the midpoint between the two and flipped his fan downward.

Instantly sweat sprang to their foreheads and shoulders their bodies rippled as it pushing against great unmoving weights their legs curled into the clay of the ring. The two of them stayed tensely immobile on their respective marks.

Killer Kudzu's neck muscles strained with his left hand he reached and quickly opened the votive box.

Man-Mountain Gento and the other wrestlers on the east side of the arena drew in their breath.

Ground Sloth Ikimoto was a vegetarian and always had been. In training for traditional sumo he had shunned the chunko-nabe, the communal stew of fish, chicken, meat, eggs, onions, cabbage, carrots, turnips, sugar, and soy sauce.

Traditional sumo rates as much as they could hold twice a day and their weight gain was tremendous.

Ikimoto had instead trained twice a day by eating only vegetables, starches and sugars. Meat and eggs had never once touched his lips.

What Killer Kudzu brought out of the box was a cheeseburger. With one swift movement he bit into it only half a meter from Ground Sloth's face.

Ikimoto blanched and started to scream. As he did, he lifted into the air as it chopped in the chest with an ax. Arms and legs flailing a wall of revolution coming from his emptied lungs.

He passed the bales marking the edge of the ring— one foot dragging the ground—upending a boundary bale— and smashed to the ground between the ring and the bales at the plastic walls.

The referee signaled Killer Kudzu the winner. As he squatted the gyori offered him a small envelope signifying a cash prize from his sponsors. Kudzu left hand on his knee, with his right hand made three chopping gestures from the left right and above— thanking man earth and heaven. Kudzu took the envelope then stepped through the doorway of the plastic enclosure and left the arena to rejoin the other west-side wrestlers.

The audience of eleven thousand was on its feet as one cheering Across Japan and around the world two hundred million viewers watched television.

Ground Sloth Ikimoto ran to his tobox bowed and left by the other door. Attendants rushed in to repair the damaged ring. Man-Mountain Gento looked up at the scoring clock. The entire match had taken a mere 4,1324 seconds.

It was three twenty in the afternoon on the fourteenth day of the Tokyo invitational tournament.

The next match would pit East Iron Polakowski of Poland against the heavily favored Hokkaidan Typhoon Takanaka.

After that would be Gento's bout with the South African Knockdown Kruger and Man-Mountain Gento stood at 13-0 in the tournament, having defeated an opponent each day so far. He wanted to retire as the first Grand Champion to win six tournaments in a row undefeated. He was not very worried about his contest with Knockdown Krugger and slated for later this afternoon.

Tomorrow though the last day of the January tournament his opponent would be Killer Kudzu who after this match also stood undefeated at 14-0.

Man-Mountain Gento was 1.976 meters tall and weighed exactly two hundred kilos. He had been a sumotori for six years and had been yokozuna for the last two of those. He was twice holder of the Emperor's Cup. He was the highest paid, most famous Zensu matori in the world.

He was twenty-three years old. He and Knockdown Krugger finished their shikiri. They got on their marks. The gyori flipped his fan.

The match was over in 3 1916 seconds.
He helped Krueger and to his feet accepted the envelope and the thunderous applause of the crowd and left the reverberating plastic enclosure.

"You are the wife of Man Mountain Gentian?" asked a voice next to her.

Melissa put on her public smile and turned to the voice. Her nephew, on the other side leaned around to look.

The man talking to her had five star tattoos to his forehead She knew he was a famous sumotori though he was very slim and his chonmage had been combed out and washed, and his hair was now a fluffy explosion above his head.

"I am Killer Kudzu," he said. "I am surprised you weren't at the tournament."

I am here with my nephew. Han. This is Mr. Killer Kudzu. The nephew dressed in his winter Little League outfit shook hands firmly."His team, the Mitsubishi Zeros, will play the Kawasaki Claudes next game."

They paused while a foul ball caused great excitement a few rows down the bleachers. Hari made a stab for it but some construction foreman of a father came up grinning triumphantly with the ball.

"And what position do you play?" asked Killer Kudzu.

"Utility outfield. When I get to play," said Hari sheepishly averting his eyes and sitting back down."

"Oh. How's your batting average?"

"Pretty bad. One twenty-three for the year," said Han.

"Well, maybe this will be the night you shine," Killer Kudzu said with a smile.

"I hope so," said Han. "Half our team has the American flu."

"Just the reason I'm here," said Kudzu. "I was to meet a businessman whose son was to play this game. I find him not to be here, as his son has the influenza also."

It was hot in the domed stadium and Kudzu insisted they buy them some Kones. Just as the vendor got to them, Han's coach signaled, and the nephew ran down the bleachers and followed the rest of his teammates into the warm-up area under the stadium.

Soon the other lackluster game was over and Han's team took the field.

The first better for the Kawasaki Claudes, a twelve-year-old bull like an orangutan got up and smashed a line drive off the Mitsubishi Zeros' third baseman's chest. The third baseman had been waving to his mother. They carried him into the dugout. Melissa soon saw him up yelling again.

So it went through three innings. The Claudes had the Zeros down by three runs 6-3.

In the fourth inning, Han took right field, injuries having whittled the flu ridden team down to the third stringers.

One of the Kawasaki Claudes hit a high looping fly straight to right field. Han started in after it, but something happened with his feet, he fell, and the ball dropped a meter from his outstretched glove. The explosion and tooed his nephew, construction foreman of a father came up grinning triumphantly with the ball.

"His Little Man phantastically avind the man a bat. "It's a miracle, Melissa."

"Oh. Yes," said Melissa. "But few more."

"I'm sure." said Kudzu.

Of course. The pitcher averting his eyes and sitting back down."

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At home plate, Han's teammates congratulated him, slapping him on the back. The game was over, the scoreboard said 7-6, and the technicians were already climbing over the inning indicator.

Melissa rose. I have to go pick up Han; I suppose I will see you at the tournament tomorrow.

"How are you getting home?" asked Killer Kudzu.

"We walk. Han lives near.

"It's snowing.

"Oh.

"Let me give you a ride. My electric vehicle is outside.

That would be nice. I live several kilometers away from—

"I know where you live, of course.

Fine then.

Han ran up. "Aunt Melissa! Did you see? I don't know what happened. I just felt I don't know. I just hit it!"

"That was wonderful!" She smiled at him.

Killer Kudzu was looking up very interested in the stadium support structure.

The stable in which Man-Mountain Gentian trained was being entertained that night. That meant that the wrestlers would have to do all the entertaining.

Even at the top of his sport, Man-Mountain had never gotten used to the fans. Their king prizes, their raucous behavior at matches, their donations of gifts, clothing, vehicles, and in some cases, houses and land to their favorite wrestlers. It was all appalling to him.

It was a carry over from traditional sumo: he knew But Zen-sumo had become a worldwide not just a national sport. Many saved for years to come to Japan to watch the January or May tournaments. People here in Japan sometimes sacrificed at home to be able to contribute toward new kesho-mawashi, elaborate heavy brocade and silk aprons used in the wrestlers' ring-entering ceremonies.

Money in the business flowed like water appearing in small envelopes in the mail, in the locker room, after feasts such as the one tonight.

Once a month Man-Mountain Gentian gathered them all up and took them to his accountant, who had instructions to give it all above a certain princely level away to charity. Other wrestlers had more, or less, or none of the same arrangements. The tax men never seemed surprised by whatever amount wrestlers reported.

He entered the club. Things were already rocking. One of the hostesses took his shoes and coat. She had to put the overcoat over her shoulders to carry it into the cloakroom.

The party was a haze of blue smoke, dishes, bottles, businessmen wrestlers and funny paper hats. Waitresses came in and out with more food. Three musicians played unheard on a raised dais at one side of the room.

Someone was telling a snappy story. The room exploded with laughter.

"Ah!" said someone. "Yokozuna Gentian has arrived.

Man-Mountain bowed deeply. They made two or three places for him at the low table. He saw that several of the host party were Americans. Probably one or more were from the CIA.

They and the Russians were still trying to perfect Zen-sumo as an assassination weapon. They offered active and retired sumotori large amounts of money in an effort to get them to develop their powers in some nominally destructive form. So far, no one he knew of had. There were rumors about the Brazilians now.

He could see it now a future with premiers, millionaires, presidents, and paranoids in all walks of life wearing wire mesh clothing and checking their Eveready batteries before going out each morning.

He had been approached twice by each side. He was sometimes followed. They all were. People in governments simply did not understand.

He began to talk. While he talked, with Cast Iron Pekowski Pekowski now 12-2 for the tournament, had graciously lost his match with Typhoon Takanaka. (There was an old saying in a tournament, no one who

"I'll have my coffee black, like the sombre state of the world's economy. Eggs scrambled, like our dismembered social values. Toast dry, like the arid wastelands of compassion and common sense. Bacon crisp, like..."
Until his death, Ban-the-Bombers and the whole gloom-and-doom set had felt

*THE WRATH OF KAHN*

BY JAMES RESTON, JR.

March 3, 2036. I turned seventy years old," wrote one student at South Mountain High School in Phoenix. "Only a year before, on the same day, I retired from the Supreme Court. I had two reasons for retiring. I wanted to avoid the senility that all eight of my colleagues had fallen into, and I thought it was about time to settle down and have a family."

The passage from a creative-writing exercise reflected the ambivalence of South Mountain students' attitudes toward their future. A survey at the school—with its equal blend of Chico, black, and white students—revealed the same mix of hopefulness and apprehension: in general, the Arizona teens were relatively sanguine about their prospects for professional and personal happiness. But they were bleak about the future of society and the world. They imagined themselves doctors and scientists and pilots and Supreme Court justices—a society of collapsed cities populated by the survivors of World War III."

It was just the kind of thinking that bothered the late Herman Kahn. From his headquarters at the Hudson Institute, in Croton-on-Hudson, New York, Kahn kept watch like a fretful weatherman on clouds of pessimism across the country. He plotted ways to replace doubt with hope, fear with optimism. Best known for work on national-security issues, the Hudson Institute has for 20 years developed the art of projecting scenarios for the future on such problems as how nuclear war might evolve. Kahn himself had wrestled with nuclear nightmares in his books *On Thermonuclear War* (1960) and *Thinking About the Unthinkable* (1962).

Now, Kahn and his colleagues had drawn up an entire campaign, a storehouse of scenarios to attack negative thinking in America's youth. To press the attack, Kahn himself...
decided to go to South Mountain High.

It was to be one of his last forays on behalf of optimism. Kahn died of a heart attack in July at the age of sixty-one. In some ways his trip to Arizona was a model of his lifelong quest against doom-thinking—against what he called "the whole cliche at the moment."

Watching him in action on the Arizona circuit, I found traces of the wit that won him many friends and the dogmatism that infuriated his many detractors.

On November 19, 1982, a class of gifted eleventh-graders at the school prepared themselves for the big day. The Hudson Institute had previously sent printed materials to establish a beachhead for hopefulness. The words identified Kahn as "the famous futurologist and expert in future studies". The Hudson texts, titled Visions of the Future, omitted the label often attached to Kahn after he published his prediction of a forthcoming economic surge—the Prophet of Boom.

But when Kahn arrived, flanked by TV minicams to catch students' reactions, his deportment suggested a man not so much of the future as of the past. Martin Van Buren perhaps or Edwin Stanton. Others might see in him the look of an Amish elder—round face, receding hairline, thick bottle-bottom glasses, crescent beard, and a body whose bulk is generally estimated at 350 to 400 pounds. On that day at South Mountain High, this awesome frame was clothed in a blue pastel suit which clashed somewhat with the greenish tint of his beard. The beard color had been imparted by the chemicals in his motel Jacuzzi.

For three hours Kahn discussed his message was personal and engaging. Their generation was the product of a 20-year malaise in America, he proclaimed. He had all kinds of curves and charts in his office; they showed how the United States had gone to hell in the early Sixties, how productivity dropped, how youthful suicides were up, how drug use and crime rates were up. Every aspect of American life began to decline several years before the students were born, and while he avoided saying so the categorical nature of this pronouncement logically included the civil-rights movement, the Green Revolution, and the women's liberation movement. There was reason for hope he promised. Revitalization was coming and great exciting opportunities awaited them. For one thing, they were the post-baby-boom generation, and there were fewer of them than in the immediately preceding generation. That makes you more valuable," he said. Despite temporary annoyances like the recession (which Kahn considered therapeutic), world history was riding on a surging Gulf Stream of progress called the Great Transition and they were on the crest of a high-tech wave.

"Two hundred years ago, mankind was everywhere few everywhere poor everywhere powerless before the forces of nature," he announced.

"One hundred years from now," he went on, "mankind will be everywhere numerous everywhere rich, everywhere largely in control of the forces of nature."

They were therefore living through the most exciting period of world history and they should reject the gloomy predictions of the doomsayers. The country was not running out of resources. Nor was the world breeding too rapidly or falling short of food. Nor were the rich countries getting richer while the poor countries got poorer, nor were businesses sacrificing safety for profit. In short, they should not overconcern themselves with any of these fashionable preoccupations for the mind of man and his technology were managing quite well, and history was being swept along on the warm current of advancement.

Kahn's visit to this working-class area of South Phoenix was considered a great success both by Kahn's staff, which visualized his Visions of the Future program in every high school in America someday, and by the staff of South Mountain High School. A ten-minute segment of the videotape was prepared for use in a national promotional campaign for the Visions program. The Institute hoped the tape would show that the program was not just for the homogeneous high-tech upper class but for other audiences as well.

So it happened that South Mountain High School became the pilot program in Herman Kahn's three-week course in optimism. In the spring of 1983, more than 2,000 Phoenix high schools took the class. This fall, four more cities will begin and within five years the hope is that it will be offered in every high school in America.

In 1974, while the country prepared to celebrate the Bicentennial, Kahn decided that it was a good time not only to look back 200 years but to look forward 200 years. Apart from Vietnam and Watergate there were long lines at gasoline stations. And an international organization of distinguished scientists, educators, economists, and politicians—called the Club of Rome—sounded the shrill, worldwide alarm. Looking at the world's economy as a single system of interdependent parts, the Club of Rome announced that unless growth patterns were changed and controlled, the world economy would collapse in 75 years. In this view, the world was hurtling along from one crisis to the next with no master plan for development. Wealthy nations were using up irreplaceable resources at a preposterous rate. Poor nations were getting poorer. The Club of Rome called for recognition of the world community as a fragile lattice and for a system of cooperative management that would transcend national boundaries.

The romantic concept of spaceship Earth was born. But to some, Earth was not so much a spaceship as a lifeboat, rich nations not only rocked the boat with their sheer economic bulk but also gobbled up
On March 3 the news of scandal in the Environmental Protection Agency (EPA) dominated the front pages of the Arizona Republican. If one had passed Kahn's visions of the future course, there was too much of the result of the EPA scandal. They were the result of bad luck and bad management, only a travesty to the upholds of the Great Transition. Of course, as Kahn himself would later concede, a nuclear war could also result from bad luck and bad management.

McClintock high serves it well-to-do district in Tampa. We many students at the children of professors at nearby Arizona State University (ASU) the state's urban campus serving 40,000 students. Kahn was the Barry Goldwater Professor of American Institutions at ASU. At the high school, McClintock had been a crazy boar to the Arizona original where family dates back to the desert frontier of the 1870s. 40 years before statehood, and whose sleepy min’s eyes andnip with his students made me think that I was in the presence of a true teacher. For ten years a businessman man before he became a teacher. Reid had taught at McClintock for 15 years. His 487 best oddities discovery makes him popular and a good catch for the Hudson Institute as someone to test their materials.

His classroom was decked out with the accouterments of future study perhaps largely for my benefit since everyone seemed primed for this vast from Omnipropelled against the blackboard were the books. Mathias on population, Paul Ehrlich’s The Population Bomb, Alvin Toffler’s Future Shock. Hal Lindsey’s The Late Great Planet Earth, and a book called Nuclear War: What’s it All For? which Reid confessed he had chosen solely for its catchy title. There were copies of Omnip and the Chronicles of St. Cuthbert and Simplicius of a somewhat prophetic description in Doomsday 21st Century. An immense chart displaying scenes from Kahn’s Great Transition spanned the room. The pictures ranged from sketches of primitive labor and dwellings from the Princial Age in the 1800s to illustrations of people happily engaged in science, technology and medicine during the twenty-first century when man will be “everywhere numerous, everywhere rich, everywhere in control of the forces of nature.”

Individualists that he is, Reid had taken the Hudson Institute materials and tailored them to his own methods, often with an amused merriment. (In a document of his own he cast appraisals on the whole process of future prediction by stating that only 4 predictions out of 364 were justified.) The djungle had been cast between 1976 and 1978. But he accepted the basic premise of the Visions program to his students an attitude of hopefulness about the future was a worthy service. The world had a future that young people could help to shape, if only their perceptions were positive enough. But it remained unclear whether this was a case in social studies citizenship or religion (both rather than fact examined of the concern), or simply in Republican politics.

I would attend two of Reid’s classes that morning. The first comprised graduates of the three weeks Vision course and Reid confirmed that their attitudes toward their world had dramatically shifted to the optimistic side. How did he know? Before and after the three weeks worked, the students had been tested. Nine propositions were put to them and they were asked their reaction on a five-point scale between ‘strongly agree’ and ‘strongly disagree’. The propositions included:

- Landings growth is the best way to improve the world’s future.
- People like me can help solve the world’s problems.
- Almost everyone in the world will double his purchasing power in 50 years.
- I believe there will be environmental catastrophes in the future.
- Lest the course appear to have no academic cut the students were also tested on their comprehension of Kahn’s concept. In the text as in the Visions meta nials the theory of the Great Transition had become the fact of the Great Transition. Past and future came together like dance
partners. There were the Middle Ages, the Preindustrial Age, the Industrial Age, the Superindustrial Age, and the Postindustrial Age of Plenty.

True or false? In the period of the Great Transition we will have global cooperation among nations instead of competing national interests.

True or false? In the future the gap between the rich and the poor will decrease and wealth will be distributed more equally.

Thus, to pass the Visions of the Future course your attitude should shift from pessimistic to optimistic and you should understand how the Great Transition will work.

All desired results are achieved, you are certified a "realist" and you possess a "skill" of how to think about the future.

The managers of the Visions program were quite pleased with the results in Ken Reid's class of teen agers. Their attitudes had changed measurably. They were less scared of the future and more convinced that poor people would double their income and the world would be healthier and richer in 50 years.

But students are rough critics and their test scores notwithstanding, Reid's first-period students did not seem to undergo much of a life change.

The materials were lousy," one student said. "They were poorly put together and written for first-graders.

"It did give me a terminology," another student said, "but it did not tell me how these changes are going to affect me.

"His program said I shouldn't be a pessimist, but I wasn't to begin with," said a third member of Reid's class.

Between periods Reid and I talked in the teachers' lounge. He too had observed with some wryness the cut of personality that Kahn enjoyed in Phoenix.

"Everyone is at his back and calls when he comes out. It is as if people say, 'The prophet is here. Let us go listen to him.' Sure he's bright and has good things to say but then there are a lot of people like that. It's more than admiration—and I'm not sure where it comes from.

Nevertheless Reid acknowledged that the Visions program has had an impact on him personally and professionally. For example, in the past he had briddled at having to teach conflicting theories. Some texts told students that the world was in danger of a new Ice Age. Others presented simultaneously that the polar ice cap was about to melt as a result of the greenhouse effect. In times past he had projected some frightening doomsday notions onto his students.

A standard exercise for him was to drop a hypothetical nuclear bomb on Phoenix and calculate the concentric circles of devastation outward. He no longer performs the frightening demonstration.

"Generally the students concluded that it would be better not to survive the bomb than to think teaching the consequences of nuclear war is counterproductive right now," Reid said. "It swamps all else and it's emotionally charged. I just don't think I ought to be teaching that.

Neither did the creators of the Visions of the Future program. Despite Kahn's reputation for facing the facts about thermo-nuclear war, the program's most glaring omission is its failure to deal with the international arms race and the possibility of a major conflagration. But the omission was deliberate even though Kahn insisted that it would be rectified later.

"We don't have the case in the nuclear area that we have in other areas," he said. "I can't say [the talk of a holocaust] is nonsense. None of the experts think there's a very high probability of war as most armists think. On the other hand, you shouldn't worry about it. I can't say that.

"It's the nuclear war is not yet one of Kahn's Visions. Students themselves have made it part of the curriculum. 'Now, this may be blatant propaganda,' Reid began teaching the second-period class. 'But America in the future is going to be a land of milk and honey right?'

"No way," came the rumbles from the class. Reid pressed on.

"Are you going to live better or worse than your parents?"

"Different.

"You think we're making a mess of things?" Reid asked.

"I can't get any worse," one of the students suggested.

"Is war certain?"

"Overdue," someone in the class said, to general laughter.

"How many of you think the world will be nuclear war? Ninety percent of the class raised their hands. "Will it be limited or full scale?" the teacher asked.

"Don't know what you mean by limited?" someone asked.

"Limited means I survived, doesn't it?" Reid observed. "How many of you think it will come in your lifetime?" More than half the class raised their hands.

"We can't do anything about it," said one of the teen agers.

"I'm going to have fun and take one day at a time," observed another.

I have to equate Jesus Christ with nuclear war. Reid went on. "But Ancient Rome thought the world was going to end with the Second Coming. What would you have done then?"

"Been real good," a student said. "Are you totally pessimistic?" Reid asked.

"Hey, we're still here, aren't we?" a student responded.

I was beginning to think that future study was a rather soft discipline.

It students were pessimistic, Kahn and his colleagues tended to place the blame on certain books. At Hudson, a survey of social studies textbooks in American high schools determined that the alarm of the Club of Rome had captured the intellectual class of this country. Future studies a Hudson Institute study concluded had
become "an exercise in moralistic judgments," a "package of New Testament virtues and preindustrial simplicity," "a glorification of the counterculture," and a blast at "hellfire and calumni." The standard method of instruction the study suggested was to scare and shame children into being virtuous and narrowly doctrinaire about the future.

The promoters of Visions of the Future cite other examples in this conspiracy to depress American youth. One is a two-minute filmstrip produced by the Canadian Film Board wherein a beautiful, rich and wild valley is invaded by a menacing jet plane. Without narration the film shows the plane spewing a cloud of slow-descending pollution over the plants and the birds which die.

To Kahn, such gloom and doom was downright dangerous. In one article, he aligned himself with an unnamed conservative "thinker" who attributed a high incidence of youth suicides to depressing textbooks. The bad news in the textbooks leads to a negative self-image he wrote, which in turn breeds troublemakers and encourages youth to drop out of school and society. In the Visions materials those who question uninhibited growth are patronized: "The people who resisted new ideas were not terrible people but they were afraid that change would be dangerous to their society. And the growth of science and technology in industrializing societies has shown that a change in technology often means a change in society."

As the Visions materials began to take shape, Kahn added Jimmy Carter to his list of villains along with the Club of Rome. In July 1975, after a three-year study involving 13 government agencies, the White House issued a massive, three-volume report entitled Global 2000: Report to the President Entering the 21st Century. For the first time, a government report treated population resources, and the environment as related areas. The study used a global model, inspired by the approach of the Club of Rome, and made projections about world trends:

- In 2000 the world's population will jump to 6.35 billion from 4 billion in 1975. By 2030 world population will reach 10 billion which is considered by the National Academy of Sciences to be the maximum carrying capacity of the earth.
- Though coal, oil and gas are theoretically sufficient for centuries, they are unevenly distributed and subject to profligate exploitation and hoarding.
- By 2050 the concentration of carbon dioxide in the atmosphere is expected to alter characteristics of the world's climate and upper atmosphere.

In short, Global 2000 predicted a planet that will be more crowded, more polluted, less stable economically, and more susceptible to disruption.

In its warning days, the Carter Administration followed Global 2000 with another report called Global Future: Time to Act. Global Future purported to be a series of immediate and long-range actions that the U.S. government could take to address the global predicament. But unlike Global 2000, which had been prepared by professionals in the Congress on Environmental Quality and the Department of State, Global Future was a political document recommending a series of measures that had previously been proposed by congressional liberals and rejected by Congress. Global Future leaned far enough toward the left that the Reagan Administration found it easy to dismiss.

But when Reagan took over, despite agreement on a hard-line position against pessimism, the Republicans weren't sure how to mount the actual attack. Reagan's Global Issues Working Group, successor to the Carter Global Future effort, proposed three options for Reagan Cabinet consideration. The first was disbanding itself. The second was issuing a minimal understated report disputing the notion that the world was going to hell. The third was launching a major counterattack on Global 2000. In the midst of this strategic waffling, Kahn was a hawk.

In an article entitled "Globaloney 2000," Kahn had treated the Carter document with acerbic contempt. The three-year government study was disgraceful. It reinforced prevailing pessimism. It encouraged an "apocalypse 2000" mind-set. It stimulated guilt feelings. It was advised and written by certified opponents of the kind of economic growth most Americans want, and it was crying wolf by the do-good establishment. All in all, Kahn could not understand why Jimmy Carter, whom he patronized as a "reasonably cheerful and responsible man" would choose such doomsdayism for his own musical.
They are just tired of teaching positivism. They want to teach upbeat stuff.

In the six hours I spent with Kahn, I kept coming back to what his intent was with the Visions program. But it was not until the end of our talks, in his motel room in Tempe, that he declared himself. He rose from his chair, his voice rising in anger.

"Yes, you're right! We are trying to desensitize these kids to the environment! We are trying to desensitize them to energy concerns! We are trying to kill the lifeboat mentality! The earth is not a lifeboat, and it is not a spaceship.

'This is not a fragile little planet that may disintegrate with the least tug.'

When a 400-pound man, especially one who revels in his reputation as the Prophet of Boom, comes over you in a rage you listen. I did listen closely to Kahn. But I heard in his passion more the tone of an ideologue than an educator.

On March 5 Kahn discharged his duty as Arizona State's Goldwater Professor of American Institutions by holding a day-long public seminar on his prediction of a coming economic boom (Hermin's predictions are always optimistic and always right — the chairman of the ASU Economics Department declared to the audience, "If you wait long enough." In his opening two-hour presentation Kahn ranged far and wide with an entertaining delivery. He was probably the only man around he joked who was interested in designing a financial system that would survive a nuclear holocaust. His listeners should enjoy their ride on the high-tech wave that was carrying everyone into the twenty-first century he said. He amused them by relating the evolution of his religious feelings.

"At twelve I was an atheist. At twenty I was an agnostic. At thirty a theist, and I expect to die a rabbi," he said. Yet in the same speech he announced that he did not trust anyone, except himself. And sometimes he didn't even trust himself.

Ironically his Visions course at its core teaches trust: trust of current and future leadership, trust in the great stream of human advancement. Visions students learn to dismiss environmental concerns and to disregard the possibility of nuclear war. Kahn's students are taught to read all the other bad news in the papers as mere wave in the Great Transition.

Kahn conceded that there were some problems with the program. He said he was ashamed of the simplicity of the writing blaming it on the professional curriculum experts who helped put the materials together. (The Visions texts had been put through a computer before they were printed to make sure they were written at the ninth-grade reading level.) Twelfth graders in Arizona — and many other parts of the country — read on the ninth-grade level. Part of the definition of ninth-grade level is no three-syllable words.)

But Kahn held fast to the central tenets of his Visions. More than that he had come to believe his position went beyond his personal feelings.

"I may be wrong," Kahn said. "I may be arrogant. I may be a megalomaniac." The Great Transition is not Einstein's theory of relativity. But it is the way the world works.

The future world of Herman Kahn is already working in Arizona. The state's growth is not manic but structured. It is the way people like it. The way they want to live. This is the culmination of Western culture. Do you know that people come from all over the world to study the shopping malls here?

To find Kahn's Tomorrowland, you have only to look at Metro Center, not so much a shopping mall as a mini-city of urban village, of more than 160 acres. In north Phoenix and within the center, the state's human yearnings and the bright promise of the future intersect at the immense Goldwater's Department Store.

It's the Greek agora. Kahn said. "The people bring the kids. They love the shopping center. That's a great way to live!"

"I'm in touch with the virus herpes 107. It says it has a right to live, too."
that simulate conditions in Alaska in winter or Death Valley in summer.

Chigier points out the beautiful snake-like laser anemometer for measuring velocity, and the high-energy ruby laser an exotic bird that will measure the burning sprays using a ten-nanosecond pulse. We are developing a combustion lab for the Nineties "he claims. "I encourage my students to look at flames to play with them in a responsible way. We have much potential for danger, with the possibility of explosions, detonations and damage from high-powered lasers—any one of them is enough to blow this lab sky high. It is my business to control fire. We want to use the most sophisticated technology in the world to unravel the complex physics and chemistry of flames."

In the CMU student cafeteria where Chigier goes "gaining strength from its vitality" he has his habitual lunch an apple and a cup of soup (to keep his athletic frame in top shape for tennis and skiing) We talk about pollution.

"Every burnable component should be burned, all the smoke, soot, carbon. It can be burned. provided one understands combustion engineering. It really is a crime that fuel is being emitted; it is an unnecessary pollutant.

We ask him about exotic new fuels. Will there be any say pseudofossil fuels made from compressed fast food containers or trapped hydrogen No good old coal seems to be what we have to look forward to Chigier's attention is focused on coalwater slurs. Thick mires of coal and water muds coursing across continents of pipelines and transported by tankers to fuel thirsty factories and utility plants. The mixture of coal to water in a slurry can range from 60 to 40 percent coal. It can be sprayed and ignited. Huge corporations such as the nuclear-plant builders Babcock and Wilcox and Combustion Engineering are investing millions in coal-water slurry research. "Industry is being persuaded to replace crude oil for electricity generation." Chigier says, "for heavy industry and for retrofitting boilers. There is a bill in Congress for laying massive slurry pipelines. But the railways have a vested interest in preventing this. Maybe he adds, "if they owned the pipelines it would make a difference."

Chigier's spray combustion research will probably have an immense impact on improving coal-water slurry combustion efficiency.

And what about the old combustion engine itself? Combustion engineering has always been the Cinderella, he tells us. The auto industry spends millions to redesign the outlets of cars and very little to develop the combustion in engines. With aircraft, it's only recently that active research has begun on engine development. There's room for radical change.

One of the few new engines he reveals, is the Army's adiabatic chamber built for its tanks and trucks—a chamber that needs no coolant. Today's tanks are powered by diesel engines. and like any other diesel they have radiators with rubber hoses connecting them to the engines. "Can you imagine a tank costing ten to fifteen million dollars, out in the field in a tank-style war? Cannons are firing, missiles are flying—everything in the modern arsenal—and a bit of shrapnel pierces the hose. All the water runs out and the tank is immobilized. The absurdity! Here you have this tank captain sitting there with water draining out of his radiator. Oh yes the Army feels very vulnerable.

"So they're building this engine without a coolant. It has a ceramic coating that prevents the engine from burning up. More heat is contained inside the engine but the ceramic material conducts the heat, transfers it to the outside of the chamber walls. It works. These tanks exist experimentally. But they're still too expensive for any other purpose now. Perhaps in the twenty-first century.

At lunch Chigier reveals that he's eager to make a TV series a sort of Ascent of Flames, rather like Bronowski's take on man. He's not deterred by Pyre's comment that fire's primacy has been usurped by nuclear energy that since Einstein the focus of science and the popular imagination has been on the atom rather than the flame. For Chigier fire was and still is pivotal. My father counted the number of times fire is mentioned in the Bible. About forty. You know the burning bush, the pillar of fire, Daniel. And there's the Greeks—Heraclitus, the first of the Hades Zeus thunderbolts.

"What about fire and brimstone?" asks a student at the table. "Sodom and Gomorrah. " The young engineer says a young engineer reminiscent of a radio disc jockey in San Francisco who played an hour of rock and roll songs inspired by fire or flames. "Light My Fire, Great Balls of Fire, Fire. White Light. White Heat. and other hot selections. There are not many paintings of fire, though," Chigier observes. "It is almost impossible to capture the reds, yellows, blues of a flame and its dynamism. I've had two or three painters try it.

"Fire is the most tolerable third party (old saying)" Chigier himself is out to capture the essence of fire, even in off-hours. He has a cabin up in the mountains, warmed by a wood fire. His wife, he says, is puzzled by the way he gazes into it hour after hour at night. "Drawn to it like a moth."

"There is a sense of awe. Always, Flames are so very beautiful and enigmatic. And because I know so much about them. I'm even more fascinated."

Postscript: "Fire is purifying," she said and gave him a great big smile. (Last line from Fire Sermon, by Wright Morris.)
Consider a tunnel, a long tunnel crossing the Atlantic, from North America to Europe. Bullet trains whisking one goods and passengers between the continents would speed back and forth. When you think that big, the possibilities are endless. What about a subway flasing at rocket velocities between New York and Los Angeles? How about routing water from Canada to the arid southwest United States through canals that would rival the vast conduits.
Astronomer Percival Lowell once imagined he saw on Mars. What about self-contained metropolises floating on the oceans? Or single building cities each a mile tall?

We are entering a new era of planetary engineering, where massive construction projects like these are feasible. Well before the year 2000, we could witness the beginning of such projects as a tunnel between Britain and France, a linkup of causeways and tubes between Japan and South Korea, or a Gibraltar tunnel.

We macroengineers have many dreams of which these are a sampling. We dream huge, but we also dream realistically. These vast projects and scores more like them are not just engineering fantasies. They make sense—technologically economically environmentally, and humanly.

For example, a continent-to-continent train running under the Atlantic would cost billions, but it would be worth every cent. For one thing, it would cut down on three Atlantic ships and plane traffic, a major polluter of our skies and seas. By using more fuel-efficient train transport we would squander less raw material. We wouldn’t have to replace ships and planes when they wear out every 25 years. We would save millions of barrels of oil we now expend on turning ship propellers and powering jet engines. And once completed, the tunnel would be relatively immune to economic fluctuations. The result would be lower shipping costs.

But realistically could we do it? Do we have the technology to build a 2,000-mile-long tunnel over a northern global route two miles down on the ocean floor?

As it happens, engineers are already working on what could be considered the trial run for such a project. An international construction firm the Bechtel Corporation has been studying a design for a natural gas pipeline across the Mediterranean Sea, from Algeria to Spain. It would stretch 156 miles and lie at a depth of up to 6,000 feet. Cost would be about $33 million per mile, a not unreasonable expenditure given the heavy use such a pipeline would get.

Moreover, last January Japanese engineers linked the islands of Honshu and Hokkaido when they completed the underwater portion of a 337-mile undersea tunnel under the treacherous Tsugaru strait. Built across a stretch of the Pacific considered too turbulent for safe ferry travel, the remarkable project is the longest of its kind in the world.

Construction of the Tsugaru tunnel was accomplished by an ingenious procedure. Experts blasted out a section of bedrock and then used an enormous machine to inject a special sealant into the walls of the finished tunnel section. Beneath the main tunnel they dug a smaller tunnel to carry off water seepage. Running parallel to the main shaft is a service tunnel for maintenance and for evacuating the passengers of trains that stall in the main tunnel.

It was an immense project. It required boring through more than 400 feet beneath the seabed through some extraordinarily difficult geological formations. Even more remarkable is the decision making support the Japanese officials gave to such a long-term project. By the time the double-track railways are laid in 1986, the tunnel will have been open 15 years in the building.

The Tsugaru strait project could be the inspiration for other large-scale subsea construction. A tunnel from Italy to Sicily is one such possibility. Another scheme calls for a Gibraltar tube that, instead of being

A top Japanese construction firm has contemplated a railroad tube from Japan to South Korea. It would open the way for bullet-train service from Tokyo to Paris.

burrowed beneath the surface would be suspended in the water to avoid tunneling costs. In fact the art of designing such immersed tubes (see large picture on the opening page) is so advanced that a leading Japanese construction firm has contemplated a railroad tube stretching 100 miles across the Fusan straits from Japan to South Korea. Now being evaluated by a team of scientists that includes one experienced macroengineer Professor Manabu Nakogawa, chairman of the Japan Institute for Macroengineering, it would open the way for bullet train service that would go from Tokyo to Paris and pass on through an English Channel tunnel to London and Edinburgh, with a spur that would pass under the Irish Sea to Dublin.

Why not think even bigger? Within a decade we could see international teams analyzing various options for a transatlantic tunnel. At depths of nearby a mile—6,000 feet—water pressure is sufficiently low to allow engineers to borrow from pipeline technology. Construction crews could lay prefabricated reinforced tubes in a prepared trench and then cover them over to keep them from shifting. At greater depths, engineers might have to bore a tunnel through the seafloor’s bedrock.

Much preliminary research still will be necessary for such a mammoth undertaking. For sections of the pipeline where water pressure might present a problem engineers could draw upon techniques used in building the shells of submarines. Also a full-scale prototype of a high-speed transport system that travels through the partly evacuated tunnel will have to be tested. But if designers can keep the construction costs reasonable for such a project—a budget of $1.00 per mile—the project would be economically fruitful.

Not all these grand tunnels will be underwater. Robert Sailer of The RAND Corporation has suggested building a subway from New York to Los Angeles. Magnetically levitated above the tracks the trains would zip through the evacuated tunnel at speeds faster than the SST, crossing the country in less than an hour. Building such a thing presents no special technological problems but the cost of tunneling from coast to coast would be astronomical. Feasible engineers would have to develop a new way to dig. The federal government’s Los Alamos Scientific Laboratory in New Mexico however may have an answer to this challenge.

Called the Subterrene the Los Alamos machine looks like a vicious giant mole (see inset photo on opening page). The beauty of the Subterrene is that as it burrows through the rock hundreds of feet below the surface, it heats whatever stone it encounters into molten rock or magma which cools after the Subterrene has moved on. The result is a tunnel with a smooth glazed lining. For power the Subterrene can use a built in miniature nuclear engine or a conventional power plant.

Carnegie Mellon University’s Robotics Institute is working on a related machine, a robot tunnel builder. It will be an unmanned boring and tunnel-lining machine that will also handle muck and debris as if bores and constructs a tunnel.

Sophisticated new tunneling equipment like those will open up other possibilities. One is a system of tubes for distributing goods between buildings and between cities. We already use oil and gas pipelines, and researchers are working on pipelines for conveying solid products. For roughly the cost of a water-distribution network, we could have underground pipes that move merchandise from stores to our homes as soon as we call in our orders.

Such pipelines have vast potential, including transportation of coal phosphates and ores. Eighty percent of all freight now moving on trucks, trains, and planes could be moved easily through a six-foot pipe. Eventually these systems could move people too—and at high speeds. New Yorkers might opt to live in Vermont away from smog and congestion, but close enough to pop in—via the tube—for an evening on Broadway.

Macroengineers have many other
schemes in mind, all of them grand but not all of them new. One such idea is to move ships overland. For example, archaeologists in Greece have excavated the tracks of ancient Hellenes once used for specially constructed oxcarts that carried ships across the Isthmus of Corinth. In 1881 American engineers proposed a mammoth railway designed to carry ships across Mexico's Isthmus of Tehuantepec between the Gulf of Mexico and the Pacific Ocean. And in the Low Countries—Holland, Belgium, and Luxembourg—barges have been routinely moved for decades from one canal to another via railways.

This option still makes sense. Instead of digging expensive canals to float ocean-going ships from one sea to another, why not simply carry them across? Of course today's liners and supertankers are gargantuan, but so are our engineering capabilities. We could still take a lesson from the ancient engineers and roll the giant ships or rafts over miles of earth.

We already have large Hovercraft that ferry cars between England and France across the English Channel. Their design suggests that we could build Hovercraft large enough to levitate a freighter and float it overland on a cushion of air. Special macrotractors, the terrestrial equivalents of tugboats, could do the pulling. Other macroengineers have proposed building an enormous "bathtub" in which a great ship could regally float as it and the tub are hauled across short stretches of dry ground. We already have made use of another option wheels. NASA regularly transports the space shuttle and rockets to the launching pads with a high-duty wheeled vehicle.

And if a canal is preferred, macroengineer E. G. Frankel has devised a clever canal-building system that, under proper conditions, would obviate the need for excavation altogether. His scheme calls for installing precast walls aboveground to form the sides of the canal and then filling the newly formed channel to the desired depth of water to accommodate the ship traffic that will pass through.

Before any country digs another canal, it would be wise to compare the costs of the different methods for moving ships overland. In fact, Canada has the perfect spot to try out any one of the approaches: the 11-mile wide Chignolo isthmus which separates the Bay of Fundy from the Northumberland Strait.

But macroengineers can do more than devise systems for carrying heavyweights like the Queen Elizabeth II. We can build bigger. Many years ago, architect Frank Lloyd Wright designed a huge skyscraper called the "Illinois." It was one mile tall. In 1964 I was discussing that project with Gabriel Bouladon, chief of the mechanical-engineering division of the Battelle Memorial Institute in Geneva, Switzerland. "My architect friends," I told him, "say the building would not fall down, but that it would consist almost entirely of elevators!"

Bouladon smiled enigmatically. "Let me give this matter some thought," he said.

Six months later a large package from Switzerland arrived at my New York office. Inside was a model for a unique elevator design. Not only had Bouladon solved the elevator problem of the mile-high building, but he had managed to patent the solution as well.

Instead of using standard, large elevators, Bouladon's system updates an old elevator design the paternoster which resembled a vertical conveyor belt. It was a continuous moving series of steps people could hop on or off as needed. Bouladon's design was a more sophisticated version that had two-person size boxes. The boxes sit atop another in a continuous chain of compartments that turns steadily keeping traffic flowing smoothly up and down.

Thus the mile-high building unworkable when Wright first conceived of it, is now possible. Land-poor Japan, for example is considering such skyscrapers to house its crowded population and in celebration of France's two-hundredth anniversary the republic is seriously contemplating the construction of similar giant structures called megatowers.

Advances in technology are sure to challenge our traditional concept of what a city should be. Beyond putting a city in a skyscraper, why not erect one in the unspoiled reaches of the mid-Pacific? With the United Nations predicting a doubling of the present world population in 40 to 50 years, we may have to move out into the oceans. New sovereign states may appear in what are now international waters, and the United Nations might well use these man-made sovereignties as living areas for dispossessed refugee populations.

To provide easy access to offshore coal mines, the Japanese have already built artificial islands in 40-meter-deep water at Kobe in the United Kingdom the Pakington Glass Age Development Committee has proposed building a 30,000-person "Sea City" 15 miles off the Norfolk coast. Especially fascinating is the notion of building new nations or port-city states for such landlocked countries as Bolivia and Nepal on the underwater mountains called seamounts that dot the Pacific.

As awesome as such city islands and city skyscrapers may seem, perhaps the most ambitious of all macroengineering schemes is the Great Recycling and Northern Development (GRAND) Canal. It was conceived by Thomas W. Kierans, a professor of engineering at Memorial University, in Newfoundland, and like any good macroengineering project, it is an attempt to solve a mammoth problem. The challenge is in alleviating the chronic shortage of water that plagues the entire North American continent—western Canada, the central and western United States, and northern Mexico. Very simply, Kierans's solution would redesign the drainage sys
If you want a smoother vodka, ask for it in English.

Now the English have always done for vodka what they’ve always done for gin.

Burrough's. The English word for vodka.
A sunset, with the red-gold light washing down the face of Shadow Mountain.

Painting by Nenad Jakesevic.
Helena Weiss was startled at what he might have just said. They had gotten to the park before noon, hiked all over creation, and then he did say something that he'd been saving as a present for her operation?" she managed to say, "What's operable, and what's not? You would have to go through a couple of higher function centers to get to the body of the growth, but this damn thing's stable—you know, sweetheart?"

"I know."

And you'd never get all the spikes. So surgery's not indicated, with a plethora of chances for both to go wrong and no guarantee of a cure or anything like one.

Weiss looked straight out at the western horizon, at the tenderly dilated teardrop in the menacing layers of the atmosphere. Her pupils were damp. She still had height. Sesselbach had been high too but you couldn't just sit and fail from orbit. You couldn't even sink.

Still staring at the boundary clouds, she asked, "How long?"

"Not long. Probably not six months. It takes longer, there would be mental changes, complications. It could get—" Messy?"

"Yeah?"

"What do you get so called?"

He didn't answer, and she felt very bad seeing his hurt. But she didn't turn because there was nothing that way to look but a rock and a tassel and toes Larkin M.D. Finally she faced him.

He was sitting on a rock, hands folded on a blue-pleated shirt, staring at the extended toe.

Weiss said, "So now what?"

He looked up. Golden light bounced from his glasses, making his face indistinct. How long to do your sympathy?"

"Quattrocycle, of course."

"Quattrocycle, yeah," he said, and stood up, the fangs of light going out. He looked very tired: "How long?"

"Not long," she said, and as she saw him twitch she realized they had just turned each other's words around. She looked back to the red sun, burning up the layers of cloud. She said, "Just tell me.

Helena Weiss was first met Dr. Boris Evgenievich Larkin in a conference room at Parry U Hospital. "Not Parey Community," Dr. Larkin had warned her over the phone. "Make sure the cabdriver knows."

The driver recognized her—Mrs. Weiss?—and she was too honest to deny it—and all the way in from the airport hotel she was sated to find out what had happened and such for walking Buddha from a tape played in the late stock. Then they arrived at the wrong hospital and he played her all of One Thousand Celts on the trip across town. And out the windows were mountains, brown mountains. Pointing up. High. She was high up in the air. It wasn't worth a first class ride.

When she walked into the hospital lobby, hands while on the shoulder strap of her keyboard, the staff tried to get her into a wheelchair and admitted on the spot. She was extended repetitions of Larkin's name and her own finally had her pointed right away into the little conference cubicle with a cup of something that had the color but no other characteristic of coffee.

At least the room had no windows. She unclipped the case touching the keyboard within. She closed on the earphones, turned on the phone, and began to play—nothing of her own, of course. The Pachetello Canon in D, that phenomenal Musik favorite, because nobody was learning it. What the hell. Even Poststructuralist archetypal composers have to have sales.

She looked up. A man was standing across the table. He was short, broad, dark, and muscular in a white lab coat over a sweater and slacks. He was in his early thirties, like herself. There were pencils and so forth in his pockets. A photo badge on his lapel. He wore very large eyeglasses.

I'm Boris Larkin," he said.

"Oh uh—heh."

She snapped off the keyboard power and took off the phones. "I'm Helena Weiss."

Pleased to meet you, Doctor.""

"Yeah. It's an honor to meet you."

"I just came out? I was
gasting
collected
starburst." She got a good push to the keyboard toward him.

She said, "I'm sure you'n instrument."

"No. I have lovely taste in music, too."

"What's a tempest gate?"

"It shapes waveforms. Under the panel—"

—their slides later after the wave eviscerate at immense increments by these decks over here."

"Do you have to do that for ever after?"

"That's just the programming panel. This key moves the setting to a memory bank. I can hold eight melodies, does that and start them from this switch."

She turned the power on again, gave him a phone, and played a low noise with different gaieties. "I love it," he said. "Do you get one of those?"

"I built this one," she said.

He laughed. "Then I really love it. Come on with me, then, and I'll show you what I do in the basement of this place."

Mrs. Weiss's head was held firmly rested a sort of Pergolas handrail, covered in a steel cylinder one meter across. Dr. Larkin was taking readings with a pocket Multimeter. He said, "You feel okay?"

"Fine."

She felt comfortably in a padded metal chair.

"Good. Some people get nervous when they're hooked up to this thing. It reminds them of that one the state rules."

"What one is that?"

"The one ever all the prison."

"Oh, yeah, right."

And, he said theatrically, "I will know if you get nervous."

"Really? She thought a moment. "I'm scared to death of heights!"

"Are you serious? Because if I wasn't."

She nodded. He added, "I'll label the tape with that. Do you think there are about eighty billion things we want to try correlations on and every piece of data helps."

Sure. What's that?"

"Larkin was extending a glass cylinder into a bright metal tube. The dye came from a metal box marked porcine evil in blue and radioactive in purple on yellow. He snapped a lever on the tube, and it became a hypodermic syringe. This is the penis that makes the magic machines work."

Redskin's 129. Scared of needles too?"

I thought everybody was scared of needles: she said as she swallowed her knock. She looked away. The stag wasn't too bad.

"Sorry," he said. "I've only got two doc-torates. I'm not a nurse."

But that stuff belongs to the Air Force?"

In the same sense, he said quite seri-ously that Johann Sebastian Bach's music belonged to the memory bank of Branden- heim. It's belong to Ludwig of Bavaria. We all have our patrimons at court."

Before she could think about that he said: Okay, now what you do is watch that monitor. Can you see it clearly?"

We're all still. Larkin closed the monitor box and went beneath an instrument board. With its knobs and little screens it reminded Weiss of a Hamilton Panoramic or a Concert Mogul. There was no keyboard, but an Arp-X synthesizer was placed on it. She touched the keyboard in her left hand, and got the feeling very tightly in her homes position.

Larkin worked on the console. The monitor cube came to life with a pattern of colored bars, knotted around and through one another. Larkin's hands moved below Weiss's line of sight, and the intertwined pattern rotated, tumbled end for end. The cube went blank. Above Weiss's head there was a faint noise of machinery. Her eyes locked up down in the arm of the chair out of sight but in easy reach was a switch that would immediately release her head from the monitor. A decision switch the European Space Agency ground crew called theirs, where there gester her for Spacelab. She hadn't pulled it even. Since it was coming through."

Larkin said in the cube monitor turned on the figure after it was filled it was something like a pink climbing vine."

"It's your cranial artery."

Larkin said. The tracer's just getting there.
The vine branched out and became diffuse. The cube flashed and a green line overlay showed a rounded outline: a humped, furrowed shape; the shape of a human brain.

Helena Weiss's technique was called Solid Image Generation by Multi-Axial Positron Scanning: SIGMAPS. On the front of the control bank, in burnished metal, was the emblem $\Sigma^B$ the Greek sigma and the symbol for a positron: an antimatter electron. The radioisotope tracer emitted positrons which crashed into the molecules of her brain to produce gamma rays. In the cylinder around her skull, scanners were triggered in sequence. Hundreds of times a second, reading the ray emissions and feeding data to the monitor. She thought of a dollar-in-the-slot arcade machine: Brain Invaders.

The green sketch plan was gone now. Weiss saw the outlines of her brain in blue, a lacy cyan haze filling out the lobes of her cerebrum. Within it, were spots of color, pink, yellow, green, with a few red stars to the left hemisphere and right. The brain revolved in space, showing a top view left side right.

"Larkin said: This is something they found out with flat positron images, what we called PET scans. The activity zone on the right, that's where all of us listen to music. But you're a professional musician and you're reacting in the left cortex, the analytical, too. You're very analytical Mrs. Weiss.

"Thank you."

"Now here's something new. The left side red zone began expanding, the whole image was being enlarged. The brain surface was soon lost beyond the limits of the cube. Until the whole monitor was filled with what must have been only a few cubic millimeters of her brain.

The structure displayed was in layers of color with strands of contrasting colors interlaced. It was thought like a molecular structure of Manhattan oil wells and deep rock strata, and—each time the image changed in her mind, the image in the monitor shifted its form.

This is the edge of a thought," Larkin said. Suddenly quite intense, "For decades we argued about whether there were really activity centers. Well, there are. The scan shows them working. But why's the difference between working center brain and no center brain? It's not a line you can see that not just a line any more than the sign was the simple mechanical structure we thought it was. There's a whole boundary complex and if these intermittent flashes—see, there's one—if those mean what I think then the active brain is interacting with the other, you can call it indirect, a call otherwise-active majority. And if the…what the heck?

The image on the monitor pitched over "Alles Menschen werden Bredor," sang the tape Weiss tried to turn her head, which hurt just a little: "What is it? Doctor?"

He was silent for several seconds, unseen behind his machinery. Then he said, "Oh nothing. Seeing things, I guess."

"His humor came back instantly. "Stare at brains all day and you'll see things in them Queen Victoria, The Yellow Brick Road."

Larkin threw some switches and the monitor went dark. "The scanner silent."

"Is that all?" Weiss's eyes pranced above the keyboard. "Enough for today. Do you think you're going to get a piece of music out of this?"

Weiss's hands moved across the keys but they were off. "Tell reporters I won't write pieces of music. I think that's too soon to tell what it'll be like but—"

"We'll do more scans. You're not really a subject until I have an hour's tape on you. But no more until Monday."

He moved the catches and released her from the scanner, stuck a label on a tape cassette and made unreadable scrawls across it.

"It's three days till Monday," she said.

"Uh huh," he said distantly. "Then he looked at her scratching his temple with his pen. "You ever climb a rock?"

It had taken two hours Friday night at a shop that seemed to stock nothing but leather and blue denim and big hats to get Weiss fitted out with hiking rig. By noon Saturday they were on a trail in Rocky Mountain National Park. It was no strain for her, she was in excellent shape for thirty-four, the hiker regularly (over rather flatter ground) she had passed the E. S. A. Physical at least it was no strain. Keep looking at the trees, keep right, stop looking at the ground. Do not look over there. There's something out there, but a thousand meters of straight down.

They stopped for lunch in view of a peak. "Larkin said was named Hallett. "Over twelve thousand feet. You look terrible pace too quick?"

No. She said looking at a point about halfway up Hallet Peak. "Half the rest of the distance up anyway, they were halfway up and she chewed a supercarbohydrate bar in deep thought of meadows and living rooms. Larkin handed her a cup of his vacuum flask, and she took a long first swallow. It wasn't water.

Larkin said: "Hey slow down that stuff is too good for guzzling."

White wine on a mountain?

"A coat of gorp, a mug of Gewurztraminer, and thou beside me in the wilderness: Hoo boy wilderness:"

"I think you're crazy," she said.

"Of course I am. Alcohol is illegal in na-"
The fourth cycle snapped into existence from silence, as if the ear refused to hear the chaos at its very beginning. Then above the rush a single line of melody rose.
"I'd have to think about it," she said, joking, and at once regretted it. Worry was marked in every part of him. She touched his shoulder, asked about several things it might have been, all of which he denied. Her head began to hurt, and she said, "It's tension," from somewhere very far away.

They went back to the city, and he left her at the hotel.

The following week he went to Denver where he could not be reached and would not return calls.

On Saturday morning he phoned early from the lobby downstairs. They went to the park, they climbed the trails, and that afternoon he told her what the SIGMAPS scan had found: the Denver specialists confirmed.

"Just tell me," she said (recalling —what the fuck? 'What is it'? 'Nothing—') "Did you know then?"

"Not for certain. Not then. And I didn't want—I couldn't say anything until I was certain."

Well she thought, this is one I can't blame on Terry's ghost.

"Larkin said, 'I really do want to hear your symphony..."

Quattro-cycle! She turned away from him, looked down at the lake, too angry to realize what she was doing. She felt slightly dizzy, touched her eye, where there was the promise of pain. He would give her pills for that, because she could not work in pain but nothing that might relax her, make her rest, he would not let her rest until the music was done. He wanted to hear it. All right. She would give it to him.

"Let's go," Larkin said to her, "before we lose all the light."

She left the Springs for home the following week, with a trunkful of notes, her suit case, and her keyboard. A taxi took her to the airport, and no one saw her off. That was just how she wanted it.

She had not been back to the house for sixteen months. There were no deliveries there to stop or start, the mail accumulated at her post office box until she or her New York agent called for it.

The house had no telephone either, and the electric power came from a generator that ran on gasoline, moonshine or anything in between. In the basement was a bombproof shelter gas/blower protective suits in several sizes, including maternity and enough dehydrated food to last for at least five years.

In a room on the main floor was Helena's master composition console, a percolator and a framed photo of Terence Gallagher Weiss deceased who had refused to be called a survivalist, insisting that he just didn't believe in miracles. He had gotten a promise out of her that if the time came she'd go on living without him.

Now and again, she would rage at his picture, calling it anything she could think of. It was not that she had been made to keep her promise. She had just never imagined that it could be so hard to keep.

Writing the quattrocycle took almost four months. The lobes of the brain failed her as a framework as did the gross structures she had to tear down and build up again. note by note, phrase by phrase.

The headaches became blinding more than once, and she would have to stop for a day, take aspirin, drink coffee, sleep but only for a day at a time.

When she was satisfied with the last note she made a shortwave call to the state police, telling them that the house would be empty again, loaded tapes and bag and keyboard into the Land Rover, and drove away through the yellow haze of autumn.

They found a sheltered spot on the lee slope of Shadow Mountain. Mrs. Weiss set up the keyboard and auxiliary tapes on a rock at a convenient height, and Dr. Larkin uncoiled a strand of wire and hooked it to a pair of thin-paned speakers.

They had a tiny amphitheater in the shadow of the spine of the land. Larkin poured some white wine from his flask and settled down. Helena Weiss began to play.

The first cycle crashed against itself in waves of amplification, a quick, bold, immediate theme for the right hand against a more deliberate and reverberating one for..."
Its secrets have been swallowed by hissing wind and the raw, wild weather of the plain.

**MERLIN'S ROCK**

Dawn, August 2484 B.C.

A great procession of men and rock crosses Salisbury plain. Under the sting of summer sun, oxen haul sacred blue stones to the entranceway of a circular bank. There men roll the stones into a ring. Some 500 years later, the descendants of those first builders post huge boulders upright in the earth, like sentinels. The constellation of stones depicted above and caught in the camera lens of photographer Pete Turner is Stonehenge in Wiltshire, England. For 4,500 years its niches and archways have been molded by Britain's raw rains and hissing, wild winds. Legend has it that while turbulent heavens and dark, billowing clouds spiraled above, Druids huddled within, performing strange hermetic rites. The Druid legend is just one of many Stonehenge myths created over the millennia. Some people relate the tale of Merlin the magician, who supposedly cast a spell to send the blue stone sailing from Ireland to the English plain. Others claim the megaliths were built by extraterrestrial "astronaut gods." But finally after decades of research, a clearer picture is beginning to emerge. Scientists speculate that the great archways pictured here—called tri-lithons—were completed centuries after the first Stonehengers began their awesome task. The builders rolled huge boulders to the site and whirled tongues and grooves so that the stones would lock together. Then, by wedging blocks of wood under a platform, they raised beams atop 20-foot-high boulders.

**PHOTOGRAPHS BY PETE TURNER**

TEX BY KATHRINE JASON
Why did the Stonehangers labor so long? Searching for a clue in 1961, American astronomer Gerald Hawkins found that by walking around the stones while applying mathematical formulas, he could track celestial patterns and predict such cyclical phenomena as solstices, equinoxes, and eclipses. Thus, he concluded in his book Stonehenge Decoded that the ancient site was actually an "astronomical observatory."

But in recent years, British prehistorian Christopher Chippindale has discredited the observatory theory. "Even if the astronomy is theoretically valid," he says, "England's cloudy weather makes accurate observation nearly impossible." Today even Hawkins admits that Stonehenge was probably not an observatory. Instead, he says, "it was a site of rituals connected in some way to agriculture, the sun and the moon."
W "We unstrap our seat belts and lean back. I am hoping for two things: to get away from the gray Chicago rain and to finish my report for the Baltimore meeting. Not by the time we reach cruising altitude I’m sure neither is going to happen. There’s no break in the clouds, and suddenly I know the old guy in the window seat is going to be a talker. I didn’t expect it— as soon as I saw him pop through the forward cabin door, hold out his boarding pass to the blond steward, and say something that made her dimple sweetly. It’s that feeling you get when there are at least fifteen empty seats in front of you, but you know, sure as prunes, he’s going to walk past every one of them and stop at your row with a little smile, and you were saving that seat in case Miss Galaxy came by. He isn’t really doing anything— just sitting there. Why do I find myself staring at him? On closer study, he doesn’t even look so old; it’s just that he seems archaic, somehow—and cautious. Imagine a thoroughly circumspect turtle eying over his shoulder the galloping approach of a half-grown Great Dane puppy. He nods, grins. “You travel much?” ”Not a whole lot,” I respond half-heartedly. “Do you?” “Oh, yes indeed. I’m on the move constantly.” He sits quietly then, and I optimistically begin sorting out my notes for the report. But as soon as the stewardess has dropped..."
off a gin and tonic for him and a vodka martini for me—and a faint, wistful scent of orange blossoms for both of us—he lowers his seatback, turns toward me and starts: "Yeah, he says with an ironic chuckle that there could have been any question about it, "I travel all night."

He has a voice that sounds deceptively unobtrusive, quiet even, yet it carries hardly above the roar of the engines—not an easy man to ignore. And immediately as if he were the Ancient Mariner and I, the Wedding Guest, I find myself putting my papers aside to listen to him.

"I'll tell you this. When you make as many towns a year as I do, you get so you can taste things in the wind. You pick up on all kinds of stuff I once read: "The constant traveler grasps propositions too subtle to describe. Too fleeting to hold. He knows things others do not."

"Like what? I know I rolled my eyes disbeliefingly toward the heavens before I could stop myself. But he doesn't pay any attention to that, or to my question.

"I come to realize it gradually," he says. "Through God knows how many thousand lonely breakfasts up too early for the body to respond, trying to come back to life on coffees too strong, pale eggs too runny, with too much black pepper and the morning paper. Then out of the red-clothed breakfast grill and into the city, still sleeping in the morning haze all cities seem to gather. Thirty years of it hasn't stopped that gnawing in the gut of a morning. That's the loneliest time there is. Not the nights. At night, people draw together. You get a feeling of order. We've conquered the night with soft electric lights and whiskey sours. Old travelers get together in quiet little bars and wear the night away. We don't say much. We don't really have to."

The Constant Traveler stops talking and pulls an orange out of his pocket, digging a stubby thumb into the peel. The aroma makes me think of the stewardess and I wish I had ordered two drinks. He offers me part of his orange, and involuntarily I start to reach for it, then draw back.

"Hey!" he says. "Were you born like that?"

"Like what?"

With three fingers, he leans forward to look across at my left side. "On each hand?"

"Yes," as a matter of fact I was. Sure."

"Well I'll be. Cause you any problems?"

"No."

"Of course not."

"Well, he says, laughing. "Long as you're not a piano player."

"No problem there. I'm what you call tone deaf. I shouldn't have said it because in slightly his eyes dart to my ears and he knows I'm studying them now."

"He starts to say something else but apparently thinks better of it, instead he forces himself to gaze at his knees and says: "Well, I'll be double-dipped damned."

"I try again to withdraw my papers, but it isn't easy."

"Now then," he says, "you travel around some, don't you? Haven't you noticed the difference lately?"

"The difference in what?"

"The feeling. In the air."

"I shake my head. "What do you feel?"

"I shouldn't have asked."

"Listen," he says, "not long ago I was in New Orleans. It was the end of summer. Actually—one of those muggy nights you can't stir with a stick. And we were sitting out on a veranda bar listening to the mournful honks of the riverboats trying to drink ourselves out of a mood we didn't like, but getting worse into it instead. Anyway, here's the story."

"There were four of us at the table. Ralph Turner and Bill Ryan—they're copies of me though we don't really look a lot alike. But all have graying, thinning hair and what I guess you'd call travel-worn faces. The other guy was new to me. His name was Frank Burgeston and there was kind of a keenness about him. As tall as Ralph, he was powerful built and in excellent physical condition. He had a longish face, but it wasn't thin. His eyes, behind horn-rimmed glasses, seemed to burn with a restless energy. And my offhand remark that night triggered something in him."

"I get a funny feeling," I've said.
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It must be sweltering in the city right now.
The Constant Traveler's story has filled me out of Baltimore. I glance at my watch. It's about ten minutes. "How long ago was all that?" I ask him as I collect my papers.

Oh let's see. New Orleans must have been three or four months. In the meantime—"Yeah. I guess it was." He looks a little sheepish.

I finish gathering my things and snap the case shut. Outside it looks completely black. We must be in some heavy clouds but the flight has actually been very smooth. Better get my jacket down they're just about ready to call the approach.

I hate landing in the rain, especially at night. It's like being thrown out of the womb at the wrong time. I hate the smell of wet coats having to stand in a little pocket of people under a roof that's too small, the school band sound the tires make on the water. All the lights are smeared.

And of course the baggage is taking longer. He waits with the ease of habit. The others are shifting their feet, turning at every new noise, checking their watches. Finally our bags come down.

"Say do you want to share a cab?" he asks. "They'll be hard to come by tonight.

No thanks. I'm renting a car. Not staying in the city.

"Oh, okay." He seems disappointed.

Can I drop you somewhere? I ask a little more kindly.

He waves negative with a palm vertical. "Wouldn't want to take you out of your way.

Come on. We'll fill our suitcases at the same time and turn down the long corridor to the transportation area. I'd be glad to have the company.

The little hotel where he is staying is several blocks off the main route. It's an old section pretty run down but it feels comfortable. There are a few islands like this one left in every city and these old salesmen know them all.

It is still raining—cold and steady. He turns his collar up pulls the checkered travel hat down tighter thanks me again and dashes for the front door. There is a quick shunt of light making silver wires of the raindrops and he's gone in a few minutes. He'll be at Old Fashioned's surrounded by the red-amber glow of antique polished mahogany warm out of the rain.

I stop to light a cigarette, hold the smoke deep for a minute then direct a slow, thin stream at the windshield wipers before I pull back out into the street. I have had an uncomfortable feeling about it for quite a while and now I'm sure. They do sense it. They don't know we are here of course but they know something is. And they're definitely not ready for our migration. If we come in now they will damage themselves trying to resist.

It may be a struggle for me to convince the rest of the Encroach Team but they've got to be convinced. We certainly have no wish to destroy this planet or any of the beings on it. But if Encroach debates too long it'll all be over. At best we'll barely be able to get word back to Leader Twelve in time to stop them. Miserable communications lag! Will we ever break the c-cubed velocity barrier? It's a good thing we decided to have a final meeting—and that group from Cappadocia finally agreed to come. With Encroach so scattered and not allowed to use normal communications channels I'd never be able to get an agreement in time to stop the migration.

As it is, maybe I won't have too much trouble. After all what is one cycle to us? But think what one hundred seventy-two of their years can do for them. They really do have a remarkable degree of perception already—even as he said a rudimentary awareness sense though they do not seem to understand the Schuman resonances at all. It's even possible we could wait for two cycles. In any case it would be unthinkable to do it now.

The group from New Zealand does not agree. Neither does the one from Galapagos. Some of the others are undecided. It's definitely not going to be easy. And the time we're losing.

I never heard of such a thing. Are you questioning whether we can handle them? When have we ever had any trouble controlling the Originals? There is much noding of agreement with New Zealand.

After all we had a full report from Exploration before anything was planned. One of the Central European groups is heard from. This is no time to be calling it off. Too late anyway.

With all due credit to Exploration I tell them—"They have not encountered this degree of development in our other galaxies. It simply is not obvious on a casual encounter. There is real sensitivity here. They are beyond accommodation.

And in another cycle or two, they may be beyond anything. Galapagos returns. I don't think we have a choice. There's no place else to go. You know how long it took us to find this planet. We certainly can't risk being burned out with no place to——

What risk? I interrupt. "They are not progressing faster than we are certainly. We'll be able to come in next cycle if we have to. And I'm convinced they will be able to accept us by then. It should be interesting they're so much like us in many ways. Take away their extra finger, their peculiar ear structure, and they're even ahead of us in certain things. The sounds they call music for example——

CONTINUED ON PAGE 154.
spokesman for the President's "star wars" policy, the secretary of defense says lasers, particle beams, and superfast computers may deter nuclear holocaust.

INTERVIEW

CASPAR W. WEINBERGER

WASHINGTON, D.C.—Over the last 36 years most of the nation's 15 secretaries of defense have left a distinctive imprint on that office. Robert S. McNamara, who served Presidents Kennedy and Johnson, made his mark as a manager. Melvin R. Laird, in President Nixon's Cabinet, was known for his ability to persuade Congress, whence he came to the Pentagon. James R. Schlesinger, who served during the Ford Administration, was a nuclear-warfare strategist. Harold Brown, President Carter's defense secretary, was regarded as a superb technician.

Today the incumbent, Caspar W. Weinberger, true to his calling as a lawyer in President Reagan's administration—a single-minded proponent of the President's policies on national security. Both the admirers and the critics of Weinberger agree that he has at least one distinctive attribute: unwavering loyalty to President Reagan. Weinberger has been the President's chief spokesman for vastly expanded military spending, for various basing plans for the wandering MX nuclear missile, and for the President's "star wars" proposal that the United States seek to defend the nation against Soviet missiles and to ease away from the doctrine of retaliation and mutually assured destruction.

Weinberger, however, is not merely the mouthpiece of the President on national security. Most of the policies Weinberger advocates in public are those he helped to formulate in Washington. He is considered the Cabinet officer with the most influence on the President. Reagan and Weinberger go back a long way in California politics, and the loyalty up is said to be matched by the loyalty down. Since Weinberger took office in January 1981, he has been in political battles with former Secretary of State Alexander M. Haig, the director of the Office of Manage-

PHOTOGRAPHS BY ANTHONY WOLFF
It's a matter of getting into a position from which we can track a rising missile, fix aim, and fire. The goal is to do it against thousands of missiles, including missiles that carry ten independent warheads.
But the goal is something better than existing ground-based conventional ballistic missile defense, which consists of missiles that destroy incoming missiles. Those missiles do it quite close to Earth and are pretty good over small target areas, but they are not totally effective. As a matter of fact, I was the capability of that existing ballistic missile to defend a small target that was one of the factors leading the President to choose closely spaced basing for the MX missile a decision he was required to make within a very tough time schedule imposed by Congress.

But that system really isn’t good enough for defending the country or defending large areas. What we would really like to do is to get Soviet missiles as they come up out of their silos and before they fall back into the atmosphere after their flight, or before they get close to the earth, and to destroy them. We hope to do that with nonnuclear weapons.

We can do some of this now. It is mainly a matter of getting into a position from which we can track very early and very, very quickly the path of a rising missile—fix an aim—and fire some kind of destructive power at that missile. We can do that now against a comparatively small number of missiles. But the test and the goal would be to try it against thousands of missiles including missiles that carry ten independent warheads, and missiles whose warheads can change direction.

It is, I am told, essentially a problem in very, very large and extraordinarily rapid computer capability. We must develop that to the point where we can reliably identify, track, and destroy several thousand targets in a very, very short space of time. As I say, we can do it with a few targets now. So to some extent it is a matter of expanding the capability and the technologies we now have. But it is far more than that. The cause as you get up into these very large-scale attacks, we see that the existing problem is more than multiples.

It is capable of solution. It will take quite a while, but it is a great dream and a great hope that we could free the world from this type of nuclear, intercontinental, ballistic missile. To be sure you would need other defenses to catch any missiles on the way down that you missed on the way up. The entire system would have layers so that it would be as reliable as possible.

The President wants to do this very much. It is completely consistent with his goal of protecting all avenging the American people and it is something that would add enormously to the stability and hope of the world. So we are organizing ourselves to do it both internally and in a government-wide basis, that is raising the priority of it very substantially.

Omni: What are the most likely technical avenues of approach here—lasers, particle beams, or something else?

Weinberger: Laser beams are promising because of their speed and potential power. Particle beams are considered to have somewhat similar properties. Platforms from which to operate are also necessary. An existing platform is a ship, an aircraft, or a satellite from which a weapon can be fired, and most of the people who have talked to us indicate those platforms should be based in space. The Soviets are doing a great deal of work in space developing space weapons and antisatellite capabilities. So from all points of view it is important that we expend considerable research and development resources in this area.

Omni: The President spoke of a program that would go on for decades. What sort of schedule do you have in mind, and what sort of phase lines could people expect for high-technology military applications?

Weinberger: I don’t think there is any plan that says we will have this program implemented by 1991. It isn’t subject to that kind of precision. It involves some new applications of what we are doing now. I have heard it compared to the Aegis system [a collection of radar and other warship-based sensors, computers, and long- and short-range weapons] which allows a cruiser to track several hundred targets while focusing aiming and controlling the fire of weapons against those targets. Whether they are planes or rockets. Then there are layers of closer-in systems: the most specific being the Phalanx missile. In case your other missiles have missed the target earlier, the Phalanx hits it on the way in, very close to its destination.

We must have that kind of concept on an enormously expanded scale. The shortness of time we have to find, track, aim, and fire means that we have to get to do calculations on a scale that we are not yet able to do. I hope that we can get this capability in the Nineties before the end of the century. But I don’t have any certainty that we can. We are going to devote considerable effort to it.

Omni: The key then is in computer technology. Are you saying that computers must be able to absorb vast amounts of information from satellites and radar examine the data, and direct weapons in outer space to aim and then to fire?

Weinberger: That is the key. That is the goal. Obviously there are a lot of parts to it. But ultimately—and indeed immediately—we need something that will lock on to missiles very early in their trajectory and, at the same time, control, by aiming and firing, weapons systems that can destroy those missiles. But we have little time and we have to do it on a very large scale because the Soviets will have literally tens of thousands of warheads.

Omni: The time here is measured in seconds, as I understand it?

Weinberger: Milliseconds.

Omni: You are talking about a total battle time of as little as possibly one hundred twenty or two hundred seconds?

Weinberger: It is very short. It is a very big
task—a task about which a lot of people say, well, we can't do it! But then, a lot of people said that we couldn't fly.

Omni: What is the first phase?

Weinberger: As I say, we can do some of it right now. But we have to improve our computer capabilities. We have got to get platforms. We have to improve the accuracy and reliability of the systems our computers can fire. And we have to do a lot with improving laser and particle beam applications and techniques.

Omni: Will this be done by the Defense Department, the scientific community, or a combination of the two?

Weinberger: A combination. The Defense Department will obviously do a lot of it. We have established a departmental committee that will coordinate the very considerable resources we are already devoting to this. There will be a government-wide effort in which NASA, the Department of Energy, and various other groups will be involved. That will be managed through an intergovernmental group, and obviously we in Defense will have a great interest in the process. Both groups, I hope, will be able to recruit substantial amounts of scientific talent from throughout the country to help with this endeavor.

Omni: Generally speaking, would those scientists be invited to come into the government, or would they do their research on contract in private laboratories?

Weinberger: One way or another. The academic community. I hope, would get interested and perhaps do its own research in certain areas. I would hope this area would attract and keep a great deal of the country's best intellects. These various complex fields represent a type of work that looks toward protection of a people. Believe it or not, these are not offensive weapons; these are not weapons that go against people. These are weapons that protect people. I would hope that a lot of the moral problems that people quite understandably have with working on a nuclear weapon would not apply in this case, because here we would be trying to destroy weapons of destruction.

Omni: What kind of research and development role will industrial companies and laboratories have?

Weinberger: On, there will undoubtedly be contracts, and there will undoubtedly be proposals; and there will undoubtedly be a number of people who will offer to help so to speak or people who will say, we know what you are trying to do, and we have the best system. But one way or another, we want to get the job done. We don't have any fixed idea that it all has to be done in a government laboratory or in the private sector or whatever. There is assuredly a lot to be done.

Omni: Two questions about cost. What is all of this going to cost, and what are the trade-offs—what should we not have to buy in the twenty-first century?

Weinberger: Well, we don't know the cost. The cost is obviously going to be a function of how long we have to spend and how quickly we have breakthroughs and what it costs to develop computer techniques of this kind. I just couldn't say.

We are going to devote substantial research and development resources to trying to find out what we have to do and how we can do it. It will be a long time effort. I don't know how much it will have cost at the end of fifteen years or so. When we total the bill, we'll be able to tell you. But certainly substantial resources will and should be devoted to this unless we are forbidden to work on it because of congressional veto. I don't see anything to suggest that such an event will happen.

Omni: The second part of the question. Mr. Secretary was about trade-offs and what you would not have to buy later.

Weinberger: If it works, we will be able. I hope to eliminate the need to keep, maintain, and continue to modernize offensive weapons. That would be particularly true if the Soviets develop comparable technology and I assume they will.

They are working on it and from a military point of view, have been in place longer than we have. I hope that we can just eliminate the whole possibility that anyone might use missiles. That would spark not only very substantial economic savings but hopes for worldwide peace as well. Now that doesn't mean we can afford to give up conventional weapons, but it does mean that we could remove this ominous nuclear shadow that has been hanging over the world for several decades.

Omni: Even in the best of all worlds, though, wouldn't you have to keep some sort of residual retaliatory force?

Weinberger: Well, you always have to worry about and plan against a scientific breakthrough that would give the Soviets monopoly or a weapon of ultimate destruction that would override deterrence.

Omni: Let me turn the discussion in a different direction. How does all this relate to the subject of arms control? Are we likely to get into a situation where there would be a race between the Americans building defensive weapons and the Russians building offensive weapons? Or would you foresee a need for an arms control agreement to make this thing work?

Weinberger: Regardless of anything else, I would like to get arms reduction—not arms control, but arms reduction agreement. I think that's vital and I think that is vital whether we have any scientific development in the defensive arena or not.

If America manages to get the kind of defensive system that we want, I would suspect the Soviets would not be far behind. That would then have the effect of canceling out these nuclear missiles altogether. Both sides would know that its missiles wouldn't be able to get through and recognizing that they would turn their attention to other means of deterrence war. But at least we would have removed the
In the tradition of the Flemish masters, a Canadian surrealist makes bold statements about our age.

Ominous Icons

By Kathleen Dilettante

Paintings by Ralle
"I paint in symbols that are part of a universal language," says Ralle, a Yugoslavian-born artist who now makes Ontario his home. Fascinated by icons, Ralle is an admirer of the fifteenth-century Flemish painter Hieronymus Bosch, who he says was a "surrealist born five hundred years ahead of his time."

Just as Bosch used rich symbolic imagery to depict religious allegory, Ralle is drawn to archetypes in his interpretation of the themes of twentieth-century life. The skull and armor in
By using symbols, I have tried to communicate a warning to people that technology is destroying the romanticism and the beauty of life. His portraits represent a false sense of protection—the feeling that one can escape technology. Ralle chose the speared fish image to communicate man's destruction of his environment. Says Ralle: "I juxtapose the symbols in my mind to create my own stories—the viewer should do the same."
thwart nuclear missiles. I wouldn't find it destabilizing to do that. It is vitally important that we work on this. We would not want to be in a position wherein the Soviets would learn how to do this and we would not. That would be dangerous.

Omni: Well, the Soviets already have an operational antisatellite system even though it has limited capabilities. We have to catch up with them if we want to deter them. Our program is moving along with the F-15 fighter and a rocket with a non-nuclear warhead.

Omni: Turning to conventional forces. Mr. Secretary, the technical experts in the Pentagon say another revolution in the use of high technology in warfare is going to come in the conventional field. They talk about sensors, the fusing of the information stream—that is the translation of all forms of intelligence data into digital form—artificial intelligence, and dissemination so good that the user will have the information almost as soon as it happens, in what the military people call real time. All of this, they say, can be linked to precision-guided munitions. What do you foresee ten or fifteen years down the road?

Weinberger: I think we will see the battlefield application of many of these things. Perhaps the use of laser weapons and certainly the use of some sensors for intelligence gathering. There will be better and different tactics whereby we can multiply our forces using technology, as opposed to just adding more and more divisions. We are looking for methods to ensure that even large masses of enemy manpower will not be the deciding factor in combat. We are also dealing with the logistical problems of assembling such effective forces of our own.

Omni: The experts say that many of the sensors can be built now, that the information-gathering and fusing technology exists, particularly if digital computers are used. And that the communication apparatus for dissemination is available. How much more needs to be done before you can really move into this arena?

Weinberger: We are doing a great deal in the field. There is electronic warfare the use of computers, and a lot of advances in technology—things that bring intelligence and information gathering right down to the division level where previously they had been active only at general headquarters.

We are seeking the ability to move very rapidly and to have very quick dispersion of forces, a high degree of mobility, and flexibility with small, light forces that can move very quickly. That means equipping all of these forces with very modern radar and other sophisticated intelligence-gathering equipment that can change the whole nature of the battlefield. But we are also working on tactics that can make it difficult for the other side to assemble reserves or to mass tanks at one particular point to take advantage of even temporary breakthroughs. We are working on improved radar and improved 'smart' weapons, guided weapons, and all-weather, all-night observation devices.

Omni: One of the things these experts say is that 'smart' technology for evading radar can be applied to any vehicle. So far we have used it on bombers, fighter aircraft, and cruise missiles, but are we getting to the point where it could be applied to a ship, tank, or anything else?

Weinberger: I am not really going to be able to talk much about that. I think it's obvious that we want to utilize whatever technology we are able to develop in a way that would be most effective on the battlefield.

Omni: Could I turn to precision-guided munitions? The technicians say that in the artillery, for instance, munitions have a probability kill factor of five or ten percent, which means that you have to fire many rounds to destroy a target. Is it true that you will be able to build munitions with such great accuracy that the kill factor will be ninety percent? Do you think that this is in the immediate future?

Weinberger: The accuracy and smartness of conventional weapons and the ability to guide and control them at night and in all kinds of weather—all of these things are being worked on constantly. Certainly the greater the accuracy, the more you can
pinpoint vital targets and have a much higher degree of confidence that they can be destroyed.

Omni: How long will it be before these advances come into the force?

Weinberger: Well, much of it is coming into the force all the time. We have a division at Fort Lewis, out in Washington, that employs some of the latest tactics and has some of the latest equipment, computers and battlefield adaptations of things that were previously way behind the lines. You might find it worthwhile to take a trip out there and let them show you all that stuff. Don't ride in the dune buggy however.

Omni: Why not?

Weinberger: It doesn't have any springs

Omni: If you can get conventional explosives to such a point of accuracy that you would need far fewer rounds to destroy a target wouldn't there be a multiplier effect on logistics? Wouldn't you need less ammunition, fewer ships or planes or trucks to haul it fewer people to handle it and maybe even fewer guns to fire it?

Weinberger: Indeed. There is no question about that. And in combat scenarios thousands of miles from home, this becomes extremely important. It affects the air and sea lift, it affects the numbers of troops and it enables us to make a far more effective use of our troops for actual combat.

It is obviously to our advantage as a defending force to multiply as much as possible and to deal with thereby favorite Soviet tactics such as massing a very large number—huge, overwhelming numbers—at narrow points

Omni: What does this do to manpower requirements both in terms of numbers and of training?

Weinberger: Well, at the moment we are having very fine success and luck with an all-volunteer system. We are getting all the people we can use and all the people we need now. We will have to make sure that that continues since we have a somewhat shrinking demographic base of young men and women of military age. It is better to utilize the forces that are already in the service more effectively and thereby not require very large additional numbers. If we had to go to war we would certainly have full scale conscription. And we'd make sure that everybody was at work on the projects most vital for the winning of that war. But if we do our job right, we'll never have to do that.

Omni: If you can bring high technology to bear conventional deterrence could work something like nuclear deterrence. Do you think that by using conventional deterrence there would be even less chance of us getting into a nuclear war?

Weinberger: Yes.

Omni: How could you achieve that?

Weinberger: There is no question that we want to reduce and someday, I hope, eliminate nuclear weapons from our deterrent. We can't do that however until we can persuade the Soviets to do it too. The old idea that we could have a short conventional exchange and that it would escalate immediately into nuclear war is no longer the plan or scenario towards which we would be working. A nuclear exchange is too terrible an action to resort to lightly.

The other side of the argument is that you have to increase conventional forces in two ways: the traditional way by recruiting or drafting a larger standing military force or through the use of very modern technologies that multiply your military power but reduce the numbers of people you need. All the things we have been discussing will do that. We have done quite a lot of it now. We have manned cruisers that are very much better and have higher fire power than those we used in World War II and as opposed to sixteen hundred people, we do it with three hundred nineteen. So we have embarked on this program.

Omni: Are you going to be able to persuade the military services to accept the implications of the new high technology for the battlefield? We are talking about a revolutionary concept here, and the services tend to be rather conservative when it comes to change. Will you be able to persuade the services to adopt the tactics the doctrine and the procurement practices to make this come to pass?

Weinberger: Oh, I think they are going to be very eager to do it. I haven't encountered anything of what used to be called the battle-ship syndrome which is opposed to the aircraft carrier. We have both aircraft carriers and battleships as well.

Omni: Meyer (General Edward C. Meyer, Chief of Staff of the Army until June 30) has been working on this from the Army point of view for quite a while. The Air Force is always interested in the very latest technologies. The Navy has already made reductions in its manpower and, although we could use more ships, they will be different kinds of ships.

I don't think there is going to be a problem with that. At the levels where I've been privileged to deal with them I haven't found the military to be either hidebound or wedded to ancient concepts or anything of that kind. They want to develop and are spending a lot of time developing ways to overcome the numerical differences.

There are always going to be those differences in numbers because free open democratic liberal societies don't like standing armies. We don't like large expenditures for defense. The problem is that reliance on reserves implies a substantial amount of time available for mobilization and I don't know that we will have that. So we have to try to get a quick response which is the best kind of deterrent.

As for the strategic nuclear deterrent if we can deter conventionally we want to deter conventionally. We want to be in the situation in which we can say we have enough military power to deter an attack. Whether it will be a much, much, much better version or not one can say. If we have enough military power to deter an attack, we'll never know whether it was too much. Because if it deter an attack, we will have succeeded.

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The Russian fleet was far from home and near unfriendly shores. Seven ships, including a guided-missile cruiser and three heavily instrumented tracking vessels, assembled in formation at their assigned duty stations. Aircraft from other nations kept watch from above while their warships lurked all around the Soviet fleet—on the surface and beneath it. The risk was great, but the mission's importance was greater.

Then, out of the dawn sky, the reason for the unprecedented naval operation materialized at supersonic speeds: A streamlined, delta-wing craft (echo's conception at night) soared into view. Instruments aboard the tracking ships testified to the vehicle's recent plunge back into the atmosphere from space at Mach 25. It had survived the fiery reentry under automatic guidance (preentry

THE ELUSIVE SOVIET SPACE PLANE

BY JAMES E. OBERG

PAINTING BY PAUL LEHR
There are observed June States. The Russian frogmen read this as the abbreviation for the Union of Soviet Socialist Republics.

High overhead, Australian P3C Orion patrol planes photographed the operation's within hours their film was rushed to military intelligence analysts in the United States. After years of myths and rumors, hard evidence was finally at hand. It was June 1982 and the homecoming of the Soviet Union's Kosmos-1374 had just been observed and recorded. Russia's space shuttle was real.

Or was it? For at least a decade Western observers had been awaiting the advent of the Soviet space shuttle—Russia's technological riposte to the NASA space fleet of Enterprise, Columbia and Challenger. And their sister ships. From Soviet spokes- men came conflicting and puzzling hints of intelligence sources spoke of strange preparations at secret Soviet spaceports. There were rumors of a fully reusable space plane that would catapult Soviet cosmonauts a generation ahead of would-be competitors among the Western nations.

Surely there was a mystery to warm the heart (and try the patience) of any analyst. Curiously official Soviet statements of recent years indicated that the USSR was not really interested in such a project at least not yet. Two of these public statements were particularly detailed and explicit: The first came in June 1980 when chief cosmonaut Lieutenant General Vladimir Shatalov three-time space veteran told a Hungarian journalist: 'Soviet specialists have also investigated the possibility of producing spacecraft that can be used more than once. At this stage however, they consider that the employment of these spacecraft is not justified for Soviet research, because the present tasks can be resolved with the well-tested methods in an economic way.'

Then, in April 1981, Cosmonaut Vitaly Sevastyanov who hosts a popular Soviet television program on scientific topics, declared: 'We are also thinking—on a long-range basis—of a reusable space shuttle. At present, however, detailed calculations confirm that the use of our existing system of transport of persons and cargo, as well as orbital stations of the new generation will be much cheaper than a space shuttle—in the next decade at least. We will build large modular orbital stations suitable for a longer stay of dozens of special- ists and for this purpose our [existing] transport techniques are more suitable.'

A few months earlier at a space conference in Paris, Sevastyanov also expressed confidence that the Soyuz-Salyut Progress system would remain in use for the next 15 years. (Salyut is a Russian space station serviced by Soyuz manned spacecraft and Progress a cargo carrying vehicle slightly larger than Soyuz.)

These disclaimers contrasted sharply with the rumors circulating in American and European space circles in the late Seventies. Most sensational of the stories was the one about 'Project Albatross' (the Soviet spelling of albatross), which supposedly consisted of a fully reusable two stage system of winged space vehicles. The craft was to be launched from a speedway by drogol on the Volga River or the Caspian Sea. The first stage, much bigger than a Boeing 747 would carry the orbiter to the edge of space and then glide back to a runway. The orbiter itself would continue into space for its cargo mission before returning to the same runway a few hours or days later. According to the stories, the Soviet terminology for such a vehicle report- edly was raketa-plan ('rocket plane') or kosmo lyot ('space flyer').

Most serious observers considered this project far too advanced for a first step into space-shuttling operations. The Soviets had demonstrated neither the materials nor the high energy rocket engines necessary for such a system. And this skepticism was born out later when the true origin of the Albatross project became known. It was merely a detailed design study by students at a Moscow aeronautical engineering institute. The real Soviet manned space program evidently had no connection with it.

Meanwhile U.S. Secretary of Defense Harold Brown told a congressional committee early in 1980 that he had seen indica- tions the Soviets really were building a space shuttle. There is evidence that they are working on something,' he said. 'It is probably more along the lines of the earlier U.S. program, the Dyna-Soar, than something of the capability of the shuttle.'

The Dyna-Soar or X-20 space glider of the early Sixties was canceled before its first flight. NASA administrator Robert Frosch confirmed Brown's suggestion. And in 1981, Robert S Cooper of the Defense Advanced Research Projects Agency (DARPA), announced that the Soviets were working on a manned space plane.

Nevertheless the June 1982 Indian Ocean splashdown came as quite a shock to most Western observers who were ex- pecting something a little more advanced and quite a bit bigger. So even though the June mission and a nearly identical follow-up flight last March were quickly identified as the rumored space plane, there were still several mysteries.

Both launches had been staged at the small Kapustin Yar rocket base on the lower Volga. Both launches had occurred at about midnight. The boosters—modified medium-range missiles similar to the

"Before we answer any questions about our six-month orbit of the planet Mercury, Commander Ferrielli and I would like to announce our engagement."
American Thor—had carried the payloads southeastward, across the Aral Sea and the Himalayas and into very low orbits about 100 miles up—roughly 40 miles below the lowest altitude of orbiting American shuttles. Both times the one-ton payloads separated from their booster rockets (which stayed in orbit several days before burning up) and circled Earth once, crossing Malaya Java Australia, the South Pacific, Panama, the North Atlantic, England, central Europe, and then the Crimea. Over the Crimea, where the main Soviet space-tracking facilities are located, the vehicles turned tail forward, and each fired a small rocket engine to initiate its return to Earth. Both fell back across Iran, southern India, and Sri Lanka, where the June mission filled the skies with a fiery streak. Minutes later it landed, south of the Cocos Islands, in the eastern Indian Ocean amid the waiting Soviet recovery fleet and the uninvited Australian snoopers.

The photographs from this first landing showed a streamlined craft with one stubby vertical stabilizer and two outboard stabilizers both tilted outward. The front of the fuselage appeared to have a three-paneled cockpit window. From a top hatch amidships parachute lines extended to a long conical, inflated balloon—presumably some sort of recovery aid. The whole craft could not have been more than 13 feet long and perhaps 10 feet across from wingtip to wingtip. It would have just fit under the standard nose cone used atop the booster rocket. Could it have been a prototype of what was to come?

The mini-space shuttle explanation was so obvious and so neat that some skeptics resisted falling for it. A few private analysts even went so far as to say these tests had nothing to do with the Soviet manned space program at all. Instead, these observers suggested the objects fired out of the Indian Ocean were dummy thermonuclear warheads designed to drop out of orbit and attack Western naval forces.

These analysts built their arguments on what they knew of past Russian performance, beginning with the fact that the launch site, Kapustin Yar, had never before hosted any man-related missions. But it had been involved in weapons testing for 35 years. They also knew that only two earlier Soviet space vehicles had splashdowns down at sea, and then only because they were returning from the moon. A splashdown would never be a feature deliberately chosen for a manned vehicle, the heretics argued. And if those flights were merely aerodynamic tests, why would the Russians have gone all the way into orbit when they could easily have achieved the desired velocities at lower altitudes? The orbital mission required them to develop a special service module complete with power source and retrorocket—waste if the spacecraft were merely a subscale model. The shape of the vehicle they went on was exactly what one would expect for a warhead designed for "cross range maneuvers" to get from orbit to target.

Would the Soviets build such a weapons system to attack American aircraft carriers? The skeptics argued that the USSR would, since they had already developed a nuclear-powered ocean-surveillance radar satellite to look for such fleets. This is the same kind of satellite that has fallen out of the sky at random times most recently last January. Moreover, there are likely to be American fleets near enough to Soviet targets to be dangerous but out of reach of other Soviet antifield weapons.

And even though such an orbiting weapon is outlawed by international treaty, the Soviets have already demonstrated their lack of regard for the treaty by developing between 1967 and 1971, the so-called Fractional Orbit Bombardment System (FOBS) for placing nuclear warheads into temporary low orbit for sneak attack.

The 2,000-pound winged orbiters fished from the Indian Ocean are large enough to carry a warhead of several hundred kilotons. The heretics and the launch vehicle is small enough to be based in already-existing missile sites in the USSR. The windows on the vehicle's nose then are for the guidance sensors to peer through not for cosmonaut eyes. And if landing system is needed, since the vehicle would detonate high in the air.

Superficially this terrifying interpretation seems to explain more elements of these missions than does the space-shuttle-test theory. But government analysts and others swear the vehicles "look like space shuttles." We can hope they have other classified data to support judgments that the weapons idea is "fantasy."

Two days after the second splashdown, DARPA director Cooper unequivocally identified the Soviet vehicles as development tests for a Soviet manned space plane. No one could say how much the test model would be scaled up for the manned version. Various estimates ranged from a factor of two to a factor of four in all dimensions.

The second Soviet mini-space-plane flight last March coincided with the release of a Pentagon special report from the office of the Secretary of Defense. The document, called Soviet Military Power, contained a special space-vehicles section that gave uncharacteristically specific parameters on not one but two distinct Soviet space shuttle projects.

The first project was the space plane, the little craft that had landed in the Indian Ocean. Orbital development test flights of the smaller vehicle have already occurred, the report claimed. But the second project allegedly involved a space craft—nicknamed "Shuttleless" by CIA photo analysts—with much greater performance capabilities than those of the American space shuttles.

The Pentagon report described this second vehicle as disturbingly similar to
the U.S. design, but with the double advantages of a lighter lift-off weight and a larger payload. Like the U.S. system, the Soviet Shuttleski includes a winged orbiting vehicle, a large disposable external tank (half again as large as the U.S. equivalent), and two strap-on boosters. In lift-off assistance. These are evidently liquid-fueled, unlike the solid-fueled ones used by NASA. The Soviet shuttle "could be in regular use within a decade," the report said.

The Pentagon's information supposedly came from actual observations of existing test hardware. But in the week preceding the report's release the Washington newsletter Aerospace Daily obtained an even more precise description of the Soviet space shuttle orbit vehicle, based on spy satellite photographs of the craft at the Ramenskoye flight test center near Moscow. The Soviet spaceship was 109 feet long (NASA's is 122 feet) with a 76-foot wingspan (compared to NASA's 78 feet). The Soviet fuselage diameter measured 18 feet and the wing leading-edge sweep was 46 degrees—little different from Columbia and Challenger. Both the Soviet orbiter and the giant external tank were said to be transported in cradles atop modified Elson aircraft veteran long-range strategic bombers. The giant new runway at Tyuratam just east of the Aral Sea was designed expressly to accommodate these planes, according to Aerospace Daily.

A few weeks later, even better photographs were obtained. These showed one of the Soviet Elson carrier aircraft— with an orbiter mounted on top—that had strayed off the runway at Ramenskoye and gotten stuck in the mud for two days.

Such observations allowed American analysts to assess the design differences between the U.S. and Soviet vehicles. For example, the Soviets evidently are still unable to build powerful and reusable rocket engines like the ones that propel NASA's shuttle. They are sticking to expendable engines mounted on their large external tank (which should thus be counted as a rocket stage and not merely a tank).

Without engines at the aft end of the orbiter, however, the Soviets can streamline the craft to give it twice the aerodynamic handling capability of the U.S. system. Additionally, analysts estimate that the Soviets built payload doors at the aft end— to look like a pair of clamshells—they could save even more structural weight.

Without reusable engines and boosters, the system is not economical. But perhaps economy is not what the Soviets are after. According to General James Abrahamson, NASA's associate administrator for spaceflight and a former Air Force Manned Orbiting Laboratory astronaut, NASA's design never delivered the launch economy that had been anticipated, although it did provide something almost as good: "special services." Speaking recently to a convention of the Aviation-Space Writers Association, Abrahamson explained that 'service'—being able to provide a man or woman—could be a matter of life or death.

Continued on Page 143.

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the left that faded and crested. Jaynes's bicameral mind, the centers of direct response having access to the higher reasoning potential only in moments of stress, and then only as an oracle's voice from beyond. The evervoice ceased oscillating, becoming coequal to the instant mind: the breakdown of bicamerality, the origin of conscious thought.

The second cycle began in thunder.

The second cycle was concrete thought. The sounds of the hunt, the battle: the crowd dance music and work song: gongs of bamboo and brass and steel. Notes progressed evenly, blocks on blocks in square measures and even time until the thunder returned. The lightning cracking if across the notes seemed to strain against the lines as it trying to expand.

The third cycle, abstract thought. Notes sequences leaped the scale as if intuitively finding the upper registers. There were five-tone scales, twelve-tone, twenty-one notes in measures of seven notes or thirteen or any number. There was ragtime. There was atonality. There were four seconds of silence. There were blue notes Doppler-shifted into the red, bending around the universe and back. Out again went the bridge, bending, stretching, galloping in a harmonic wind, until it shifted into the black.

The fourth cycle snapped into existence from silence as if the ear had refused to hear the chaos at its very beginning. Then above the incoherent rush of sound, a single line of melody rose like a vocalist in an unknown language: singing of those things that no language has ever found words for. A counterpoint split from the voice, the "Starscape" theme from *One Thousand Orbits* and the melody sang against a background of stars: of crystalline, human precision: but in the melody the inhumanity dissolved, and the distance to the stars—the boundary between what was thought and what was not thought—was bridged.

She launched into the last line. Her left hand played an overpowering major-chord sequence while her right fingers picked out delicate knottworks of sound in the keyboard's pipe voicings: a million impulses of thought submerged in the torrent of intelligence, moving on forever.

And Amen!

She leaned on the rock that held the board. Her knees were weak and the sweat was cold on her forehead and the back of her neck. She turned slowly to face him. And no headache, she said. "Guess you were right. It was just tension. Just—"

Larkin was sitting with his back against a boulder. His left leg stuck out, twisted at a bizarre angle. His head was back against the stone. Eyes open and staring at the sky hard as ice. There was a dark trickle from his nose.

"Not very messy. She thought.

She touched him. He was stiff and quite cold. Oh, Boris . . . how did you get so cold? She wondered if he had first realized he was dying the day she arrived. She had that small seizure behind his console. "What is it? 'Nothing.' But surely there had been earlier signs. The man who built SIGMAPS must have known his own brain. The goddam son of a bitch who had swindled her out of the only fear that she could admit to having.

She shouted. "You got it out of me, didn't you, you selfish son of a bitch? You wanted me to do it up here so you could hear it just for yourself—all for yourself—and now what? How am I supposed to get us off this rock? Listen to me, you bastard!"

Two fingers of Larkin's right hand were thrust deep into his vest pocket.

Inside the pocket was his FM phone with instructions typed because his handwriting was so bad.

The helicopter came very soon, just as he had said it would. And as it lifted them away its lights like gemstones on the velvet cloth of the sky. Helena Weiss sat in its open door. Playing the last cycle with her fingers bloody. The notes echoing from the peaks and in every layer of the air.
The contestants in a game of mind manipulation find they are caught in their own malicious trap.

CARRION COMFORT

BY DAN SIMMONS

Nina was going to take credit for the death of that Beatle, John. I thought that was in very bad taste. She had her scrapbook laid out on my mahogany coffee table, newspaper clippings neatly arranged in chronological order, the bland statements of death recording all of her feedings. Nina’s smile was radiant, but her pale-blue eyes showed no hint of warmth.

“We should wait for Will,” I said.

“Of course, Melanie. You’re right, as always. How silly of me. I know the rules.” Nina stood and began walking around the room, idly touching the furnishings or exclaiming softly over a ceramic statue or piece of needlepoint.

This part of the house had once been the conservatory, but now I used it as my sewing room. Green plants still caught the morning light. The light made it a warm, cozy place in the daytime, but now that winter had come the
room was too chilly to use at night. Nor did I like the sense of darkness closing in against all those panes of glass.

"I love this house," said Nina.

She turned and smiled at me. "I can't tell you how much I look forward to coming back to Charleston. We should hold all of our reunions here."

I knew how much Nina loved this city and this house.

"Will it be all right," I said, "that the people you have invited..."

"Oh," Nina said, "it'll be fine. We can have them over to our house too..."

...to bring the smoke and the noise of the city into her world of the past. For Nina, Charleston was more than just a city; it was her personal microcosm, a place where she could escape from the pressures of life and find a sense of peace.

She sat there, lost in thought, as I rearranged her thoughts and tried to answer her questions. But it was clear that she was not interested in my answers, only in the act of sharing her thoughts with me.

"But children should not play with such things," she said. "I had none of them."

"You mean it's loaded?"

"Yes, of course not," I lied. "But children should not play with such things."

"You mean it's loaded?"

"No, of course not," I repeated. "But children should not play with such things."

We both laughed, a rare moment of shared understanding between two people who had lived very different lives. For Nina, Charleston was a symbol of her past, a place where she could escape the pressures of the present and find a sense of peace. For me, it was a place of mystery and intrigue, a city that held secrets waiting to be discovered.

"If I were still here," she said, "I would have thought he was seeing an aging but attractive niece visiting her favorite aunt. (I draw the line at suggesting that anyone would mistake us for mother and daughter.) People usually consider me a well-dressed if not stylish person. Heavenly knows I have paid enough to have the wool skirts and silk blouses mailed from Scotland and France. But next to Nina I've always felt dowdy.

This day she wore an elegant light-blue dress that must have cost several thousand dollars. The color made her complexion seem even more perfect than usual and brought out the blue of her eyes. Her hair had gone as gray as mine, but somehow she managed to get away with wearing it long and tied back with a single barrette. It looked youthful and chic on Nina and made me feel that my short, artificial curls were glowing with a blue rinse.

Few would suspect that I was four years younger than Nina. Time had been kind to her. And she had Fed more often.

She set down her cup and saucer and moved aimlessly around the room again. It was not like Nina to show such signs of nervousness. She stopped in front of the glass display case. Her gaze passed over the Hummel's and the pewter pieces and then stopped in surprise.

"Good heavens, Melanie. A pistol! What an odd place to put an old pistol."

"It's a heirloom," I said. "A Colt Peacemaker from right after the War Between the States. Quite expensive. And you're right; it is a silly place to keep it. But it's the only case I have in the house with a lock on it, and Mrs. Hodges often brings her grandchildren when she visits."

"You mean it's loaded?"

"No, of course not," I lied. "But children should not play with such things."

"Darn her."

"It's said volumes about Nina that she did not recognize that pistol."

On the day he was killed, Charles Edgar Larchmont had been my beau for precisely five months and two days. There had been no formal announcement, but one went to be married. Those five months had been a microcosm of the era itself—nave, flirtatious, formal to the point of preciosity and romantic. Most of all romantic. The woman who was the most important was the one who was married. We were children playing with loaded weapons.

Nina was more active. She and her friends had a small but strong following. She was Nina Hawkins; she was Nina Hawkins at the party. She as Nina Hawkins of the Hawkinses' Grand Tour Declaring herself smitten—another absurdity of those times—the tall Englishman had followed her from one European capital to another until after being firmly reprimanded by Nina's father (an unimaginative little millionaire who was constantly on the defensive about his doubtful social status) Harrison returned to London to settle his affairs. Some months later she showed up in New York just as Nina was being packed off to her aunt's home in Charleston in order to terminate yet another flirtation. Still unimpressed, the clumsy Englishman followed her south, over mindful of the protocols and restrictions of the day.

We were a gay group. The day after I met Nina at Cousin Celia's June ball, the four of us were taking a hired boat up the Cooper River for a picnic on Daniel Island. Roger Harrison was serious and solemn on every topic was a perfect foil for Charles's irreverent sense of humor. Nina paid no mind to the good-natured jesting, since she was now joining in the laughter with his peculiar haw-haw-haw.

Nina loved it all. "Both gentlemen showed attention on her and although Charles never failed to show the priority of his affection for me, I was not offended by all that."

Nina Hodges was one of those young women who invariably becomes the center of male gallantry and attention in any gathering. Nor were the social strata of Charleston blind to the combined charm of our foursome. For two months of that distant season no party was complete, no excursion adequately planned and no occasion considered a success.
He reads the fine print on our government contracts.
"Oh well another day is digging shot to hell"
paws of Willi's before. It did not matter.

"Why don't we go into the parlor?" I suggested. It was an awkward procession ending with the three of us seated on the heavily upholstered chairs surrounding the Georgian tea table that had been my grandmother's. More tea please Mr. Thorne. Miss Kramer took that as her cue to leave, but Willi's two pawns stood uncertainly by the door, shifting from foot to foot and glancing at the crystal on display as if their mere proximity could break something. I never would have supposed it had not proved to be the case.

"Dense!" Willi snapped his fingers. The Negro hesitated and then brought forward an expensive leather attaché case. Willi set it on the tea table and clicked the catches open with his short broad fingers. Why don't you two see Mrs. Fuller's man about getting something to drink?

When they were gone Willi shook his head and smiled apologetically at Nina.

"Sorry about that Love."

Nina put her hand on Willi's sleeve. She leaned forward with an air of expectancy.

"Melanie wouldn't let me begin the Game without you. Wasn't that awful of me to want to start without you? Willi dear?"

Willi troweled. After fifty years he still bided at being called Willi. In Los Angeles he was Big Bill Borden. When he returned to his native Germany—which was not often because of the dangers involved—he was once again Wilhelm von Borchert lord of dark manor, forest, and hunt. But Nina had called him Willi when they had first met in 1931 in Vienna and Willi had remained.

"You begin Willi dear," said Nina. "You go first."

I could remember the time when we would have spent the first few days of our reunion in conversation and catching up with one another's lives. Now there was not even time for small talk.

Willi showed his teeth and removed news clippings notebooks and a stack of casettes from his attaché case. No sooner had he covered the small table with his material than Mr. Thorne arrived with the tea and Nina's scrapbook from the sewing room. Willi briskly cleared a small space.

At first glance one might see certain similarities between Willi Borchert and Mr. Thorne. One would be mistaken. Both men tended to the florid, but Willi's complexion was the result of excess and emotion. Mr. Thorne had known neither of these for many years. Willi's balding was a patchy, self-consciously concealed thing—a weasel with mange. Mr. Thorne's bare head was smooth and unrinkled. One could not imagine Mr. Thorne ever having had hair. Both men had gray eyes—what a novelist would call cold gray eyes—but Mr. Thorne's eyes were cold with indifference; cold with a clarity coming from an absolute absence of troublesome emotion or thought. Willi's eyes were the cold of a blustery North Sea sailor and were often clouded with shifting curtains of the emotions that controlled him—pride, hatred, love of pain, the pleasures of destruction.

Willi never referred to his use of the Ability as Readings—I was evidently the only one who thought in those terms—but Willi sometimes talked of The Hunt. Perhaps it was the dark forests of his homeland that he thought of as he stalked his human quarry through the sterile streets of Los Angeles. Did Willi dream of the forest? I wondered. Did he look back to green wool hunting jackets, the applause of retainers, the goal of blood from the dying boar? Or did Willi remember the slam of jack boots on cobblestones and the pounding of his lieutenants' fists on doors? Perhaps Willi still associated his Hunt with the dark European night of the ovens that he had helped to oversee.

I called it Feeding. Willi called it The Hunt. I had never heard Nina call it anything.

"Where is your VCR?" Willi asked. "I have put them all on tape."

"Oh Willi," said Nina in an exasperated tone. "You know Melanie. She's so old fashioned. You know she wouldn't have a video player."

"I don't even have a television," I said. "I have a VCR."

"Goddamnit," muttered Willi. "It doesn't matter. I have other records here."

He snapped rubber bands from around the small black notebooks. "It just would have been better on tape. The Los Angeles stations gave much coverage to the Hollywood Strangler and I edited it. Ach! Never mind."

He tossed the videocassettes into his attaché case and slammed the lid shut.

"Twenty-three he said Twenty three since we met twelve months ago. It doesn't seem that long does it?"

"Show us," said Nina. She was leaning forward and her blue eyes seemed very bright. "I've been wondering since I saw that interview on Sixty Minutes. He was yours? Willi? He seemed so—"

"Ja ja, he was mine. A nobody. A timid little man. He was the gardener of a neighbor of mine. I left him alive so that the police could question him. Easiest of all."

He tossed the briefcase. His mind was on his cell next month and afterwards. The press loses interest. But this is more interesting. Look at this."

Willi slid across several glossy black-and-white photographs. The NBC executive had murdered the five members of his family and drowned a visiting soap-opera actress in his pool. He had then stabbled himself repeatedly and written his story in blood on the wall of the bathhouse.

"Reliving old glories Willi?" asked Nina "Death to the miss and all that?"

"No goddamnit. I think it should receive points for irony."

The Girl had been scheduled to drown on the program. It was already in the script outline."

"Was he hard to use? It was my question."

"I was curious despite myself,

"Willi lifted one eyebrow. "Not really. He was an alcoholic and addicted into cocaine."

"There was not much left. And he hated his family. Most people do."

Now that you've set the world on fire enjoy some of the warmth.
"Most people in California, perhaps, said Nina primly. It was an odd comment from Nina. Years ago her father had committed suicide by throwing himself in front of a trolley car.

"Where did you make contact?" I asked.

"A party. The usual place. He bought the coke from a director who had ruined one of my—"

"Did you have the repeat contact?"

Willi frowned at me. He kept his anger under control, but his face grew redder.

"Ja ja. I saw him twice more. Once I just watched from my car as he played tennis."

"Points for irony," said Nina. "But you lose points for repeated contact. If he were as empty as you say you should have been able to use him after only one touch. What else do you have?"

He had his usual assortment. Pathetic skid-row murders. Two domestic slayings. A highway collision that turned into a fatal shooting. I was in the crowd, said Willi. "I made contact. He had a gun in the glove compartment."

"Two points," said Nina.

Willi had saved a good one for last. A once-famous child star had suffered a bizarre accident. He had left his Bel Air apartment while it filled with gas and then returned to light a match. Two others had died in the ensuing fire.

"You get credit only for him," said Nina. "Ja ja."

"Are you absolutely sure about this one?"

It could have been an accident.

"Don't be ridiculous," snapped Willi. "He turned toward me. 'This one was very hard to use.' Very strong. I blocked his memory of turning on the gas. Had to hold it away for two hours. Then forced him into the room. He struggled not to strike the match."

"You should have had him use his lighter," said Nina.

"He didn't smoke. Growled Willi. He gave it up last year."

"Yes," smiled Nina. "I seem to remember him saying that. Johnny Carson."

"I could not tell whether Nina was jesting.

The three of us went through the ritual of assigning points. Nina did most of the talking. Willi went from being sullen to expansive to sullen again. At one point he reached over and patted my knee as he laughingly asked for my support. I said nothing. Finally he gave up crossed the parlor to the liquor cabinet, and poured himself a tall glass of bourbon from father's decanter. The evening light was sending its final horizontal rays through the stained glass panels of the bay windows and it cast a red hue on Willi as he stood next to the oak cupboard. His eyes were small red embers in a bloody mask.

"Forty-one," said Nina at last.

She looked up brightly and showed the calculator as if it verified some objective fact. "I count forty-one points. What do you have, Melanie?"

"Ja," interrupted Willi. "That is fine. Now let us see your claims, Nina. His voice was flat and empty. Even Willi had lost some interest in the Game."

Before Nina could begin, Mr. Thorne entered and motioned that dinner was served. We adjourned to the dining room—Willi pouring himself another glass of bourbon and Nina fluffing her hands in mock frustration at the interruption of the Game. Once seated at the long mahogany table I worked at being a hostess. From decades of tradition talk of the Game was banned from the dinner table. Over soup we discussed Willi's new movie and the purchase of another store for Nina's line of boutiques. It seemed that Nina's monthly column in Vogue was to be discontinued but that a newspaper syndicate was interested in picking it up.

Both of my guests exclaimed over the perfection of the baked ham. But I thought that Mr. Thorne had made the gravy a little too sweet. Darkness had filled the windows before we finished our chocolate mousse. The reflected light from the chandelier made Nina's hair dance with highlights while I feared that mine glanced more blue in the ever-darkening room.

Suddenly there was a sound from the kitchen. The huge Negro's face appeared at the swinging door. His shoulders were hunched against white hands and his expression was that of a querulous child.

"The hell you think we are sitin' here like goddamned—The white hands pulled him out of sight.

"Excuse me," said Mr. Thorne.

Nina poked at her chocolate. There was a sharp bark—a command from the kitchen and the sound of a slap. It was the slap of a man's hand—hard and flat as a small caliber rifle shot. I looked up and Mr. Thorne was at my elbow cleaning away the desert dishes.

"Coffee," said Mr. Thorne. "For all of us."

He nodded and his smile was gentle.

Franz Anton Mesmer had known of it even if he had not understood it. I suspect that Mesmer must have had some small touch of the Ability. Modern pseudosciences have studied it and renamed it. It removed most of its power. Confused its uses and origins, but it remains the shadow of what Mesmer discovered. They have no idea of what it is like to feel.

I despair at the rate of modern violence. I truly give in to despair at times, that deep, futureless pit of despair that poet Gerard Manley Hopkins called carnage comfort. I watch the American slaughterhouse the casual attacks on papal presidents and uncounted others. And I wonder whether there are many more out there with the Ability or whether butchery has simply become the modern way of life. All humans feed on violence. The small exercises of power over another. But few have tasted—as we have—the ultimate power. And without the Ability, few know
the unequaled pleasure of taking a human life. Without the Ability even those who do
feed on life cannot savor the flow of emotions in stalker and victim: the total exhila-
ration of the attacker who has moved beyond all rules and punishments; the strange
almost sexual submission of the victim in that final second of truth when all
options are canceled: all futures denied: all possibilities erased in an exercise of ab-
solute power over another.
I despair at modern violence: I despair
at the impersonal nature of it and the cas-
ual quality that has made it accessible to
so many: I had a television set until I sold
it at the height of the Vietnam War. Those
sanitized snippets of death—made distant
by the camera's lens—meant nothing to
me. But I believe it meant something to
these cattle that surround me. When the
war and the nightly televised body counts
ended: they demanded more and more and
the movie screen and streets of the sweat-
and-dying nation have provided it in medi-
crime mob abundance. It is an addiction
I know well.
They miss the point. Merely observed
violent death is a sad and sullied tapestry
of confusion. But to those of us who have
Fed death can be a sacrament.

My turn! My turn! Nina's voice still re-
ssembled that of the visiting belle who had
just filled her dance card at Cousin Cellie's
Soirée.
We had returned to the parlor. Willi had
finished his coffee and requested a branchy
from Mr. Thorne. I was embarrassed for
Willi. To have one's closest associates show
any hint of unplanned behavior was cer-
tainly a sign of weakening Ability. Nina did
not appear to have noticed
'I have them all in order,' said Nina. She
opened the scrapbook on the now-empty
teaparty table. Willi went through them carefully
sometimes asking a question more often
grunting assent. I murmured occasional
agreement although I heard none of
them. Except for the Beatles: Of course
Nina saved that for the end.
Good God Nina that was you? Willi
seemed near anger: Nina's Feeding had
always run to Park Avenue suicides and
marital disagreements ending in shots
fired from expensive small caliber ladies
guns: This type of thing was more in Willi's
crude style. Perhaps he felt that his terri-
itory was being invaded. I mean you were
asking a lot weren't you? It is so
damn if so public.
Nina laughed and set down the cal-
culator. Willi dear: that's what the Game is
about. Isn't it not?
Willi strode to the liquor cabinet and
refilled his brandy snifter: The wind tossed
bare branches against the leaded glass of
the bay window. I do not like winter. Even
in the South it takes toll on the spirit.
'Didn't this guy what's his name buy
the gun in Hawaii or someplace?' asked Willi
from across the room. 'That sounds like his
initiative to me: I mean if he was already
attacking the fellow—
Willi dear. Nina's voice had gone as
cold as the wind that raked the branches
no one said he was stable. How many of
yours are stable? Willi? But I made it hap-
pen. daring. I chose the place and the
time. Don't you see the irony of the place?
Willi? After that little prank on the director of that
witchcraft movie a few years ago? It was
straight from the script—
'I don't know,' said Willi. 'He sat heavily
on the divan, spilling brandy on his expen-
sive sport coat. He did not notice the
lamplight reflected from his balding skull.
The mottles of age were more visible at
night: and his neck where it disappeared
into his turtleneck was all ropes and tan-
dons.I don't know.' He looked up at me
and smiled suddenly as if we shared a
conspiracy. 'It could be like that writer fel-
low, eh Melanie? It could be like that
Nina looked down at the hands on her
lap: They were clenched and the well-
manicured fingers were white at the tips.

The Mind Vampires. That's what the writer
was going to call his book.
I sometimes wondering if he really would
have written anything: What was his name?
Something Russian.
Willi and I received telegrams from Nina.
Come quickly you are needed. That was
enough. I was on the next morning a flight
to New York. The plane was a noisy pro-
peller-driven Constellation and I spent
much of the flight ensuring the overly so-
lcitous stewardess that I needed nothing.
that indeed I felt fine. She obviously had
decided that I was someone's grand-
mother who was lying for the first time.
SOVIET PLANE

CONTINUED FROM PAGE 126

a woman in orbit to tend equipment and to exploit what happens there—may be the most important service the shuttle provides for the future. He explicitly pointed to the development of the Soviet shuttle as proof that they too are convinced of the value of such services.

This flurry of new data on "Soviet space-shuttle programs" that became public early in 1983 did not really solve any of the mysteries. However, even the first hard evidence for a Soviet shuttle from the Indian Ocean test reflected nothing more than a technology mastered in the mid-Sixties by American space engineers. It seems likely that the Russians will need several years to produce a full-scale manned version ready for testing.

At that rate the vehicle could hardly become operational much before 1990. And it is difficult to imagine any manned orbital missions for a 1990 space plane that couldn't be conducted now by the already available Soyuz-T.

The Soyuz-T is a three-man spacecraft based on the structure of the classic Soyuz but outfitted with entirely new equipment. It began operations in 1981 after an expensive five-year test program. The expense will have to be amortized over years of use—another reason Western observers tend to doubt the imminence of a new Soviet manned space vehicle.

As for the giant shuttle described by the Pentagon and bedeviled by "leaks" of spy-satellites imagery, its purpose is even more questionable than that of the Indian Ocean craft. Perhaps one disturbing answer can be found in Moscow's propaganda blitz against the American space-shuttle program. Soviet news broadcasts consistently portray the NASA spacecraft as carriers of weapons (including H-bombs), weapons platforms, satellite interceptors, and "space pirates" out to kidnap peaceful Soviet scientific satellites.

Conceivably Soviet leaders believe this doctrine, or Soviet military planners fear it. In either case they might decide to create their own system as a counterbalance whatever the cost.

If the Soviets are indeed building such vehicles for this reason, they have allowed gross misperceptions of U.S. intentions and capabilities in space to foster a potentially wasteful technological detour. The project could actually damage any of the really valuable Soviet programs such as their permanent space station. It could even help bring about in reality the scenario the Soviets just imagine at present armed and highly maneuverable space shuttles on combat missions in orbit.

We can only hope that the code name Albatross will prove to be close to the mark that the Soviet space shuttle, in whatever manifestation it finally takes, hovers peacefully aloft, threatening no harm.
ballplayers are a healthy population "full of strong, determined, independent people. Nevertheless, because the players face incredible stress— including constant public scrutiny and the possibility of a sudden early end to their careers—they can often use professional help.

To find out just what strategies to use, Ogilvie, and his contemporaries, generally begin by giving a subject two or three psychometric profiles that yield insights into a player's particular psychological needs. Once the tests are completed the psychologist holds a one- to two-hour interview with the player. For those with serious problems, Ogilvie likes to conduct what he calls a "mini-marathon"— an extended one-on-one encounter. During the 10- or 15-hour session, Ogilvie probes relentlessly for the secret causes of the man's anxieties. Often enough he finds his answers in obvious, startling bursts of revelation. Toward the end of one marathon an athlete who had plummeted seemingly on purpose from the top of his profession suddenly cried: "Daddy why don't you love me?" In an instant Ogilvie knew the man's triumphs were meaningless because they brought no parental acceptance.

Athletes like that young man, Ogilvie notes, might need intensive counseling. But for most professional ballplayers the basic techniques are used as "performance enhancement strategies" designed to ease anxieties caused by the game itself.

The first step in reducing an athlete's anxiety is teaching him to relax, says Bill Little, who has counseled members of the St. Louis Cardinals for more than four years. Any relaxation technique from yoga to transcendental meditation can help but, the psychologist says, the best technique is usually hypnosis. Little usually tapes hypnosis sessions so that the athlete can listen to them on his own whenever he's feeling anxious. After enough run-throughs with the tape, Little says Little the player can induce his own relaxation, even when he's on the field.

In the relaxed state, adds Ogilvie, the player enters a sort of "emotional isolation chamber" a state in which he can concentrate better pinpointing the specific cues and causes of his tension. During one relaxation session, a pitcher recalled that whenever he walked a batter he felt a searing pain behind his shoulder. This was the cue, says Ogilvie, that he was losing his confidence and tensing up.

To correct such tension triggers, a psychologist may take the player through a series of visualizations, using the player's memory of himself performing at his best. "If he's a pitcher," says Little, "you have him envision himself on the mound, and you lead him through every motion, from the time the catcher gives the signal, to the moment when the ball curves perfectly and settles in the strike zone. After he has rehearsed these visualizations enough times, the imagery of success will eventually overcome the imagery of failure.'

In addition, Ogilvie says, the sports psychologist tries to cultivate a player's "language of success"— the way he speaks to himself when he is in command of a situation. When a pitcher who gives up a few hits keeps saying to himself "I'm screwing up again, the manager's going to pull me any minute" it's liable to become a self-fulfilling prophecy. The psychologist gets the player to look at his hand and say such things as "You beautiful son of a bitch, you're gonna make me a million dollars!"

Though many of the teams in baseball have dabbled in psychological techniques one of kind or another, the Philadelphia Phillies may be the first to wholeheartedly embrace them. In addition to referring troubled players to New Jersey psychiatrist Tom McGinnis, the team also has access to a couple of very effective psychological weapons right in the clubhouse.

First of all, team trainer Jeff Cooper keeps a 4' x 5' x 8' fiberglas float tank tucked away in his training room. An athlete can lie in it on his back in the solution of Epsom salts and float as easily as if he were lying on an inner tube. The tank is pitch black inside, and the athlete's ears are stuffed with plugs; he can neither hear nor see. In this relaxed, isolated state freed of distractions, he can concentrate on marshaling his physical and emotional resources.

An even more important protector of the Phillies' mental hygiene is Gus Hoefling, the team's strength and flexibility trainer. The title understates Hoefling's function since he actually uses everything from kung fu to hypotherapy to toughen up his charges. Of all Hoefling's techniques, the most avant garde is his "breakthrough environment chamber," a computer-operated cubicle that combines many of the performance-enhancement strategies in one neat package. At the center of the blue-carpeted room sits a reclining massage chair that faces a painting of a shoreline. When a player sits back in the chair, Hoefling closes the door and hits a button. Within seconds the chair heats up and rolls massage the athlete's back muscles. The lights begin dimming and a soothing voice fills the room: "Relax, you are going on a journey. For the next half-hour a hypnototherapeutic tape of Hoefling's voice leads the athlete through relaxation exercises, words of encouragement, and such subliminal instructions as "I will keep control..."

Hoefling has a personalized tape for each player who uses the chamber, and he changes the messages according to the player's needs. If a player has been downing a few too many drinks lately, for example, Hoefling may sneak in a subliminal message such as "Alcohol is bad for my body" to help him break the habit. As the tape ends, the lights slowly brighten simulating dawn on the picture of the ocean. The athlete usually emerges feeling relaxed, positive and in the best possible mood for a day of long, hard work.

Several Phillies sing Hoefling's praises, but none sing louder than the usually taciturn Steve Carlton, whom many consider to be the greatest living pitcher. When Carlton came to the Phillies in the early Seventies he had a respectable lifetime winning percentage of .566, but he had yet to realize his full potential. Since giving himself over to Hoefling's mind-body over haul, he has had one 20-game-win season after the next, brought his percentage up to an incredible .658 and recently broken the all-time record for strikeouts. Like a religious zealot, Carlton comes early to the stadium before each game, spends his half hour in the breakthrough-environment chamber then two or more hours following Hoefling's regimen of weight training, stretching and meditation. As the pièce de résistance, each afternoon he and Hoefling head off to the lawns around the stadium for a session of kung fu.

Devises like Hoefling's chamber may be important experiments in sports psychology but professionals like Tom McGinnis think that the most important goal for teams is to take on full-time clinical psychologists to predict what will happen as the problems of drug and alcohol abuse worsen. As more open-minded college educated players come into the game such an enlightened time may not be that far off. In the past few years alone, Ogilvie has helped inaugurate a Ph D program in sports psychology at the United States International University in San Diego, and an associated research center called The Institute for Athletic Motivation. Last year the St. Louis Cardinals became the first Major League club to openly take on a part-time team psychologist when they hired Little to provide counseling services throughout spring training and at all home games. And in the even harder nosed sport of professional ice hockey, the Philadelphia Flyers took on Dr. Julie Anthony as the first full time team psychologist in the history of professional athletics. Most important, more athletes are using psychological techniques to realize their full abilities—and to protect their careers.
Meteorologist Bill Hele was cruising the Taconic State Parkway in Westchester County, New York, when he saw a checker-mark-shaped object with six prismatic lights. The row of multicolored lights blinked off for a moment, Hele recalls, then shifted to brilliant green. The whirling form was almost 1,000 yards across, he adds and hovered 1,000 feet in the air. Two or three minutes later it gradually drifted to the north and out of view.

So began the most spectacular display of UFOs in the history of New York State and possibly the nation. On three consecutive Thursday nights as well as a couple of Friday and Saturday nights, from March 17 through March 31, 1983, hundreds of people around Westchester reported a boomerang-shaped object that hovered soundlessly and shot dazzling rays of light.

Within days of the first sighting accounts were appearing in newspapers throughout the country. And the mounting reports soon reached Phil Imbrogno, a Westchester science teacher and field investigator with the Center for UFO Studies, based in Evanston, Illinois. Imbrogno co-investigator George Lesnick and J. Allen Hynek, director of the center, quickly launched an in-depth investigation interviewing witnesses and cross-matching data with an Apple II computer. Doctors, lawyers, nurses, heads of corporations and housewives, the team found all gave descriptions that matched Hele's. Even a group of striking Metro-North trainmen were startled to see the spectacular lights over their picket line in Brewster.

The saucer-investigation squad also came up with some bizarre contradictions. Simultaneous sightings in towns miles apart suggested the presence of more than one object. And hundreds of sightings in five Connecticut towns a month after the Westchester incidents indicated a possible hoax. Witnesses described engine sounds and maneuvers that could not have been performed by a formation of small planes trying to mimic the original open V. Such reports, in fact convinced one local Federal Aviation Administration official that a group of top-notch pilots flying out of the tiny Stormville airport in Dutchess County, New York, had manufactured the glowing UFO.


As for Hynek, he says the case is one of the most unusual he's ever seen. Most UFO sightings occur in lonely back roads in places like Oklahoma, he notes. But this UFO was seen in a relatively urban area over a number of days with a broad spectrum of witnesses.

Well-known UFO critic and aerospace journalist Philip Klass also ventured an opinion. "I've been investigating UFO reports for seventeen years," he commented, "and have yet to find an indication of an unknown or extraterrestrial phenomenon. If I could take a test to prove me, it could be that for the first time in seventeen years this is an unexplainable case." - TONIA SHOUMATOFF
MAMMOTH BURGERS

Next time you visit Siberia, you might be offered some exotic culinary fare: mammoth meat, roasted or fried. The mammoth, that hairy ancestor of today's elephant, has been presumed extinct for thousands of years. But people have reported eating the animal's frozen remains for centuries. During the Twenties, tourists visiting Siberia claimed they feasted on mammoth flesh. It's been rumored that Russian scientists occasionally gather for mammoth banquets. And just recently a group of Soviet construction workers caused a stir among paleontologists by preparing mammoth meat for their dogs.

The issue came to a head last year at a Helsinki symposium on mammoth tissue. Some researchers suggested that mammoth meat may still be roaming the Siberian plains. And zoologist Nikolai Vereshchagin of the Soviet Academy of Sciences even proposed cloning a new mammoth herd from a few frozen cells.

American researchers who examined the frozen mammoth tissue, however, cast doubt on such plans. Paleontologist David Webb of the Florida State Museum in Gainesville, for instance, found the flesh was poorly preserved. "By and large, Webb said, the specimens were about fifty percent sludge and fifty percent real cells: and the chance of cloning them is pretty slim with today's technology.

Eating the disintegrating flesh may not be too good an idea, either. Geologist Robert M. Thorson of Fairbanks is presently excavating a local partially preserved mammoth. Though he hasn't had the chance to taste mammoth meat, he did sample the flesh of a bison found in permafrost sediments 30,000 years old. The piece he tasted pretty bad," Thorson says. Colleagues who ate mammoth meat also found the quality "a lot to be desired," he adds. But at least no body's gotten sick.

Soviet geologists and spiritualists alike regard them as sacred. And in just three years, the group has grown from a phone line in Big Sur to a 24-hour referral service, with on-call counselors in 32 countries. Workers are currently organizing retreats for long-term care.

"If understood and treated as difficult, confusing or dramatic stages in a natural developmental process, these experiences can be regarded as transformative and evolutionary; they don't have to be dark nights of the soul.

SEN asks troubled ESPers and past-lifers for potential counselors. To call the network at (408) 667-2151. Sandor Hansen, 32-year-old counselor, says, "For whatever a man may do, he does it in order to annihilate time in order to rework it and that revocation is called space.

Hermann Broch
BLUE DEMON

Most high schools have a mascot—usually a panther or a knight—displayed on football helmets, athletic jackets, and class rings. But at Christiansburg High School in Christiansburg, Virginia, the mascot is a bit more diabolical: a blue demon complete with horns, goatee, flowing cape, and pitchfork.

The Christiansburg Blue Demon has been trayed on ships and in a foot-high painting in the school gym for decades. But now a group called Parents Against Demons is trying to get that changed. "Demons are real," explains mother and group founder Diane Kitts. "And they do evil things in the world. I don't want my kids cheering the devil." Kitts, who attended Christiansburg High School herself, took petitions to area churches, collecting 500 signatures against the symbol. As a result, school principal Sam Lucas put the issue to a vote last spring. The student body decided by a 96 percent margin to keep the demon much to the relief of school officials. (It would have cost the school system some $30,000 to replace the demon logo on rings, uniforms, and more.)

Unfortunately, the students thought we were criticizing them," Kitts noted. "But I'm not saying that there is anything satirical about them."}

VULTURES OF GETTYSBURG

Each winter hundreds of vultures descend on the cannons and monuments of Gettysburg National Military Park. The carrion eating birds—labeled by myth and history as sentinels of death—roost amid the grapevines, and their droppings cover the ground like a heavy dusting of snow.

Black vultures and turkey vultures, says park resource specialist Harold J. Greenlee, have been visiting the Pennsylvania site for at least a century. But now Greenlee and colleagues have launched a study to find out why the group's prime theory. The birds were attracted to the area on July 1, 1863, after the start of one of the bloodiest battles of the Civil War.

After three days of fighting, says Greenlee, Plum Run, a small stream that flows through the battlefield, ran red with blood. Nearly 50,000 men lay slaughtered or dying. And thousands of dead horses covered the ground for months. The birds roosted on Little Round Top and Big Round Top fields where some of the heaviest battles took place.

"The voice of the vultures sounded different, and it was loud," says Greenlee. "We want to explain to the public why they are here." Greenlee says that vultures are attracted to battlefields because the area is rich in nutrients from the blood and flesh of the dead. They continue to roost in the national park and other areas where there is a high concentration of wildlife.

"You can't blow dust away without making a lot of people cough," —Prince Philip, Duke of Edinburgh
Are the United States and the Soviet Union sending people to Mars? Yes, according to the book *Alternative 003*. The kidnapped zombies, the book explains, are building a Martian retreat for geniuses hand-picked to create a master race and rule the universe. Once the colonies are built the zombies will be destroyed.

*Alternative 003* is only a joke, of course, was published on April Fool's Day of 1977 by Avon. But despite the book's obviously outlandish claims has convinced and terrified readers around the world.

To make his book believable, author Leslie Watkins admits he mixed fiction with a twisted version of the truth. For instance he

1. The STANISLAV DEDDUKOVIC, an official of the British House of Lords, has long been responsible for the first UFO Investigation Committee in British history. Let's face it, says the 11th countess president, every UFO can be explained in this *Alternative 003*. It may be the omens that I probably a most horrible copy of the Third Reich.

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**ALLEMAGE ZAUR**

**EARL OF CLANCARTY**

The Aquatic Apes was recently published in the United States by Stein and Day. It is better served by a layer of fat on the inside of its skin than by a layer of hair on the outside of it.

Speech would not have emerged as an aid to the hunt, either Morgan continues, adding that primitive tribes surviving today hunt in silence despite their use of language. More likely speech became essential to prehistoric man when the need to swim and dive cut down on eye-to-eye contact making facial expressions difficult to read.

Morgan also notes that while human tears distinguish our species as the weeping primates seals and other sea mammals cry as well. "If we view man as a land animal, he says, he is unique and inexplicable. If we view him as an ex-aquatic, he is conforming to the general pattern in the absence of fossil evidence for the missing link," contends Morgan. The aquatic theory makes as much sense as other arguments formulated to fill the gap.

"History is more or less bunk."

—Henry Ford
wished more than nine matches ever beat an opponent who has lost seven. That had been the case with Takanaka. Eight was the number of wins needed to maintain current ranking.

"I could feel him going," said Pekowski in Polish. "I think we should talk to him about the May tournament."

Have you mentioned this to his stablemaster?

"I thought of doing so after the tournament. I was hoping you could come with me to see him.

"He'll be just another retired wrestler by then."

Takanaka respects you above all the others. Your damatsu shiki ceremony won't be for another two weeks. They won't have cut off all your hair yet. And while we're at it, I still wish you would change your mind.

Perhaps I could be Takanaka's decoy. I have the ceremonial cloth for him when he enters his last tournament. I would be honored.

"Good! You'll come with me then Friday morning?"

Yes.

The hosts were much drunker than the wrestlers. Nayakano the stablemaster was feeling no pain but still remained upright. Mounds of food were being consumed. A businessman tried to grab a waitress. This was going to become every bit as nasty as all such parties.

"A song! A song!" yelled the head of the fan club, a businessman in his sixties. "Whom will we favor with a song?"

Man-Mountain Gentian got to his feet and went over to the musicians. He talked with the samisen player. Then he stood facing his drunk attentive audience.

"How many of these parties had he been to in his career? Two, three hundred? Always the same drunkenness, discord, braggadocio on the part of the host clubs. Some fans really loved the sport, some lived vicariously through it. He would not miss the parties. But as the player began the tune he realized this might be the last party he would have to face.

He began to sing.

"I met my lover by still Lake Biwa just before Taira war banners flew
And so on through all six verses in a clear pure voice belonging to a man half his size
They stood and applauded him, some of the wrestlers in the stable looking away as only they, not even the stablemaster knew of his retirement plans and what this party probably meant.

"He went to the stablemaster who took him to the club host. Made apologies concerning the tournament and a slight cold shook his hands. Bowed and went out into the lobby where the hostess valiantly brought him his shoes and overcoat. He wanted to help her but she restooded the coat grimly and brought it to him.

He handed her a tip and signed the autograph she asked for.

It had begun to snow outside. The noon sun made the sky a swirling, multicolored smudge. Man-Mountain Gentian walked through the quickly emptying streets. Even the ever-present taxis scurried through the snow like raucous from a light. His home was only two kilometers away. He liked the stillness of the falling snow, the quietness of the city in times such as these.

Shelter for a stormy night? asked a ragged old man on a corner. Man-Mountain Gentian stopped.

Change for shelter for an old man? asked the beggar again looking very far up at Gentian's face.

Man-Mountain Gentian reached in his pocket and took out three or four small ornate paper envelopes that had been thrust on him as he left the club.

The old man took them opened one
Then another and another.

There must be more than eight hundred thousand yen here, he said very quietly and very slowly.

I suggest either the Imperial or the Hilton," said Man-Mountain Gentian then he
wrestler turned and walked away.

The old man laughed; then straightened himself with dignity and stepped to the curb and imperiously summoned an approaching pedicab.

Melissa was not home.

"He turned on the entry light as he took off his shoes. He passed through the sparsely furnished, low living room turned off the light at the other switch. He went to the bathroom and put depilatory gel on his face, wiped it off. He went to the kitchen, picked up half a ham, and ate it, washing it down with three liters of milk. He returned to the bathroom, brushed his teeth, went to the bedroom, unrolled his futon, and placed his cinder block at the head of it.

He punched a button on the hidden tape deck, and an old recording of Kimo Eto playing 'Ruokodan' on the koto quietly filled the house.

The only decoration in the sleeping room was Shuncho's print 'The Strongest and the Most Fair' showing a theater district beauty and a 'sumator' three times her size. It was hanging on the far wall.

He turned off the light. Instantly the silhouettes of falling snowflakes showed through the paper walls of the house cast by the strong streetlight outside. He watched the snowflakes fall as he listened to the music; and he was filled with monotonous awareness of the transience of beauty in the world.

Man-Mountain Gentian pulled up the puffed cotton covers. He put his head on the building block and drifted off to sleep.

They had let Haru off at his house. The interior of the runabout was warm. They were drinking coffee in the near-empty parking lot of Tokyo Sonic #113.

"I read somewhere you were an architect," said Killer Kudzu.

"Barely," said Melissa.

"Would you like to see Kudzu House?" he asked.

For an architect, it was like being asked to one of Frank Lloyd Wright's vacation homes. For a child of bird-like buildings designed by Eero Saarinen in the later twentieth century, Melissa considered.

"I should call home first," she said after a moment.

"I think your husband will still be at the Nue Vue Club whooping it up with the money men.

"You're probably right. I'll call him later. I'd love to see your house.

"The old man lay dying on his bed.

"I see you finally heard," he said. His voice was tired.

Man-Mountain Gentian had not seen him in seven years. He had always been old but he had never looked this old. This week.

Dr. Wu had been his mentor. He had started him on the path toward Zen hump (though he did not know it at the time). Dr. Wu had not been one of those cryptic koans.
spouting quiet men. He had been boisterous, laughing, playing with his pupils yelling at them, whatever was needed to get them to see.

There had been the occasional letter from him. Now for the first time there was a call in the middle of the night.

"I'm sorry," said Man-Mountain Gentian. "It's snowing outside.

"At your house too?" asked Dr. Wu.

Wu's attendant was dressed in Buddhist robes and seemingly paid no attention to either of them.

"Is there anything I can do for you?" asked Man-Mountain Gentian.

"Physically no. This is nothing a pain shot can help. Emotionally, there is no answer.

"You can win tomorrow, though I won't be around to share it.

"Man-Mountain Gentian was quiet a moment. "I'm not sure if I can promise you that. Either way, I'll be done with you at the end of the day."

"If it didn't mean anything to you, you could have lost by now," said Dr. Wu.

"No. Not at all. I think I've finally come up against something new and strong in the world. I will either win or lose. Either way, I will retire.

"If it didn't mean anything to you, you could have lost by now," said Dr. Wu.

"Man-Mountain Gentian was quiet again.

Wu shifted uneasily on his pillows. Well there is not much time. Lean close. Listen carefully to what I have to say.

The novice Itsu went to the Master and asked him, "Master, what is the key to all enlightenment?"

"You must teach yourself never to think of the white horse," said the Master.

"Itsu applied himself with all his being. One day while raking gravel he achieved insight.

"Master! Master!" yelled Itsu running to the Master's quarters. "Master, I have made myself not think about the white horse!"

"Quick!" said the Master. "When you were not thinking of the horse, where was Itsu?"

The novice could make no answer.

The Master dealt Itsu a smart blow with his staff.

At this, Itsu was enlightened.

Then Dr. Wu let his head back down on his bed.

"Goodbye!" said Dr. Wu.

In his bed in the lamasery in Tibet, Dr. Wu let out a ragged breath and died.

Man-Mountain Gentian standing in his bedroom in Tokyo began to cry.

Kudzu House took up a city block in the middle of Tokyo. The taxes alone must have been enormous.

Through the decreasing snow, Melissa saw the lights. Their beams stabbed up through the night. All that she could see from a block away was the tangled kudzu.

Kudzu was a vine originally transplanted from China, raised in Japan for centuries. Its crushed root was used as a starch base in cooking; its leaves were used for teas and medicines; its fibers to make cloth and paper.

What kudzu was most famous for was its ability to grow ever and cover anything that didn't move out of its way.

In the Depression Thirties of the last century, it had been planted on road cuts in the southeastern United States to stop erosion. Kudzu had almost stopped progress there. In those ideal conditions it grew runners more than twenty meters long in a single summer, several to a root. Its vines climbed utility poles, hills, trees. It completely covered other vegetation, cutting off its sunlight.

Many places in the American south were covered three kilometers wide to each side of the highways with kudzu vines. The Great Kudzu Forest of central Georgia was a U.S. national park.

In the bleaker conditions of Japan, the weed could be kept under control. Except that this owner didn't want it to. The lights playing into the snowy sky were part of the heating and watering system that kept vines growing year-round. All this Melissa had read. Seeing it was something again.

The entire block was a green tangle of vines and lights.

"Do you ever trim it?" she asked.
The traffic keeps it back,' said Killer Kudzu and he laughed. 'I have gardeners who come in and fight it once a week. They're losing!'

They went through the green tunnel of a driveway Melissa saw the edge of the house cast concrete as they dropped into the sunken vehicle area.

There were three boats, four road vehicles, a Hovercraft and a small sport flyer parked there.

Lights shone up into a dense green roof from which hundreds of vines grew downward toward the light sources.

'We have to move the spotlights every week,' he said.

A butler met them at the door. 'Just a tour, Mrs,' said Killer Kudzu. 'We'll have drinks in the sitting room in thirty minutes.'

Very good, sir.'

This way,' Melissa went to a railing. The living area was the size of a bowling alley or the lobby of a terrible old hotel.

The balcony on the second level jutted out from the east wall. Killer Kudzu went to a console punched buttons.

'Moe and the Meanies boomed from dozens of speakers.'

Killer Kudzu stood snapping his fingers for a moment. 'Oh send me! Honorable cats!' said That's from Spike Jones and irreverent American musician of the last century. He died of cancer,' he added. 'Melissa followed him noticing the things everyone noticed—the Chrome Room, the Supercharger Inhalatorium. The archery range (the object is not to hit the target said Kudzu) the Mosasaur Pool with the lizards embedded in the sides and bottom.

She was more affected by the house and its overall tawdriness than she thought she would be.

'You've done very well for yourself. Some manage it, some give it away, some save it. I spend it.'

They were drinking kudzu tea highballs in the sitting room which was one of the most comfortable rooms Melissa had ever been in.

'Tasteless, isn't it?' asked Killer Kudzu.

'Not quite,' said Melissa. 'It was well worth the trip.'

'You could stay here, you know,' said Kudzu.

'I thought I could.' She sighed. 'I would only give me one more excuse not to finish the dishes at home,' She gave him a long look. 'No thank you. Besides, it wouldn't give you an advantage in the match.'

'That really never crossed my mind.'

'I'm quite sure.'

'You are a beautiful woman.'

'You have a nice house.'

'Hmmm. Time to get you home.'

'I'm sure.'

They sat outside her house in the cold. The snow had stopped. Stars peeped through the low cloud.

'I'm going to win tomorrow, you know,' said Killer Kudzu.

'You might,' said Melissa.

'It is sometimes possible to do more than win,' he said. 'I'll tell my husband.'

'My offer is always open,' he said. 'He reached over and opened her door on the runabout. Life won't be the same after he's lost. Or, after he retires.'

She climbed out, shaking from more than the cold. He closed the door and whipped the vehicle in a circle and was gone down the crunching street. He blinked his lights and was gone out of sight.

She found her husband in the kitchen. His eyes were red. He was as pale as she had ever seen him.

'Dr Wu is dead,' he said. 'And wrapped his huge arms around her covering her like an uprooted sofa.'

He began to cry again. She talked to him quietly.

'Come to bed. Let's try to get some sleep.' she said.

No. I couldn't rest. I wanted to see you first. I'm going down to the stable.' She helped him dress in his warmest clothing. He kissed her and left, walking the few blocks through the snowy sidewalks to the training building.

The junior wrestlers were awakened at four a.m. They were to begin the day's work of sweeping, cleaning, cooking breakfast and catering to the senior wrestlers. When they came in they found him stripped to his mawashi at the three hundred kilo push bag. Pushing, pushing, straining, crying all the while not saying a word. The floor of the arena was torn and grooved.

They cleaned up the area for the morning workouts. One junior wrestler following him around with the sand trowel.

At seven a.m. he slumped exhausted on a bench. Two of the jurio covered him with quilts and set an alarm clock beside him for one in the afternoon.

Your opponent was at the ball game last night,' said Nayakano the stablemaster.

Man-Mountain Gentian sat in the dressing room while the barber combed and greased his elaborate chonmage. Your wife asked me to give you this.

It was a note in a plain envelope addressed in her beautiful calligraphy. He opened and read it:

Her letter warned him of what Kudzu said about more than winning the night before and wished him luck.

He turned to the stablemaster.

Had Killer Kudzu injured any opponent before he became yokozuna? the last tournament? Man-Mountain asked.

Nayakano's answer was immediate. 'No. That's unheard of. Let me see that note.'

He reached out.

Man-Mountain Gentian put it back in the envelope. Tucked it under his arm. 'Should I alert the judges?'

'Sorry, I shouldn't have mentioned it,' said Man-Mountain Gentian.

'I don't like this,' said the stablemaster.
Three hefty junior wrestlers ran in to the dressing room carrying Gentian’s kesho mawashi between them.

The last day of the January tournament always packed them in. Even the maega shira and komusobi matches in which young boys threw each other or tried to draw enough of an audience to make the novices feel good.

The call for the ozeki class wrestlers came, and they went through the grand entrance ceremony wearing their great kesho-mawashi aprons of brocade, silk and gold, while their dew-swept faces, ceremonial and smiling, drew young mawashi.

There the referee flipped his fan. Gorilla Tsunami felled a man in a heap, then wriggled backwards out of the ring.

Then the yobidashi said, “East—Man-Mountain Gentian West—Killer Kudzu.”

They turned their shirts. Each threw a salt twice, mixing once. Then Man-Mountain Gentian moving with the grace of a dancer, lifted his right leg and stamped it into his left, and the sound was like the double echo of a cannon throughout the stadium.

He went immediately to his mark.

Killer Kudzu jumped down to his mark glaring at his opponent across the meter that separated them.

The yobidashi, Guard, took a few seconds to turn sideways to them and bring his fan into its position.

In that time, Man-Mountain Gentian could hear the quiet hum of the electrical grid, hear muffled intake of breath from the other wrestlers. Hear a whistle in the nostril of the north side judge.

“Huu!” said the referee and his fan jerked.

Man-Mountain Gentian felt as though two freight trains had collided in his head. There was a snap as his muscles went tense all over and the momentum of the explosion in his brain began to push at him, threatening to make him give or tear through the back of his head.

His feet were on a slippery sandy bottom; neck high wave crests smashed into him. A no tide was pushing at his shoulder at one side, pulling his legs up twisting his muscles. He could feel his eyes pushed back in their sockets as it by iron thumbs ready to pop them like ripe plums. His ligaments were iron wires stretched tight on the turnbuckles of his bones. His arms ended in strands of noodles: his face was soft cheese.

The sand under him was soft, soft, and he knew that all he had to do was to sink it. Let go. Cease to resist.

And through all that haze and blunting he knew what it was that he was not supposed to think about.

Everything quit. He reached out one mental hand, as big as the sun as fast as light as long as time and he pushed against his opponent’s chest.

The lights were back; he was in the stadium in the arena and the dull pounding was applause screams.

Killer Kudzu lay blinking among the ring bales.

“Hooves? Man-Mountain Gentian heard him ask in bewilderment before he picked himself up.

Man-Mountain Gentian took the envelope from the referee with three quick chopping motions. Then made a tourth to the audience and they knew then and only then that they would never see him in the ring again.

The official clock said 0.981 second.

“How did you do it, Man-Mountain?” asked the Tokyo paparazzi as the wrestler showered out his chon-mage and put on his clothes. He said nothing.

He met his wife outside the stadium. A lone newsman was waiting with her ‘Scoop’ Hakomoto.

“For old times sake,” begged Hakomoto, “How did you do it?”


“He didn’t think about the white horse,” she said. They left the newsman standing there staring.

Killer Kudzu, tired and pale, was getting in his vehicle. Hakomoto came running up.

“What’s all this? I hear about Gentian and a white horse?” he asked.

Kudzu’s eyes widened then narrowed. “No comment,” he said.

That night to celebrate Man-Mountain Gentian took Melissa to the Beef Bowl.

He had seventeen orders and helped Melissa finish her second one.

They went back home climbed onto their futons and turned on the TV.

Gilligan was on his island. All was right with the world.
Willi managed to arrive twenty minutes before Nina was distraught and as close to hysterics as I had ever seen her. She had been at a party in lower Manhattan two days before—she was not so distraught that she forgot to tell us what important names had been there—when she found herself sharing a corner a fondue pot and confidences with a young writer. Or rather the writer was sharing confidences. Nina described him as a scruffy sort with a wispy little beard. thick glasses; a corduroy sport coat worn over an old plaid shirt—one of the type invariably sprinkled around successful parties of that era, according to Nina. She knew enough not to call him a beatnik for that term had just become passe but no one had yet heard the term hippie, and it wouldn't have applied to him anyway. He was a writer of the sort that barely eked out a living these days at least by selling blood and doing novelizations of television series Alexander something.

His idea for a book—he told Nina that he had been working on it for some time—was that many of the murders then being committed were actually the result of a small group of psychic killers. He called them mind vampires who used others to carry out their grisly deeds.

He said that a paperback publisher had already shown interest in his outline and would offer him a contract tomorrow if he would change the title to "The Zombie Factor" and put in more sex.

"So what?" Willi had said to Nina in disgust. "You have me fly across the continent for this? I might buy the idea myself! That turned out to be the excuse we used to interrogate this Alexander somebody during an impromptu party given by Nina the next evening. I did not attend. The party was not overly successful according to Nina but it gave Willi an opportunity to have a long chat with the young writer would be novel. In the writer's almost pitiable eagerness to do business with Bill Borden, producer of Paris Memoirs. Three on a Swing, and at least two other completely forgettable Technicolor features touring the drive-ins that summer. He revealed that the book consisted of a well-worn outline and a dozen pages of notes.

He was sure, however, that he could do a treatment for Mr. Borden in five weeks, perhaps even as fast as three weeks if he were flown out to Hollywood to get the proper creative stimulation.

Later that evening we discussed the possibility of Willi simply buying an option on the treatment, but Willi was short on cash at the time, and Nina was insistent. In the end the young writer opened his femoral artery with a Gillette blade and ran screaming into a narrow Greenwich Village side street to die. I don't believe that anyone ever bothered to sort through the clutter and debris of his remaining notes.

"It could be like that writer, ja, Melanie? Willi patted my knee. I nodded. "He was mine," continued Willi. "And Nina tried to take credit. Remember?"

Again I nodded. Actually he had been neither Nina's nor Willi's. I had avoided the party so that I could make contact later with the young man noticing he was being followed. I did so easily. I remember sitting in an overheated little delicatessen across the street from the apartment building. It was over so quickly that there was almost no sense of Reading. Then I was aware once again of the retching radio-tors and the smell of salami as people rushed to the door to see what the screaming was about. I remember finishing my tea slowly so that I did not have to leave before the ambulance was gone.

Nonsense!" said Nina. She busied herself with her little calculator. "How many points?" She looked at me. I looked at Willi.

"Six," he said with a shrug. Nina made a small show of totaling the numbers.

"Thirty-eight", she said and sighed the_atrically. "You win again Willi. Or rather, you beat me again. We must hear from Melanie. You've been so quiet. Do you have some surprise for us?"

"Yes," said Willi. "It is your turn to win. It has been several years." "None," I said. I had expected an explosion of questions, but the silence was broken only by the ticking of the clock on the mantelpiece. Nina was looking away from me at something hidden by the shadows in the corner.

"None?" echoed Willi.

"There was—" I said at last. "But it was by accident. I came across a man behind the counter, and it was completely by accident."

Willi was agitated. He stood up, walked to the window, turned an old straight-back chair around, and opened it, arms folded. "What does this mean?"

You're quitting the Game?" said Willi as she turned to look at me. I let the question surface as the answer.

"Why?" snapped Willi. "In its excitement it came out with a hard v."

If I had been raised in an era when young ladies were allowed to shrug, I would have done so. As it was, I contained myself by running my fingers along an imaginary seam on my skirt. Willi had asked the question, but I stared straight into Nina's eyes when I finally answered. "I'm tired. It's been too long. I guess I'm getting old."

"You'll get a lot older if you do not Hunt," said Willi. "His body had the voice of the red mask of his face, everything signaled great anger just kept in check. "My God, Melanie, you already look older! You look terrible. This is why we hunt, woman. Look at yourself in the mirror. Do you want to die an old woman just because you're tired of using them? Willi stood and turned his back.

"Nonsense!" Nina's voice was strong..."
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confident, in command once more! Melanias tired. Willi! Be nice. We all have times like that. I remember how you were after the war. Like a whipped puppy. You wouldn't even go outside your miserable little flat in Bacter. Even after we helped you get to New Jersey you just sulked around feeling sorry for yourself. Melanie made us the Game to help you feel better. So quiet! Never tell a lady who feels tired and depressed that she looks terrible. Honestly, Willi, you're such a Schwachsanger sometimes. And a crashing door to boot.

I had anticipated many reactions to my announcement, but this was the one I feared most. It meant that Nina had also tired of the Game. It meant that she was ready to move to another level of play.

It had to mean that.

"Thank you, Nina darling," I said. I knew you would understand.

She reached across and touched my knee reassuringly. Even through my wool skirt, I could feel the cold of her fingers.

My guests would not stay the night. I implored. I remonstrated. I pointed out that their rooms were ready that Mr. Thorne had already turned down the quilts.

"Next time," said Willi. "Next time, Melanie, my little love. We will make a weekend of it as we used to. A weekend! Willi was in a much better mood since he had been paid his thousand-dollar prize by each of us. He had sulked, but I had insisted. It soothed his ego when Mr. Thorne brought in a check already made out to William D. Borden.

Again I asked him to stay but he protested that he had a midnight flight to Chicago. He had to see a prize-winning author about a screenplay. Then he was hugging me goodbye. His companions were in the hall behind me, and I had a brief moment of terror.

But they left. The blond young man showed his white smile and the Negro bobbed his head in what I took as a fare well. Then we were alone.

"Nina and I were alone. Not quite alone. Miss Kramer was standing next to Nina at the end of the hall. Mr. Thorne was out of sight behind the swing-ing door to the kitchen. I left him there.

Miss Kramer took three steps forward. I felt my breath stop for an instant. Mr. Thorne put his hand on the swinging door. Then the husky little brunette opened the door to the half closet, removed Nina's coat, and stepped back to help her into it.

"Are you sure you won't stay?"

"No, thank you, darling. I've promised to take Miss Barrett that we would drive to Hilton Head tonight."

"But it's late."

"We have reservations. Thank you anyway. Melanie and I will be in touch."

"Yes."

"I mean it clear. We must talk. I understand exactly how you feel, but you have to remember that the Game is still impor-tant to Willi. We all have to find a way to end it without hurting his feelings. Perhaps we could visit him next spring in Kranhalle or whatever he calls that gloomy old Bavarian place of his. A trip to the Continent would do wonders for you, dear."

"Yes."

"I will be in touch. After this deal with the new store is settled. We need to spend some time together. Melanie and the two of us, like old times."

Her lips kissed the air next to my cheek. She held my forearms tightly. "Good-bye, darling."

"Good-bye, Nina."

I carried the brandy glass to the kitchen.

Mr. Thorne took it in silence.

Make sure the house is secure," I said. He nodded and went to check the locks and alarm system. It was only nine forty-five. But I was very tired. Age. I thought I went up the wide staircase, perhaps the finest feature of the house and dressed for bed. It had begun to storm, and the sound of the cold raindrops on the window carried a sad rhythm to it.

Mr. Thorne looked in as I was brushing my hair and washing it. I turned to him. He reached into the pocket of his dark vest. When his hand emerged a slim blade flicked out. I nodded. He palmed the blade shut and closed the door behind him. I listened to his footsteps recede down the stairs to the chair in the front hall, where he would spend the night.

I believe I dreamed of vampires that night. Or perhaps I was thinking about them just prior to falling asleep. And a fragment had stayed with me until morning. Of all mankind's self-inflicted terrors of all its pathetic little monsters only the myth of the vampire had any vestige of dignity. Like the humans it feeds on, the vampire must respond to its own dark compulsions. But unlike its petty human prey, the vampire carries out its sordid means to the only possible ends that could justify such actions—the goal of literal immortality. There is nobility there. And a sadness.

Before sleeping I thought of that summer long ago in Vienna. I saw Willi young again—blond, flushed with youth, and filled with pride at escorting two such independent American ladies.

I remembered Willi's high stiff collars and the short dresses that Nina helped to bring into style. That summer I remembered the friendly sounds of crowded Ber-gartten and the shadowy clance of leaves in front of gas lamps.

I remembered the footsteps on wet cobblestones, the shouts, the distant whispers, and the silences.

Willi was right. I had aged. The past year had taken a greater toll than the preceding decade. But I had not Fed. Despite the hunger, despite the aging reflection in the mirror. I had not Fed.

I fell asleep trying to think of that writer's last name. I fell asleep hungry.

To be concluded next month.
badly wanted to hug her but did not do so for fear of jeopardizing the first trust she had been able to place in a human being.

Coco sat on my lap calmly for a few minutes before walking to a long bench below the windows that overlooked nearby slopes. With great difficulty she climbed onto the bench and gazed out at the mountain. Suddenly she began to sob and shed actual tears, something I have never seen a gorilla do before or since. When it finally grew dark she curled up in a nest of vegetation I had made for her and softly whimpered herself to sleep.

During the next two days Coco ate increasing amounts of natural vegetation Galium, thistles, nettles, and — after a battle of wills — she accepted a milk mixture containing all the medications I considered essential for her health. Yet she continued to cry frequently, particularly when looking out of the window of her room. One day gorilla vocalizations were heard from the slopes behind camp, causing Coco to keen more than ever. Quickly I turned on the radio as loud as possible to drown out the sounds of the group, but Coco continued to gaze up at the slopes for most of the day whimpering softly, with the knowledge that her own kind were near.

On the third day the youngster's partial satisfaction with her new environment diminished, and as is the case with every captured gorilla I have ever known, she took a sudden turn for the worse. She completely stopped eating, her dung seeped out in liquid bloody pools, and she lay huddled in a pile of nest vegetation, shaking uncontrollably. Nothing I could do, including playing tape recordings of other gorillas, could shake her out of this semicatatonic lethargy. I started her on antibiotics but there was no sign of response and she continued to fall at an alarming rate.

On the sixth night of Coco's stay at camp, I carried her to bed with me for what I assumed would be her last night alive. Warmth and security were all that I could now provide. At five o'clock the following morning, instead of finding a corpse in my arms, I found Coco still alive and both of us lying in a bed soaked with diarrhea and dung. She seemed somewhat more lively, and I hoped that her crisis might have passed during the night. After giving her the medicine, I carried her outside into a large wire enclosure adjoining her room, and put her in fresh foliage and saplings.

While we were working I suddenly heard porters' voices approaching camp. I ran outside and saw about six men carrying what looked like an oversized beer barrel suspended between long poles supported on their shoulders. The head porter handed me a note from a friend. They had captured another gorilla. They want you to take care of it but didn't know how to send it up to you, so I improvised this thing. Hope all is going well with the first. Doubt this one will survive either.

Incredulous I paid the porters and had the barrel brought into Coco's room, leaving Coco outside in the sun-filled pen.

Because the captive showed no inclination of emerging I laid the barrel on its side and gently spelled her onto the foliage-covered floor. I was horrified to see that the young female was far more emaciated than Coco had been. Pus was oozing from wounds on her head, wrists, and ankles from deep cuts where she obviously had been bound by wire. From the extent of her infections and deterioration I judged she had been captured about the same time as Coco but had had to spend nearly a week longer with her captors.

Three days passed before Pucker — named for her morose and depressed facial expressions — would accept the same milk formula. I was giving Coco Estrogen to be about a year older than Coco Pucker was far more introverted and depressed by the changes brought about in her capture than the younger female. Much later I learned that Pucker had come from a group of about eight animals and, like those of Coco's group, all the family members had died trying to defend the younger. Despite my constant reassurance that she wasn't going to be further harmed, Pucker remained extremely apprehensive particularly when people were heard or seen near the infants' room or outdoor cage.

The day finally came when Coco was healthy enough to be allowed the freedom of the trees and meadows around camp. Pucker had not yet sufficiently recovered from her wounds and I doubted my control over her. On our first venture outside the cabin I had to carry Coco on my back since she seemed overawed by the vast amount of open space around her. Even when we perched on a huge Hagenia tree trunk laden with Galium and other gorilla foods, she wouldn't leave my lap.

The 30-minute reintroduction to the wild took us no farther than some 185 feet from the cabin. Pucker who had gone into the outdoor cage to watch Coco and me leave began whimpering softly. The crises soon built up into loud sobs terminated by screams and shrieks as Coco and I moved farther away. I was obliged to return much sooner than intended, although Pucker's cries seemed to be ignored by Coco. The howling subsided upon my obedient return, but in typical Pucker style our reentry was totally ignored as she regained a sudden interest in feeding. Her behavior might have seemed comical, nevertheless I felt it indicated a deep sense of deprivation.

On the morning I was ready to take both babies out the park guards came up to camp unexpectedly. The two youngsters
were in their outside run when the guards noiselessly arrived, carrying spears and guns. Terrified, the infants fled into the room climbed onto the highest shelf, and clung there for the remainder of the day. The guards demanded that I immediately turn the gorillas over to them for the trip to the Cologne Zoo. After an hour I was able to get rid of the intruders by convincing them that the gorillas were not well enough to leave—the truth at least in Pucker's case. Two days passed before the babies could be coaxed out of their room.

Some weeks later we again had an unexpected visitor in the form of the Conserver. The behavior of the two youngsters upon his arrival epitomized my own feelings exactly. Coco hid and Pucker went to the door separating my room from theirs and slammed it shut.

The Conserver had made the long climb to camp to demand the infants' prompt release to the Cologne Zoo. For the second time I insisted that they were not well enough to travel. While I was desperately insistent for more time, the sounds of play clucked and chattering. After the conferences overhear from the next room, I silently cursed them both for choosing this inopportune time to play. Even though I was pleased that they would play in spite of the Conserver's presence. The harder I pleaded to keep them, the more insistent he was about taking them. He claimed that the Cologne Zoo was exerting pressure on him for the animals. I could not tell me that the zoo was giving him a trip to Germany ostensibly to act as a companion for the gorillas. For a man who had never been out of his own country, this was an exciting prospect.

After a circuitous and argumentative conversation, the Conserver stated flatly that if I did not immediately relinquish Coco and Pucker, he would send poachers to capture two more young gorillas. He had called my hand. That same day I sent a cable to the Cologne Zoo officials telling them that they could have the captives once I felt the infants were well enough to make the long journey. Sending cable in order to avoid further slaughter was one of the biggest compromises I had to make during the years of my gorilla research. At that time there were few regulations concerning exportation or importation of endangered species. The Conserver's intentions to capture more young gorillas left me no alternative but to relinquish Coco and Pucker. Once the man had left, I went into the infants' room and received enthusiastic welcomes from both. Hugging them to me I felt like a traitor.

The days of feeding and playing went on as usual for Coco and Pucker. Their lively behavior resembled that of two rowdy little girls at summer camp. For myself, most of the joy of watching them flourish into near-normal, playful juveniles was gone, knowing their time in the forest was so limited and their future so bleak was constantly depressing, particularly since there was nothing I could do to prevent their return to cages. I wrote to Cologne implementing the zoo director to allow me to reintroduce the gorillas to the wild in a foster group but received a flat negative reply.

Several weeks after the Conserver's visit, the park guards returned to camp and demanded the gorillas, but this time in a very aggressive manner, by waving rusty riddles at me. The young people, and the Eisenhower camp staff. By now Coco and Pucker freely accepted the men on the staff but retained a deep fear and timidity around unknown Africans. For this reason I was quite surprised when the gorillas tried to "attack" the guards by screaming and beating violently at the wire between themselves and their would-be captors. Their actions were just the cue I needed to tell the guards they were more than welcome to enter the room to collect the gorillas but that they could not expect my help. Nothing, including the wrath of the Conserver could possibly have induced the men to enter the pen and in a few minutes they left. Afterward I learned that they told the Conserver that the juveniles were still much too sick to travel.

A few days later the Conserver arrived at camp accompanied by guards carrying a small newly built cell-like box intended for the captives. Flight to Cologne. The only opening to the box was a small 12-inch door. Ventilation had not been considered. The Conserver moreover had the effrontery to ask that I pay for the container. Eventually he left content with the equivalent of $30 in his pocket. I was slightly pleased only because I had gained several more weeks until the terrible depature day by explaining that the box would have to be entirely rebuilt.

When the dreaded day came and the Conserver's instructions for Coco and Pucker's care were provided. Tins containing their milk formula were strapped on to the crate's sides and a fresh selection of forest vegetation. The last they would ever eat was packed up. Also placed two large blankets inside the crate. The instant the youngsters ran in to grab them, the door was latched shut. The porters who would carry the box down arrived a few seconds later. That was all I could endure. I ran out of the cabin ran through the meadows of our countless walks and ran deep into the forest until I could run no more. There is no way to describe the pain of their loss. Even now more than a decade later.

For a number of years a member of the Cologne Zoo periodically informed me of Coco and Pucker's welfare through bulletins and photographs. The photographs revealed to me all too clearly that the captives were barely tolerating their caged environment. While reading this book I learned that Coco and Pucker, within a month of each other, died in 1976 in the Cologne Zoo.

This article was condensed from a draft of a manuscript written in 1983 by Dr. Dona Forsythe.

SEVENTH SENSE

CONTINUED FROM PAGE 107

We agree with Central USA. The African groups stand up. We've seen it too. There is no question of their sensitivity. It must be allowed to develop before we approach them. They must be able to understand—to accept us.

Agreed! Shuts Far North.

"If we are going to call it off," Enprocro Leader says, "it has to be done immediately. Let's have the vote now!"

I think you're imagining things. Galapagos mutters. And I'll tell you something else. Disengagement won't be trivial.

Galapagos right about that. We can't fix the vote—though it was closer than I had expected. But it has taken until Friday to work out the details of the disengagement. I am thoroughly tried by the time I finally get to the airport.

He is there. The Constant Traveler. He lits the arm resting on the bar a couple of inches in greeting. "Hello, Traveler," he says, "is this a coincidence, or is somebody following somebody?"

He grins, showing the wide gap in his front teeth. "Pure plain coincidence. Happens all the time. Believe me."

Well—I signal for a beer. "I don't know about that."

"Oh yes," he assures me. "When you've traveled more you'll know what I mean. You keep running into the same people."

"How was your stay?" I reach for the beer.

"Great. Made a couple of good sales. Hey! How about that market? Up near sixty points this week."

"Yeah! I'm not so tired anymore. Interesting isn't it."

"Interesting? Hell, it means about three thousand bucks to me. Say, what flight are you on?" Going back to Chicago?

"No. Another direction."

"Too bad," he says, just before he drains the glass and pops it down on the bar with a loud sign of pleasure. "Sorry I won't be having your company."

He slides easily off the stool and picks up his case. But I'll see you again somewhere. Better run, I got a plane to catch..."

I watch him walk out into the main corridor, then angle off to the left and merge into the stream of shoulders, heads, and assorted luggage moving to the flight gates. I am sorry to see him go. He's like part of the furnishings. But just before he said goodbye there was an instant when he looked at me, wanting to say something—and in that instant he's a superbly trained professional. I knew he had violated security. He is a machine-tool salesman like I am a Xenian shepherdess.

That story of his—fantastic. It bought them one hundred seventy-two years anyway. But there was no Frank. And no Bill. And no Ralph or New Orleans bar. There was a light in the sky all right. Was there really a dead man? Perhaps."

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this particular case. Because it is directed And it is controlled. But the control is not that control of directing your heartstrings It makes the wilderness yours in one sense because there's such a distance between the means of recording it and the kind of thing that the wilderness is. And it also brings into question the whole process of the perception of nature.

Forever resourceful in reusing material, Snow later remounted Abaloos's machine in a video-installation piece with four monitors. "The camera goes in the center and you can set it for different patterns. It's really nice the National Gallery of Canada bought it. It's called De la. Obviously it's a completely different thing from the film because you get involved in watching the machine move and seeing the kind of drawing that it makes on the monitors relating the movement to the kind of images that are produced."

Something of a prankster and philosopher at the same time, Snow in his mid-fifties has a flair for starting off with an unlikely or outrageous idea and somehow making it work. In his first major film (Wave-length, 1967) 40 odd minutes long, he begins with a stuttering camera zoom across an 80 foot Manhattan loft not much action, as most movies go. But he uses this central concept like a clothesline on which to hang abstract notions about space-time color waves, death, storyline, and representation. Characteristically the shooting took him a week and the editing a couple of weeks, but I did spend a lot of time muscling— a year—in Snow's most recent film (So Is This, 1982) with roughly the same running time he has the brass to fill his silent screen with nothing but one printed word after another, his imagination and resources keep audiences amused and involved all the way through.

How does he pack so much into so little? In Wave-length the camera journeys across the loft—joined in the sound track by a sine wave gradually moving from its lowest note to its highest—starts uneventfully. But as the camera approaches the four double windows and intervening wall space of the other side of the loft, a man is heard breaking into the building and walking upstairs. He staggers into the frame and drops dead on the floor—just before the zoom blithely lurches past him.

Still later, a woman enters discovers the mortified body and phones her boyfriend while the camera steadily approaches one of the photographs posted on the central wall space. The photo proves to be a picture of sea waves. The sound of an approaching police siren merges with the sine wave which by now has risen from 50 to 12,000 cycles per second.

As prosaic as all this sounds, Snow has been passing his painterly image through many changes along the way. He uses a variety of color filters film stocks superimposed flashbacks of earlier stages in the zoom and qualities and degrees of processing and light exposure to keep the film moving like a kaleidoscope yet, it seems to be practically standing still. (Many of the same technical variations in Wave-length are used to comparably fluid effect on the single words in So Is This.) In Snow's elegant description of the move's progress, "The space starts at the camera's—spectator's—eye is in the air then is on the screen, then is within the screen—the mind." He has also described the film as a "sum of the room-length zoom to the photo of sea waves through the light waves and on the sound waves."

A simpler and witter forward camera movement defines a 1976 Snow short called either Breakfast or Table Top Dolly. In this case a camera fronted by a shield of see-through plastic slowly creeps across a table converting an artistic still life of groceries—eggs, orange juice, sugar, Dixie cup plates and fruit—into a sticky gooey mass of garbage while the sounds of dishwashing are heard off screen. A movie about consumption? If eating is believing and hearing is deceiving, you had better believe it!
ers" in their specific field or domain. One Cognitive program, *Explorer*, was developed for an oil company to respond to natural-language questions. It consults a database, retrieves information, and converts it into maps of oil wells. Another program, *Marketeer*, was developed as a natural-language interface for Access, a marketing-analysis database from Dialogue Inc. And *Broker* accesses information from Standard and Poor's stock-market database, *Compustat*. The company is now developing advisory systems costing between $250,000 and $350,000 to provide linguistic fluency and decision-making support in personal investment and tax preparation. "Our advisory systems are basically computer models of human experts," Schank explains.

For the future, the company is considering a way to offer such computer expertise to owners of personal computers. Using a modem—a device to connect home computers to distant mainframes via telephone—anyone could tap into the wisdom of Cognitive's advisory systems paying only for the amount of time they were connected. Users could pick up advice on investments for example, almost as easily as dialing a long distance call.

Symantec, a spinoff of Machine Intelligence Corporation (which makes robot vision) has ambitious plans for its natural-language system. Based on work first done at Stanford Research Institute, the company is developing a $300 to $500 program that combines rules of syntax and semantics with a proprietary database management system (DBMS) designed for the IBM personal computer. A businessman could use the system to keep his own file of personal and sales data that could be accessed easily using ordinary English. An earlier version of the technology called *Straight Talk* is currently available for $360 as a natural-language interface for the Dictaphone System 6000 word processor. Symantec hopes to market the new DBMS system by the end of this year.

Meanwhile, one company already markets a widely used English-language system for personal computers. Mention *Savvy* to anyone in the artificial-intelligence community and you will immediately trigger a semantic debate. Developed by Excalibur Technologies Corporation, this $348 to $360 tool talks to computers but ignores such niceties as semantics and syntax completely. Instead, it concentrates on recognizing letters of the alphabet as they are punched into the keyboard. It uses a pattern-recognition system—matching up strings of characters—to identify key words and phrases typical of the user. The *Savvy* system may not be artificial intelligence but it is already popular with Apple II users, and the company is introducing a model for the IBM personal computer.

What's next for *Savvy*? Natural-lang—
guage interfaces for personal robots. Savvy has developed a general-purpose interface that will be marketed for the RBX5 robot manufactured by RB Robots of Denver. And says company spokesman Nelson Winkless, this interface could be adapted to other robots like Heath Company’s Hero. In fact, predicts Savvy president Jim Dowe, the personal robot and the personal computer will eventually merge into one mobile, intelligent system capable of humanlike decision and behavior.

In research-and-development laboratories from Bell to Bolt Beranek and Newman, work is already under way on the next generation of natural-language technology—programs that can combine the in-depth knowledge of an advisory system like Explorer with the adaptability of a query system like Intellect. What’s hitting the market now is just the tip of the iceberg’s nose under the flap of the tent, says William Woods, of Bolt Beranek.

Widespread use of natural-language systems for computers is still a decade away believes Ken Lim, of Dataquest. But each piece of technology further closes the gap between man and machine. Someday, Lim predicts, the human brain may actually be able to think commands directly into computers. Until then, we will have to be happy with machines that understand slang.

NEW WARES. HARD AND SOFT

Personal computers can create some pretty powerful color graphics—from simple pie charts and bar graphs to complex computer-aided designs. Now there is a simple way to instantly reproduce these cybernetic doodles and preserve them for posterity. The Palette system, developed by Polaroid, is a desk-top unit that plugs into the Apple II and the IBM PC and automatically converts even monochromatic displays into full color prints or slides. The Palette system includes a software diskette, a 35mm camera back and adapter plate, and the Polaroid 35mm Autoprocess slide developer introduced earlier this year. The instant print attachment is offered as an option ($1,500, from Polaroid Corporation, 575 Technology Square, Cambridge MA 02139.)

Chinese, with as many as 40,000 ideograms, is certainly not the easiest language to master. But now any computer can be retrofitted with a circuit board to print perfect Chinese. The board, a Chinese character generator developed by Eastern Computers Inc., works with any ordinary English keyboard. Letters of the English alphabet are combined to construct each ideogram. It takes multiple keystrokes to generate one character. But each ideogram represents a word rather than just a letter, the total time required is comparable to that needed to type in English ($400 to $500 from Eastern Computers Inc., 120 South Lynnhaven Road, Virginia Beach, VA 23452.)

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I hate being a mechanic.
Once—just once—I’d like to know
how it feels to work
in an office.

No problem.

Hey! Great.

How can I ever repay you?
That’s easy.

Let me see the expression
on your first patient’s face.
while you might tell the guy next to you to piss off, but later you will go out and have a beer together.

Thrown together in a foreign country, often under difficult working conditions, ESA workers undergo a crash course in multinational integration. They form sports clubs, hold barbecues, and respectively await Italian French German or English trim night at the company canteen. They suffer the inevitable affairs common to enclaves of foreigners and accentuate themselves to one another national characteristics.

At ESOC the Germans share a reputation of being thorough and methodical practically to a fault. The Italians and French register as hotheaded and impulsive. Brits are stubborn and the Scandinavians party a lot. Yet when its zero minus ten and counting with hundreds of millions of dollars worth of equipment on the multiple computer and data screens at operations center no one is checking passports.

All the pressures build at launch and at that point we’re in the same boat no matter where we come from,” says a Scottish shift leader at ESOC. That’s when we tend to work best together. If the mission fails, we’re all upset. You’re part of a team.

“It’s around the board-meeting table where it often falls apart,” adds a colleague. “The British delegation can’t be seen as giving in to the Germans; the Germans can’t be seen as giving in to the French and so on.”

It the team spirit felt at launch is seemingly absent around the conference table at ESA headquarters in Paris. It’s not because the pressures are any less intense. Both politically and economically the member nations of ESA lie galaxies apart. With worldwide recession widening the void between inflation-riddled Italy and relatively stable Switzerland, for instance, seemingly minor problems over when to align currencies assume huge import.

Yet tempering these discussions is the underlying awareness that the countries of Europe can mount a meaningful space challenge only if they are unified. No European country acting alone could have achieved satellite launch and operations capability in such a short time. And along the way to positioning the agency as a solid third behind the U.S. and Soviet space efforts, ESA officials did pioneering work in multinational space cooperation.

One of the first lessons we learned at ESA was that when you put different nations with very different ideas together working for a common goal, you have to consider the individuality of those nations,” says Lennart Ackegren. “Each decision has psychological and sociological implications, and each country expects a certain return for its investment.”

That return comes most significantly in the form of contracts awarded to industries in a country that has proved particularly generous to a project. Indeed, the willingness to fund the ESA stems in large part from the realization among politicians that to compete in the coming technological era, Western European industries need the research and technological benefits of a vital space program. As with most ESA decisions, however, the repercussions of the contracts for contributions policy are most clearly felt at the operational level.

A prime example according to ESOC operations was the awarding of a contract to a state-run British firm for the computer support system of the Meteosat satellite. That computer should never have been there, admits a British head operator on the Meteosat operations team. We know it was done so that Britain could share in the spoils so to speak. But we’re trying to support a spacecraft, which is difficult enough. And we had to do it with this totally untried and unfamiliar computer system.

If the compromise inherent in its multinational character stands as an ESA weakness, it also requires lengthy political debate—it may also prove the agency’s greatest strength. A successful launch in late June proved that Ariane is over some of its teething problems. From now on the ESA rocket should be able to place a communications satellite into geosynchronous orbit for about the same price as the space shuttle. Yet the cost cutting and basic design that resulted from compromise kept the development cost to about 10 percent of that of her American competition.

Compromise also resulted in the strictly nondefense role of the ESA adopted in the charter at the insistence of neutral members Switzerland and Sweden and establishing the agency as the closest in spirit to the United Nations declaration for a weapons-free space. In their resulting role as goodwill ambassadors among space agencies, ESA officials have established relations between the agency and space programs in every interested country in the world. In the United States, the Soviet Union and China. And on such cooperative projects as last year’s launching of India’s Insat satellite, ESA operators are quick to put a Hindi inflection in their English or to sneak guest operators on the audio loop for illegal calls to faraway friends.

Eventually the cooperative project that could prove the agency’s most successful and innovative is ESA’s very reliance on 11 separate member nations for support and direction. Says former director general Sir Hermann Bondi, now chairman of the National Environmental Research Council in England. There are certainly advantages and disadvantages to ESA’s multinational character. It’s bound to make the agency a little slower and less efficient than strictly national space programs. Yet it gives the ESA a measure of stability. Every country goes through periods of uncertainty.

“With eleven members it’s less likely that trouble in any one country will hurt the space program. You spread the risk.”

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Closer to home Arthur C. Clarke prefaces his latest work, 2010 Odyssey Two (Ballantine) with the honest disclaimer that his book will "be out of date by 2001. The novel, a sequel to 2001 A Space Odyssey, is engaging and imaginatively wrought but as a work of extrapolative fiction it deserves Clarke's qualification. 2010 is the story of the rendezvous of Spaceship Alexander Novakov at Jupiter with the U.S. Discovery, the craft David Bowman abandoned to confront the alien monolith in 2001. Bowman and the infamous computer HAL reappear in this novel and the book is loaded with marvelous ideas about the alien world. The science of the story blurs into mysticism instead of technological prediction.

Has science become so complex that it can only be extrapolated mysteriously? Gregory Benford's Timescape (Pocket Books) successfully projects a near-future society and its physics without resorting to the supernatural—and its realism is frightening. His novel connects the post-Sputnik/pre-moon walk decade of great scientific optimism with a bleak 1998, where science is blamed for the imminent collapse of civilization. The links between the two times are tachyons, faster-than-light particles. The scientists of 1998 use these time-reversed signals to send a message backward in time to the physicists of 1962 with the desperate hope of undoing the human causes of a future ecological disaster.

The disenchantment with science of Benford's future society mirrors a dissatisfaction that already exists. Fear of the unknown in science has led many to see William Blake's "dark Satanic mills" echoed in the skyline of Three Mile Island. The optimistic expectations of progress prevalent in Wells's time have been tempered by grim disillusionment since then. In a world on the brink of self-destruction it is no wonder that fantasy fiction predominates in the marketplace. Where does this leave science fiction? Traditionally, science fiction's role has been to traverse the yawning gap between technology and the popular imagination. For the writer this has become a dangerous assignment. Unless an author is naturally endowed with the wide-ranging sapience of an Asimov he must either be an expert like physicist Benford or have expert guides, like those Clarke acknowledges in his book.

Despite the difficulties of creating Wells's kind of fiction in these science-shy times, our future committed society must use its imagination to test new technologies against the human principles we've inherited from our past. And it is not just the general public that needs to compare discoveries and values. Scientists must also look up from their research and consider the ways that their ideas will affect people. The guilt that physicists experienced after Hiroshima and Nagasaki is the price they paid for forgetting that the search for knowledge is also a quest for wisdom. Science urges us toward a hopeful future. If we use our souls along with our minds we will arrive; because through fiction and science—as dreamers and thinkers—we are already there.
The story is as old as art itself. Fingers of fire inscribe stone tablets, mysterious visitors leave a statue behind, an ethereal image precipitates on wood or cloth. All of these are familiar calling cards to both art historians and theologians. But the scientific investigation of religious objects "not made by human hands" is as new and disconcerting for scientists as it is for believers. After they take off their vestments and put on their private selves churchmen doubt "What if it's a forgery?" in their laboratories scientists fret: "What if it's not?"

These questions are now being asked about a picture of the Virgin Mary that is the most revered religious icon in the Americas. Every year millions of pilgrims travel to the Basilica of Guadalupe in central Mexico, to see two strips of old sacking cloth, coarsely woven and weakly stitched together, bearing the image of an olive skinned girl in a pink robe. This Dark Virgin has been the center of Latin American religious symbolism ever since December 12, 1531 when Catholics believe the Virgin Mary appeared to an Aztec convert named Juan Diego. She gave him roses, mysteriously blooming in winter, as proof of her visitation. According to tradition Mary's likeness miraculously stamped itself upon Juan Diego's tilma, or shroud, which he used in carrying the roses to an unbelieving bishop.

Scientific controversy over the tilma dates back to 1666 when the first of several panels began their investigations. By the eighteenth century experts recognized peripheral decorations (an angel, a sunburst, and stars on the blue mantle) as obvious additions to the original. But the lifelike execution of the central figure confounded artists because it seemed to combine oil, watercolor, tempera, and fresco effects simultaneously—a combination they considered even more remarkable given the crude unconventional canvas of agave, a vegetable fabric. Doctors could deduce no natural cause for the survival of the fragile tilma exposed to centuries of humidity and the smoke of numberless votive candles. Attempted replicas showed badly faded colors and signs of decomposition.

Modern scientists theorized that some preservative in the pigments themselves might account for the crisp, unsullied hues of the Virgin's portrait. A sample sent to Nobel Prize winning Austrian chemist Richard Kuhn however, was returned to church officials in 1936 with a cryptic appraisal: "On the two fibers analyzed one red and the other yellow, they do not exist animal, vegetable or mineral colors. No one knows what this means, since explanations from chemistry dropped abruptly outside the animal vegetable and mineral kingdoms. Efforts to find Kuhn's complete study of the fibers have so far failed and new analyses are still in the planning stage.

Others suspected Renaissance artists of aging—glazing—the tilma, a procedure judged indispensable for making paint adhere to such a difficult surface. But infrared photography employed by Philip Callahan, a biophysicist and infrared expert with the U.S. Department of Agriculture and Jody Smith, a philosophy-of-science professor from Pensacola College in Florida detected neither underlayers of aging nor overlays of protective varnish. It is remarkable, Callahan wrote following a three-hour examination of the painting, that after more than four centuries there is no fading or cracking of the original figure on any portion of the agave tilma which unaged—should have deteriorated centuries ago.

"We also used infrared to search for an undersketch," Smith explains, "because paintings without underdrawings are almost nonexistent from that era. There was none. We were even more surprised by the absence of brush strokes—it looks as though someone applied the paint with a jet spray instead of a brush. We concluded that the image was created by an unknown technique."

The same conclusion is being reached by another line of inquiry that began in 1951 when an occultist examined the pupil of the Virgin's right eye with a high-
strange marriage between astronomy and particle physics is reshaping our understanding of that primordial explosion known as the Big Bang. Most recently particle physicists have suggested that the universe may have begun not only with a bang but with a sort of cosmic burp—an infinitesimally brief moment of superaccelerated expansion.

Why are particle physicists suddenly interested in astronomy and cosmology? They have recently realized that the tremendously hot birth of the universe provides the perfect laboratory to test their latest mathematical musings—grand unified theories or GUTs for short.

With GUTs, investigators of the submicroscopic world of elementary particles are beginning to show how the three nongravitational forces of nature—electromagnetism, the weak interaction that governs some forms of radioactive decay, and the strong nuclear force—are really the same. Each force acts differently at the low temperatures of our everyday life, but say GUT theorists, they all become identical or symmetrical when energies get high enough.

Testing such ideas, however, is another matter. The energies required to achieve the symmetry are cosmic—on the order of 10^19 electron volts. As MIT particle physicist Alan Guth points out, “Generating such energy in a lab would require a linear accelerator a light year long.” This is why particle physicists eagerly turned to cosmology. The forces of nature were assuredly one during the first moments of the Big Bang.

Guth was the first to suggest that at its inception the cosmos underwent a period of exceedingly rapid expansion or inflation (the big burp). He arrived at this conclusion when he used GUTs to theoretically re-create the universe’s cataclysmic birth. Guth’s inflationary model was announced three years ago and has since been revised by particle physicists Andreas Albrecht and Paul Steinhardt of the University of Pennsylvania and Moscow physicist A. D. Linde. Their scenario begins 10^-35 second after the Big Bang, when the universe was only one trillionth the size of a proton.

At that stage the submicroscopic expanding ball of hot radiation was beginning to cool to less than 10^10 degrees K. Normally that’s the temperature at which symmetry should have broken—when the unified force would start to differentiate elementary particles like quarks, electrons and neutrinos would become separate entities. But this did not happen right away. Instead, according to the inflationary model the cosmos became supercooled and remained symmetrical as the temperature plunged just as water can sometimes remain liquid below its freezing point. This delay in its “crystallization”, placed the universe into a state of high energy that pushed it outward faster than had been postulated by previous Big Bang models.

Once symmetry broke, the energy was suddenly converted into all the particles and radiation that surround us today.

Researchers are enthusiastic about the idea because it explains some longstanding cosmological mysteries. Why is the universe so flat? That is, neither measurably open (destined to expand forever) nor closed (ready to collapse)? Guth and his colleagues suggest that if inflation had occurred at the moment of creation, space would have quickly flattened out much as the surface of a balloon smooths out under expansion.

And there are other questions. Why are galaxies and energy distributed so unevenly in all directions? Because just before inflation, our universe was a fraction the size of an atomic particle, small enough for matter to get uniformly mixed.

But one problem remains: galaxy formation. The inflationary model can explain how dust and gas eventually clumped together to begin the formation of galaxies. “According to the simplest grand unified theories, however,” admits Guth, “galaxies tend to collapse into black holes at a rather early point in the universe’s history.” That dire prediction obviously did not come true but supporters of the inflationary model are confident that someday they’ll be able to match theory with observation.

We think the universe began with a Big Bang, but was it followed by a cosmic burp as well?
See what I mean professor? There's something damned familiar about this cluster of computer chips.
Another Soul Saved
I wish to thank Omni for changing the direction of my life. Having been born a complete klutz, I’d never mastered the art of tying a tie. Scot Morris came to my rescue however with his item ‘Tie One On’ in the Games column of the April 1983 issue. Therein, he described a procedure so simple to master, that even a total klutz like myself, can be happily tying away after only a few hours of diligent practice.

Once, my first question at a job interview was, ‘Er, what is the dress code here?’ Salary and perks meant nothing if a tie was required. Having suffered from years of such humiliating taunts as ‘clip-on nerds’ I saw no relief in that approach. ‘Omni’s has saved my life! Now I can confidently move up into management. Head held high (no clips showing!) looking toward a bright future. Why, this completely justifies my two year renewal’

Don Stockbauer
Webster TX

Clearing the Air
The article ‘The Greening of West Germany’ by James Kilfield (Earth, April 1983) is accompanied by a photo showing a large electric power plant with five smokestacks. The air above those stacks is entirely clear — not a trace of emissions or pollution is seen coming from them. Nearby are a set of large cooling towers. We see that emissions are indeed coming from them. Anyone who knows about power plants will see that those emissions are not something but steam which does not contain any added humidity to the air. Clearly then, this power plant represents the best available in pollution control.

The photo caption reads: ‘Pollution in West Germany has spawned a generation of youth dedicated to the environment.’

Since successful efforts at controlling pollution are denounced as pollution, it appears clear — as clear as the air above those smokestacks — that these West German youth are not really worried about attacking pollution. Instead, they are concerned with attacking industry. Of course, they wouldn’t dream of going without the electricity they use, they just don’t want it produced by power plants, no matter how advanced their pollution controls.

Still, amid the fever swamps of the German left, such flights from reality are far from new.

At the end of World War I the Socialists took over in Berlin and canceled all contracts and payments to the Krupp firm which employed over 100,000 workers. These same Socialists then decreed that no Krupp employee was to be laid off. How were they to be paid? The answer from Berlin: ‘Irgendwé — Somehow.’

T.A. Heppenheimer
Fountain Valley, CA

Genetic Reversal
At Thomas Jefferson Junior High School, in Teaneck, New Jersey, we have incorporated the material from Omni into the science curriculum. We have found all your articles interesting and informative — particularly the ones that deal with genetic research. The following poem was inspired by your publication.

The scientists say we all were once slime — away back in the past dark ages of time. Perhaps we came out from under a rock, as gooey as Volvox or blue-green Noctophytes.

Once before I composed another dark verse — just imagine evolution all in reverse. In your place the algae — supreme rectitude! The new Homo sapiens a green Thalophytes.

Buffalo Bill Volvox shot bison with guns and mighty Babe Uvolix swatted sixty foot Orions (Beer-Wadsquo; Protothecococcus, the American writer and J. Edgar Sprotogyra, the elder crime fighter.

So treat the green plant with a new point of view. Who knows it might someday be great to ponder Ronald Reagan Eugenia as your president! Taking Victoria Gronnosea out on a date.

Love the gelatinous Arabenna do not show disdain — for it could have been a diatom washing you down the drain. So doubt not my words: Just let the thoughts linger an algal strand washing you off its fingernail.

Neil Glazer
Principal
Thomas Jefferson Junior High School
Teaneck, NJ

THE MISTEYES
THE TWO WORLDS WE LIVE IN

Man is not just an isolated entity on Earth. He is also of a greater world— the Cosmos. The forces that create galaxies and island universes also flow through man’s being. The human body and its vital phenomena— Life —are of the same spectrum of energy of which all creation consists. The universe is you because you are one of its myriad forms of existence. Stripping away the mystery of these Cosmic forces within you increases the personal reality of the Self. There is no adventure greater than the exploration of Self.

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Oughtagaphs: signatures the way they oughta be

COMPETITION
By Scot Morris

Our Competition #26 announced in the January issue asked for "oughtagaphs"—the ways various famous personalities should have signed their names.

Many names suggested obvious presentations and were repeated often: Moses, Zeus, Mickey Mouse, Van Gogh, Johnny Cash. The single name entered more often than any other: Dolly Parton.

We favored oughtagaphs that looked as if they really could be signatures, but we broke our rules in a couple of instances (Rube Goldberg and M.C. Escher) for some intricate signatures that wouldn't very likely appear on the backs of checks.

The idea and the name for this competition came from Jeffrey Scott of Los

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GRAND PRIZE-WINNER $100

[Signature]

—Kristin Hagen, Alameda, CA

RUNNERS-UP $25 EACH

[Signature]

—Jacques Laforté, Chicago

[Signature]

—Brenda Potruska, East Brunswick, NJ

—Eleanor Klein, Los Angeles

[Signature]

—Melissa Jay Craig, Cleveland

—Pascal Portfolio, Huntington Beach, CA

[Signature]

—Beverly Kopp, Wayne, NJ

—Gina Bluso, Northfield Center, OH

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Oughtagaphs: signatures the way they oughta be
Honorable Mention

Elizabeth Taylor
—Howard Aho, Ferndale, MI

Hermine Cohen
—Hermine Cohen, Saipua, AL

Gordon Carleton
—Gordon Carleton, East Lansing, MI

Salvador Dalí
—Steven W. Reed, Ypsilanti, MI

Kidliah
—No name or address

David
—Ed Guyot, Reseda, CA

—Grand and Shirley Newlands, Newmarket, ON

—which Guyot Reseda, CA

Betty Grable
—Patricia A. Burns, St. Louis

—Melba B. Stapleton, Lenoir, NC

Lech Walesa
—Diane Romatowski, East Brunswick, NJ

253926337 472426 2355
—Brenda Petruska, East Brunswick, NJ

—Michael A. Gapinski, Hill AFB, VT

—Steve Magnuson, Cabin John, MD

—Melba B. Stapleton, Lenoir, NC

J. C. Alil
—Merrick S. Ketcham, New York City

—Howard Aho, Ferndale, MI

—Melba B. Stapleton, Lenoir, NC

Angela, the originator of the animated Pac-Man TV series. Scott helped us choose the winners. In the January issue we printed Scott's original designs for Charles Richter, Galileo Galilei, Hermann Rorschach, Count Dracula, Uri Geller, Dr. Joseph Guillotin, and the Three Stooges. The grand prize-winner will receive $100 and nine runners-up will receive $25 each. The autographs on this page receive honorable mention. It is worth noting that Omni's female readership shone especially brightly in this competition. Six out of the ten money winners were female. The entry from Melba B. Stapleton ('May West') gets a special booby prize. The calligraphy is well rendered, the spelling, however, merits a "dishonorable mention." Shall we take away Ms. Stapleton's Omni subscription?
1. **TUNNEL TRAIN.** A gravity train would indeed work. Strangely enough, such a train would make all of its trips in about 42 minutes, the same time it would take an object to fall through the center of the earth. The time is constant regardless of the tunnel's length.

2. **TILTING.** To compen...are the sides deep—you wouldn't be able to feel them on the miniaturized globe. In the fact, the compressed earth would feel smoother than an ivory billiard ball.

3. **TOUCH.** Although the wrinkles and bumps on the earth's surface appear large to us—mountains that rise more than five miles up, ocean trenches over six miles deep—you wouldn't be able to feel them on the miniaturized globe. In the fact, the compressed earth would feel smoother than an ivory billiard ball.

4. **SHOOT.** Photographs show that the moon is the size in both positions. Atmospheric refraction, however, has the apparent size of the moon. The illusion is universal—imagine a planetarium, but there is still no fully accepted explanation for it. Ptolemy argued that the horizon moon appears larger because we can compare it with distant trees and buildings. This theory is still the most widely accepted one, but it doesn't explain why sailors see the moon illusion just as vividly at sea.

5. **SURF.** It is convenient to speak of the moon going around the earth, but it is more accurate to say that they form a two body system that revolves around its center. This common center of gravity is actually inside the earth because of the earth's greater mass. As the earth swings around this center, centrifugal force causes the ocean waters to flow away from the center, producing two outward bulges on opposite sides of the globe.

6. **WATER POWER.** The earth's rotation is gradually slowing down. Don't look forward to a 25-hour day, or getting a few extra minutes of sleep in the morning. However, the effect is just enough to add about one second to the earth's day every 100,000 years.

7. **UP AND OVER.** About 18.5 feet, it isn't the distance from the ground to the bar that is important, but the distance from the jumper's center of gravity (CG) to the bar. A six-foot male's CG is about 3.5 feet above the ground, so to jump his height he must raise his CG 2.5 feet. On the moon he would be able to raise his CG six times as high or 15 feet. By raising his legs up to clear the bar the same way he does on earth, he could add that 3.5 feet back to the jump (just as on earth), bringing him to the 18 feet 6 inches mark which is just over half the height that is commonly quoted.

8. **PULLS.** The moon's most pronounced orbit is around the sun, just as the earth's is. So, in a sense, the sun has captured the moon. The earth causes only a small perturbation in the solar orbit that the moon would have if the earth weren't here.

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**PLANET IDENTIFICATION**

A. Jupiter huge as it is, Jupiter is the fastest turning planet, completing a revolution in about 9 hours, 50 minutes.

B. Venus it turns once on its axis in 243 Earth days. In that time it has gone more than once around the sun (an orbit takes 224.7 days). Thus, incredibly, Venus is the only planet with a day longer than its year.

C. Mercury

D. Earth

E. Saturn

F. Neptune (Pluto's orbit is so eccentric that since January 23, 1979, it has been inside Neptune's orbit. Pluto won't be the most distant planet until March 15, 1999. Until then the mnemonic should be: 'My very eccentric mother just served us pickled nuts'.

G. Pluto The first two letters are the initials of Percival Lowell, who predicted the existence of Pluto; the last two letters are the surname of Clyde Tombaugh, the man who in 1930 discovered Pluto from Lowell Observatory in Arizona.

H. Uranus The axis of its rotation is so nearly on the plane of the solar system that either end could be called north. Because of this, one cannot say its rotation is clockwise or counterclockwise without ambiguity.

I. Mars The two moons that Swift predicted are Phobos and Deimos.

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9. **ON TRACK.** The moon's orbit around the sun is always concave toward the sun. At no time, even when it is swinging toward the back side of the earth does it ever recede from the sun. The moon's annual path looks like a 13-sided polygon with rounded corners.

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**SHOOT.** Photographs show that the moon is the size in both positions. Atmospheric refraction would have the opposite effect—decreasing the apparent size of the moon. The illusion is universal—imagine a planetarium, but there is still no fully accepted explanation for it. Ptolemy argued that the horizon moon appears larger because we can compare it with distant trees and buildings. This theory is still the most widely accepted one, but it doesn't explain why sailors see the moon illusion just as vividly at sea.

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**PERFORMANCE**

The 18 segments that make up United States Part I, called Americans on the Move, were first performed in 1979 and revolve around the theme of transportation (along with electronic communication one on the Big Science networks). Parts II-IV center on politics, money and love, she adds, "Really, really hot topics!"

If United States, Parts I-IV can be said to be about anything, it is about connections—the connection between Anderson and the audience, and the mysteriously but electrically charged spaces between her words sounds, and images. Physically those spaces are energized by the connections she establishes with her machines and her fellow "technicians" in some segments she makes use of a double harmonizer and synthesizer with a repeat mode capacity that can change pitch over a range of two octaves. Her engineer, Bob Bielecki, supervises amplification levels and acoustic design, and projectionist Perry Hoiberman coordinates the customized projection system that superimposes images throughout the performances. In Big Science the segment that closes Part III, Anderson conducts synthesizers, engineers and photographs into a symphonic evocation of American cities and towns and the "science" that connects them: "Golden cities, golden towns, and long cars in long lines. And great big science!" Behind her mammoth architectural photographs of city buildings throb and glow in layered images on movie screens.

For people who play video games watch the news and eat at the same time and consider home computers a necessity rather than a luxury, Anderson's work hits home. For a society that thrives on sensory overload, she has created hieroglyphics that speak with deadly accuracy.
FUTURE SHIPS

If we could fly to the moon in less than four hours, and to Mars in 55 hours, how long would it take to get to the edge of the solar system? About 16 days aboard one of the spaceships of the future. Writer James E. Oberg forecasts the lines of some of the ungainly-looking vehicles that will bring the stars within reach and make planet-hopping almost as simple as taking a weekend excursion. He reports on new developments in ion drives, on lightsails dotted with tiny holes, and on fusion and antimatter engines. And he predicts that the new technologies will have a profound effect on the way we perceive space. In the future, we'll view travel not in terms of distance but of time.

FICTION

John Updike, America's leading novelist, helps celebrate Omni's fifth anniversary with a short story, "During the Jurassic." In a delightfully perceptive fantasy, Updike takes a satiric look at the cocktail set. This is one party you won't want to miss. Also in this issue Omni presents an excerpt from Isaac Asimov's new novel, Robots of Dawn. A top investigator from Earth is brought to Aurora when a robot is mysteriously murdered. Politics and intrigue run rampant in Asimov's thriller. And Dan Simmons's novelette Caron Comfort concludes with a terrifying and deadly chase.

RETROSPECTIVE

Whatever became of the 1,080 Continuum terms, 250 features, and 60 interviews that have appeared in Omni? To commemorate its fifth anniversary, Omni did a follow-up of the leading stories that have run since 1978. The findings reveal that Omni was right on target in predicting the triumph of the space shuttle, the advent of test-tube babies, and the checkered success of the artificial heart. For a retrospective of the future the way we saw it, read "Across Five Octobers."

ASTROGENESIS

Cosmic seas of interstellar gas and dust swarm with both simple and complex molecules in the largest chemistry set imaginable—the universe itself. These are the ingredients for planets and the life that flourishes on them. Isaac Asimov, a skilled biochemist as well as a famed science-fiction author, charts the progress that the young science of astrochemistry has made in piecing together the biggest puzzle of all: how random chemicals in space could have coalesced to form such a planet as ours. The clues are everywhere—in the burned casing of a meteorite, amid interstellar clouds, and locked in the geochemistry of the asteroids. In all these places, astrochemists are finding signs of chemical evolution.
Dewdrops appear as crystal globes of light in this fly's-eye view of a spiderweb. Nature photographer R. Hamilton Smith caught this ghostly study of light and form early one morning while searching for unusual spiderweb formations in a field in his native northern Minnesota. Working quickly, before the morning sun could burn away the dew, Smith attached a Nikkor zoom lens and a bellows unit to his Nikon F and moved in close for a series of macrophotographs. The shallow depth of field made a constellation of lights appear in his viewfinder and in the final picture. Each point reflected the sunlight mirrored in the individual droplets strung along the fragile rigging of the web. The resulting view was distinctly unearthly, Smith says it was "like peering into another galaxy." He recorded the image on Kodachrome 64 film.
powered ophthalmoscope. He was astonished to see the tiny embedded bust of a man, a finding since confirmed by a half-dozen oculists.

Of course, the human corneas reflects what a person sees at any given instant. And several doctors were convinced that the Virgin's corneas were reflecting a specific sight in Juan Diego's line of vision. Intrigued by these reports, Astie Tonsmann decided to undertake the "digitalization" of the eyes of the Virgin of Guadalupe. Tonsmann is a Cornell Ph.D. currently active in satellite image processing; first tried computer enhancement with photographs of human eyes and was able to reproduce by magnification of the corneas exactly what his subjects saw the instant the shutter snapped. He then applied the same method to the Virgin's corneas, dividing each square millimeter into 27,778 tiny blocks, color-coding each one and enlarging them all by a factor of 2,000. Thus, a computer re-creates what the Virgin "saw" more than 450 years ago.

Tonsmann identifies the following figures in his dramatic tableau: an Indian (Juan Diego), opening his tilma before the Franciscan who is the Franciscan himself (the bishop), or whose face a single tear is seen: a young man with his hand on his head in a pose of extreme consternation; a bare-chested Indian in an act of prayer; a black woman, a family group and other religious persons also dressed in Franciscan habits. Tonsmann argues that the Guadalupe painting is really a life-size "snapshot" of the Virgin Mary whose eyes reflect a remarkable scene. Juan Diego opens his tilma on December 12, 1531, before the Franciscan bishop of Mexico, Juan Zumarraga, while members of Juan Diego's household look on.

To most people all of these computer data look like a series of Rorschach blots open to any subjective interpretation. Tonsmann replies that the faces are better recognized by someone accustomed to image processing—easily distinguished, for example, from the enhancement of eyes taken from other paintings. The figures correspond surprisingly well to historical records of Juan Diego's meeting with Bishop Zumarraga: when the picture first unexpectedly appeared, in fact, Zumarraga looked like Zumarraga, as he was portrayed in a painting by the artist Miguel Cabrera. We also know the excited Tonsmann continues: That the bishop had a black female servant who can be recognized by her hair.

"When we compare the enlargements from both of the Virgin's eyes," Tonsmann claims, "we find the same figures, in the same positions, but in different sizes. This is exactly what I would expect from the enhancement of human corneas, given the difference in angle and distance between each one and the scene in question.

Image enhancement technology is so new in art that few qualify to retrace Tonsmann's work. The first successful application of digital image processing was by three scientists at NASA's Jet Propulsion Laboratory who reconstructed the underdrawing of a Flemish masterpiece last year. One member of the team, Donald Lynn, suggests that Tonsmann's findings would be more useful if he could obtain the image of the corneas directly, perhaps through a television camera operated at much lower light levels, and with a broader dynamic range than the photographs he's presently enhancing.

Lynn is trying to assemble a group of scientists and art conservators who will effect these kinds of sophisticated experiments on the Guadalupe painting. Until more is known, however, critics will have their hands full explaining how sixteenth-century Aztec painted microscopic Franciscans into the infinitesimal spaces of the Virgin's corneas—without underdrawings or brush strokes—on an unprotected, unstructured gauze cloth using a pigment whose origin is neither animal, vegetable, nor mineral. It's an old story..."
has been an Akihabara merchant for more than 26 years. Take began in a small stall (from which he still sells) and has expanded his company to a modest three-store chain. Now he sells everything from calculators to reel-to-reel tape decks. 'I once sold things like condensers and vacuum tubes,' he recalled. 'I remember in 1958 when the first transistor radios were sold here. We never thought there would be anything like an integrated circuit.'

Take said the area experienced some of its biggest growth in the late Sixties. When U.S. soldiers on leave from combat duty in Vietnam flocked in to buy cameras and high-quality stereo equipment. Today Akihabara draws huge numbers of hard-core kit builders who scour the second-floor shops and busy stands for semiconductors, memory chips and circuits or liquid-crystal-display digital readouts. There are about 200 outlets for such electronic parts.

Neal Ulevitch, an American living in Tokyo for the past four and a half years, has built two home computers from parts bought in Akihabara. Ulevitch said there is a growing market for Apple II computer knockoffs—counterfeits by all definitions—sprouting up in the back rooms of some stores. They look exactly like the real Apple IIIs only without the Apple logos. Ulevitch said, 'It's the forty-eight K centra' processing unit with the regular keyboard. The software is a direct ripoff: it even says APPLESOFT when you boot it up. The price is about two hundred fifty dollars.'

If you're shopping for a legitimate product in the district there are a few suggestions that might help you obtain the cheapest price. The best way to get the salesman's attention is to begin playing with the item you're interested in. (Demo models are available everywhere, and almost every major store has at least one English-speaking salesman.) Let's say that you see a Sony Walkman III, for instance, with a list price of 22,000 yen (about $82 at current exchange rates). The salesman may cross out the price and write 16,000 yen on the card (about $65), saying something like 'special price for you.' If you point to the shop next door and shake your head—meaning you can get it cheaper down the block—you might persuade him to go as low as 15,000 yen (about $55). Don't buy a camera or lens in Akihabara. There are better deals in the Ginza district, or even in the United States.

High-fidelity cassette tape is very expensive, and it's almost impossible to buy without seeing it cheaper somewhere else in Akihabara. Be certain that electrical appliances have 110-volt outlets plugs. Many warranties are honored only in Japan, so be sure that in mind if you make a major purchase. And shops with 'tax-free' signs will save you a 15 percent commodity tax when you produce your passport.

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HTCA!
A hole through the earth
and questions on a cosmic scale

GAMES
By Scot Morris

Last month we presented here the outrageous "outside-in" theory, which claims that the earth is a hollow sphere and that we are inside it along with everything else in the universe. When the geometrical operation called inversion is performed on the earth's sphere, everything formerly outside the sphere is mapped to a corresponding spot inside, and vice versa. As we explained last month, if the inversion is followed completely (which would invert the laws of physics as well as the geometry of space) there would be no practical test that could prove this creaky idea was true.

We don't believe the outside-in theory for a moment but one writer who does says that the only test would be to drill a hole straight through the center of the earth to the other side. If the earth is convex as conventional views have it the hole will come out on the other side of the earth, some 8,000 miles away. If the earth is a concave sphere, no one knows how this experiment will come out since no one has ever drilled through the shell to the "outside" of the universe.

We're not sure this through-hole would really settle the question and we would therefore support Senator Proxmire and any others who might oppose federal funding for such a project.

Still, the hypothetical question is an interesting one. What would happen if you jumped down a hole that went straight through the center of the earth? One of Alcoa's "first" wonders occurred as she fell down the rabbit hole. "I wonder if I shall fall right through the earth? How funny it seems to come out among the people that walk with their heads downwards! The Antipathies, I think."

The question itself goes back to Plutarch, and even Francis Bacon and Voltaire argued about it. Galileo gave the answer we accept as correct. You would fall faster and faster (increasing your speed but decreasing your acceleration), until you reached maximum velocity—about five miles per second—at the earth's center. Then you would decelerate until your speed reached zero at the other end of the hole. If you never touched the edge of the hole, and there were no effects of air resistance, you would continue oscillating back and forth forever.

The trip would be amazingly fast—about 42 minutes for one way blank to the antipode, 84 minutes for the round trip.

Global thinking along these lines has inspired us to put together some other questions about our planet's nearest companion, and our fellow travelers.

1. TUNNEL TRAIN. Lewis Carroll proposed another sort of earth hole in the second part of his fantasy novel Sylvie and Bruno in which a German professor described a train that would travel from city to city powered only by gravity. "Each railway is in a long tunnel; perfectly straight so of course the middle of it is nearer the center of the globe than the two ends, so every train runs halfway downhill, and that gives it force enough to run the other half uphill."

Ignoring friction and air resistance as before, would such a gravity train work? About how long would it take to get from, say, Los Angeles to San Francisco? From L.A. to New York?

2. TILTING TOWERS. The longest suspension bridge in the world is the Humber Estuary Bridge in England, just short of a mile long between the supports. (Opened in June 1981, it beat out New York's Verrazano Narrows Bridge.) The two towers are not quite parallel. They are 1375 inches farther apart at the top than at the bottom. Why?

3. TOUCH TEST. The earth is almost a sphere but not quite. Not only is it flattened at the poles and bulging at the equator, and slightly larger in the southern half (as who among us is not?) but it also has irregular features on its surface that anyone can see—mountains, canyons, ocean bottoms. If the earth were reduced to the size of a billiard ball and all the oceans were dried off with a towel, what would it feel like? Would you be able to feel the mountain ranges, the ocean valleys, and the continental boundaries?

4. SHOOT THE MOON. If you want to take a picture of the full moon and get the largest possible image on film, should you shoot it when it is directly overhead (and therefore at its closest point to your position on Earth) or when it is down near the horizon? Almost everyone says that the moon is largest near the horizon. Is this an atmospheric effect or a psychological one? Does it show up in photographs?

5. SURF'S UP. The ocean tides are caused by the gravitational pull of the moon and sun mostly of the moon. But why are there two high tides a day? When there's a high tide on one side of the earth closest to the moon, there is simultaneously a high tide on the opposite side of the earth farthest from the moon. How do you explain the second high tide? What makes the water bulge in a direction away from the moon?

6. WATER POWER. The motion of the earth and moon causes the tides. And the ceaseless sloshing of the tides is having an effect on the motion of the earth. What is happening?

7. UP AND OVER. The moon's gravity is about one sixth that of Earth. If you weigh 120 pounds on your bathroom scale, you'd weigh a mere 20 on the moon. An object tossed straight up on the moon will go six times as high as it would on Earth if thrown with the same force.

The first Lunar Olympics will be held in an enclosed arena, warmed and air filled so that athletes won't be encumbered by space suits. If a high jumper can clear a six-foot bar on Earth, to what height will he or she be able to jump on the moon? The answer usually given—36 feet—is incorrect.

8. PULLS. About how much do you think the moon is attracting the gravitional pull of the sun as compared with that of the earth? The moon stays with us and doesn't go flying off toward the sun, so the earth's attraction is greater, right? Wrong. The sun pulls more than
twice as hard as the earth. So why hasn't the sun stolen our moon away?

9. ON TRACK What sort of path does the moon trace in its yearly cycle around the sun? Clearly it stays close to the earth's orbit. The drawing at top right shows the moon wobbling back and forth across Earth's orbit. Aside from not being to scale, is the diagram approximately accurate? When is the moon's orbit convex toward the sun? In other words, about how much of the time during its orbit is the moon curving away from the sun?

PLANET IDENTIFICATION

Sure you know the planets. As in the old mnemonic: "My very earnest mother just served us nine pickles. Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto.

But do you really know them? Each of the statements below describes one planet only. Can you put each onto in its proper place?

A. The planet with the shortest day—it spins on its axis more rapidly than any other.
B. The planet with the longest day—it takes longer than any other planet to turn once around.
C. The planet that achieves the highest velocity in its orbit around the sun, averaging over 107,000 mph.
D. The densest planet. It is approximately 5.5 times heavier than an equal volume of water.
E. The least dense planet. With an average density of 0.7, it would float on water if you could find a pool big enough.
F. As we go to press, this planet is farthest from the sun.
G. The only planet (other than Earth) with only one moon; this planet was named after a Roman god. Perhaps not coincidentally, the spelling of the name commemorates both the man who predicted the existence of the planet and the man who actually discovered it.
H. The only planet on which one cannot identify a north pole or specify unambiguously whether it is spinning clockwise or counterclockwise.

I. The planet whose moons were first described in this uncanny passage from Jonathan Swift's Gulliver's Travels: "They [the Laputans] have likewise discovered two lesser stars or satellites, which revolve about [the planet] whereas the innermost is distant from the centre of the primary planet exactly three of his diameters, and the outermost five, the former revolves in the space of ten hours and the latter in twenty-one and an half."

The description is approximately accurate. What's hard to believe is that it's from a work of fiction published in 1726. The first telescope was not strong enough to see the satellites in question was not built until 1820, and they were not, in fact, identified until 1877—more than 150 years after Swift's remarkable prediction.
Of all the mysteries of the universe, death ranks among those we know least about. One reason: It usually occurs half in jest, as a last statement to make us think what it's like. Or has someone? Death has gotten a lot of scientific attention in the past few years. Are we on the brink of unraveling the great mystery of the hereafter? Let us briefly examine some of the theories and research.

First there is the question of when death occurs. Until recently doctors had a simple rule of thumb: When a person's heart stopped beating, that person was considered to be clinically dead. (Even if a person didn't happen to be in a hospital.) At the moment the heart stopped beating, the rule still applied.

But now that medical technology can revive a person whose heart has stopped, doctors are struggling to write an entirely new definition. This is no easy task: since most doctors already have trouble making their own writing (let alone anyone else's). Still, they now generally agree on a new criterion: Death occurs when there is no longer any brain activity. (This definition puts many a politician in immediate deep trouble.)

Then there is the hotly debated question of whether there is an afterlife. Long before the scientific community became intrigued with the possibility of a hereafter, there had been various artistic attempts to examine the question. Most notably, there were the two Broadway plays, Life After Death of a Salesman and Whose Life After Death Is It, Anyway? And of course, with somewhat lesser success, there is the television show The Dukes of Hazard.

Scientists who believe in an afterlife generally agree that after a person dies, his soul leaves the body and travels to a different plane. The only exception to this rule occurs when a person dies in a plane crash, in which case his soul will have to remain on board, or he'll have to change planes in Atlanta.

Does this mean death automatically spells the end of contact with others? At the moment there is no scientific evidence to suggest that anyone is capable of making contact with someone who has died. (This same holds true for making contact with a doctor, a lawyer, or a dead person during a weekend.) Of course there are those who will try to contact a deceased loved one through a medium. But anyone claiming to be a medium is probably nothing more than a con man whose only interest is making contact with your wallet. Law enforcement officials have cracked down on this scam, but people should beware there is still a small group of mediums at large.

There is, however, one area coming under more intense scientific investigation. Out-of-body experiences, sometimes known as astral projections. Many such cases have been reported, but the most famous astral projection occurred last year in Cleveland. While in a hospital having a chronic bout of a forty-five-year-old Christophone repairman named Lance Rivers suffered a massive heart attack. His heart stopped beating for two minutes, and he was pronounced clinically dead. Rivers later reported that during those 120 seconds he felt as though he were floating up near the ceiling of the room and watching quietly as frantic doctors and relatives hovered around his hospital bed. Rivers's account of what he saw and heard is the most chilling account to date of what actually happens after death.

I remember lying in bed and suddenly feeling this sharp pain in my chest. Rivers reports, "I went blank for a few seconds, and when I came to, I was sort of floating, slowly being lifted higher and higher. I clearly remember hearing the doctors say, 'I'm sorry. He's dead.' This was followed immediately by my brother-in-law sobbing, 'Oh, God. I just hope he has insurance.'"

"Show some respect!" my sister snapped. "After all, it's my brother. We gotta do what's right."

"Yeah, sure," my brother-in-law answered, "as long as it doesn't cost an arm and a leg."

"Speaking of which, the doctor asked, 'Have you reconsidered leaving your brother, or parts of him, to science?' We have a patient just down the hall who needs new set of knuckles desperately."

"I'm too upset to talk about it now," my sister replied. "Besides, I have to get out of here and buy a black dress before the niffl closes."

"Then everything went dark. When I awoke I was back in my hospital bed. The doctor was gone. My sister and brother-in-law were gone. So was my watch, my transistor radio, my St. Christopher medal, my extra pair of pajamas, two fruit baskets, and my lunch tray."

"Do experiences like Mr. Rivers's suggest that there is something like an afterlife?"

"If that can be proven, is it possible that we are already dead and this is the afterlife?"

"Talk about your major disappointments." Would that mean the more enterprises of us could make a small fortune in the long-term leasing of softins as "low-maintenance, one-bedroom condos"?"

And most important, will this mean that giggling at funerals will suddenly become more socially acceptable? We look to science for the answers.

John Ficarra, an associate editor at Mad magazine, says that as a comedy writer, he has experienced death many times.