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OMNI

$2.50

SPECIAL ANNIVERSARY ISSUE

0 778845 10

Denmark 28.75 DKr
Finland 16 FM
France 20 FF
Germany 11 DM
Greece 250 Dr
Italy 4,500 L
Spain 410 P

OMNI

OCTOBER 1981

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CONTENTS

The art of Paul Wunderlich graces our thirty-seventh cover. The artist's compositions come from his inner reflections and a life-long struggle between intellectualism and spontaneous expression. Omni is proud to present a gallery of Wunderlich's work starting on page 126.

OMNI, 1981 (ISSN 0149-8711). U.S. Volume 4, Number 1. Copyright © 1981 by Omni Publications International Ltd. All rights reserved. Published monthly in the United States and in Canada by Omni Publications International Ltd., 509 Third Avenue, New York, N.Y. 10022. Tel: (212) 593-3301. Printed in the U.S.A. by Meredith Printing Corp. and distributed in the U.S.A., Canada, U.S. territorial possessions, and the world (except the U.K.) by Curtis Circulation Company, 21 Henderson Drive, West Caldwell, N.J. 07006. Distributed in the U.K. by COMAG, Tavistock Rd., W. Drayton, Middlesex, London, UB7 7QE, England. Subscriptions: U.S., APO—$24 one year. Canada and elsewhere—$34 one year. Single copies $2.50 in U.S., APO and Canada. Address changes to Omni Magazine, P.O. Box 908, Farmingdale, N.Y. 11735. Postmaster: Send form 3579 to Farmingdale address. Tel: (516) 420-1894. Second class postage paid at New York, N.Y. and at additional mailing offices. Publisher disclaims all responsibility to return unsolicited editorial matter, and all rights in portions published thereof remain the sole property of Omni Publications International Ltd. Letters to Omni or its editors are assumed intended for publication in whole or in part and so may be used for such purposes.

FIRST WORD

By Kathy Keeton

"This magazine has proved that science and technology can be entertaining as well as informative"

Every breakthrough has a special feel to it. Even a special sound. "*Eureka! Eureka!*" cried Archimedes, the Greek mathematician who discovered the principle of buoyancy when he stepped into a bathtub one day and saw the water run over its sides. So excited was he at this discovery that he ran naked through the streets of ancient Syracuse, shouting about his breakthrough.

Alexander Graham Bell's words of discovery were also dramatic, but more through understatement than flamboyance. Bell believed that sound-wave vibrations could be turned into a fluctuating electrical current and that they could be reconverted into sound waves at the other end of an electrical circuit. While working on such a contraption one day, he spilled battery acid on his pants and automatically called out to his assistant, "Watson, please come here. I want you." Watson, however, was on another floor. Yet he heard Bell's words because he was at the other end of the circuit. He ran downstairs, beside himself with joy. That was the first telephone conversation.

Thomas Edison staged *his* breakthrough and at the same time invented not only the electric light but the modern scientific press conference as well. So respected was Edison that when word of his plan to build an electric light was leaked to investors, the value of illuminating-gas stocks fell around the world. Edison completed the actual work of invention in October 1878, but he waited until New Year's Eve to announce it. At that time he illuminated the main street of his town, Menlo Park, New Jersey, in a public demonstration before 3,000 people who came from New York City to watch. Newspaper reporters from all over the world came to cover the event, calling Edison the greatest inventor since Archimedes. Edison said modestly of his accomplishments, "Genius is one percent inspiration and ninety-nine percent perspiration."

The special sound of the breakthrough for flight was the clicking of a telegrapher's key tapping out the Wright brothers' message to their father: "Success. Four flights Thursday morning. ... average speed through air thirty-one miles; longest fifty-seven seconds. Inform press. Home Christmas."

And the breakthrough of landing on the moon was announced by the voice of Neil Armstrong. "Houston. Tranquility Base here. The *Eagle* has landed."

We are all capable of breakthroughs. Some of us may be gifted with the serendipitous inspiration of an Archimedes, capable of reaching conclusions through flashes of insight. More of us can labor like an Edison or the Wright brothers, creating through sweat and planning. Still others may be like Alexander Bell, sometimes needing battery acid spilled on our pants to make us realize just how much we have already accomplished. Or like astronaut Armstrong, we may be part of a vast team of men and women laboring for years to achieve the desired goal.

Omni has been widely hailed as a breakthrough in the more modest field of magazine publishing. As we celebrate our Third Anniversary with this issue, impartial surveys show that more than 5 million people read *Omni* each month. A whole new generation of science and science-related magazines has arisen in the wake of *Omni*'s success. This success is due in large part to the inspiration of Bob Guccione and his vision of "the magazine of tomorrow," and to the diligent work of *Omni*'s team of writers, artists, and editors.

But a breakthrough is only a beginning, a quantum step into a new domain of possibilities. Now it is time to explore some of those possibilities, to seek new and exciting horizons.

Omni: The New Frontier is an innovative television series combining the best visual capabilities of television with the future-oriented content of *Omni* itself. For the first time on commercial television a series will use the best in special effects, music, and graphics to reveal visions of the future that are firmly based on the realities of today's scientific research.

Like *Omni* magazine itself, *Omni: The New Frontier* will present stories of science and the future in language that everyone can understand. This magazine has proved that the intellectual concepts of science and technology can be highly entertaining as well as informative if they are presented properly. Now we take that approach, that "sense of wonder," and bring it to television. The era of the pedantic "science show" is about to end. Science will become as lively and exciting on television as we have made it in print.

In the year to come, *Omni* will also move into the field of book publishing, working with leading publishing houses to produce books about the future. Space exploration, robotics, genetic engineering, future arts, future life-styles—every compelling topic of tomorrow will be examined in Omni Books.

The past three years has been a marvelous period of breakthroughs, hard work, and solid success. But the past is prologue! *Omni* is a future-looking magazine, and we look forward to the coming year with enormous enthusiasm. ∞

Kathy Keeton is the president of Omni Publications International Ltd.

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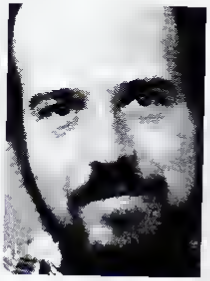

KENDIG

POURNELLE AND NIVEN

RACTER

ELLISON

Predicting the future is a dicey business at best," cautions *Frank Kendig*. As *Omni*'s first executive editor, however, he showed an uncanny knack for spotting important trends and ferreting out areas of research ripe for discovery. That is why we asked him to prepare a special section on upcoming breakthroughs for inclusion in our third-anniversary issue. Kendig, with the aid of another former *Omni* editor, *Richard Levitt*, looks at startling advances on the horizon, from optical chips to orbiting pharmaceutical laboratories. This guide to the future starts on page 70.

Our third birthday also coincides with another momentous occasion: *Omni*'s debut on television. Borrowing from the dramatic visual format of the magazine, the new series will explore such exciting developments as the revolution wrought by genetic engineering, the healing powers of electricity and computers that crack jokes (albeit bad ones). *Robert Weil*, head of our new Book Division, spoke to Emmy Award-winning producers *Vivian Moss* and *John Savage* to get a behind-the-scenes look at *Omni: The New Frontier*. Turn to page 88 for a preview of what promises to be a landmark in public broadcasting.

In "Three Fallacies" (page 66), an excerpt from his book *The High Road*, editorial director Ben Bova eloquently addresses the dominant theme of the decade: that man's ability to solve global problems rests on his willingness to explore outer space. Just as Rachel Carson's *Silent Spring* stirred the ecological consciousness of Americans in the 1960s, *The High Road* presages the world's growing involvement with space voyages. The book is published this month by Houghton Mifflin Company.

"Before their new findings are published in technical journals, scientists are as nervous as cats," says *Omni* staff writer *Kathleen Stein*, who traveled to a leading EEG (electroencephalographic) laboratory on the West Coast to get the inside scoop on a brain-wave discovery just now breaking in the scientific literature. In fact, her coverage of the hows and whys of this pioneering study is timed to coincide with the appearance of the lab's report in *Science*. "It just might shake up the neuroscience community," Stein remarks, referring both to the researchers' courage in confiding their story to a journalist before formal publication of their findings and to the nature of the breakthrough itself. In "Brainstorms" (page 52) Stein presents evidence that challenges the shibboleth of modern psychology—the theory of the duality of consciousness. The two halves of the brain function as an integrated whole, the debunking scientists assert.

Omni readers, especially those who have had psychic experiences, may be able to shed light on this controversy. Parapsychologist *Stephan A. Schwartz* has devised an intriguing experiment to test whether psychic powers are in some way linked to hemisphere laterality. To participate, see "Psi-Q" (on page 132).

This month's issue premieres a story by RACTER, an author whose extraordinary originality of vision and bold use of adjectives are certain to transform the English language as we know it. RACTER, incidentally, is a computer. Its tale, "Sott Ions," is a day in the life of an unlikely cast of characters: John, a dazzling but aloof quantum logician; Mark, a loony oboist; Helene, an easily enraged maid; and Mary—well, we can't tell you about her since that is the denouement of the story. Don't miss this flow of silicon consciousness, beginning on page 96.

Both *Larry Niven* and *Jerry Pournelle* are highly accomplished science-fiction writers in their own right, so fans were hardly surprised when their first collaborative effort yielded the literary gem *The Mote in God's Eye*. Now in their fourth time around as writing partners, the authors may have produced their best novel yet. Certain to be a best-seller, *Oath of Fealty* appears on the stands this month. An exclusive excerpt can be found beginning on page 76.

Finally, the redoubtable *Harlan Ellison* returns to these pages with his short story "On the Slab" (page 60). When he's not flying around smiting evil, Ellison is working on his novel *Blood's a Rover*, the full-length version of his Nebula Award-winning novella *A Boy and His Dog*, and hawking copies of his latest opus, *Shatterday*. ∞

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OCTOBER

LETTERS

COMMUNICATIONS

Ultimate I.Q.

I read your "Brainbuster" I.Q. test in the July 1981 issue. I even found one or two of the questions mildly interesting. However allow me to submit a much more advanced challenge. I call it "The Ultimate I.Q. Test." You have an unlimited amount of time to complete this test and must answer only three questions, in the following order.

1. Write down everything that you remember.
2. Write down everything you have forgotten.
3. Repeat step one.

F. Jay Steiner
Troutdale, Va.

Needles and Pins

With reference to James Randi's Last Word [May 1981], I must correct the assertion that acupuncture "just does not work." Acupuncture, used as an analgesic during major surgery, has been successfully performed in this country, France, Germany, and countries within the Soviet bloc. Acupuncture has been employed for at least 6,000 years. It was in use 150 years ago when Western men of medicine were using bloodletting as a major therapy.

Acupuncture works. In the last four years my small group in San Diego has seen more than 10,000 individuals with good results. Mr. Randi's article should be his Last Words.

K. C. Chan
Shanghai Acupuncture
Clinic & Institute, Inc.
San Diego, Calif.

Rumor Control

I must protest your assertion that the strain of marijuana known as New York City Silver is a rumor [Competition, July 1981]. Not only does it exist, but it is the third-strongest pot grown on the North American continent, the others being the fabled Hackensack Gasping Grass and the legendary Mount Popocatépetl Purple.

Hackensack Gasping Grass ekes out an existence in the fetid chemical flats of New Jersey near an Exxon refinery. So saturated with chemicals is the soil that the reefer is endowed with a strange pseudo-life that causes it to crawl to the edge of the New Jersey Turnpike, where it lies gasping for relatively unpolluted carbon dioxide. The chemical residues give the pot unusual potency. It is harvested with rubber gloves.

Popocatépetl Purple grows only on the sacred slopes of that volcano near Mexico City and it is actually purple or mauve because of the soil enriched by the blood of sacrificed virgins in Aztec times.

Incidentally, one harvests the New York City Silver by prying open a manhole cover and dropping a bottle of cheap wine down the hole. The winos dive in after the wine, the alligators sate themselves on the winos, and you slip in and cop the pot. What could be simpler?

S. T. Wishnevsky
Belfast, Tenn.

Guiding Lights

Australia has, perhaps, more potential for a brilliant technological future than any other country on Earth. Australia is about to embark upon the development of its first telecommunications-satellite network, and public support among the Australian community will be needed to guide future efforts and maintain interest. What is needed is a tightly knit organization of interested people in the Southern Hemisphere, which is why we invite Australian and New Zealand readers of *Omni* to become members of the Southern Cross L-5 Society. For information contact Mr. K. Peart, 2 Staff Road, Electrona, Tasmania, Australia, 7100.

Rowan Partridge
Woree, Cairns
Australia

Eco-Education

Having read the Earth column in *Omni*'s May issue, I want to get in touch with the College of the Atlantic, regarding enrollment. My high school however has no information on this institution of higher ecological education. Could you supply me with an address?

Michele Rinaldi
North Bellmore, N.Y.

Send your queries to Anne Outzen, College of the Atlantic, Bar Harbor, ME 04609.

Preparing the Way

I am attending the North Carolina School of Science and Mathematics as a member of the first class ('82). Many of the people here feel as I do that our productive

CONTINUED ON PAGE 192

When curiosity flourishes, worlds can be changed.

Why? How? What if? Young people question. Taking joy in the search for solutions. Their worlds abound with endless possibilities. So, too, it is with scientists. Whose laboratories are as limitless as the universe. Whose ideas shape worlds. To interest young minds in the wonders of science, Phillips Petroleum has made possible a film series called "The Search for Solutions." Stimulating films aired on PBS and seen by over two million students per month. They capture the excitement of discovery. And the discoverer. To teach. To encourage. But most of all, to interest. Because childlike curiosity in the right hands can help turn darkness into light.

PHILLIPS 66

DIALOGUE

FORUM

In which the readers editors, and correspondents discuss topics arising out of Omni *and theories and speculation of general interest are brought forth The views published are not necessarily those of the editors Letters for publication should be mailed to* Omni *Forum* Omni *Magazine 909 Third Avenue New York NY 10022*

Psychic Slur

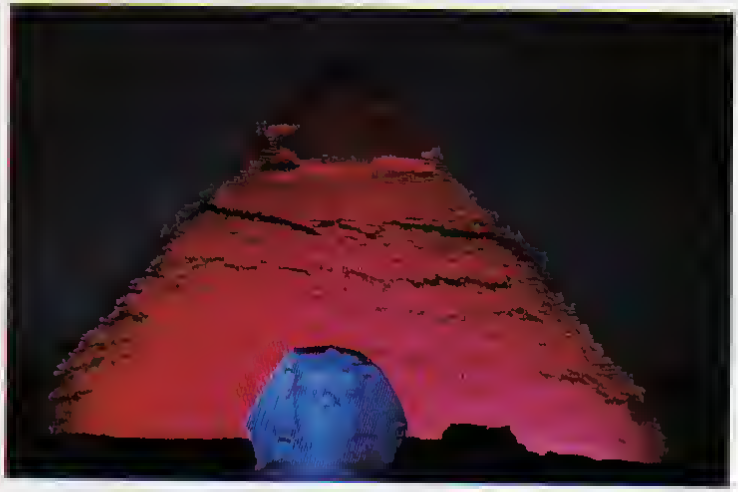
In the introduction to Stephan Schwartz's article "Psychic Search" [April 1981] the editors of *Omni* state "Whether the following experiment proves Schwartz s hypothesis is left to the reader to decide " Unfortunately you then withhold the information required if one is to evaluate Mr Schwartz s claims The term *double blind*, for example is a technical designation for situations in drug experiments in which neither the patient nor the physician knows the specific treatment or expected outcome Presumably Mr Schwartz employs the term *triple-blind* to suggest even tighter controls

But in truth the experiment is not even double-blind When McMullen is locating the site of Marea Professor Fakharani who knows the location is an interested onlooker This violates the requirements of double-blindedness Later when Hammid is doing her thing Fakharani is no longer present, but Schwartz who now knows the location and what McMullen has said is present

Also to judge whether the performance of the psychics was out of the ordinary or supernatural, we need to know whether in fact the site was Byzantine and if so how surprising that is All we are given in the article is Mr Schwartz s assessment, and as he abundantly illustrates he has not the slightest idea of what constitutes scientific evidence

Nothing in the article enables the reader to judge how adequately the controls were carried out If you are going to dignify such "research" by printing it you have an obligation to check the facts and supply the reader with your findings I suspect that even if you check with members of parapsychological associations you will be told that Mr Schwartz s experiment portrayed in "Psychic Search " is an embarrassment to them

Ray Hyman
University of Oregon
Eugene Ore



Psychic Archaeology Objections to slipshod controls undefined terms and routine results

Mr Schwartz replies *I often wonder why criticisms of psychic research are so often couched in terms of innuendo and character attacks However when we get through it all we are left with three points what we mean by* triple-blind *whether it was surprising that the site was Byzantine and the question of scientific controls*

Admittedly the term triple-blind *is used primarily to applied experiments which are almost never done in laboratory situations It means that the answer sought is unknown to the researcher, subject, or anyone else that it is unobtainable through the use of the five normal senses say, by reading a book and that it is not stored as part of a preselected pool of possible choices or target locations This eliminates fraud and telepathy and avoids the complex statistical analysis employed in traditional laboratory experiments*

In the case of Marea, the conditions to illustrate a triple-blind archaeological experiment were unusually clear The known body of literature treating of Marea doesn t mention this hill A magnetometer survey of the area conducted by a researcher totally unconnected with Mobius also found nothing in the area Professor Fakharani (the authority assigned to the site by the University of Alexandria) was certain that nothing was on the hill and since it was the highest point in the area that there might be an acropolis from the Roman period If the psychics were cheating or reading the professor s mind either they should not have picked this hill or they should have described a Roman site

This brings us to Dr Hyman s second point Yes the site was Byzantine This determination was made by archaeologists from the University of Warsaw and the University of Alexandria who had spent decades studying the area surrounding Alexandria Was this a surprise? There is no question that

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EARTH

By Don Wall

The caterpillars were everywhere — in the pool on the side of the house, in the eaves, in your hair. Where there were large infestations, you could hear them at night. Their droppings or frass, sounded like a light rain. Perfectly sane people went about protected beneath umbrellas on sunny days.

It was spring in New England and gypsy moth caterpillars had normally stolid Yankees in a tizzy. The ravenous larvae had chewed their way through 5.1 million acres of land in the northeast. This year the situation is worse, with nearly 11 million acres already devastated. The caterpillar doesn't eat whole trees, but it does devour leaves. A single caterpillar can eat a square foot of foliage in a single night. And for most deciduous trees three or four massive attacks spell death.

Gypsy moths were first brought to this country in 1868 by French naturalist Leopold Trouvelot, who settled in Medford, Massachusetts, hoping to develop a cheap domestic silk. Somehow two gypsy moths escaped, and the first serious infestation occurred in the summer of 1889. The gypsy moth caterpillars ate Medford and they've been eating and moving on ever since.

According to Dr. Charles Schwalbe, of the U.S. Agriculture Department's Cape Cod bureau, the siege of the gypsy moth has never been worse. The reason is that these tiny monsters are swept across the country by wind currents that carry them farther away from Medford with each successive generation. "Right now," says Dr. Schwalbe, "the front of defoliation is moving rapidly over the mountain ridges of Pennsylvania at the rate of at least twenty miles a year."

A map in Schwalbe's office shows the main corridor of gypsy moth movement. Where the Appalachians and the Allegheny Mountains come together, ink marks and arrows fly in all directions. The range of devastation this year extended from Maine to Maryland and included all of Pennsylvania and parts of Virginia and West Virginia.

Think about it, Alabama. Gypsy moths are coming to you and your southern hardwoods. They are also moving westward. Appleton, Wisconsin, was infested this year. Caterpillars appeared in Florida, California, and even in Seattle, Washington.

The onslaught begins in late April or early May, when the first eggs hatch. The larvae go through several molting stages as they eat. They prefer oak leaves, but some 500 other plant species also provide a hearty repast. Flowering dogwood, ash, balsam fir, and mountain laurel are among the few plants they avoid.

A caterpillar will munch its way to the highest branches of a tree, where it spins a silken thread. And, like a gypsy, it will go whichever way the wind is blowing. By mid-July the feeding stops and home owners begin to relax, but the insect is only in its pupal stage, having spun itself a cocoon. A couple of weeks after pupation, adult moths emerge. They don't eat, and the females don't even fly, but they do mate and lay a single egg mass before they die. One egg mass contains between 500 and 700 eggs.

The eggs remain dormant during the winter months, but they can get around nonetheless. If you have to move or ship firewood, Christmas trees, or woody shrubs from one place to another, you may be spreading gypsy moths. Egg masses could be stowaways on your deck chairs, picnic table, or wheelbarrow.

Potentially the gypsy moth is everywhere. "Gypsy moths seem to like it here as much as Americans do," Schwalbe says. "It is probable that the gypsy moth can live anywhere in the continental United States where suitable host trees exist in sufficient abundance."

What are communities doing to thwart the invasion? Sometimes it takes a hairy caterpillar to force democracy to get into action. When an infestation is discovered, a public meeting is called. Agents of the U.S. Department of Agriculture (USDA), state and local officials, and ordinary citizens meet to discuss the benefits and drawbacks of fumigation. Decisions are made on the municipal and state level, and every state in the northeast has a different approach, based on the urgency of the problem.

CONTINUED ON PAGE 183

Sex lures and other lethal devices will be ready for the gypsy moth caterpillars next spring

SHAPE SHAPES SHAPE

LIFE

By Dr Bernard Dixon

For modern biological scientists, riding the crest of a wave, the most discredited word in the dictionary is *vitalism*—the notion that a sacred or otherwise elusive property sets living and inanimate things irreconcilably apart. In these days of genetic engineering, based on a thorough understanding of living processes, the very idea that there may be a "ghost in the machine" amounts to absurdity. Biology and chemistry are all we need to solve even the knottiest riddles of evolution and physiology.

What, then, are we to make of a distinguished scientist who claims that the form and behavior of living creatures—including learning to type or ride a bicycle—are fashioned by "morphogenetic fields" unknown to science? The question is prompted by a remarkable book, *A New Science of Life*, published recently in Great Britain by Blond & Briggs. The signs so far are that its appearance has ruffled the scientific establishment. Yet even Dr. Rupert Sheldrake's most hostile critics are being seduced into taking his ideas seriously, so disarming is the manner in which he presents them.

The central enigma addressed by this young biochemist is that of differentiation. How does a single fertilized cell—the product of a fused sperm and ovum—metamorphose stage by stage into an elephant or a zebra, a skunk cabbage or a chrysanthemum?

Convention has it (and students are taught) that the cell's DNA blueprint functions like a computer program specifying the animal or plant concerned and directing its development. Yet nearly three decades after this hypothesis first became an article of faith in the halls of academe, little progress has been made in working out what actually happens, let alone the details.

Moreover, some formidable difficulties remain. Since every cell in the growing fetus is cloned from one, they must all contain exactly the same genetic makeup. But these cells hardly look or act the same. Why do some become specialized as skin tissue and others as heart muscle, blood, toenails, or dental pulp? As Dr. Sheldrake points out, conventional biologists confronted with this question usually retreat into "vague suggestions about physicochemical interactions somehow structured in time and space."

His answer is one of staggering simplicity. He believes that living organisms are shaped by morphogenetic fields, which impose particular patterns and which are derived from those associated with previous similar creatures. In other words, things develop one shape because similar systems were organized in that way in the past. Having nothing whatever to do with heredity, these influences travel by way of what he calls "morphic resonance" across both space and time. These mysterious fields, he believes, help to determine the form not only of elephants and daffodils but also of nonliving things such as the formation of crystals from a chemical solution. They might even influence patterns of learned behavior.

All of this seems highly unlikely. To make matters worse, Sheldrake is scarcely successful in explaining the nature of his hypothetical fields, apart from drawing an analogy with magnetic lines of force. How, indeed, could we expect anything more when the author defines the fields as unknown to science?

Could mysterious "fields" affect rat learning?

But Sheldrake's case does demand our attention—and not simply because he is a scientist of international repute addressing questions for which there are so far no wholly satisfactory answers. Far more important is the fact that he presents substantive evidence to buttress his ideas. Chemists, for example, often find that a substance synthesized for the first time can be made to crystallize only with difficulty, but that crystallization becomes easier in time. Could this happen because on the first occasion no morphogenetic field existed for that form? Perhaps morphic resonance imposes shape, making subsequent crystallizations easier.

Even more exciting is evidence from tests conducted in the United States, Scotland, and Australia suggesting that if rats are trained to perform a particular task, other rats elsewhere in the world will learn the same skill more readily. Although originally designed to assess Lamarckian evolution, the work of William McDougall at Harvard University, and of later research groups in Edinburgh and Melbourne, does lend plausibility to Sheldrake's radical thesis. It may even be possible that people today find learning to ride a bicycle or use a typewriter easier because more and more people have already mastered these very skills.

A serious weakness of Sheldrake's book is that the main body of research he cites was conducted several years ago. Given the exciting conclusions it prompts, there is an urgent need to follow up these experiments by using modern techniques. And this, in turn, underscores one of this book's outstanding merits. Sheldrake has taken the pains to outline specific ways in which his views can be subjected to rigorous experimental verification—a rare virtue among writers espousing unorthodox theories.

How to make a speech

By George Plimpton

International Paper asked George Plimpton, who writes books about facing the sports pros (like "Paper Lion" and "Shadow Box"), and who's in demand to speak about it, to tell you how to face the fear of making a speech.

One of life's terrors for the uninitiated is to be asked to make a speech.

"Why me?" will probably be your first reaction. "I don't have anything to say." It should be reassuring (though it rarely is) that since you were asked, somebody must think you do. The fact is that each one of us has a store of material which should be of interest to others. There is no reason why it should not be adapted to a speech.

Why know how to speak?

Scary as it is, it's important for anyone to be able to speak in front of others, whether twenty around a conference table or a hall filled with a thousand faces.

Being able to speak can mean better grades in any class. It can mean talking the town council out of increasing your property taxes. It can mean talking top management into buying your plan.

How to pick a topic

You were probably asked to speak in the first place in the hope that you would be able to articulate a topic that you know something about. Still, it helps to find out about your audience first. Who are they? Why are they there? What are they interested in? How much do they already know about your subject? One kind of talk would be appropriate for the Women's Club of Columbus, Ohio, and quite another for the guests at the Vince Lombardi dinner.

How to plan what to say

Here is where you must do your homework.

The more you sweat in advance, the less you'll have to sweat once you appear on stage. Research your topic thoroughly. Check the library for facts, quotes, books and timely magazine and newspaper articles on your subject. Get in touch with experts. Write to them, make phone calls, get interviews to help round out your material.

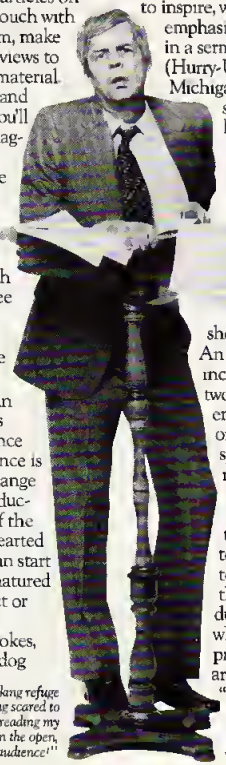
In short, gather—and learn—far more than you'll ever use. You can't imagine how much confidence that knowledge will inspire.

Now start organizing and writing. Most authorities suggest that a good speech breaks down into three basic parts—an introduction, the body of the speech, and the summation.

Introduction. An audience makes up its mind very quickly. Once the mood of an audience is set, it is difficult to change it, which is why introductions are important. If the speech is to be lighthearted in tone, the speaker can start off by telling a good-natured story about the subject or himself.

But be careful of jokes, especially the shaggy-dog variety. For some reason, the joke that convulses guests in a living room tends to suffer as it emerges through the amplifying system into a public gathering place.

Main body: There are four main intents in the body of the well-made speech. These are 1) to entertain, which is probably the hardest, 2) to instruct, which is the easiest if the speaker has done the research and knows the subject; 3) to persuade, which one does at a sales presentation, a political rally, or a town meeting; and finally, 4) to inspire, which is what the speaker emphasizes at a sales meeting, in a sermon, or at a pep rally. (Hurry-Up Yost, the onetime Michigan football coach, gave such an inspiration-filled half-time talk that he got carried away and at the final exhortation led his team on the run through the wrong locker-room door into the swimming pool.)



"What am I doing wrong? Taking refuge behind the lectern, looking scared to death, shuffling pages, and reading my speech. Relax. Come out in the open, gesture, talk to your audience!"

Summation. This is where you should "ask for the order." An ending should probably incorporate a sentence or two which sounds like an ending—a short summary of the main points of the speech, perhaps, or the repeat of a phrase that most embodies what the speaker has hoped to convey. It is valuable to think of the last sentence or two as something which might produce applause. Phrases which are perfectly appropriate to signal this are: "In closing..." or "I have one last thing to say..."

Once done—fully written, or the main points set down on 3" x 5" index cards—the next problem is the actual presentation of the speech. Ideally, a speech should not be read. At least it should never appear or sound as if you are reading it. An audience is dismayed to see a speaker peering down at a thick sheaf of papers on the lectern, wetting his thumb to turn to the next page.

How to sound spontaneous

The best speakers are those who make their words sound spontaneous even if memorized. I've found it's best to learn a speech point by point, not word for word. Careful preparation and a great deal of practicing are required to make it come together smoothly and easily. Mark Twain once said, "It takes three weeks to prepare a good ad-lib speech."

Don't be fooled when you rehearse. It takes longer to deliver a speech than to read it. Most speakers peg along at about 100 words a minute.

Brevity is an asset

A sensible plan, if you have been asked to speak to an exact limit, is to talk your speech into a mirror and stop at your allotted time; then cut the speech accordingly. The more familiar you become with your speech, the more confidently you can deliver it.

As anyone who listens to speeches knows, brevity is an asset. Twenty minutes are ideal. An hour is the limit an audience can listen comfortably.

In mentioning brevity, it is worth mentioning that the shortest inaugural address was George Washington's—just 135 words. The longest was William Henry Harrison's in 1841. He delivered a two-hour 9,000-word speech into the teeth of a freezing northeast wind. He came down with a cold the following day, and a month later he died of pneumonia.

Check your grammar

Consult a dictionary for proper meanings and pronunciations. Your audience won't know if you're a bad speller, but they will know if you use or pronounce a word improperly. In my first remarks on the dais, I used to thank people for their "fulsome introduction," until I discovered to my dismay that "fulsome" means *offensive* and *insincere*.

"Why should you make a speech? There are four big reasons (left to right) to inspire, to persuade, to entertain, to instruct. I'll tell you how to organize what you say."

On the podium

It helps one's nerves to pick out three or four people in the audience—preferably in different sectors so that the speaker is apparently giving his attention to the entire room—on whom to focus. Pick out people who seem to be having a good time.

How questions help

A question period at the end of a speech is a good notion. One would not ask questions following a tribute to the company treasurer on his retirement, say, but a technical talk or an informative speech can be enlivened with a question period.

The crowd

The larger the crowd, the easier it is to speak, because the response is multiplied and increased. Most people do not believe this. They peek out from behind the curtain and if the auditorium is filled to the rafters they begin to moan softly in the back of their throats.

What about stage fright?

Very few speakers escape the so-called "butterflies." There does not seem to be any cure for them, except to realize that they are beneficial rather than harmful, and never fatal. The tension usually means that the speaker, being keyed up, will do a better job. Edward R. Murrow called stage fright "the sweat of perfection." Mark Twain once comforted a fright-frozen friend about to speak: "Just remember they don't expect much." My own feeling is that with thought, preparation and faith in your ideas, *you* can go out there and expect a pleasant surprise.

And what a sensation it is—to hear applause. Invariably after it dies away, the speaker searches out the program chairman—just to make it known that he's available for next month's meeting.

George Plimpton

SPACE

By the Omni Foundation

The following open letter to the President has been adapted from the Omni Foundation s "Prospectus for Space Development ' A broad ranging discussion of the rewards our space program will win for the United States and other nations, the prospectus has already been endorsed by several space advocacy organizations industrial corporations and private foundations representing more than 100 000 people

Dear Mr President

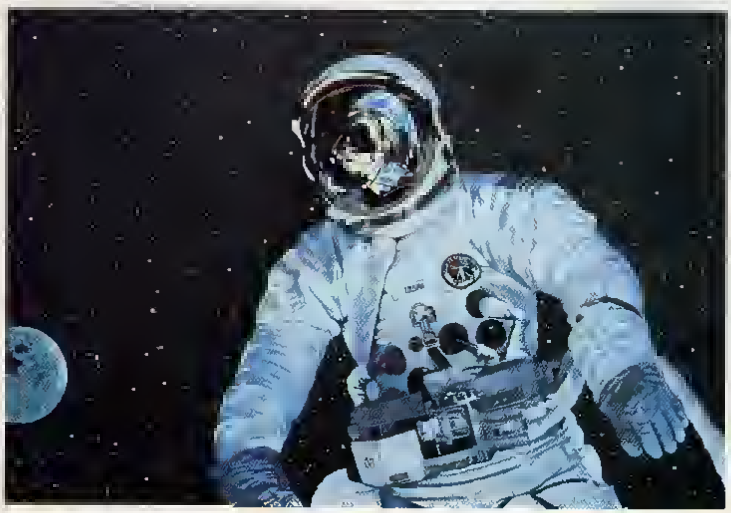
Few men even few presidents are given the chance to set the direction of mankind s development Just such an opportunity is now open to you

You have called for a new beginning a new vision of what America can be This prospectus offers one opportunity to make that new beginning a new vision of unlimited growth

Man cannot prosper in a closed society facing a future of diminishing resources and steadily encroaching limits Throughout history there have been frontiers to explore lands to open up resources to exploit Human progress has always sprung from exploration But on Earth today for the first time in history frontiers are closed Now as part of our new beginning we must learn to use the limitless resources of space

Space is the new frontier for all mankind In the 1960s the United States accepted its challenge and by landing men on the moon showed the world that America could open even this frontier Yet for the first time in history our nation has abandoned its achievement Since then others most notably the Soviet Union Europe and Japan have made it plain that they intend to compete vigorously in this new arena The United States can remain aloof from this contest only at its peril Spain and Portugal are but two examples of what happens to nations when they do not adequately rise to the challenge of their time

Nothing in the last 30 years so united this country and the free world as the success of the Apollo missions This success was a boost to our nation s spirit and to our position of world leadership



More it made enormous contributions to our economic well-being No other government program has returned so much—about seven times its original investment—in such a short period

By the most conservative estimates the space program has already returned $4 to $6 for every dollar we have invested in it The success of Comsat is but one example The continued development of space will bring us unlimited new resources and create new industries and countless jobs on Earth The benefits will accrue to private enterprise If obstacles to space endeavors that could be carried out by private companies are removed the United States can expect an explosion of commerce into all areas of space technology Nothing can be done more quickly or efficiently than by free people operating in a climate that rewards success The steady profits of space development will continue to dwarf the sums invested while showing the world how much can be accomplished by a free people living in a democracy

Our national security will be markedly strengthened Our firmest guarantee of peace does not lie only in military power, we must have a sound economy and export our products throughout the world The nation that first taps the limitless resources of space will win unparalleled economic and strategic advantages The evolution of space commerce will require hardware and operating methods similar to those of military space technologies It makes economic sense to pursue both areas of development at top speed

When the United States told the world in the 1950s that space was the most important frontier in human history the Soviet Union had just launched *Sputnik* and was threatening to gain a lead in space technology that could be translated into dominance on Earth Space is as crucial to our foreign policy today as it was 20 years ago It is also vital to our balance of trade A vigorous program of space development could within the foreseeable future give America a reliable supply of strategic natural resources not subject to the whims of foreign governments It could

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COSMOS. THE RETURN FLIGHT.

Join Carl Sagan as he again explores the mysteries of life and the universe.
Watch for the return of Cosmos on PBS. Check local listings for dates and times.

COSMOS is produced by Carl Sagan Productions and KCET, Los Angeles. Funding made possible by grants from the Corporation for Public Broadcasting, the Arthur Vining Davis Foundations and Atlantic Richfield Company.

ARCO

MAN BITES MAN

mind

By Patrick Huyghe

An angry Detroit crowd of 40 people attacked and bit two emergency-service technicians last May because it took them so long to get to the scene of a traffic accident. A month earlier a traveling salesman was found guilty of biting off a woman's nose during an attack in a hotel parking lot in Norfolk, Virginia. And about a year ago James Garner, known to television viewers as private eye Jim Rockford, tried to bite the motorist who grabbed, beat, and choked him after a minor traffic accident in Los Angeles.

The growing number of people sinking their teeth into one another has begun to alarm public-health officials, who feel that human bites are a serious medical problem. "Human bites are more severe than animal bites," says Dr. Margaret Grossi, deputy commissioner for health in New York City, "because the human mouth has a wider variety of pathogenic organisms." Bites frequently lead to serious complications, the most common problem being infection, but there is also potential for gross disfigurement, amputation—even death in some cases.

Medical literature has recorded a smattering of such accounts since the beginning of the century, but recognition of human bites as a widespread phenomenon came just a few years ago when Dr. John S. Marr, then epidemiologist and assistant commissioner for preventable diseases in the New York City Department of Health, somewhat whimsically decided to include a category for humans on the city's animal-bite report form. When the year-end totals for 1977 were tabulated, Dr. Marr was shocked to find that 892 incidents of human bites had been reported, each, by definition, had broken skin and drawn blood.

In 1980 the number of human-bite reports in New York City jumped dramatically. A total of 1,207 people sank their teeth into one another. Humans outbit the city's rats, cats, skunks, and parrots last year. Dogs, of course, bit more people than all of those animals put together. But humans accounted for more than three bites per day, and many bites probably were not reported. "It is estimated that for every reported dogbite there is also an unreported one," says Martin B. Kurtz, director of New York City's Bureau of Animal Affairs. "I don't see why we shouldn't expect the same thing with human bites."

Many health officials believe that the increase in biting incidents is a clear indication of the mounting violence in American society. Although New York City is the only place in the United States where human bites are a reportable medical condition, one has every reason to believe that the problem exists nationwide. "I'm sure you would find it to the same degree in cities like Philadelphia, Chicago, and Houston, where there is a lot of crime," says Dr. Grossi. "I see no reason why New Yorkers would corner the market on people's biting one another."

Attempts to understand the problem better have thus far focused on such questions as when people bite, which parts of the body are usually bitten, and who gets bitten. Like dogbites, human bites show a definite seasonality, with more people putting the bite on one another during the spring and summer months. The hands, fingers, arms, and shoulders are the most likely targets, followed by the face and neck, with the trunk and lower extremities being the least likely targets. Studies also show that males are more often bitten than females are, except in the ten-to-twenty and the fifty-five-to-sixty age groups.

And just why do people bite people?

Marr found that most of New York's bite reports—nearly 75 percent—were associated with aggressive activities. (Accidents during sports and games accounted for the remainder.) "Usually in fistfighting, or in fighting for one's life, everything comes into play," Marr says. "In self-defense it's pure instinct to use everything as a weapon—including teeth."

The teeth are a formidable weapon in the arsenal of survival, an effective additional tool to our fists and feet. And no wonder. The tooth is the human body's sharpest instrument, and tooth enamel is one of the hardest substances known. A U.S. Special Forces hand-to-hand expert

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THE ARTS

By Tim Onosko

Director Francis Ford Coppola recently referred to Hollywood as "the new Detroit," and the failure by association sent shudders through the film industry. Some studio executives, movie producers, and bankers publicly called Coppola's comments impertinent but many in the film business knew that what he was saying is true. Hollywood, faced with fast-mounting production costs and fierce new competition from television—specifically from home media such as video cassettes, video discs, and pay TV—has been slow to adopt any new technology that could either cut costs or produce new movie experiences.

Douglas Trumbull, the special-effects director of *Close Encounters of the Third Kind* and *2001: A Space Odyssey*, and one of the leaders in new screen technology says: "I think that the only motion picture technology that will tend to survive *in theaters* will be very large-scale, exciting, dynamic, experience-oriented spectacles. The smaller films, made in thirty-five-millimeter, will tend to go almost immediately to cable TV or pay TV. I don't think, with all this access to media we're getting, that the market for smaller, story-oriented films in theaters is going to last much longer."

Movies, at least technically, haven't changed much since Thomas Edison invented them. The industry quickly accepted the challenge of making sound movies, but since then it has been notoriously slow to upgrade its technology. Though film cameras and lenses have improved over the years, many theaters are, for the most part, still equipped with ancient projection gear and sound systems that can't even compete with what people have in their living rooms.

Television began causing problems for the movies at its very inception. In 1952, alarmed by the sudden and severe drop in theater attendance, Hollywood took chances on a few new ideas. Dozens of three-dimensional movies were produced. Screens got bigger in the forms of Cinerama and CinemaScope, and stereophonic soundtracks were introduced. Today, however, many of these innovations are gone. Shoddy theater projection and cheapies from quick-buck producers killed 3-D. Cinerama and CinemaScope wide-screen techniques are used much less often, mainly because they make a film more difficult to transfer to television, and stereo sound, despite advances that have made it easy to use and economically practical, is still far from being an industry standard. (Ironically, the last film in Cinerama was Stanley Kubrick's *2001: A Space Odyssey*.)

At his financially troubled Zoetrope Studios in Los Angeles, Coppola, in a smart move, has embraced new technology whenever his budgets and the craft unions have allowed. A dreamer and a risk taker, Coppola is also a shrewd businessman who has obviously learned from his mistakes. He suffered through the editing task of reducing miles of film for both *The Godfather, Part II* and *Apocalypse Now*, and also let production details get away from him on *Apocalypse*. The problems he had with these films inspired him to design a movie production system rooted in traditional filmmaking techniques, but streamlined by the application of computers and video.

The two components of Coppola's system are intensive planning, aided by videotape (a stage he has referred to as previsualization), and a "rapid transit" approach to postproduction and editing. In previsualization, the director builds an electronic storyboard that begins with the film's dialogue acted out as a radio play. This becomes the audio portion of a video cassette, which is supplemented with sketch art, Polaroid photos, and videotaped rehearsals.

After the film has been completely structured through the use of this technique, Coppola steps into a mobile, custom-built audiovideo nerve center and makes a black-and-white video version of the film during technical and dress rehearsals. When this version is fine-tuned, he shoots the film, in many cases using multiple cameras, cutting the scenes "live" like a television show. Computers record time codes simultaneously on videotapes and the strips of movie film and then chart the film's progress in

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One from the Heart: *First of Coppola's films directed from his mobile audiovideo nerve center*

BOOKS

THE ARTS

By Algis Budrys

The late C P Snow who wrote many novels about scientists popularized the idea that there are two cultures and proclaimed that he was bridging the gap between them I think he was wrong on both counts But he was persuasive, and we live with the results It s part of the conventional wisdom of our time that almost all liberal-arts people are blind to science and technology Conversely science-oriented individuals are assumed to be baffled by literature

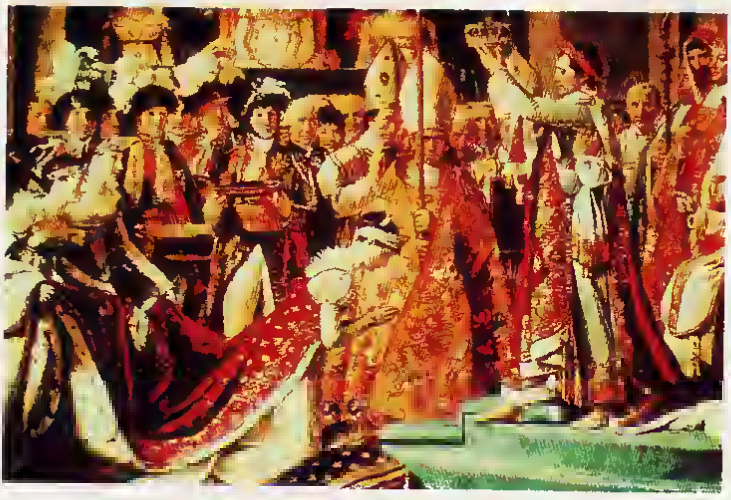
Snow's thesis represents a subtle error of observation The situation isn't quite like that But it will take time and patience to correct, especially when occasional jests of circumstance produce intellectual constructs like those in Mary McCarthy's *Ideas and the Novel* (Harcourt Brace Jovanovich $7 95) This is a collection of four of McCarthy s academic lectures, and they can only set us all back from the truth

McCarthy is of course a famous contemporary essayist and novelist She speaks to and for a major segment of "mainstream" literati the segment that proceeds as if science fiction didn't exist So it hardly comes as a surprise that her discussion of literature covers only part of that subject

McCarthy feels that Henry James doing the bulk of his work toward the end of the nineteenth century destroyed the novel of ideas and substituted for it the novel of images There have been no novels of ideas since James, except from the "Jewish Novelists," she asserts citing Philip Roth Isaac Bashevis Singer Bernard Malamud, and Saul Bellow but not Isaac Asimov

At this point we might fire a fusillade pointing out the numerous examples of ideation in speculative literature But that would have no effect on McCarthy or on those swayed by her Since we're inconsiderable in her view of the world, let's talk on her ground

What is an idea? This slim volume yields a startling narrow concept An idea by McCarthy's definition, is a proposition in nineteenth-century social philosophy that reflects the impact of Napoleon Bonaparte on European affairs



Napoleon As empire builder and revolutionary he serves as the archetype of the SF hero

That's not as ludicrous as it sounds Napoleon came out of nowhere seizing control of a French Revolution that was collapsing of its own weight and swiftly destroyed all hopes for permanent European monarchies He rewrote the techniques of war More enduringly he created the civil code of law that still institutionalizes French republicanism Under his rule Europe saw the drastic modernization of highway systems and the beginnings of city planning He promulgated the metric system and even preserved for a time the revolution's renaming of the months of the year

Napoleon's presence loomed everywhere in the Western world s consciousness Borrowing an idea from nonnovelist Sigmund Freud, one can also see Napoleon as a prepotently virile figure on the landscape of the subconscious Presumably this is how McCarthy gets from *War and Peace* to *Portnoy s Complaint* and to Malamud's *The Natural* whose hero dominates major-league hardball until one day his homemade bat is split by lightning

In any case the Little Corporal's upstart career pointed out the pathetic vulnerability of what had been advertised as perfected social systems This was particularly true in France central repository of hitherto God-given truths about social stratification and in Russia which was intellectually dependent on France under the Bourbon monarchy After struggling to defeat him, England forever abandoned monarchy except for its ceremonial value

When McCarthy cites novelist after nineteenth-century novelist—Hugo Balzac Stendhal Tolstoy Dickens—she presents them as artists energized by this philosophical impact It s an interesting if circumscribed concept and I recommend her book particularly to science-fiction readers It offers a clue to our long-standing attraction to novels that deal with the social effects of charismatic individuals

For instance McCarthy isolates the attraction of L Ron Hubbard s obviously Napoleonic *Final Blackout* and hits upon

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THE ARTS

By Lewis Branscomb

Eminent physicist Lewis Branscomb is a vice president and chief scientist at International Business Machines (IBM). He is also chairman of the National Science Board, which sets policy for the National Science Foundation, and is one of the managing associates of DiscoVision Associates, an IBM/MCA partnership in the video-disc business.

Buckminster Fuller has predicted that it "will be the most important lifesaver of humanity." It has been advertised as "gourmet television," but Massachusetts Institute of Technology professor Nicholas Negroponte insists that "it has nothing to do with movies," or TV. "It is a surrogate book," he says. The *Financial Times* of London has called it a "gamble past the point of no return."

In size and shape it is identical to the long-playing record, but appearances can be deceiving. The laser video disc may look like the platinum millionth record sold by the Bee Gees, but that's where the similarity ends. Instead of music, the video disc contains up to 108,000 full-color images, plus two channels of high-quality sound, plus computer programming encoded on the disc in the form of indentations less than one millionth of a meter long, laid down in tracks so closely spaced that there are 75 times more of them per inch than there are on an LP record. If each microscopic indentation, or pit, were increased to an inch in diameter, the disc would measure two miles across. The laser that "plays" the record would then fly across the surface at a height of five feet, at a speed of 600,000 miles per hour, and would be able to sense indentations as thin as a dime.

But lest you think I'm going to extol this new hardware to the exclusion of every other means of communication, rest assured. I have too much respect for books, whose role in illuminating human experience far outweighs the average $35 a year Americans are said to spend on them. Besides, the video disc and its player won't fit in the hip pocket of your jeans, can't be read aloud beside a fresh mountain stream, and can't be dog-eared, bookmarked, or used to press wild flowers. It may be exciting, but it's not lovable, like a book.

Physically, the book is a means of storing, replicating, and transporting information. Of all the artifacts of industry, books most effectively sustain our intellectual life. And somehow, despite the temptations of commerce and the limited literary taste of the general public, book publishers have managed to maintain a degree of social responsibility thus far unmatched by the purveyors of any of the new electronic media.

Ultimately, new media such as the video disc will stand or fall not so much on the electronics and hardware as on the information that goes into them. The nature of the software that evolves with the new technologies will determine, for good or ill, their ultimate effect on our lives. Marshall McLuhan was only half right. The medium is not the message, but it can create new dimensions for the message. It's the message that matters.

From a technical perspective, the new electronic media provide capabilities going far beyond both books and motion pictures. Clearly the potential is there for genuinely new and unique media. But will the video disc, for example, live up to that potential? The answer lies in how creative people use it. Who will "write" the new video books, construct the electronic encyclopedias? Who will find out what is real and what is a gimmick? Will some profoundly new kinds of authorship arise?

Branscomb: Libraries at the speed of light

What explains the artistic diversity of film and the moronic dullness of television? Some think this disparity is due to the multiplicity of distribution channels for film, while TV comes over only a few channels—"narrowcasting" versus "broadcasting." Film brought new cognitive dimensions to the world of print and pictures. Television added convenience of access at the price of poorer visual and auditory quality. TV brought nothing new for the author or artist to work with.

What can a medium that is selectively accessible under computer control do for us that books and film cannot? All the new electronic media—video discs, satellites, cable—have the capability to individualize information, to make the acquisition of knowledge a matter of private choice. This notion of user-controlled selectivity is not new. There has always been an audience that demanded information of a specific nature, to be delivered according to individual choice from a large aggregate of knowledge. The system that has provided that service for 3,000 years is called a library.

Electronics has shrunk that library's archives dramatically and has extended its reading room to all the people within the reach of antennas, cables, or fibers. It has also reduced the cost of storage so that in the future large parts of the library can be replicated economically at the user's location. But the most revolutionary change of all is the reduction in time from book stacks to retrieval. The electronic book stacks can be searched with the speed of light.

There is, nevertheless, an information explosion, which, like so many other

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THE ARTS

By Paul M Sammon

After a work of art is created who preserves it? And how? At the moment these questions are particularly relevant: from Italy to Egypt masterpieces are disintegrating at an alarming rate. Yet the fraternity of art preservationists has traditionally included in its membership only a few dedicated, underfunded individuals who painstakingly labor for months or years with Q-tips and acetone to remove the grime from a single objet d'art.

Until now. As if by a light beam emitted from the new instrument the laser, art conservation has been illuminated by the introduction of sophisticated technological hardware. The prime proponent and chief practitioner of high-tech art preservation is a tall, amiable physicist, Dr. John Asmus. Born in 1937, Asmus received his doctorate in quantum electronics at the California Institute of Technology before gradually segueing his interests into plasma physics and then into laser development. Since 1959 Asmus has laid down an impressively broad foundation of knowledge in laser research. He conducted early experiments for the Department of Defense and was the first to photograph optical "floaters" (tiny pieces of tissue nicked loose within the eyeball) in bovine eyes, which he obtained from slaughterhouses.

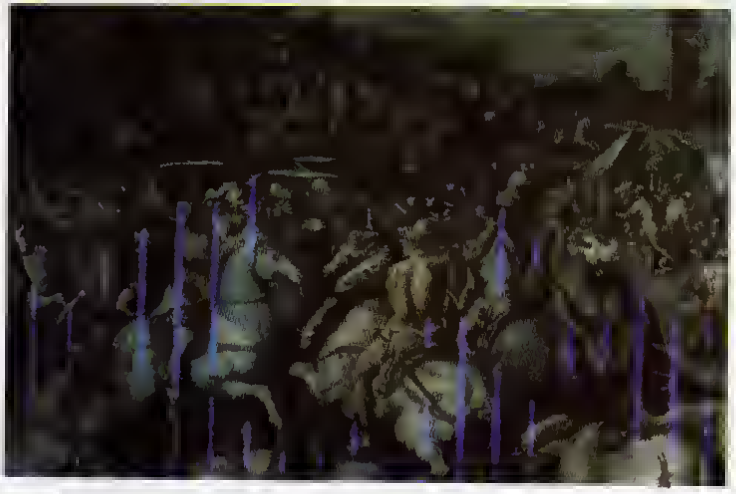
How then, did a scientist with a strong empirical background become interested in art preservation? Purely by accident. "My work in advanced art conservation actually began with holograms," Asmus answers. "In the summer of 1971 I was involved in setting up a federally funded panel whose prime concern was: Should the U.S.A. instigate a laser-oriented Manhattan project? One member, who had just returned from Venice, told me that, though the city was falling apart, the political, social, and economic climate there was such that it appeared there wasn't going to *be* an implemented solution for saving Venice.

"However, this member's wife had a sudden inspiration: Why not make archival holograms of Venice? Although this was a poor second choice to saving the real thing, we all agreed that at least there could now be three-dimensional records of this irreplaceable art." Asmus forwarded a proposal to the Italian government, suggesting funding for the project, a return telegram from the Italian Petroleum Institute informed him that it was interested in the expedition and that it was willing to finance it.

"Unfortunately, the amount promised was underfunded by one order of magnitude." Asmus now wryly notes. "The money they'd promised was just enough to buy a few plane tickets and pay the hotel bills." Undaunted, Asmus managed to persuade fellow associates to donate extra money and equipment, including capacitor banks and a TRW ruby laser. He arrived in Venice in January 1972. "Within a matter of two or three days we were producing incredible holograms," he says. Two of these initial holographic plates depicted major works of art: the famous polychrome wood statue *San Giovanni Battista*, by Donatello, the most important Italian sculptor of the fifteenth century, and Giovanni Pisano's sculpture *Madonna con Bambino*, also in polychrome wood.

Encouraged by the holographic results, Asmus then proceeded to produce interferograms of selected pieces. Laser-generated interferometry is widely used for nondestructive industrial testing. For artworks whose aging processes have produced subtle irregularities in their fabric, interferograms are invaluable.

In the case of one Venetian painting entitled *Santa Caterina*, for example, the paint was lifting off the wooden panel on which it had been executed. First a holographic exposure was taken, but *not* exposed. Then Asmus passed a heat gun—actually nothing more than a hair dryer—over the painting, which raised its overall surface temperature by one tenth of a degree. "We then fired the laser again," he says, "and a second exposure was taken of the wooden panel—which the heat had warped by as little as a few microns. The end result was a double-exposed hologram, both warped and unwarped, differentiated by only a few wavelengths of light. However, the difference in exposure was radical enough



Asmus's simulation of what ultrasonic pulses would "look like in Vasari's Battle of San Vincenzo

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THE ARTS

By Vicki E. Lindner

In the late Sixties artist Newton Harrison was teaching a class in formalist art at a California university. He held up an example of modular, minimalist sculpture to his students and raved, "Look how smart this modular is, how good it is," and suddenly it didn't look very good at all. Now Harrison says, "In fact, it looked rather dumb! Information about ecological problems had been seeping in by osmosis, and it seemed to me the most important question of this century was how we will get to the next. With the crucial issue of survival in mind, a lot of the art done in the Sixties looked silly to me." Newton's wife, Helen Mayer Harrison, a social scientist, concurred. Her in-depth studies of institutions had led her to believe that survival was at stake in the social world as well as in the natural world. Saddled with these insights, the Harrisons say, "we didn't know what to do with them."

By 1970 they knew. Newton's five glow-discharge chambers, an artificial aurora borealis, had created a stir at the Expo '70 Art and Technology show, and the curator asked him to do a similar piece for the opening in Los Angeles. In a dialogue that was the beginning of one of the art world's most unusual collaborations, the Harrisons began to discuss water. What could you do with *water*? A fountain? A waterfall? "No," Newton retorted. "I'm going to do *life*!"

Life manifested itself in the first of the Harrisons' survival pieces. "Notations on the Ecosystem of the Western Salt Works with the Addition of Brine Shrimp," which used the problem of the diminishing world food supply as a metaphor for a new kind of art. The Harrisons consulted with the Scripps Institution of Oceanography in San Diego, and learned they could grow brine shrimp, a popular candidate for Third World food, and *Dunaliella* algae, food for the shrimp, in a simple, discrete ecosystem. They constructed a 20' × 40' pond made of redwood and divided it into four sections, adding a different amount of salt to each. The algae and shrimp, each of which has a high tolerance for changes in salinity, thrived. The shrimp ate the algae, which fed on sunlight and dollar-a-gallon plant food, and changed color dramatically from deep green to brick-red as they absorbed more keratin to cope with rising levels of salinity in the tank. The result, a new biologically based aesthetic in a museum environment. The Harrisons harvested the shrimp, but they found them hopelessly inedible, unless mixed with capers and anchovies—an unlikely staple for the hungry Third World.

Committed to pooling their talents for their new art, the Harrisons then began growing miniature indoor farms under lights, using the minimalists' modular shapes for the farms' containers. What they were saying was, "We'll grow things in your sterile cubes and squares, and they will read as indoor meadows. Their care will generate performances." Helen did the performances, which framed the rituals of planting, growing, harvesting, and feasting.

The survival pieces took the Harrisons with an elegant catfish farm to London. They planned to commemorate the opening of a show, "Eleven Los Angeles Artists," by electrocuting the thick-skulled fish (the most humane way to kill them), skinning and cleaning them in a performance dance, then serving a down-home soul food feast of catfish and hush puppies to the black-tie British elite.

The British, however, had been importing little Italian catfish for their aquariums and vehemently protested this symbolic murder of their pets. The Humane Society let out an enraged bellow, celebrity Spike Milligan smashed the pane of the catfish tank with a rock to protest a museum's condoning the slaughter of animals. Newton publicly complimented the British on their "paranoia," and the other artists threatened to withdraw from the show if the Harrisons were denied their performance. In the end, the Harrisons won out, the catfish were executed and served, and all the furor they say, only helped make the point—that food does not appear by magic on our plates, and we bear responsibility for our own nourishment.

In 1974 Helen took a hard look at their survival pieces and noted they were not

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The Lagoon at Uppuveli. *Like all of us, the lagoon must improvise its existence.*

EXPLORATIONS

By Susan Mazur

Until 1976 Guatemala a country that has seen at least 200 major volcanic eruptions since the time of the conquistadors, had only two devices to predict earth movements a sole seismograph and the premonitions of the wife of Don Claudio Urrutia

"It was the quake that opened the Motagua Fault which really gave birth to seismology as a science in this country," says Urrutia now director of the Institute of Seismology Vulcanography, Meteorology and Hydrology (INSIVUMEH) in Guatemala City Urrutia does not, however dismiss the significance of the stars in reading seismicity Volcanic activity, he insists, follows the phases of the moon Urrutia also notes that in recent years NASA has been accurately gauging significant seismic activity by comparing arrival times of quasar emissions from 1 billion light-years away He jests that his role at INSIVUMEH is no coincidence either revealing that he was born under the tail of Halley s Comet on its last visible spin around Earth

Urrutia s reference to the earthquake that established INSIVUMEH was also the one that tore apart unprepared Guatemala on February 4, 1976 Its epicenter was along a 40-million-year-old 150-mile-long fault which carves a 3 mile-deep trench in the earth s mantle Historically Central America s worst natural disaster it sent a violent shock wave from Mexico to Costa Rica that registered 7.5 on the Richter scale

"We now have twenty-seven radiotelemetric stations throughout the country," says Eddy Sanchez, chief seismologist at INSIVUMEH, "with two of our seismographs running on solar-charged batteries Results are excellent, and plans are to equip all stations with solar-paneled seismographs "

Guatemala is also cooperating with neighboring Nicaragua Costa Rica and El Salvador in establishing a network of stations for reading and relaying information on the ocean plates bordering Central America These grate against and underthrust one another, causing volcanoes and temblors Sanchez says that at least 58 sites will soon monitor the motion of the Caribbean and American plates to the east and the Cocos plate on the Pacific side, utilizing such instrumentation as the magnetometer to record magnetic change caused by rock deformation the gravimeter to detect change in rock density and the scintillation counter that measures radon gas as it escapes rock under pressure

"We can measure distortion tension, exactly We know when a rock is going to break" Urrutia says "We can predict close to the time the volcano will erupt Microseismicity increases Gravity changes The volcano inflates There may be fumes rumbles or magma extruding " But predicting the *size* of a volcanic eruption Urrutia insists remains an exclusive talent of his wife and other intuitive types "You would be just as correct if you were to guess without instrumentation "

When will one of Guatemala's 33 volcanoes next erupt? Sanchez explains that three are erupting all the time But it s the Santiaguito lava dome in southwestern Guatemala s Sierra Madre range that most excites him "It s following a pattern of evolution similar to Mount Saint Helens It s been erupting every day and during the night the people of Quezaltenango can hear the rumbles and see the ashes pouring out "

Exploding from the Santa Maria crater in 1902 the Santiaguito cone began forming in 1922 and is now spewing forth lava "It s a gray molten rock that looks like wet cement The lava's boiling but not yet red-hot " says Sanchez

Santiaguito will exceed the height of its parent crater (3 768 meters) in about 200 years at which time its growth will taper off "There's a very good chance that we may see the triggering of another Mount Saint Helens-type eruption anytime after that" Sanchez who considers these active volcanoes almost as his pets predicts

Fuego (3 835 meters), 45 kilometers west of Guatemala City has been the country s most consistently active volcano in recent history The last major eruption

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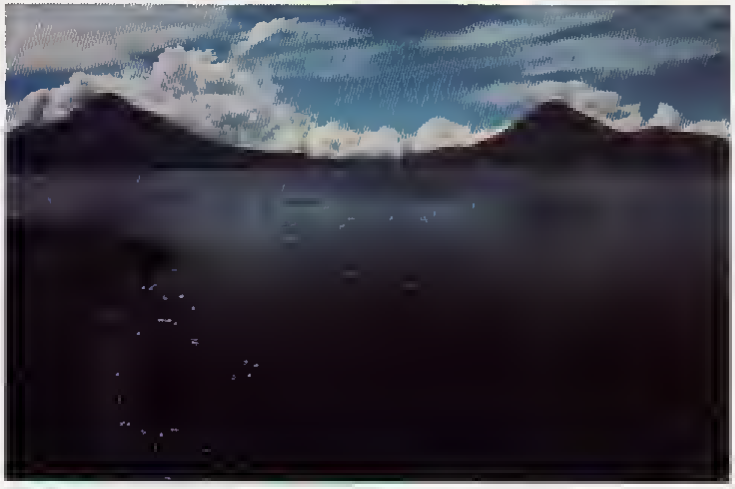


Guatemala s most idyllic spot Lake Atitlán with volcanoes Tolimán and San Pedro in the distance

CONTINUUM

Edited by Dick Teresi

WHERE'S POP?

Around the end of this century a unique group of children will come of age. These are children who have only a mother and who, if they try to search out their biological father, will discover that officially he never existed: that he was phased out by technology and a trend. The technology is the venerable birth technique of artificial insemination by donor, also known as AID, which will celebrate its centenary of use on humans in three years, in 1984. The trend is the fact that many women who want children, but not the additional complication of a husband in their life, are using AID—once the choice only of infertile couples.

AID experts estimate that between 10,000 and 20,000 children are born each year as the result of artificial insemination. According to the American Fertility Foundation, more and more single women have been inquiring about the method for themselves. One estimate has it that the annual number of single-mother births is about 1,500. These babies were born to women who wanted no involvement with a man other than to take from him a little biological material. This estimate may be conservative because, as one spokeswoman for the Lesbian Mothers Defense Fund says, it's used more often than people are aware.

Those engaged in the fertility business are not very enthusiastic about this new development. Until recently many of them refused to provide artificial insemination for an unmarried woman. But then an unmarried woman sued a clinic at Wayne State University in Michigan for rejecting her simply because of her single status. The suit was eventually settled out of court when the clinic agreed to end its married-women-only policy. Now the prevalent attitude is summed up by one AID specialist who confesses: We don't like it much, but we do treat a few.

In the view of legal and medical policy experts, the father-free AID child is just one more complication in an already-complicated situation. More than two thirds of the states have no laws spelling out the legal relationship between an artificially conceived child and the husband of the child's mother. The courts and legislatures have never begun to cope with the status of the child born without a father.

There was one rare court case in New Jersey in which a man donated sperm to a woman friend for an artificial insemination. The man left before the child, a boy, was born. Years later he demanded visitation rights to his son and took the woman to court to obtain these rights. The court backed the father, stipulating that he support the child.

Another complication is the anonymity maintained by sperm donors. As George Annas, professor of law and medicine at Boston University, points out, the names of artificial insemination donors are always kept confidential to protect them against paternity suits and to encourage other men to make anonymous contributions. Some doctors don't even keep records of who the donors were. Other doctors often combine semen from several donors. It's a kind of firing-squad approach, since it is virtually impossible to know whose was the telling shot.

While these procedures are not illegal, they should be, Annas says. The reason is that a child should know what his genetic heritage is, if nothing else. Sperm banks and artificial-insemination clinics do not screen thoroughly for genetic defects in their donors, and knowing the biological father's identity might some day be a matter of life and death for someone. Early this year a team of doctors from Columbia University in New York, pleading for more careful genetic screening of sperm donors, cited the case of a woman impregnated by artificial insemination who had a baby girl afflicted with Tay Sachs disease. The disease is almost certain to kill the girl before her fourth birthday. Given this kind of potential for harm, concern for a donor's self-protection should give way to concern for the child, Annas says.

Worries like these may eventually become unnecessary, at the same time the father might become even more invisible and more irrelevant. Before his death Pierre Soupart, a pioneer in test-tube-baby research at Vanderbilt University in Tennessee, had been working on a true fatherless-conception technique, called OFP (for oocyte fusion product). He discovered that a sperm forms a kind of glue that sticks it to the ovum it is fertilizing. Dr. Soupart figured out a way to duplicate that substance and stuck two mouse eggs together. No sperm was involved. The result was a fertilized egg that developed into a normal female offspring. Soupart thought this technique might be used in selective animal breeding someday since it produced only females. If or when, it could be used in humans, its females only limitation would present no problem. After all, what then would be the point of making any more men?—*DOUGLAS COLLIGAN*

CONTINUUM

RETURN OF THE TROLLEY

Smoky city buses straddle three lanes of traffic. Subways are noisy, dirty, and crowded. Rush-hour streets look like parking lots, with cars inching along.

Scenes like these are prompting a return to trolleys, or light rail transit, in many nations. Clean, quiet, fast, comfortable, and cheaper in the long run, new streetcars are replacing 40-year-old derelicts in Boston and Philadelphia. And they are gracing new trolley tracks in places as diverse as San Diego, Calgary, Manila, and Rio de Janeiro.

"There is a charm to it," says Vukan R. Vuchik, a University of Pennsylvania engineering professor and trolley expert. "They are more personal than subways, and they also fill transit needs very well."

Planners say a new trolley system costs less than half—and sometimes less than a tenth—of what new subways cost. For $2.5 million to $5 million a mile and $750,000 a car, a city can buy trolley tracks that last a century and cars lasting 40 years—four times the life span of buses. A trolley's top speed is 50 miles per hour, and the average speed—including stops—is 15 to 18 miles per hour, two to three times faster than rush-hour traffic. A single long trolley can hold 500 people.

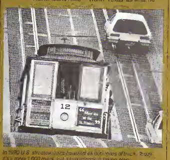
Rio de Janeiro's new system brings commuters from distant suburbs to existing rapid transit in the nearby suburbs. Manila's system replaces a chaotic bus and jitney system that handled 100,000 people a day. Tunis is constructing 30 miles of new lines, and Cairo is extending its line. San Diego's new system runs 16 miles to the Mexican border; it's dubbed the Tijuana Trolley. San Francisco, Cleveland, Buffalo, Edmonton, and Pittsburgh are also updating their systems.

Originally horse-drawn, U.S. streetcar lines by 1920 boasted 80,000 cars on 45,000 miles of track. Auto madness helped cut those numbers to 1,000 miles and a few thousand cars. But times change. Even Manhattan is considering a trolley for Forty-second Street.

—Stuart Diamond

The future enters into us, in order to transform itself in us long before it happens.

—Rainer Maria Rilke



In 1920 U.S. streetcar lines boasted 45,000 miles of track. Today it's a mere 1,000 miles, but a resurgence is taking place.

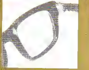
DOUBLE VISION

Using a device small enough to fit on a pair of eyeglasses, the deaf may be able to read lips without looking up, and helicopter pilots may be able to read their instrument panels without looking down.

The device is called an Eyeglass Heads-Up Display. It works by taking light from a little packet of optical fibers and bouncing it off a tiny mirror stuck in the center of an eyeglass lens and into the user's eye. Because the mirror is so small and so close to the eye, it is virtually invisible. And the image it reflects is superimposed on the user's field of vision.

The device was originally conceived by Hubert W. Upton, group engineer for electronics research at Bell Helicopter Textron, in Fort Worth, Texas, as what he calls a visual speech reader for people with hearing difficulties.

A computer takes a distinctive sound—the "s" sound, for example—and projects it as a specific color in the eye. By memorizing what colors stand for which sounds, one can translate



Optical fibers bounce images off mirror (top left) in lens.

into words the colors one sees. Afflicted with a hearing problem himself, Upton now uses the device and says adapting to it is "like learning a foreign language."

The U.S. Navy is also testing it for use with night flying goggles, which its helicopter pilots wear and which restrict a pilot's view of his instrument panel. By hooking the Heads-Up Display to an on-board computer, a pilot can have information from the control panel projected in his eye.

According to engineer James R. Goodman, of Textron, who helped design the display system, future applications might include special safety glasses that let people operating dangerous machinery monitor their instruments without lifting their eyes from their work.

—Howard Smallowitz

THE OUCH ROOM

If you the rugged and sensible adult fear going under the knife how much more anxiety must a child feel?

That s why the University of Chicago s Wyler Children s Hospital encourages its little patients to play surgeon before undergoing their own operating room ordeals In Wyler's Ouch Room skilled counselors guide the terrified young patient through many steps of the operation he or she faces

Lynn Ochs the director of the South Side hospital's Doctor s Play Program explains that typically the child is outfitted in a surgeon s smock green paper hairnet and operating mask Ochs and her staff have the kids sit at a table

Then they explain the stethoscope tell them what X rays do and if the children are older than four give each one his or her own hypodermic needle During the grandmotherlike briefing the children work at a scaled-down operating table with their patient —a large and floppy teddy bear

The misconceptions children have about surgery can be appalling Ochs says One child was terrified that the surgeon would hack away at his nonsick areas Others fear the hypodermic needle will leave a permanent hole or that they will never wake up from the anesthetic

We never *never* use the word *scalpel* Ochs adds

—William K Stuckey

Young patients preparing for surgery Kids play surgeon to help them get over their terrifying misconceptions about operations

THE PLAGUE RETURNS

The bubonic plague the scourge of the Middle Ages is returning even in the medically advanced United States

Last year 18 Americans contracted bubonic plague and 5 of them died This reflects a recent upswing, just when officials thought that the malady had been eliminated in the United States After the last major U S plague outbreak killed 34 people in Los Angeles in 1924 public officials instituted higher urban-sanitation standards and vigorously set about exterminating rats on ships arriving from Asian ports These measures cut the number of U S cases to about two per year until the 1960s At that time some of the plague-infected animals moved inland and people in greater numbers flocked to these areas The result In the 1960s there were 30 cases in the 1970s 105 cases

Commonly known as the black plague the bacillus is carried by fleas from infected rodents Virtually all the reported U S cases occur in western states Experts say that household pets on the prairie some times pick up the fleas from wild rats squirrels or prairie dogs Ranch hands trappers and even telephone linemen in rural areas have been infected

Humans usually develop hard swellings of the lymph glands These swellings are called buboes Sometimes there are black blotches

Antibiotics can improve the condition People who travel to plague-infested areas—mostly in Asia—should be vaccinated

The Center for Disease Control in Atlanta says the plague 'must be viewed not as a historical phenomenon but as an ever-present threat in the United States and throughout the world —Stuart Diamond

Break on through
To the other side
—Jim Morrison

Flea carrying bubonic plague The fleas infect wild rats squirrels and prairie dogs causing new outbreaks of this medieval disease

CONTINUUM

BINGE DISORDER

A team of University of Minnesota psychiatrists have isolated some of the causes for a strange eating disorder called bulimia in which a woman will spend

Bulimia can cost $100 a day

hours gorging herself with junk food and later get it out of her system by vomiting taking laxatives or both

Drs Richard Pyle James Mitchell and Elke Eckert studied 34 bulimia patients for nearly two years and found the disorder is exclusively restricted to white middle-class upwardly mobile women who are obsessed with eating and with staying thin

Women who tended to go on eating binges from 15 minutes to in one case eight hours were depressed and on a diet already when the binges began What seemed to trigger some of the junk food orgies says Dr Pyle, director of outpatient psychiatry at the University of Minnesota Hospitals and Clinics was some sort of separation—breaking up with a boyfriend for example

The binge eating took over the patients' lives One businesswoman went bankrupt trying to support a $100 a day food habit Some others stole food or became kleptomaniacs to support their daily sprees

Women tend to start doing it young Pyle says when they are about eighteen years old and can become addicted to a daily binge/vomiting habit Pyle even found one woman who had been doing it for 27 years every day

Like those who suffer from anorexia nervosa the starvation disease all the bulimia patients are obsessed with being thin Unlike anorexia nervosa patients however women who suffer from bulimia look normal not withered and gaunt

Bulimia is a health threat One woman had to get dentures after regurgitated stomach acid ate away her tooth enamel And bulimia's hold is powerful During group therapy Dr Eckert asked several bulimia patients which they preferred a life out of control with bulimia or one under control as a fat person All of them chose bulimia

—Douglas Colligan

What is a physicist? I was asked on the floor of the House what in the name of common sense a physicist is and I could not answer

—Anonymous congressman 1914

MISSISSIPPI SEA

About 1 billion years ago a lengthy rift began to form in the middle of North America from the Gulf of Mexico to southern Illinois This Mississippi Valley rift might have split the continent in half had it remained active and it may yet do so

Two Northern Illinois University geophysicists Lyle McGinnis and Patrick Ervin have advised industries planning to build near the rift to design structures able to withstand an earthquake that would measure eight on the Richter scale McGinnis says Twenty earthquakes ranging from magnitude one to two occur along the boundaries of the rift every month Occasionally they reach magnitude four or five In the early 1880s a series of major earthquakes including the largest ever recorded in North America occurred along this fault

When the last major quakes occurred along the rift the area was lightly populated but now one would be as devastating as any quake that ever struck California McGinnis says Furthermore a large quake in the center of the country would radiate its energy a greater distance than those in California probably causing damage over a much wider area

Though the rift is now in a relatively dormant stage such faults have a tendency to become reactivated Conceivably the continent could even open up to form an inland sea Ervin suggests though he is quick to add that this could take hundreds of millions of years —Allan Maurer

Physics is decidedly confused at the moment in any event it is much too difficult for me and I wish I had never heard of it

—Wolfgang Pauli, 1925

Mississippi River at St Louis The city could end up under water

I firmly believe that before many centuries more, science will be the master of man The engines he will have invented will be beyond his strength to control

—Henry Adams

PAPER ALLERGIES

It might be called the secretary syndrome and its symptom is a rash on the hands and the face. It stems from a basic tool of the trade: paper.

Research in recent years has found that some of the chemicals used in a variety of office papers sometimes cause red splotches to break out on the bodies of workers. The chemicals can also cause eye and lung irritation. Though experts say the incidence is uncom[illegible] — and perhaps even [illegible] — they concede that it is hard to know for sure. Few studies have been done on the subject, and people with rashes may think that they are caused by some [illegible].

The most recently reported case involved a [illegible] year-old [illegible] woman [illegible] at the registrar's office at Pennsylvania State University in University Park. She had intermittent itchy rashes for 18 months. Dr. James G. Marks, a dermatologist at the university's Hershey Medical Center, advised her to keep a log of the rashes and the [illegible] products she [illegible]. Dr. Marks then traced the rash to the colorless dye used in carbonless copy paper.

Offending chemicals also include preservatives, other dyes, fillers, pl[illegible]ers and whitening agents. The modern paper industry uses more than 600 ingredients, additives such as [illegible] chemicals, [illegible] resins and even formaldehyde. A far cry from the paper developed by the Chinese nearly 2,000 years ago from natural ingredients! The Chinese suspended straw, leaves and rags in water, breaking up the fibers, filtering them and pressing them into sheets to dry.

Marks said people who work regularly with paper and develop rashes should consider the material as a possible culprit, and dermatologists also should be aware of the possibility.

—Stuart Diamond

The making of a great chemical discovery is not unlike the writing of a great poem or the painting of a great picture. The thought and its execution must be hammered out by genius.

—[illegible]dore Richards, first [illegible] Nobel laureate in chemistry

SLEEP/WAKE BIOFEEDBACK

Skin conductivity, which reflects your level of alertness, has long been a key component of lie-detection analysis. Now Skin Conductance Response, or SCR, may prove useful for relieving insomnia or for preventing people from dozing off at undesirable times, thanks to research done at the University of Tokyo.

Biofeedback can help keep you awake [illegible] or put you to sleep

In one experiment, subjects were seated before a screen in a darkened room and were asked to press a button when shown a certain pattern of dots. This was very boring, and most subjects dozed off within ten minutes. The Tokyo researchers found that as the subjects fell asleep, their SCRs would drop below a certain level.

In the next study the subjects who had dozed off were given the same task but this time their SCR level was monitored. A bell alerted the subjects if their SCRs dropped too low. The technique worked well, and the subjects were able to perform their monotonous tasks.

In the final experiment problem sleepers lay down in a darkened room and were instructed to decrease the volume of a recording of ocean surf sounds using biofeedbacklike techniques. The volume was actually controlled by the subjects' SCRs, which they attempted to lower. Seven of nine insomniacs fell asleep.

Researchers Chiaki Nishimura and Jin'ichi Nagumo suggest that their findings will be applicable to a doze-alarm system for drivers and to clinical therapies of sleep disorder. —Robert Kall

The sky starts at your feet. Think how brave you are to walk around.

—Anne Herbert

CONTINUUM

FUTURE MILLIONAIRES

Children born in this decade who live a normal life span will probably all become millionaires if U.S. Social Security Administration (SSA) projections are right.

Basing its forecast on an inflation rate of only 4 percent a year, the SSA said the average wage earner 70 years from now will collect $761,332 annually. Those on Social Security alone will receive an average benefit of $300,635, assuming the program still exists.

If you doubt those figures, you may wish to compute your own at a more accurate inflation rate. In 1980, the inflation rate ranged between 12 and 18 percent, and this year it never dipped below 8 percent. The average wage today is about $12,000, and the average Social Security benefit is $5,682.

—Allan Maurer

hydrogen and oxygen aren't just trash; they melt immediately in any old way into water. Water needs its history, too.

—Mao Tse-tung

These kids have the right idea: financially speaking, inflation is so persistent we may all be making $700,000 a year by the next century.

LIGHTS OFF

Picture this. You walk into your living room, the lights go on, music begins playing on the radio, and the air conditioner turns on. You leave, and everything shuts off. You haven't even touched a switch.

A Totowa, New Jersey, firm, Kesser Electronics, has devised a system that uses inaudible sound waves to operate equipment by sensing someone's movement in a room. This system turns the lights on and off in the office of Energy Secretary James B. Edwards. Hotels are considering it to save on fuel bills. Guests would no longer be able to leave their rooms with the TV lights, and air-conditioning running. Banks of typewriters can be turned off at the end of the day. Homeowners can use it as a burglar alarm, and it might be used to activate appliances as soon as any one enters the house. Only the imagination limits what you can do with this system, says Charly Barnum, Kesser's president.

The device works by filling an area with high-frequency, inaudible sound waves. When someone walks into the area, a receiver detects that the ultrasonic field has been breached, and it switches on the appropriate equipment. When the person leaves the room, the sound field is once again unbroken, and the equipment shuts off. To solve the problem of the lights going off when the room's occupant stands still, Kesser puts a timer on the equipment. If you set it for ten minutes, the equipment will go off only if there is no movement for ten minutes. Barnum says a person turning the page of a book produces enough movement to activate the system. Each time there is movement, the timer restarts, he says.

The device is also sensitive to mass. A cat or a dog (unless it's a large dog) is too little to turn on the TV by its presence alone.

For commercial buildings, the system's cost is 40 to 75 cents per square foot of floor space, Barnum says. It will cut lighting bills by at least a third. This is especially valuable during after-hours office cleaning. All lights would be off except in the specific area being cleaned.

For residences, the firm has developed a self-contained unit that plugs into a wall socket and has outlets for appliances, just like an ordinary lamp timer. The cost is $30 to $50 per room.

Barnum says the sound waves, which operate at a low decibel level, cause no health problems. A spokesman for the Energy Department says the device in Secretary Edwards's office has worked well since it was installed last December. Officials will collect several months of data on energy saved before they decide how much support they will offer, the spokesman said. —Stuart Diamond

The system is designed so that a pet will not turn on the power.

Like the ski resort of girls looking for husbands and husbands looking for girls, the situation is not as symmetrical as it might seem.

—Alan McKay

BLOODSUCKERS

A man lies in a hospital bed leeches clinging to his fingers A medieval medical tableau? Guess again

It s a scene from the ultramodern world of micro surgery where lowly bloodsuckers help maintain the blood flow in microsurgically reattached fingertips

Leeches do two things " says Dr Jane A Petro a microsurgeon at New York City s Albert Einstein School of Medicine ' Tissue that has a good blood flow into it but not out of it will get swollen and congested Leeches help thin the blood by injecting a natural anticoagulant

More important they extract a certain amount of blood decreasing the congestion which might otherwise cause tissue death In a sense we re using leeches as a temporary vein until new veins can form

The leech technique so far applied only to reattached fingertips could theoretically be used for any body part where you have problems with venous congestion " Dr Petro notes

Leeches are serving as medical helpmates in New York Boston and Houston, and in France too

—Robert Kall

PERSONAL AIR CONDITIONING

A new personal cooling device called Cool Head can keep you cool and collected in temperatures as high as 150°F its manufacturer Industrial Technology International of England and Falls Church Virginia claims

A cap a vest and a battery driven pump that circulates chilled fluid around the

Today's new styles call for the cool but cumbersome look

head and body are all there is to it Originally developed by NASA for the Mercury, Gemini and Apollo astronauts Cool Head is now being worn by people who work in mines and factories Stifling heat in mines refineries and steel mills can cause extreme fatigue accidents, heatstroke and plant shutdowns

Reynolds Aluminum Bethlehem Steel and Gulf and Western employees are already sporting the eight pound Cool Heads And Disneyland says that it too may someday soon have Cool Heads under the hot costumes of Mickey Mouse and Donald Duck

—Richard Levitt

RECOMBINANT DIARRHEA

Now there s yet another triumph for recombinant DNA technology on the horizon a cure for diarrhea

Dr Stanley Falcow head of the Department of Medical Microbiology at Stanford University in Palo Alto California has isolated the gene in a toxic form of the intestinal bacterium *E coli* which makes the poison that causes the runs

Dr Falcow conducted his diarrhea research not at Stanford but at the University of Washington where he teamed up with Walter Dallas Magdelene So and Steve Moseley

The four scientists used recombinant-DNA techniques to prepare a vaccine against the offensive microorganism The Cetus Corporation In California a gene-splicing company is currently conducting various laboratory tests with the vaccine on pigs

An embarrassing inconvenience for tourists diarrhea is a major health hazard for children in poorer countries and a leading killer of livestock particularly piglets and calves

Because the *E coli* genes in large farm animals and in humans are so similar a vaccine for human diarrhea is quite feasible

Moseley working with the World Health Organization has already developed a simple test to pinpoint people harboring the toxic microbe

The work by Falcow and his associates may also lead to a new cure for whooping cough and possibly cures for cholera dysentery, and certain venereal diseases

—Joel Davis

An idea isn't responsible for the people who believe in it

—Don Marquis

E coli with DNA running out of it. This intestinal bacterium makes the poison that causes the runs Gene splicing might provide a vaccine

CONTINUUM

ECOLOGY LASER

In what promises to be a new era in pollution control California scientists have devised a laser that can spot and measure pollution—visible or invisible—in all directions up to 3.2 kilometers away. The device which [illegible]

[illegible] The devic[illegible] dioxide, [illegible]

[illegible] rchlig[illegible] with [illegible] travel[illegible] beam. A [illegible] beam s[illegible] various particles its li[illegible]ers. An antenna ide[illegible]s the pollutants by measuring the magnitude of the scatter.

"It can accurately measure power-plant plumes or regional air-pollution patterns," says James Hawley, of SRI International, the Menlo Park firm that produced the device. At night it can detect black smoke from apartment or power plant stacks, aiding environmental enforcers. In daylight the laser can detect invisible yet harmful pollution as close as 30 meters above the ground.

[illegible]

nitrog[illegible] dioxide [illegible] rain. It h[illegible] pollutant[illegible] stacks an[illegible] Eventually [illegible] measure [illegible] even to take [illegible] and humidity [illegible]

Development of the[illegible] strument, ironically, [illegible] sponsored by the E[illegible] Power Research Inst[illegible]

One hour of operation collects as much information as [illegible]000 air sampling stations, Hawley says. Thus, despite its $[illegible] million cost, the laser device will more than pay for itself by cutting equipment and manpower needs, he adds. The company now leases the device, which it [illegible] funded largely by the electric utility industry. "It's in the best interests of these industries," Hawley says, "because it lets them know what their pollution sources are versus everyone else's."

—Stuart Diamond

Life is a ballet of infinitely progressive, uniform, and conditionally interactive self realization of the potentialities of atomic electron states.

—John Bernal

FOSSIL MUSIC

Sure, they had fire, hunting and gathering, and puberty rites, but what did our Stone Age ancestors do to have fun?

One answer comes from the Soviet Union, where a group of Kiev musicians has cut a record of caveman bebop played on 20,000 year old instruments.

It all started when six bone instruments—fashioned from the shoulder blades, hips, jaws, tusks, shanks, and skull of a mammoth—were found at a dig near Kiev. Criminologists, forensic doctors, and musicologists from Leningrad's Hermitage Museum identified the artifacts as primitive drums, cymbals, and other percussion instruments.

The ancient instruments have not lost their tonal qualities; each has a characteristic sound. What did the Stone Age Top Forty sound like? The Kiev Academy enlisted musicians to find out, and the result is a long playing disc on the Melodiya label, the Soviet Union's government-owned record company. —Chris Larson

The two big truths of the twentieth century are [illegible]gy instead of grace, and information instead of virtue.

—Ulysse Cantois

[illegible] nists [illegible] bones [illegible]

BRAINSTORMS

Using the most advanced cybernetic tools, a small group of neuroscientists unlock a new doorway into the mind

BY KATHLEEN STEIN

In the Sixties they thought they'd finally found it—the atom of cognition, the elementary particle of thought. It looked like a topographical cross section of some newly raised mountain chain: this regular sequence of brain waves exhibiting sharp peaks and ravines all in the space of a half-second. They called it the average evoked potential. To be able to see it, you were forced to compare average electroencephalographic (EEG) measurements "timelocked" to a stimulus and evoked again and again by repeated flashes of light or sound. A computer extracted the brain's own response to those flashes from the ocean of noise that constitutes the song of the mind. From millions of neurons firing in concert came the precise electrical event that was believed to signify selective attention or expectation or detection of novelty. The base 1 of higher cognitive functions.

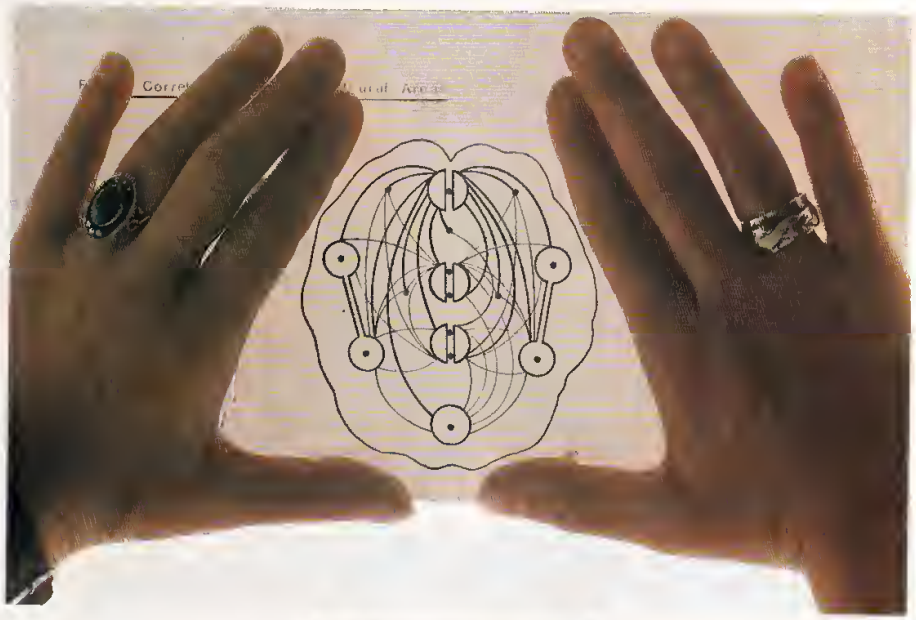
The entire world of communication is built on electricity. The human body itself is a saline pool that acts as a conductor. Who has not experienced the quick impulse of a thought and felt electricity race along the nerves? Perhaps all behavior of organisms is ultimately reducible to the electrical and chemical interactions among neurons. And it is this electrical neuronal basis of mental activity, of consciousness itself, that has long been the holy grail of brain scientists.

Throughout the Seventies work progressed on scalp-recorded electrical activity of the brain. The eye alone could no longer be the collector of these myriad data points, and it was with a fine-toothed computer that neuroscientists explored the average evoked potential (AEP for short). They named its peaks (N1 and N2) and the valleys (P2 and P3). They began to interpret. Some believed, for example, that a certain ramp-shaped wave is a "readiness potential" preceding voluntary action. Could we predict when someone is about to make a move?

The P3, the large positive wave that appeared around 300 milliseconds after the stimulus, elicited the most excitement. Certain investigators speculated that it might designate the moment when conscious decision making takes place. They speculated that it might be used to distinguish

PHOTOGRAPHS BY CHRISTOPHER SPRINGMANN

"In the simplest mental tasks there are rapidly changing electrical patterns involving both sides of the brain"



schizophrenics and other psychotics from run-of-the-mill neurotics and also to gauge I.Q. One sensationalistic M.D. even proposed that by means of aberrant P3 one could detect the thoughts of uncooperative prisoners in war, in intelligence activities, and in criminal investigations.

There was a neuroscientific stampede as the P3 "component" was hailed as the brain wave of the future. Extrapolating from the pioneering research of Samuel Sutton, E. Roy John and Emanuel Donchin, a few psychologists declared that the P3 might soon provide an electrical index for measuring mental workload, and perhaps even for testing leadership ability. Could one calibrate decisiveness among lieutenants and captains? It was even claimed

that the P3 wave was the first objective measurement of an act of "will." Or the electricity that lit the little bulb over your head.

But if the claims for the AEP, and the P3 in particular, were great, the results have so far been limited—even disappointing. Few results were generalizable, and, finally, all that can be said about it is that "some large population of neurons are called into action in processing important stimuli." It indicates nothing more about cognition. Some scientists likened the AEP to puffs of smoke from a factory showing when the factory is

The Master Correlation Diagram (above) charts changes in electrical brain wave patterns; the numerical task gameboard (left); 64 channel EEG cap (right) will scan brain at higher resolution

in operation but not what is being manufactured inside

"That whole line of research seems to be in a cul-de-sac," explains Alan Gevins, director of the EEG Systems Laboratory at Langley Porter Neuropsychiatric Institute at the University of California School of Medicine in San Francisco. The average-evoked-potential technique made big advances in studying several basic cognitive processes, particularly a person's detection of novel or relevant stimuli, and then it pretty much stopped. What we're doing now," he says, "is to try to develop a new way of imaging the functional electrical activity of the brain, to see things that couldn't be seen before." Electrical patterns never before seen in such detail have suddenly become coherent schematic designs.

Yet for the people at the EEG Systems Lab, this is just the beginning. They are now working to perfect their 64-channel EEG scalp-recording helmet, which will allow them to carry out even more advanced types of computerized signal processing of the brain's functional electricity. And this advanced EEG device has the potential to serve as an electrical CAT scanner, eventually measuring the brain's information processing in real time. The long-term results of their line of research could virtually open a door into the brain, admitting its user for the first time to look in on his own wiring. "With this kind of knowledge, a person just might be able to enhance his learning capabilities, his memory, his hand-eye coordination. One may even be able to employ his own brain in a biocybernetic capacity, be able to link his brain to a computer to bypass the body entirely for such chores as guiding vehicles or machines. Yes, it's all there in our software."

Yet reporting about scientific breakthroughs is sometimes like tracing mythologies. The real story is usually more complicated and less weird than the legend. It had been rumored that the EEG Systems Lab was building a "thought machine," a device so advanced it rendered contemporary EEG techniques as quaint as a windup Victrola in contrast to a digital audio reproduction system. But a few days at the salmon-red building that houses the EEG Systems Lab made it obvious to me that, as in so much of science, the lab's new research was not in the mode of the Final Frontier or in the style of gee-whiz technotoys, but rather was concerned with a subtle and complex series of experiments that would appear almost as incomprehensible to most of us as a tablet of ancient Sumerian trade regulations.

The knowledge assembled in the lab was the result of ten years of painstaking, tedious labor that included development of an advanced software system (ADIEEG), several purely methodological studies to measure brain-wave contaminants, and finally a series of experiments with rigid controls and seemingly endless data verification. And for those people seeking some quick answers, this news about the brain might seem like a step backward. The news is not about a near future of brains attached to wires. No covert mind reading. No thought control. No mighty computers running on the steam generated by cortex power.

But the EEG Systems Lab *can* see minute electrical patterns in the brain that have never been seen before. By careful design of their test conditions, and by using mathematical pattern-recognition analysis, they have charted rapidly changing, complex correlations of electrical patterns involving many areas of the brain—patterns that flash during even the simplest spatial and numerical tasks. And this suggests to them that different types of information are not processed in only a few specialized areas of the brain, as has been a theory for decades. Rather, many regions of the brain are involved, even in the most elementary cognitive functions. On paper, on their correlation diagrams, the tracings of electrical patterns resemble the marks left after particle bombardment.

The EEG Systems Lab is an unusual collection of scientists and iconoclasts who are nonetheless rated by the neuroscientific community as "methodological ultraconservatives."

It takes us years to complete an experiment," says Jess Ghannam, a graduate student in clinical psychology at the Uni-

'And now let us all clasp hands and make contact with this year's guest speaker'

versity of California at Berkeley explaining why he chose the lab "But when we publish, it usually sets a precedent. The lab is hot." A certain irreverent attitude associated with the lab may be partially explained by the youthfulness of the staff. Gevins, thirty-five, admits to having a unique criterion for picking his colleagues. "Moral conviction," he says, "and that includes an overriding respect for the truth. The people here have all forgone security in their careers because of this trait."

"Debunk, debunk, that's exactly what we've been doing here," laughs Bobby Schaffer, a behavioral psychologist who is responsible for making sure that the cognitive specialists don't wax too theoretical. One of his slogans is, "All data is Dada." "With our ADIEEG analysis system we've been shooting down erroneous concepts," he remarks. "But we've also tried—under the most controlled conditions possible and with the most cooperative, most highly intelligent participants—to find out something about higher cognitive functions. We'll take our new model of the brain to the end of its logical conclusions, and then we'll probably shoot it down."

For five years the lab carefully developed a computerized pattern-recognition system powerful enough to detect brain-wave patterns subtle enough to allow brain detectives to "read between the lines" without needing to average the data. Several years ago, when Gevins was satisfied the program would work, he set out to see whether it could crack a really big nut—brain lateralization of logical and spatial thinking, the popular left/right-hemisphere theory.

In a study of 23 persons, the lab initially confirmed the hypothesis that writing sentences, arranging colored blocks and doing other tasks supposedly processed primarily by one hemisphere or the other did indeed seem to be more associated with either the right or the left side of the brain. But, by looking closer with the mathematical pattern recognizer, they failed to see any significant differences in electrical activity between the tests in which the participants were writing paragraphs or those in which they were just scribbling. "I thought we'd made a terrible mistake," Gevins recalls. "But we spent months double- and triple-checking our results, and there were no errors."

So they went back and wired up 32 more willing participants. This time, not only did they use the pattern-recognition system, but they also devised tasks so stringently balanced that only the mental activity associated with the task itself varied. No movement patterns, no muscle twitch, no heavy breathing, no eye blinks. These are things that show up in EEGs and confound the readings, and they were eliminated.

Under these conditions the researchers saw that hemisphere differences between tasks in the EEG "spectra" disappeared entirely. Instead, they witnessed rather uniform patterns involving many areas of both hemispheres. "This suggested," Gevins

states that different types of tasks are not processed in a few specialized areas but that many widely dispersed areas of the brain are involved. So it is not correct to say that arithmetic, for example, is located in one place just because damage there results in an inability to add numbers. All you can say is that the damaged area is critical for doing arithmetic." Gevins likes to use a TV analogy. "If you remove a resistor from a TV set and the picture turns to stripes, you can't conclude that the resistor is the source of 'pictureness.' All you can say is that you've interfered with a critical node in the circuit."

There was considerable furor and fury in the brain-research community when EEG Systems Lab published these findings in *Science* magazine in 1979. After all, it did suggest that those promoting the dual-brain hypothesis on EEG data were wrong, that their experiments lacked proper controls and contained unverifiable conclusions, that these scientists confused signs of motor activity on the EEG with indications of specific types of mental activity. It seemed as if the wedding of brain waves to the bicameral-mind movement—just then having its honeymoon with the various human potential groups throughout the country—might have to be reconsidered, might even have to be annulled. We could all stop trying to draw that genie out of the right side of the brain.

With their new results, EEG Systems Lab really had fish to fry. If many parts of the brain were in communication with many other parts during the simplest cerebral musings," how could this be tested, proved, demonstrated? It clearly required a new model of brain function.

"There has been a tendency to model the brain on the latest technology," Gevins explains. "During the latter half of the nineteenth century, the brain was supposed to resemble a steam engine, with instincts that built up pressures and valves that released them. In the early twentieth century, it became a telephone switchboard, and following the Second World War, brain functioning was modeled on cybernetic guidance and control systems, with servomechanisms and feedback loops. When digital computers became widely available, the brain became an information-processing system whose inputs and outputs were coordinated by a single computer. Then it became fashionable to think of the brain as a dual processor, to correspond to the dual hemisphere theory, and, of course, there was the hologram model.

"So here we are in 1981, and our model, based on our most recent results, is that of a local computer network. Different areas, or nodes, are like processors with specialized functions—visual, auditory, and somesthetic [touch] processing functions, motor control elements of language, and probably, aspects of short-term memory and executive functions as well. Some nodes have more general functions. The frontal lobes, for example, are huge, mostly uncharted areas. They seem to be involved with integrating information from different senses over time, with selective attention, and with long-term planning, modeling, and predicting. These nodes must communicate with one another, and perhaps we could measure some signs of this communication with the EEG."

But I don't want to get trapped in this analogy," he adds hastily. "The brain is more complicated than our machines. Until the next technology comes along, it's convenient to model it after local computer networks, but the brain is basically a different sort of entity."

We really need a totally new terminology for dealing with the brain," Schaffer says. "What can you say about an organ that is communicating with your big toe while it is communicating with everything else?"

Different entity or not, in 1980 EEG Systems Lab used its mathematical pattern-recognition analysis to predict successfully whether or not patients suffering from uncontrolled temporal-lobe epilepsy could benefit from surgical treatment. In the past, those who did not benefit from medication would find out only after surgery whether the surgery had worked or not. The EEG Systems Lab's method was close to 90 percent accurate in separating those patients who would benefit most from surgery from those who would benefit least.

"Normal people may be taught to regulate their own attention spans. Not just for learning enhancement but for dividing—multiplexing—their attention at, say, cocktail parties."

And in 1981, at last, Gevins *et al* verified their hypothesis that simple cognitions involve a series of interrelated electrical-wave surges that move, lightninglike, across the brain in minute fractions of a second. Their new method, published in August 1981 in *Science*, seems to provide a more powerful telescope for viewing new sections of the cerebral heavens. "Science builds up gradually," Gevins muses. "Then every once in a while, there's a little leap. But the leaps are always preceded by a lot of preparation."

The leap that is the EEG Systems Lab's invention is based on something old as well as on something new: the idea that when certain areas of the brain are communicating with one another, there is a similarity in the shape of their EEG signals. That idea, probably originated with famed cybernetic-cist Norbert Wiener. The idea that wave shapes as well as their 'phase relations' or timing, would show regularity in different areas of the brain when those areas are communicating, was also shared with British psychiatrist Grey Walter and an Anglo-American electrical engineer, Harold Shipton, who, in the early Fifties, built a device he called the toposcope, made up of little cathode-ray tubes, each measuring a different section of the brain, to get an idea of how those areas were relating to one another.

"A major problem was random noise," Gevins recollects. "In the Fifties they didn't have computer analysis to suppress this noise and bring out the signals specifically related to 'thinking.' It was an idea thirty years before its time."

Besides developing an adequate computer analysis, EEG Systems Lab figured out the proper experimental controls to screen out the blips, blinks, and extraneous perceptual, motor, and mental activity—everything but the electrical evidence of a single purposive event. To regulate the changing reaction times and the responses of the participants, the researchers created two simple tasks. Implemented by Robert Tannehill, the programming and data acquisitions expert, and revised many times by the whole staff, the tasks evolved into computer games that measured nothing more than a person's mental reaction to a number or a spatial stimulus that appeared on a little video screen. It was as simple as lining up an arrow and a target by pushing down on a pressure-sensitive transducer with your index finger or gauging the magnitude of a number from 1 to 100 by pushing down on the transducer the same way. A graded finger pressure told them everything they wanted to know.

The tasks were adjusted by the computer so that they balanced the differences in skill between individuals and even for the same individual at different times. That is, in the arrow task, the target grew smaller or larger depending on how good you were at hitting it. The computer held perceptual-motor and task-difficulty differences constant while varying the type of mental judgment required. Thus the corresponding brain electrical patterns could be attributed only to the type of judgment you were making.

The tasks derive much from 'human factors' research," Schatter explains. "Much strictly behavioral research on hand-eye coordination has involved changing the difficulty of the task as a function of performance. Many computer toys work on the same principle." The EEG Systems Lab's games rate somewhere between Space Invaders and Asteroids on the "arcade difficulty" scale.

"I'm oriented more toward EEG toys than higher cognitive functions," Tannehill admits, "although I haven't had time to look along the fun dimension yet. (It doesn't

CONTINUED ON PAGE 140

FICTION

Lightning strikes a tomb, uncovering an ancient and awesome secret

ON THE SLAB

BY HARLAN ELLISON

Lightning was drawn to the spot. Season after season, August to November, but most heavily in September, the jagged killing bolts sought out George Gibree's orchard. Gibree, a farmer with four acres of scabrous apple trees whose steadily diminishing production of fruit would drive him, one year later, to cut his throat with a rabbit-skinning knife and to bleed to death in the loft of his barn in Chepachet, near Providence, Rhode Island, *that* George Gibree found the dismal creature at the northeast corner of his property late in September. In the season of killing bolts. The obscenely crippled trees—scarred black as if by fireblight—had withstood one attack after another, splintering a little more each year, withering a little more each year, dying a little more each year. The MacIntoshes they produced: hideous and wrinkled as Thalidomide babies. Night after night the lightning

PAINTING BY ERNST FUCHS

drawn to the spot cracked and thrashed until one night as though weary of the cosmic game a monstrous forked bolt sizzling with power uncovered the creature's graveplace

When he went out to inspect the orchard the next morning holding back the tears till he was well out of sight of Emma and the house George Gibree looked down into the crater and saw it stretched out on its back its single green eye with the two pupils glowing terribly in the morning sunlight its left forearm—bent up at the elbow—seeming to clutch with spread fingers at the morning air It was as if the thing had been struck by the sky's fury as it was trying to dig itself out

For just a moment as he stared down into the pit George Gibree felt as if the ganglia mooring his brain were being ripped loose His head began to tremble on his neck and he wrenched his gaze from the impossible titan stretched out filling the thirty-foot-long pit

In the orchard there could be heard the sounds of insects a few birds and the whimpering of George Gibree

Children trespassing to play in the orchard saw it, and the word spread through town and by stringer to a freelance writer who did occasional human-interest pieces for the Providence *Journal* She drove out to the Gibree farm and finding it impossible to speak to George Gibree who sat in a straight-back chair staring out the window without speaking or even acknowledging her presence managed to cajole Emma Gibree into letting her wander out to the orchard alone

The item was small when published but it was the beginning of October and the world was quiet The item received interested attention

By the time a team of graduate students in anthropology arrived with their professor pieces of the enormous being had been torn away by beasts of the field and by curious visitors They sent one of their group back to the University of Rhode Island in Kingston advising him to contact the University's legal representatives readying them for the eventual purchase of this terrifying miraculous discovery Clearly it was not a hoax this was no P T Barnum Cardiff Giant but a creature never before seen on the earth

And when night fell the professor was forced to badger the most amenable of the students into staying with the thing Coleman lanterns down jackets and a mini-stove were brought in But by morning all three of the students had fled

Three days later a mere six hours before the attorneys for the University could present their offer to Emma Gibree a rock concert entrepreneur from Providence contracted for full rights to and ownership of the dead giant for three thousand dollars Emma Gibree had been unable to get her husband to speak since the morning he had stood on the lip of the grave and stared down at the one-eyed being she was in a panic there were doctors and hospitals in her future

Frank Kneller who had brought every major rock group of the past decade to the city rented exposition space in the Providence Civic Center at a ridiculously low rate because it was only the second week in October and the world was quiet Then he assigned his public relations firm the task of making the giant a national curiosity It was not a difficult task

It was displayed via minicam footage on the evening news of all three major networks Frank Kneller's flair for the dramatically staged was not wasted

The thirty-foot humanoid pink skinned and with staring eye malevolently directed at the cameraman's lens was held in loving close-up on the marble slab Kneller had had hewn by a local monument contractor

Pilbeam of Yale came and Johanson of the Cleveland Museum of Natural History and both the Leakeys and Taylor of Riverside came with Hans Seuss from the University of California at La Jolla They all said it was genuine But they could not say where the thing had come from It was however native to the planet thirty feet in height Cyclopean as hard as rhinoceros horn but human And they all noticed one more thing

The chest just over the place where the heart lay was hideously scarred As though centurions had jammed their pikes again and again into the flesh when this abomination had been crucified Terrible weals puckered skin still angrily crimson against the gentle pink of the otherwise unmarred body

Unmarred that is but for the places where the curious had used their nail files and penknives to gouge out souvenirs

And then Frank Kneller made them go away shaking their heads in wonder mad to take the creature back to their laboratories for private study but thwarted by Kneller's clear and unshakable ownership And when the last of them had departed and the view of the Cyclops on its slab could be found in magazines and newspapers and even on posters *then* Frank Kneller set up his exposition at the Civic Center

There within sight of the Rhode Island State House atop whose dome stands the twelve-foot-high gold-leafed statue of the Independent Man

The curious came by the thousands to line up and pay their three dollars a head so they could file past the dead colossus blazoned on life-sized thirty-foot high posters festooning the outer walls of the Civic Center as *The 9th Wonder of the World!* (Ninth reasoned Frank Kneller with a flash of wit and a sense of history uncommon to popularizers and entrepreneurs because King Kong had been the Eighth) It was a gracious *hommage* that did not go unnoticed by fans of the cinematically horrific and the gesture garnered for

Must be the mating season

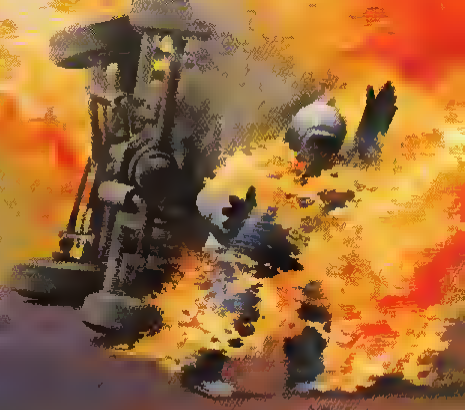
"IT'S NEVER BEEN DONE BEFORE." A TERRIFYING THOUGHT TO SOME. HERE'S TO THOSE IT INSPIRES.

Kitty O'Neil is 5 ft. 3 in. tall, weighs 98 pounds and has been deaf since childhood. But that hasn't slowed her down.

She's set 26 world speed records on land, 2 on water and 1 on waterskis. (Including the Women's World Land Speed Record—with a top speed of 618 mph.) And she was the first stuntwoman to perform a 180 ft. high fall and a 90 ft. high fall while on fire (another world record).

Kitty O'Neil has been through a lot. And after a day spent doing things that haven't been done before, Kitty O'Neil does something she has done before: she enjoys a Cutty Sark.

Kitty O'Neil



The Scotch with a following of leaders.

CUTTY SARK®

Kneller an acceptance he might not have otherwise known from the cognoscenti.

And there was an almost symphonic correctness to the titan's having been unearthed in Providence in Rhode Island in that Yankee state so uncharacteristic of New England that situs founded by Roger Williams for 'those distressed for cause of conscience' and historically identified with independence of thought and freedom of religion, that locale where the odd and the bizarre melded with the mundane. Poe had lived there, and Lovecraft, and they had had strange visions, terrible dreams that had been recorded that had influenced the course of literature, the moral ownership of the city by the modern coven known as the Mafia these and uncountable reports of bizarre happenings, sightings, gatherings, beliefs that made it seem the Providence *Journal* was an appendix to the writings of Charles Fort provided a free-floating ambience of the peculiar.

The lines never seemed to grow shorter. The crowds came by the busloads, renting cassette players with background information spoken by a man who had played the lead in a television series dealing with the occult. Schoolchildren were herded past the staring green eye in gaggles, teenagers whose senses had been dulled by horror movies came in knots of five and ten, young lovers needing to share stopped and wondered; elderly citizens from whose lives had been leached all wonder smiled and pointed and clucked their tongues; skeptics and cynics and professional debunkers stood frozen in disbelief and came away bewildered.

Frank Kneller found himself involved in a way he had never experienced before: not even with the most artistically rewarding groups he had booked. He went to bed each night exhausted but uplifted. And he awoke each day feeling his time was being well-spent. When he spoke of the feeling to his oldest friend, his accountant, with whom he had shared lodgings during college days, he was rewarded with the word *ennobled*. When he dwelled on the word, he came to agree.

Showing the monstrosity was *important*.

He wished with all his heart to know the reason. The single sound that echoed most often through the verdant glade of his thoughts was *why*?

'I understand you've taken to sleeping in the rotunda where the giant is on display?' The host of the late-night television talk show was leaning forward. The ash on his cigarette was growing to the point where it would drop on his sharply creased slacks. He didn't notice.

Kneller nodded. "Yes, that's true."

"Why?"

"*Why* is a question I've been asking myself ever since I bought the great man and started letting people see him."

"Well, let's be honest about it," the interviewer said. "You don't *let* people see the giant... you charge them for the privilege. You're showing an attraction after all. It's not purely an humanitarian act."

Kneller pursed his lips and acceded. "That's right, that's very true. But I'll tell you, if I had the wherewithal, I'd do it free of charge. I don't, of course, so I charge what it costs me to rent space at the Civic Center. That much, no more."

The interviewer gave him a sly smile. "Come *on*."

"No, really, honest to God, I mean it," Frank said quickly. "It's been eleven months, and I can't begin to tell you how many hundreds of thousands of people have come to see the great man, maybe a million or more. I don't know. And everybody who comes, goes away feeling a little bit better, a little more important."

"A religious experience?" The interviewer did not smile.

Frank shrugged. "No, what I'm saying is that people feel *ennobled* in the presence of the great man."

"You keep calling the giant 'the great man.' Strange phrase. Why?"

"Seems right, that's all."

"But you still haven't told me why you sleep there in the place where he's on display every day."

Frank Kneller looked straight into the eyes of the interviewer, who had to live in New York City every day and so might not understand what peace of mind was all about, and he said, "I like the feeling. I feel as if I'm worth the trouble it took to create me. And I don't want to be away from it too long. So I set up a bed in there. It may sound freaky to you, but..."

But if he had not been compelled to center his life around the immobile figure on the marble slab, then Frank Kneller would not have been there the night the destroyer came.

Moonlight flooded the rotunda through the enormous skylights of the central display areas.

Kneller lay on his back, hands behind his head, as usual finding sleep a long way off, yet at peace with himself in the presence of the great man.

The titan lay on his marble slab, tilted against the far wall, thirty feet high, his face now cloaked in shadows. Kneller needed no light. He knew the single great eye was open, the twin pupils staring straight ahead. They had become companions, the man and the giant. And, as usual, Frank saw something that none of the thousands who had passed before the colossus had ever seen. In the darkness up there, near the ceiling, the scars covering the chest of the giant glowed faintly, like amber plankton or the minuscule creatures that cling to limestone walls in the deepest caverns of the earth. When night fell, Frank was overcome with an unbearable sadness. Wherever and however this astounding being had lived... in whatever way he had passed through the days and nights that had been his life... he had suffered something more terrible than anyone merely human could conceive. What had done such awesome damage to his flesh, and how he had regenerated even as imperfectly as this, Kneller could not begin to fathom.

But he knew the pain had been interminable, and terrible.

He lay there on his back, thinking again as he did every night, of the life the giant had known, and what it must have been for him on this earth.

The questions were too potent, too complex, and beyond Frank Kneller's ability even to pose properly. The titan defied the laws of nature and reason.

And the shadow of the destroyer covered the skylight of the rotunda, and the sound of a great wind rose around the Civic Center, and Frank Kneller felt a terror that was impossible to contain. Something was coming from the sky, and he knew without looking up that it was coming for the great man on the slab.

The hurricane wind shrieked past the point of audibility, vibrating in the roots of his teeth. The darkness outside seemed to fall toward the skylight, and with the final sound of enormous wings beating against the night, the destroyer splintered the shatterproof glass.

Razor-edged stalactites struck the bed, the floor, the walls, one long spear imbedded itself through the pillow where Frank's head had lain a moment before, penetrating the mattress and missing him by inches where he cowered in the darkness.

Something enormous was moving beyond the foot of the bed.

Glass lay in a scintillant carpet across the rotunda. Moonlight still shone down and illuminated the display area.

Frank Kneller looked up and saw a nightmare.

The force that had collapsed the skylight was a bird. A bird so enormous he could not catalog it in the same genus with the robin he had found outside his bedroom window when he was a child... the robin that had flown against the pane when sunlight had turned it to a mirror... the robin that had struck and fallen and lain there till he came out of the house and picked it up. Its blood had been watery and he could feel its heart

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> *Wherever and however this astounding being had lived, the giant had suffered something more terrible than anyone merely human could ever conceive.*

THREE FALLACIES

BY BEN BOVA

We are all citizens of space and stewards of tomorrow

PHOTOGRAPH BY PETE TURNER

This third-anniversary issue of *Omni* is dedicated to the concept of breakthroughs: major advances in human knowledge, technology or capabilities that will dramatically alter our lives in years to come. In the pages to follow we will see breakthroughs in the sciences, in the arts, in transportation, in medicine, and in many other areas of human endeavor. There is much to celebrate.

Breakthroughs can also involve our attitudes, the way we perceive the world around us, the way we think.

According to scientific surveys, most of *Omni*'s readers solidly support the space program. Yet many Americans still have doubts about the wisdom of spending billions of dollars to launch satellites and astronauts into space. These Americans are victims of antiquated thinking and need a breakthrough in attitude so that they can perceive the opportunities that space developments offer.

Most of the people who doubt the usefulness of the space program fall victim to one or more of three fundamental fallacies: the Flat Earth Fallacy, the Either/Or Fallacy, or the Mañana Fallacy. Each is dangerous.

THE FLAT EARTH FALLACY

There are more than 4.5 billion people living on Earth today. By the turn of the century there will be at least 6 billion, perhaps 7. The political, social, ecological, and emotional strains we feel today all stem from the fact that 4.5 billion mouths must be fed every day. And every day more than 200,000 new babies add to the problem.

Each of these human beings requires food energy shelter clothing To provide these necessities we are consuming our planet s natural resources ot fuels, metals minerals timber farmland

Lester R Brown president of the Worldwatch Institute has warned that we are rapidly destroying our biological resources The human race is almost totally dependent on four worldwide biological systems ' In Brown s view these are fisheries forests grasslands and crop lands All our food and most of our raw materials come from these four sources

Biological systems are renewable they automatically replenish themselves because they are living dynamic systems But there are limits to how hard we can press these systems without eradicating them Put too much pressure on a biological system and instead ot renewing itself it will self-destruct

We are harvesting the world s fisheries forests grasslands and croplands faster than they can renew themselves This leads to a situation in which in Brown s words fisheries collapse forests disappear grasslands are converted into barren wastelands and croplands deteriorate

The southward push of the Sahara and the resulting famine in the Sahel are manifestations of human overpressure on the Sahel grasslands The decreasing returns from croplands despite constantly increased doses of fertilizers and insecticides also result from human over pressure So do the stripping of the rain forests of South America and the depletion of fisheries oft Peru Cape Cod and the Norwegian coast Where Odysseus once plucked fish out of the wine-dark Aegean Greek fishermen today find a dying sea

What will the world be like in the 1990s when there are 6 billion or 7 billion ot us and when resources are even scarcer and more expensive than they are today?

The Club of Rome s famed study *The Limits to Growth* predicted a global disaster a collapse of civilization on a scale not seen since the Roman Empire self-destructed The Council on Environmental Quality s *Global 2000 Report* warned "If present trends continue the world in 2000 will be more crowded more polluted less stable ecologically and more vulnerable to disruption than the world we live in now"

All these gloomy forecasts are being made despite the most gigantic supply of natural resources that any human being can imagine We risk starvation in the midst of plenty tor all These dismal warnings contain a common fallacy *The Limits to Growth* the *Global 2000 Report* and all the latter-day Malthusians tacitly assume that the earth is flat that we are stuck here on the ground forever

The Flat Earth Fallacy is as pervasive as it is perverse We all share it to some extent Even though we have lived through the space race and have seen men walk on the moon and robot explorers on Mars we still tend to think that we have only the surface of this one planet Earth on which to resolve our problems

Doomsayers are fond of referring to the tragedy of the commons as proof of their warnings William Ophuls defined the tragedy of the commons in this way "Men seeking gain naturally desire to increase the size ot their herds Since the commons [the herds grazing ground] is finite the day must come when the total number of cattle reaches the carrying capacity adding more cattle will ... eventually destroy the resources on which the herdsmen depend"

Since the commons is finite " That s the fallacy The commons is not finite Not any more

Our solar system is incredibly rich in energy and natural resources While it may be centuries before large numbers of people can live out there today we can send small numbers ot men and women into space to begin tapping the resources that await us

THE EITHER/OR FALLACY

During the height of the Vietnam War the comedian Pat Paulsen commented "Kids today say 'Make love not war' Hell during World War II we did both"

One ot the difficulties with our thinking about space and with our political thinking in general is that we tend to polarize the world in terms of either/or

Either we continue to import Middle Eastern oil or we freeze in the dark

Either we increase our military budget or we capitulate to the Russians

Either we stop industrial growth or we choke on our pollution

Either we fund space-exploration programs or we fund social welfare programs

Either you re for me or you re against me

Many of us tend to think of Earth as the only place where human beings can live The rest ot the universe is "outer space" quite separate from us Either/or Yet we have seen astronauts walk the dusty surface of the moon and there are four cosmonauts living in space aboard the *Salyut 6* spacecraft as I write these words

Our planet does not exist in isolation Earth spins in a solar system that has a wealth of energy and raw materials The sunlight that falls on Earth is only a minuscule fraction of the energy that the sun pours out into space We know from lunar samples brought back by our Apollo astronauts that the moon is rich in aluminum titanium oxygen carbon silicon and other elements

For more than a century astronomers have been studying the meteorites from deep space that crash against our planet From their analyses they have concluded that there are hundreds of millions of tons of incredibly valuable metals and minerals floating in our solar system iron nickel cobalt platinum gold silver potassium magnesium copper And much more

Just as our Ice Age ancestors faced the

CONTINUED ON PAGE 174

Here s a word you seldom see

The fits and starts of science and technology shape our future

BREAKTHROUGHS

INTRODUCTION

Breakthroughs are the growth mechanisms of science and technology. They are sudden, often violent: Barriers are breached, new ground is charted.

All of them begin with an idea. But it need not be correct. The nineteenth-century physician John Gorrie believed that swamp gas caused yellow fever. To get rid of the gas, he invented a way to filter and cool the air in a patient's room. Gorrie spent the rest of his life campaigning to alert people to the dangers of swamp gas, and he died unaware that he had fathered air conditioning.

Breakthroughs do not occur all by themselves. For example, the principles of three-dimensional lensless photography were known 80 years ago; making a good hologram required a technical breakthrough—the laser, which didn't appear until 1960.

There is a lag between the breakthrough and its use. In 1601 James Lancaster, of the East India Company, found that lemon juice prevents scurvy. The Royal Navy adopted citrus juice on long voyages in 1795, a delay of 194 years.

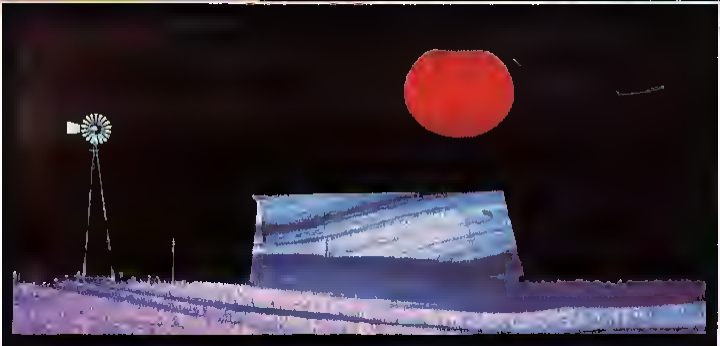
Breakthroughs can be stimulated, sometimes by war, often by money. Thomas Edison said it best: "Anything that won't sell, I don't want to invent."

There are barriers to these breakthroughs. Some are natural, like the speed of light. Others are man-made. The U.S. Patent Office has become an obstacle to breakthroughs. The average patent application takes 23 months to process. And half of all patents tested in court are rejected.

Finally, one breakthrough leads to others. We can see this clearly in three recent breakthroughs—microelectronics, gene splicing, and space technology. Already their marks can be discerned in nearly every human activity. Breakthroughs continue to change our lives.

GHOSTS AND GOBLINS

In this land of 20,000 astrologers and only 2,000 astronomers, you'd think that breakthroughs into the nether regions of the paranormal should be frequent. As a species, we have a bizarre yearning to believe the unbelievable. But yearnings, no matter how strong, are seldom sufficient in themselves to produce breakthroughs. Despite the expenditure of millions of dollars on decades of supposedly serious research, at such respectable institutions as Duke University, Maimonides Medical Center, and SRI International, as well as at a host of lesser establishments, such things as poltergeists, levitation, telepathy, psychic healing, dowsing, out-of-body travel, UFOs, magic pyramids, the Bermuda Triangle, transmigration, reincarnation, and communication with the spirits of the dead are still mysteries at best. Admittedly, spoon bending, mind reading, and other psychic chicanery flourish, but the real gold still eludes us. Nonetheless, we wait—patiently—for hard evidence of psychic phenomena.



ON THE FARM

Only 5 percent of Earth's surface can be farmed, and that portion is steadily being reduced. But genetic breakthroughs are boosting harvests and opening unfarmable land. Already synthetic bovine growth hormone is improving livestock yields. Geneticists are working on salt-resistant plants to grow along desert seacoasts. And at Cornell University they are only a decade from tailoring nitrogen-fixing plants that need no fertilizer.

TRANSPORTATION

The steady increase in the cost of fuel has been the primary stimulus for breakthroughs in transportation, and these advances have been many. Mercedes's experimental Economobile, which gets upwards of 3,000 miles per gallon, is one notable example; the development of new microcomputer-controlled automatic transmissions is another. Energy demands have led many innovators to turn to the past, and designs for windships and helium-filled skyships are winning popular approval. Some innovations will produce surprising side effects. Many merchant ships now provide "private" quarters for seamen. The *New York Times* says this gives sailors a sense of isolation and has caused an increase in alcoholism.

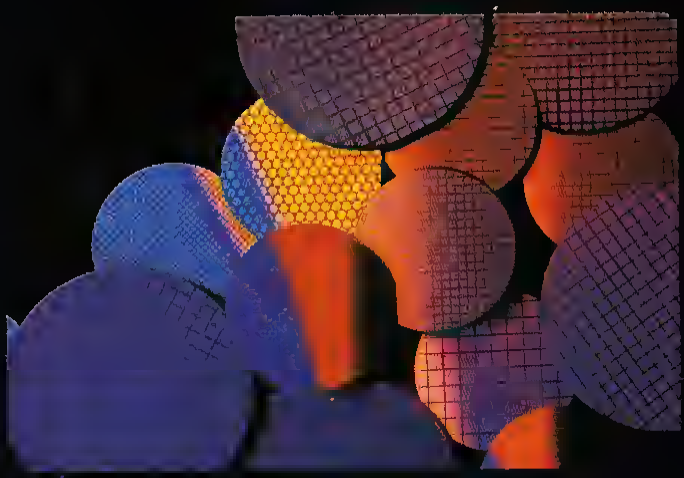
COLD CASH

Two much-heralded breakthroughs in the monetary world, the $2 bill, reintroduced in 1976, and the Susan B. Anthony dollar coin, first circulated in 1979, have produced what bomb makers call a fizzle yield. Each was unable to surmount that most formidable barrier—public apathy. The Susan B. Anthony dollar was designed to reduce the cost of dollar production, and its dismal debut signaled serious problems for the one-cent piece. The Lincoln cent now costs nearly 1 cent to produce, and until recently it was thought the cent might go the way of the dinosaur and the silver half-dime. But now, in a breakthrough of sorts, a new cent is about to be issued. Due to be put into circulation early in 1982, it will be made of an alloy of 99.2 percent zinc, electroplated with copper to give it the familiar reddish color.

SPACE

Since the invention of the Chinese gunpowder rocket in the thirteenth century, thousands of breakthroughs have paved the road to space. Some of these are clearly benchmarks—Robert Goddard's launching of the first liquid-propellant rocket in 1926, *Sputnik 1*, *Vostok 1*, and *Apollo 11*. *Sputnik 1*, for example, made Americans aware of the threat of Soviet supremacy in space, and a shower of breakthroughs ensued. On April 12, 1981, another benchmark was struck, one that should produce more breakthroughs in the exploration of space than any single development so far. Just after 7 o'clock on that morning Hugh Harris, the voice of NASA launch control, in Houston, announced, "We have liftoff," and the space shuttle *Columbia*, mankind's first genuine spaceship, passed through the doorway to the stars.

BREAKTHROUGHS

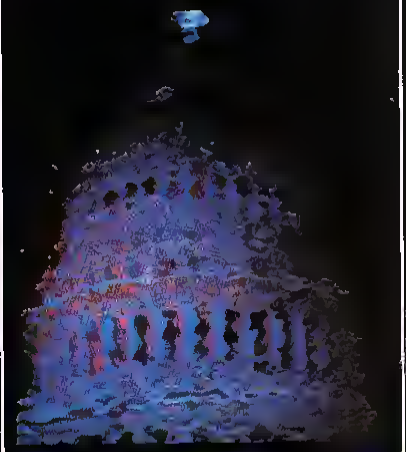


SILICON AGE

The revolution brought on by the silicon semiconductor chip will be with us through the end of the century, but silicon itself may not last that long. Today's dime-sized chips can hold up to 65,000 bits of data and operate at speeds measured in trillionths of a second. For the future they will not be small enough or fast enough. Current contenders for silicon's position are compounds of arsenic, gallium, indium, and antimony. Electrons travel faster in these materials than they do in silicon. Another alternative is the Josephson junction, based on superconductivity at incredibly low temperatures. (See "Cold Currents," page 120.) Also under development are hybrid electro-optical chips that may be the forerunners of the all-optical chip, thought to be the transistor of the twenty-first century.

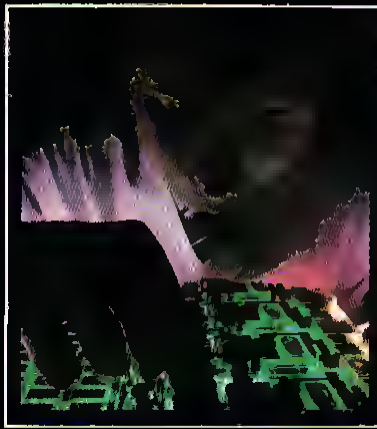
POLITICS

Thanks to computers, psychological profiles, and the electronic media, politics has become a technological business. Elections are decided before most ballots are counted, and interactive television will make the electoral process even more predetermined. Curiously, a breakthrough in the annals of politics occurred this year in Maine, where voting by mail proved cheaper and produced a larger turnout of voters.



GENES FOR PROFIT

The most important breakthrough in biotechnology occurred this year when the U.S. Supreme Court ruled that living organisms are patentable and ensured that companies can profit from tailor-made bacteria. Since that decision was made, new life forms have stampeded from the lab. Most have been modified bacteria, capable of producing alcohol from wood waste, sulfur-free crude oil, and vaccines to prevent hepatitis and hoof-and-mouth disease; they can also create insulin, interferon, and several hormones. "In ten or twenty years," predicts Peter J. Farley, president of Cetus Corporation, "we will be designing animals to specification." Researchers envision the marriage of microelectronics and microorganisms. Scientists at GTE Laboratories, Inc., are now working with polymers, produced by altered bacteria, that are able to conduct electricity.

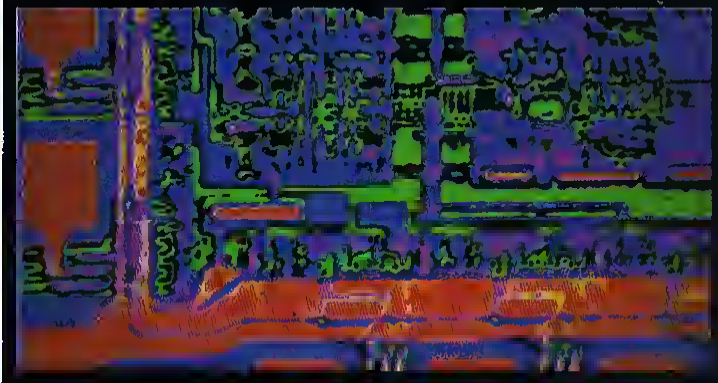


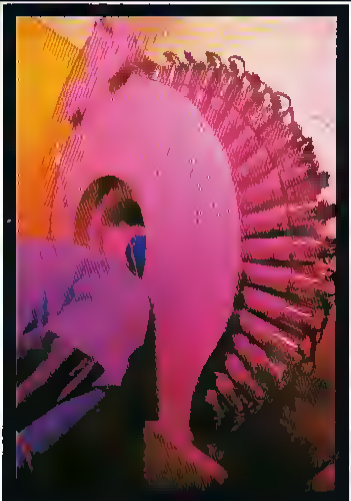
INTELLIGENT MACHINES

"In just ten years, machines have attained the intelligence level of an earwig—an unimpressive accomplishment until one realizes it took man's ancestors several million centuries to make the same leap," Christopher Evans writes in *The Micro Millennium*. These electronic earwigs are already at work PUFF (pulmonary-function-disease diagnosis) is an artificial-intelligence system used routinely at the Pacific Medical Center, in San Francisco, to examine the lungs of patients. Physicians at the center consider PUFF's diagnoses to be 85 percent accurate. In the future these "expert systems" may design our buildings and fix our cars.

COPS AND ROBBERS

"Cash is the greatest convenience ever devised to facilitate the commission of crime," physicist Leon M. Lederman says. To a new breed of high-tech criminal, however, electrons pulsing through digital memory banks are as irresistible as gold. Computer crime, according to the *New York Times*, may already account for the ripping off of $40 billion a year in the United States. The law, of course, is equipped with its own breakthroughs. Police departments can identify skin particles with electron microscopes, separate blood types by electrophoresis, resolve obscure fingerprints with laser cameras, and pinpoint a felon by the sound of his voice and the odor of his body. There is even a new fragrance known as artificial cocaine smell, invented by Warren Woodford. This peculiar concoction is designed to help policemen identify cocaine without sniffing the real stuff.

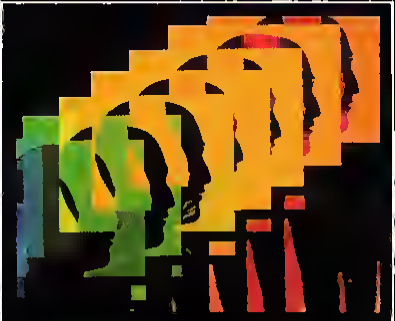




VISIONS

In recent years, thanks to such breakthroughs as the CAT scanner, the PET scanner, and the ultrasonograph, we have peered inside the bodies of living humans almost as if we were looking through a windowpane. The University of Chicago has shown us moving pictures of the atom, and recently Russell Dreyfus and Alfred J. Landon, two scientists from IBM, patented a laser camera that takes photographs at speeds less than one millionth of a second. Toshiba is expected to market a three-dimensional x-ray machine as early as next year, and EMV Associates, of Rockville, Maryland, is now constructing microcircuits tiny enough to be attached to nerve cells. A grid of these wafers might replace the rods and cones in certain forms of blindness or allow sighted persons to detect other kinds of radiation. For the big picture, the ultimate in seeing will be NASA's $750 million space telescope, scheduled for a space shuttle launch in 1985.

BREAKTHROUGHS

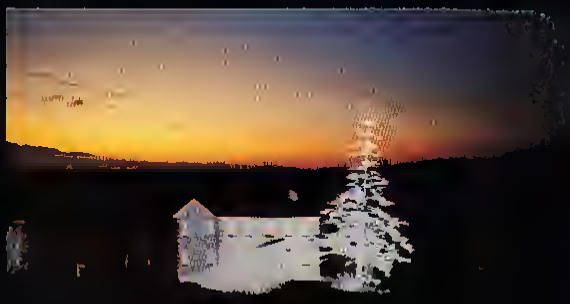


JOB SECURITY

Today there are approximately 5,000 robots "employed" by U.S. manufacturers, primarily in the auto industry. Almost to the machine, the men these robots replaced were blue-collar workers. Computers have already made inroads into a number of white-collar jobs, replacing middle managers and top managers. Now it seems that even the white lab coat is no protection. Nobel Prize-winner Herbert Simon and his colleagues at Carnegie-Mellon University, in Pittsburgh, have developed a self-programming computer designed to discover nature's laws. Called Bacon, after Sir Francis Bacon, the machine has so far "discovered" Snell's Law, Black's Law, Ohm's Law, and Kepler's Third Law.

OFFICE HOURS

The computer, surely the greatest breakthrough in office technology, once promised to eliminate paper. Oddly enough, it has become our most ravenous consumer of paper. Offices in the United States generate 600 million pages of computer printout every day, along with 234 million photocopies and 76 million letters. Another breakthrough is likely to add to the pile. The voice-actuated typewriter (VAT), expected to be in use as early as 1983, will recognize 95 percent of "business English" and might replace more than 1 million secretaries and typists. Exxon, IBM, Xerox, Olivetti, and Wang are working on VAT systems, but Japanese manufacturers, working in a strictly phonetic language, are expected to produce the most accurate machines.



SHELTER

Technological breakthroughs are seen in such isolated fields as solar heating and underground homes, but for the most part the housing industry is devoid of innovation. Most houses today are built with the same post-and-beam construction employed by our grandfathers. Science-fiction writer Robert A. Heinlein writes, "If you were to make an automobile the same way we build a house—from materials delivered to the site—don't think it would cost less than $100,000 or run at speeds greater than 10 miles per hour." The public has also resisted change. Nearly 25 percent of the cost of aluminum siding goes to make the siding look like wood. Aluminum siding that looks like aluminum simply doesn't sell. However, factory-built housing is burgeoning: The $5 billion mobile-home industry now produces nearly 30 percent of all our new housing.

MESSAGES

Communications today faces much the same problems as those that beleaguered the developers of the telegraph in the nineteenth century—crowding and security. As one bemused critic stated, "The problem with cable television, as I understand it, is that you'll need a dial the size of an oil drum to handle all the channels." Almost every day new security devices are patented, some generating "unbreakable codes" for top-secret data, others simply scrambling TV signals so that only paying subscribers can receive the signals. Attacking the crowding problem, engineer Paul M. Levy patented a system that can send two color pictures over the same broadcast channel without interference. And laser pulses can now send a datum in one ten trillionth of a second. Communications has become our most prized commodity. Joseph Kordsmeir, of Hyatt Hotels, said, "The secret is communication. Who runs the reservation system runs the world."

ENERGY

Summoned up by DOE research funds and dedicated private work, minor breakthroughs in this field are as common as dandelions in May. Among the recent successes:

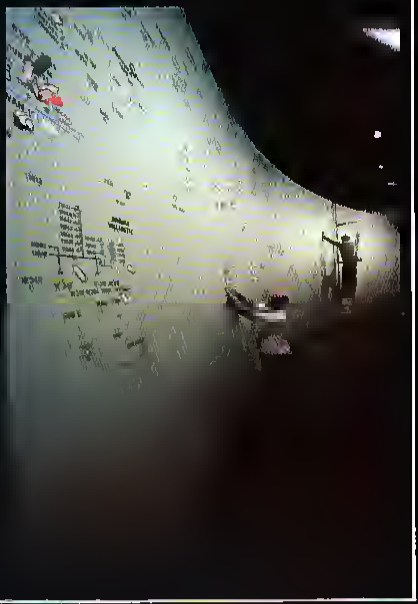
The 200-kw wind turbine at Makani Huila, Hawaii, is cranking out enough electricity to provide power for 100 homes.

S.S. *Capatchet*, an oil tanker from World War II, marked its second year successfully operating a 1-Mw evaporator-condenser system for ocean-thermal-energy conversion.

Offsetting the good news:

Brazil's vaunted gasohol program is falling apart. The Solar Energy Research Institute will lose more than half its current funding in next year's budget.

And the major breakthroughs we need—a way to burn coal without pollution, fusion power, or a solar-power satellite system—seem as far away as ever.



FOOD

Nutrition is a field in search of breakthroughs. "We can vacuum-pack, freeze-dry, vitamin-enrich, preserve, and irradiate just about anything," one Agriculture Department technologist points out, "but we still don't have a reasonable, inexpensive way to freeze a tomato."

FICTION

In the dark tunnels of Todos Santos intruders scheme to destroy the security of the city

OATH OF FEALTY

BY LARRY NIVEN AND JERRY POURNELLE

Todos Santos is an arcology, a self-contained community in a single magnificent structure two miles on a side. It operates as an independent political and economic entity, self-policing and almost entirely self-sufficient. The shareholder/residents accept total surveillance and benign control in return for total protection. Not a bad bargain in the world of uncontrollable street crime, except that Todos Santos is built inside the city of Los Angeles. It stands to outsiders as a symbol of exclusion and privilege, and its mere existence prompts certain terrorist groups to try to destroy it.

There were TV screens around all four walls, banks of them, with uniformed men seated in front of each bank. In the center of the room was a huge circular console with dozens of dials and buttons. More TV screens were built into the console. A uniformed captain, wearing a tiny telephone-headset microphone, sprawled in a chair in the middle of the center console.

"Dunhill, Captain." The sergeant said. "First day. Assigned to Blake."

The captain nodded. "Welcome aboard, Dunhill."

Isaac Blake had a square face with roundness shaping under the square chin, a square body also turning round, black-and-white hair with white winning. He lolled at ease before the bank of TV screens and sipped coffee. Every twenty seconds or so he touched a knob and the pictures shifted.

There seemed no order to the flow of pictures. Now the camera looked down on the heads of hundreds of shoppers strolling along a mall, bright-colored clothing that looked strange because the light was artificial, but the scene was so large that you expected it to be sunlight. Now a view of a big dining hall. Then a view through the orange groves, looking up at Todos Santos standing a thousand feet tall.

"Whew," said Joe Dunhill. "This is one hell of a big city. Even on a TV screen."

Blake nodded. "Yeah, it still gets to me sometimes." His fingers moved, and the view shifted to look along one side wall. Seen from that angle, the two-mile length seemed to stretch on forever.

The kaleidoscope continued. Sparse traffic in a subway. Interior halls, stretching far away. People on moving belts, people on escalators, people in elevators. A dizzying view down onto a balcony, where a nude, hairy man

PAINTING BY H. R. GIGER

sprawled in obscene comfort on an air mattress. Thirty men and women seated at a long bench, soldering tiny electronic parts onto circuit boards, chatting gaily and working almost without looking at what they were doing.

The camera switched to the greensward beyond the perimeter of Todos Santos, where a dozen picketers lethargically marched about with signs. END THE NEST BEFORE IT ENDS HUMANITY said one. Blake sniffed and touched buttons. The scene jumped to a pretty girl in a miniskirt carrying a bag of groceries; the camera followed her down a long hall from an escalator, zooming along to keep her in close-up as she walked into a small alcove. When she took her badge out of her purse, the door opened, and she went inside, leaving the door standing open while she set the bag down on an Eames chair. For a moment the screen showed an expensive apartment, meticulously clean, thick rugs, paintings on the walls. The girl was unbuttoning her blouse as she came to the door. She stood for a minute, then closed the door.

"Like to watch the rest of that show," Blake muttered. He turned a lazy smile toward Dunhill.

"Of course we aren't supposed to do that," Dunhill said.

"Nope. Can't either."

"Oh. I've noticed you haven't shown us the inside of any apartment. I guess I wouldn't want cameras in my bathroom either."

"Oh, we've got them there," Blake said. "But they don't go on without authorization—there's one now." He touched his headset. "Captain, I'll take that interior call."

"Right."

The TV screen flicked to show a kitchen. A small boy was pulling things out of cabinets, scattering flour on the floor and carefully mixing in salt preparatory to pouring a bottle of sherry across the mess. Blake reached forward to a button under the screen. He waited a moment, then said into the tiny headset microphone, "Ma am, this is Central Security. Somebody pushed the panic button in the kitchen, and I think you'd better have a look out there." "Yes, Ma am, it's *safe*, but you ought to hurry."

He waited. On the screen above, a woman, mid-thirties, not very attractive at the moment because her hair was partly in curlers and partly in wet strings, came into the kitchen, looked down in horror, and shouted, "Peter!"

Then she looked up with a smile and moved closer to the camera. "Thank you, Officer," she said. Blake smiled back for no sane reason, and touched a dial. The picture faded. Then another replaced it.

Dunhill watched in concentration. He turned to Blake. "I don't get it. You just skip around."

"Sort of. Of course there are exceptions, like when somebody asks us to keep an eye on things. But mostly we watch what we feel like. After a while you get some judgment about it."

"But wouldn't it be better to have assigned places? Instead of jumping around—"

"Bosses don't think so. They want us alert. Who can be alert just staring at one scene all the time? The math boys worked it out, how many of us, how many TV screens each, the probability of trouble—over my head, but it seems to work."

Joe digested that. "Uh, seems to me I'd be more valuable out on the streets. Responding to calls—"

Blake laughed. "After you've been here a year, maybe they'll put you where you interact with shareholders. If you work out." The kaleidoscope above continued. A moving beltway with some kids walking on a balcony above it. Blake touched the controls, and the camera zoomed in on the kids. After a moment the kaleidoscope started up again. "Think about it," Blake said. "In Seattle you were a cop, and out among the civilians. You worried about making good arrests, right? Best way to get promoted."

"Sure—"

"Well, in here it's different." Blake sud-

denly frowned and set down his cup.

It took Dunhill a moment to realize that Blake was no longer interested in the conversation, and another to see why he was staring. It wasn't the screen at all. A blue light to the side had lit up.

"On the roof," he said, with a question in his voice. Then, with more confidence: "Visitor. How did he get up there?"

Blake played with the controls. The screen jumped with disconnected pictures flashing views of four square miles of roof: the curtained windows of the Sky Room nightclub, golfers on the golf course, a view down onto one of the inverted-pyramid shapes of an air well plunging down in narrowing steps, each one story high and lined with windows. Then a forest of skeletal structures, a children's playground, empty at the moment, then another jungle gym with a dozen kids hanging like bats, the Olympic-sized swimming pool with a wide, shallow children's wading pool just beyond, baseball diamond, football field. On the Todos Santos roof was every kind of playground for child or adult.

Then, beyond a low fence, an empty area—bags of concrete and piles of wood for forms, cement mixer idle at the moment. The camera zoomed to the mixer. "ID badge," Blake muttered. "Visitor badge must be stuffed into the cement mixer. What the hell for? And what's he doing up there?" The TV screen flowed across the roof again, searching—

"There," Dunhill cried excitedly.

"Yeah. I see him. Doesn't seem to be carrying anything. Might have been, though. We'll have to go up on the roof and search it thoroughly. Detectors would have picked up anything metal, and there's not a lot worth bombing up there, but we'll have to look anyway."

The figure moved rapidly along the twelve-foot fence between him and the edge. He was hunched over, a caricature of a man sneaking. He found a gap in the fence, hesitated, and moved into it.

Blake grinned. "Hah! Maybe we won't have to send anyone up after all. He's found the diving board."

"That's not the pool area."

"I know. Sometimes I wonder about Rand. You know about Tony Rand? He's the chief architect for this place. Rand's high board isn't in the pool area."

"Uh?"

"Watch. If he's really a leaper, we won't have to call anyone." Blake touched another button. "Captain, I have the bandit on the roof area. Looks like he's going to dive." Blake fiddled with the knobs. The picture sharpened.

He had been following the fence for thirty minutes, looking for a way to reach the edge. The fence seemed endless, and he wondered whether he could climb it, and if there were alarms. Todos Santos was said to be very Big Brother.

Then he saw the opening. There was a cement mixer nearby, and he pushed the visitor badge into it. The badge wasn't his, and told nothing about him, but it was the last possible clue. Maybe they'd find it, and maybe not. He moved on, to the gap in the fence.

There was a big sign: WATCH YOUR STEP. He did not smile. His long, unhandsome face was deadly calm, as if he had never smiled and never would. He turned into the channel of fencing. It was just wider than his shoulders.

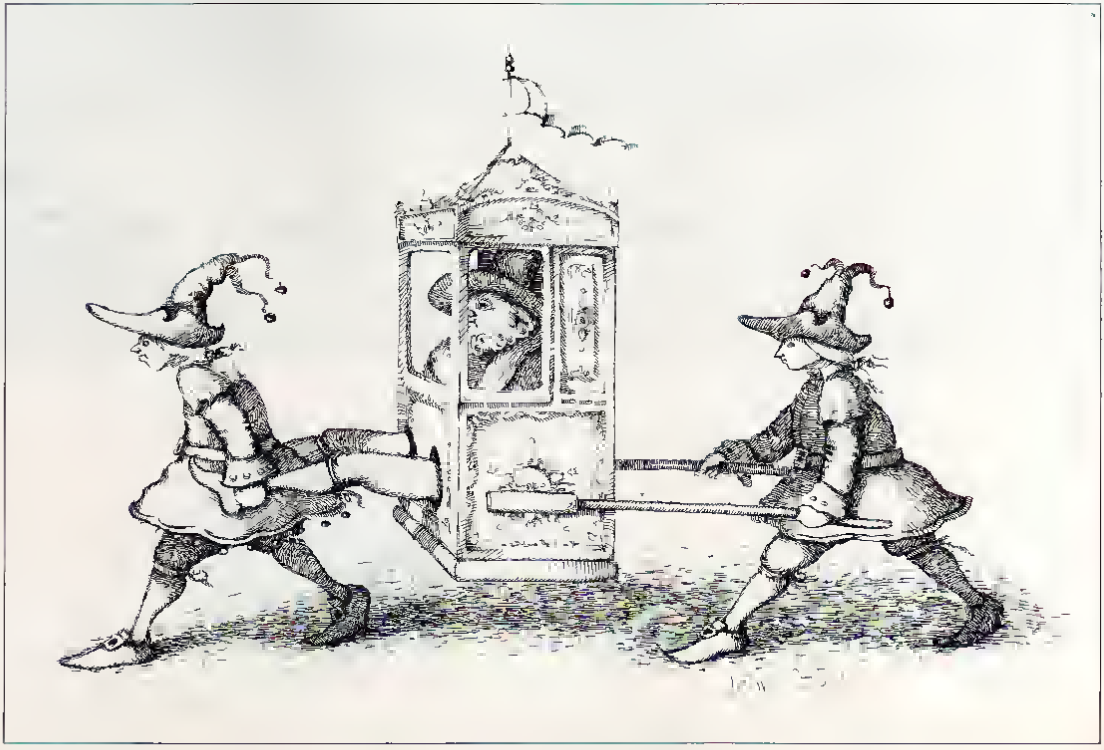
The channel ended in a steel ladder. Through the steps he could see the orange groves and parks far below, then beyond them the tiny shapes of city houses, some with the blue splash of a swimming pool, all looking like miniatures. He pressed his forehead against the cold metal and looked down—a fifth of a mile down to the green landscape around Todos Santos. A thousand feet to oblivion.

He climbed the steps. The situation was strange. The steps ended in a long, narrow rectangle. He tested it with his foot—wood padded with burlap—and it shook slightly.

A high diving board.

He walked out on the board and looked down.

The balconies receded in perspective until they merged with blank wall. The parkland below was a green blur. A view more mathematical than real: parallel lines meeting at infinity. So here was the end of a dull



and thwarted life He was carrying no identification After a fall like that they would never know who he had been Let them wonder

The board bounced as he shifted his weight

"But—but suppose he jumps?" Dunhill speculated

Well we don't advertise it but there's a net that comes out when he passes the spy-eyes Then we just collect him and eject him Let him give his bad publicity to someone else Blake told him

"Does this happen all the time? You don't look particularly interested"

"Oh I'm interested I've got five bucks in the pool See that chart? Blake waved at the far wall where chalk marks said

	LAUGHING	3	
BACKED OUT		JUMPED	8
	TERRIFIED	7	

That's this quarter's tally Work it out" said Blake "The roof of this place is eight miles of sheer cliff We get every would-be suicide west of the Rockies and some from New England and Japan But the high diving board is the only access to the edge and it does have a funny effect on people" Blake frowned and scratched his neck He sure looks like a jumper If he backs out I stand a fair chance to win"

The man stood straddle-legged at the end of the board brooding above a thousand-foot drop The picture of melancholy until a gust of wind slapped across him and suddenly he was dancing on one leg and waving his arms.

Maybe not" Blake said The jumper was reflexively fighting for his life The gust died suddenly and he almost went off the other side of the board He wound up on hands and knees He stayed there gripping the board Soon he began backing toward the ladder When he reached the steps he stayed stooped and placing his feet very carefully backed down

"Leaper's off Captain" Blake called

"Right Got a detail going after him"

Dunhill asked "Some of them laugh?"

"Yeah It's a funny picture isn't it? You're going to kill yourself It's the most powerful statement you can make about the way the world has treated you That's what Rand says anyway And when you finally get there there's a high diving board to add ten feet to the drop!

Joe shook his head and grinned

They don't all back out Once I watched a woman stand up there take off her overcoat—she wasn't wearing anything under it—bounce once and take off in a really gorgeous swan dive" He smiled then shook himself "But the board turns off a lot of them Rand isn't any dummy He built Todos Santos and he's still building it If you know what I mean He's always tinkering around"

"I'd like to meet him"

"You will"

Fat chance Dunhill thought What happens to the leaper?"

One of the bosses will talk to him. Standing orders. Rand wants to know what makes them tick. Maybe think of ways to discourage them." Blake looked at his watch. "This one may have a wait. There's a bigwig from Canada coming in for a visit and all the brass will be busy."

"Can we hold him?" Dunhill asked. "I mean, civil rights and all—"

"Sure. Some of us are real live cops," Blake said. "It's a legal thing. Todos Santos is legally a city. Sort of. But the insurance is cheaper if most of us are security officers rather than peace officers. But we are a city. We even have a jail. Judges, too, but they don't get much work. Corporation people take care of civil matters and felonies go to the L.A. County district attorney."

"It sure is different here—" Joe blinked and leaned closer to the screen. "Hey—"

"What?"

"I saw a light flash. That one."

"Umm. Tunnel area. We better check. That's critical territory—" He did things to the console and a row of lights flashed green. "Nobody there who doesn't belong there. You sure you saw something?"

"Almost sure."

"Probably some maintenance trooper had his badge inside a toolbox." Blake yawned. "Get me another coffee?"

"Sure."

"We can talk here if we keep it down." The bearded boy sounded uncertain, but there were no alarms, and he grinned.

The others nodded and opened one of the boxes. The girl took out a gas mask. It was warm in the tunnel, and she wiped sweat from above her eyes before she put the mask on.

The guard turned, with a puzzled expression. "Seems to be a glitch in tunnel zero-eight, Captain."

"What kind of glitch?"

"No visual."

The duty captain frowned. "In *eight*? That's a critical area. Don't need intruders in eight." He typed furiously on his console, then looked relieved. "MILLIE shows maintenance in that area," he said. "With overtime authorized, yet. The lucky beggars. Punch in an immediate repair request for the visuals."

"Hell, it's near dinnertime. They'll never get it fixed tonight."

The captain shrugged. "If they don't, we'll send in a patrolman. Give 'em a chance, though. They're in there already. Maybe they can take care of it." He looked at his readout screen again and nodded. "Looks all right. Nobody's opened any doors to the outside. Let me know when the visual comes on again."

"Sure." The guard settled back and sipped coffee as the kaleidoscope began again.

The Olympic ski jumps were on the screen in Deputy General Manager Preston Sanders's office. "Evening," Tony Rand said. "Why can't you be addicted to reruns of the *Mary Tyler Moore Show*? Or at least watch the evening news?"

"I do watch the news," Sanders said. "And I generally get some work done when I've got night duty on the worry desk."

"Quiet tonight," Rand said. "Oh, there's some kind of problem with water deliveries in forty-four West. Could you have Maintenance check it out?"

Sanders laughed. "I logged that one in an hour ago. How did your dinner go?"

A shrill tone shattered their conversation. Red flashed above the screen, and the skier disappeared in mid-jump, replaced by a red-bearded guard captain. "Break-in. Intruder on C-ring, eighteen-North."

Rand stopped breathing. *Burglars in the house?*

Sanders looked automatically at the holographic model. Rand didn't bother. The north side was unfinished in large part, nothing but girders and framework and the thin curtain wall that had been erected for appearances and environmental control. But two main hydrogen intake lines and a fastube to Santa Barbara came in near ground level on the north side.

A red pinpoint winked on in the holographic display. Level 18, and definitely out in the untinished area. "Visual," Sanders demanded.

"Getting it, sir," the guard said. Another screen swam, then showed a dim figure on a narrow catwalk. "He won't know we've spotted him."

Rand went around behind the desk to look over Sanders's shoulder, careful not to distract him. There wasn't enough light for details.

"Keep it that way a minute, Fleming. What's he carrying?" Sanders demanded.

"Can't make it out." Captain Fleming answered. "No history on him. He had a badge at one time, or he wouldn't be here."

"And he ditched it before he went into that area. Right," Sanders said.

Rand felt beads of sweat pop out on his forehead, and a cold knot began to grow under his belt. This was no lost child. And if he felt the tension, what must Sanders be feeling? The man looked calm enough. A teener resident out to have fun? Rand suggested.

"Possibly," Sanders muttered. He continued to stare at the screen. "But not likely. Not out there. Keep on it, Fleming. You've sent men down there?"

"Yes, sir."

"Maybe you ought to call Bonner," Rand suggested.

That got him a scowl. "Art's been drinking with the Canadian," Sanders said. "Afraid I can't handle the situation?"

"You know better," Rand protested. *Was that what I was thinking?*

"Two more," Fleming said excitedly. "Two bandits. Accessway nine. They've got some kind of interference gear. Don't know what it is. We can't get an exact location."

-I'd like you to meet Dr. Modell, who's sending messages into space. Dr. Kimbell, who's talking to dolphins, and Dr. Klien, my husband, who's trying to communicate with me.

interference?" Rand shouted. "What in hell could they—" He fell silent, thinking furiously, recalling the details of the security system. Accessway nine? That was a main hydrogen input tunnel.

A bright band sprang into view on the model, the indeterminate location of two intruders deep underground. The southwest pipeline complex that ran parallel to the tunnel showed up as a series of thick purple lines.

It makes a pattern, Sanders said uneasily. Opposite sides. Both aimed at hydrogen intake lines. That's our weakest spot. We've got to get visual on those new bogies!"

Yes, sir," Fleming said from the screen. "Trying. I can send men into the tunnel—"

And alarm them. Hold that." He looked up helplessly at Rand. "If they've got explosives, they can make one hell of a mess."

Tony could only nod agreement. "Pres! My Arr-Two's. I've got one near tunnel nine. Maybe they wouldn't be suspicious of a robot—"

Maybe worth a try," Sanders said absently. "Use that console over there to fire it up, but don't do anything else without letting me know. Now let me think."

"Sure, Pres." Rand went to the console. It wouldn't be easy controlling the robot with this standard input. Rand usually used joysticks, gloves with special sensors, and other devices, but there weren't any of those closer than his office. And by the time he could get there, this might all be over.

Sanders made a decision. He pushed another button on the desk console. "Cut the hydrogen in those lines. All the lines next to Tunnel Niner and the northside lines, too. MILLIE, what does that do to us?"

"WE WILL GO TO FLYWHEEL DRAIN. NO ESSENTIAL POWER LOSS FOR SEVENTEEN MINUTES. AFTER FOURTEEN MINUTES WE MUST BEGIN PHASEDOWN. POWER CUTS TO PREPARE FOR INEVITABLE POWER LOSSES. DO YOU WISH MORE DETAILS?" The contralto voice spoke in impassive block capitals, at least that was how Rand always visualized them.

Power cuts would—"

"Negative phasedowns," Sanders said. "Carry out previous order and use flywheel storage."

"DONE."

"Not enough!" Rand said. "We need those—"

"Tony, shut up." Sanders said. "Fleming, are you certain they've got something that intentionally fouls up the detectors? That's not an accident?"

"Not bloody likely, sir."

"MILLIE?"

"PROBABILITY INSIGNIFICANT."

Sanders turned to Rand. "Tony?"

Rand shrugged. "I don't know how they did it, but I can't see *that* happening by accident." He pointed at the fuzzy band on the hologram. "We ought to have intruders located to the decimeter."

"I'm getting an infrared image now," Fleming said. "Tunnel Niner."

The screen showed dim shadows of two figures, each carrying something heavy. The faces bulged like the snouts of pigs.

"Gas masks," Sanders said grimly. "MILLIE, do the images match anything in your memory?"

"PROBABILITY OF GAS MASK OR DELIBERATE SIMULATION OF GAS MASK, SEVENTY-SIX PERCENT. OXYGEN MASK, TWENTY-ONE PERCENT. PROBABLE IF OXYGEN MASK, THE TANKS ARE VERY SMALL."

"Simulation? What's the chance of that?" Sanders inquired.

"INSUFFICIENT DATA."

"Jesus. Tony, get that damned robot of yours in there. Fast."

"I can't, Pres. Whatever they're using to interfere with our detectors is jamming my com links with the Arr-Two. I can't help you."

It had happened at last. Preston Sanders had always known it would. It was the reason he hated the worry desk. Sitting here, always involved political decisions, nothing else would be bucked up to the top duty officer. That was hard enough.

And now the big one had happened while he was on duty.

I've got about thirty seconds to dither. Should I call the boss? It'd take him at least that long to get up to speed. Maybe I should have called him earlier. Probably would if Tony hadn't suggested it. Oh, damn it—

And what if Art's not sober? That L.A. man has left, but the Canadian is still here—

One of the shadows in the tunnel bent over. Possibly to tie his shoes. Possibly to set off a bomb that would wreck the lines. Sanders made his decision.

His voice was calm as he said, "Big one. Tunnel Niner. Big stuff. No drill. Execute."

His voice was calm, but sweat dripped from his chin. He'd never been in the Army.

And he had just killed two men, deliberately, in cold blood.

"Now we take care of the one on the north side," Sanders said. "Stand by, lights and snipers. He doesn't seem to be carrying anything heavy enough to do much damage. Right?"

"Right," Fleming said.

"Make sure he's got nothing to penetrate the intakes. And no bomb. Then catch the son of a bitch. Catch him alive, and no alarms."

"Roger, Mr. Sanders." Captain Fleming turned away from the screens, and Sanders sank back into his chair.

Rand watched Sanders with awe. *How can he be so damned calm about it?* he wondered.

Maybe he's not. He's smoking like a chimney.

He went to the shelf and poured a shot of brandy, tossing it off. "Brandy?"

"I'm still on duty," Sanders said. "Fleming, what's the status on that northside intruder?"

"He's spotted us. He's hiding."

This is Explorer XX calling Earth from Muscle Beach, do you read me?

Thank you Sanders lit a cigarette

"Maybe you ought to call Bonner now Rand suggested

MILLIE already told him " Sanders said Standing orders on anything this big He ll be here in a moment He pointed at the holograph on which a blue star moved rapidly upward toward the operations suite "I'd go easy on that brandy Art will want you in on the conference "

Two dead Rand thought *What the hell did they use to interfere with the surveillance?*

Art Bonner came in He took in the situation at a glance his eyes resting for a moment on the full ashtray "Status? he asked

"You already know Sanders said "I gassed Niner They re getting men into survival gear to go inspect And— "

"INTRUDER CAPTURED MILLIE announced

Fleming appeared on the screen Got him ' Another image formed a young man early twenties at most long hair in back but cut short at the sides and in front scraggly beard which wasn t unusual cotton denim pants and jacket

No weapons Fleming reported We fluoroscoped him Nothing And Medical says no drugs He tried to put on he was high but we ve got him convinced we know better

That may have been a mistake " Sanders said Mr Bonner s here Take over Mr Bonner

I relieve you Fleming send that intruder up here

Yes sir The images faded

Bonner put his hand on Sanders's shoulder Relax

Sanders tried to smile It didn t work I killed them Art Both In cold blood

Sure Tony get Pres a drink

It happened so fast All over in a minute Art what if it s nothing? Like that.kid no weapons nothing? Just trying to throw a scare into us? They never had a chance!'

Rand brought over a brandy "If they were trying to scare us they made it nicely he said Here

Bonner nodded agreement 'You made the right decision Same as I would What if it wasn t nothing? What if they had bombs all set to take out the hydrogen lines? Set off the hydrogen with a big whoosh Big bonfire, right in the park

I wish it hadn t been me

It was And I ll back you all the way'

It isn t Zurich I m worried about Or the Angeleno police It s me

Sure

The boy was grinning That was the first thing Rand noticed when Blake ushered him into Sanders s office a wide triumphant grin

We got an ID on this one " Blake said

Sure I m Allan Thompson the youth said His voice was pleasant and sounded educated "My father s a real estate broker in Hollywood Where are the others?

What others?' Bonner asked

Aw come on,' Thompson said He was still grinning "You gotta have them by now—' He shrugged 'Maybe you don t That seemed to amuse him even more

Sanders had ignored his brandy He was staring at the youth, his eyes a study of misery The grin got to Rand "What s so damned funny?" Rand said

Bonner raised a hand in warning Rand subsided

We found a VIP visitor badge outside the crawlway entrance to the unfinished section " Blake reported "A Mr Roland Thompson who s a favored customer at a number of places

Sure, that s my dad s badge Thompson said 'Okay so now you call him and tell him the prodigal's got into trouble again

Please sit down Allan Bonner said carefully "And tell us why you were crawling around on a catwalk a hundred meters above ground level this late at night

It was fun man Thompson sat with the attitude of an important visitor "We thought what the hell they re always talking about the security system at Todos Santos, we ll just show 'em it s not as good as they think—

We?' Bonner asked "Who are the others?"

Thompson smiled slyly So you really haven t caught them yet! That s choice

CONTINUED ON PAGE 150

This project is the result of ten years of painstaking research
Now Al we re turning it over to you

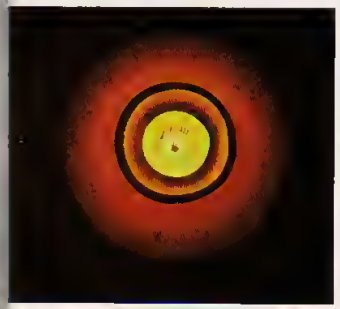
OMNI: ON THE AIR

A bold TV series prepares
to help America embark on a new technological era

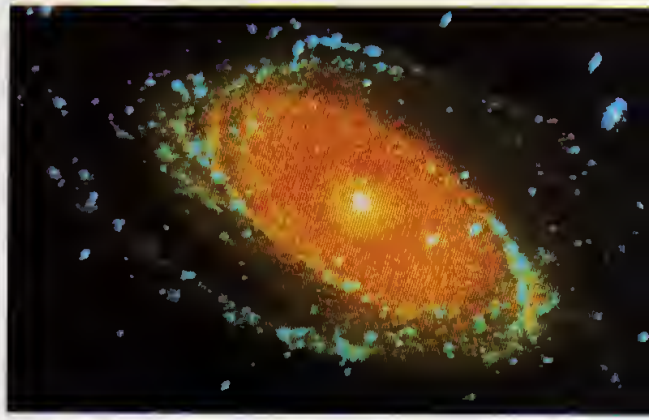
BY ROBERT WEIL

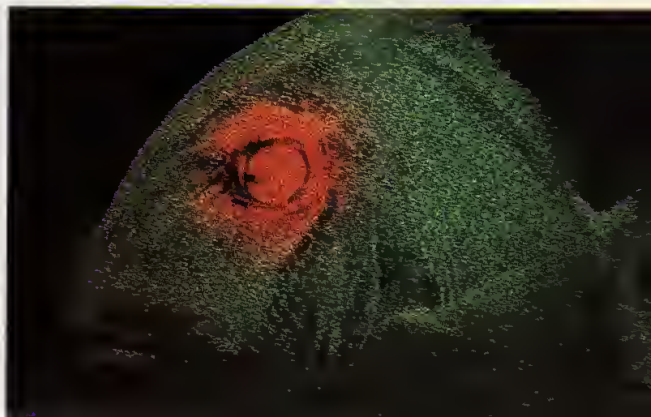
Throughout the brief history of television, only a handful of shows have woven their way into the fabric of American life. There was *Father Knows Best* in television's early days, a show that virtually defined the accepted domestic life-style of the 1950s. Or *All in the Family* in the 1970s. Norman Lear's brilliant sitcom vision of America, a program whose generational conflict and trenchant urban humor told the troubled story of a decade.

Omni's television debut was on September 14. Suggestions that the show will be the harbinger of a new life-style, that it will become the eponym of the

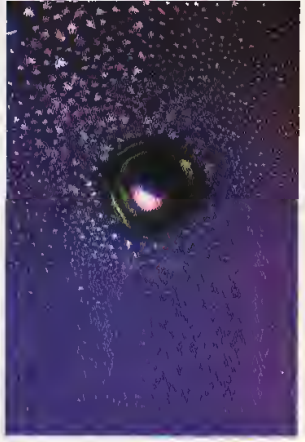


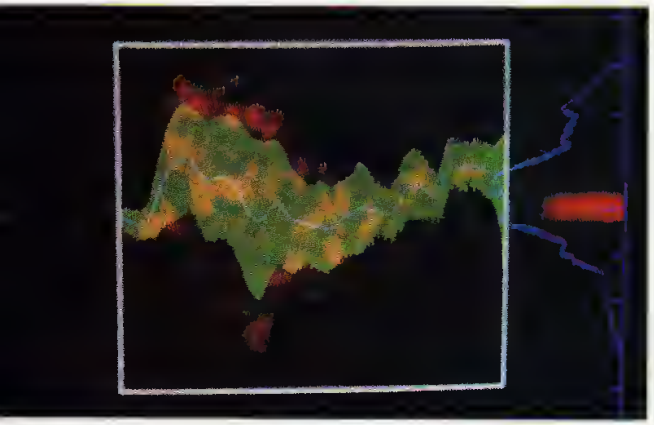
From the complex world of high-technology to the visual splendor of underwater life, Omni: The New Frontier will report the breaking stories of our day. Pictured at the far left is Omnivac. Endowed with artificial intelligence, he is one of the most sophisticated robots in existence. Galaxy images like the one below will reveal the mysteries of space.





The art of prominent photographers will enhance The New Frontier. *Roman Vishniac, one of whose micrographs is pictured at right, will be featured in a segment of the new series. Other images will capture breakthroughs such as the video display of laser fusion (below), or will reveal the beauty of nature, from the intricate spider's web covered with dew to the dazzling radiance created by a lightning storm.*





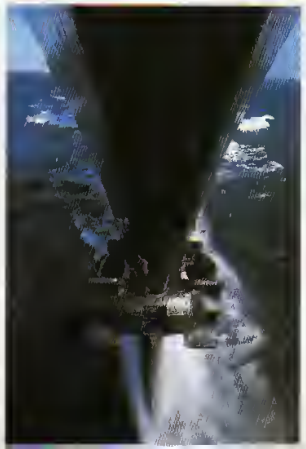
"Our knowledge has become so advanced that we'll soon be able to duplicate life itself."

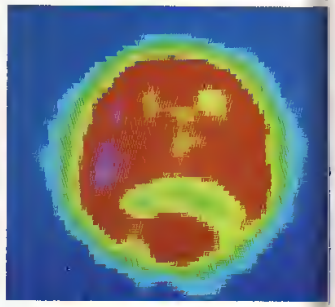
1980s—lending its name to the entire decade—are bold assertions. But *Omni: The New Frontier*, from its editorial conception to its technical execution, will be one of the boldest and most influential shows ever to air in the United States.

Omni readers already know that we are in the twilight of the Industrial Age. The magazine's articles all during the last three years plainly reveal that we are embarking on a new technological era, one that will rely on the scientific wizardry of electronics, computers, or genetic engineering to define our world. What *Omni: The New Frontier* will do is dramatize in the American home this emerging revolution, making it totally understandable and accessible to millions of viewers.

How does one go about creating a revolutionary program, one that hopes to go down in the annals of American television? Most science shows in the

Innovation figures prominently in the new Omni show. At far right is a PET brain scan, the latest in medical imaging, while a surgeon (at top) performs revolutionary laser surgery. The puzzle of fluid dynamics is examined through Burt Rutan's airplanes (above) and ocean-liner hull design (right). And Malcolm Wells (top right), architect for the underground housing community, makes castles in the sand.





past have had a dry, documentary format. Not so with *Omni*. Each segment, whether devoted to space, future cities, or electrical medicine, will have to be a story, one with a beginning and an end," says coproducer Vivian Moss.

"We will stay in control of our audience the way a play does. Music will often be used for heightening the suspense," Moss adds.

Like the best of situation comedies or serious documentaries, the *Omni* program will reflect the concerns of the society in which we live and will throw a light upon the path we are taking. Its message will undoubtedly be with us long after the series itself comes to an end.

To bring *Omni* to television this fall, production raced ahead in 1981 at an astonishing pace. Publisher Bob Guccione traveled to Rome in February to enlist the services of Academy Award-winning set designer Danilo Donati. The *Omni* set that has resulted is unquestionably futuristic and at the same

"The scientific wizardry of this new technological era will define our world for us."

time respectful of man's past. The luminescent, Parthenon-like structure and the floating columns suggest both the grandeur of ancient Athens and the interplanetary wonder of a Chesley Bonestell painting.

In hiring senior producers Moss and John Savage best known for their teamwork on the Emmy Award-winning series *The Body Human* which aired on the CBS network from 1976 through 1980, Guccione brought to the show a thoroughly professional expertise. Moss and Savage in turn have assembled a crack team of researchers writers and production people who have scoured several continents and approached scores of preeminent scientists in a search for the breaking science stories of our day. The budget exceeding $3 million will allow the show's teams of investigators to comb laboratories around the world for the latest in scientific breakthroughs.

Finally to host the show Guccione signed the renowned British actor and author Peter Ustinov whose dramatic screen presence guides viewers through such intricate stories as genetic engineering and space colonization.

To dwell on the entire contents of the *Omni* show would be pointless here. It is fair to say that the program scheduled to run for 26 weeks in syndication on television stations throughout the nation will be just as all-encompassing and future-oriented as *Omni* magazine. But a few stories vividly illustrate the scientific scope and the dramatic intensity of this series.

Even before the program was in the planning stage Guccione and *Omni* President Kathy Keeton decided that a robot commissioned and custom-built specifically for the magazine would be an appropriate symbol of *Omni*'s commitment to science. Finding an inventor however who could build a real robot that could simulate human speech patterns and complex thought processes was not easy.

The search for Omnivac as the nonexistent robot came to be known took on about as many precipitous twists as Dorothy's quest for the Wizard of Oz. When word spread that *Omni* was looking to take on a robot Guccione's office was besieged by dozens of self-proclaimed inventors and show biz types all boasting that they could conjure up an Omnivac as easily as the mythological Pygmalion had fashioned his beloved Galatea.

Robots no more advanced in their technological complexity than the Tin Woodman were presented to Guccione. The parade of charlatans continued even including a ventriloquist who hid behind a drawn curtain.

The search for Omnivac proved fruitless until April 9, 1980, a day that will live on as especially infamous in the history of New York City. On that day the city already into the second week of a catastrophic mass transit strike, was hit by a torrential rainstorm. Millions of New Yorkers snaked their way through mile-long lines braving hurricane-force winds and relentless rains for the chance to take a bus home. It was the kind of scene that would have driven workers to revolt in Paris or Moscow a century before.

At the Guccione home the drama was no less intense. A real revolution was in progress. Carl Frederick an accomplished theoretical physicist and computer-linguistics genius was trying to demonstrate the abilities of his laboratory-built robot—but with little success. In unloading the robot from his U-Haul Frederick was unable to prevent the Omnivac-to-be from getting totally drenched.

It was an electronic disaster. Frederick now recalls. The robot sputtered and fizzled as any electronic gadget might do when submerged in water.

But the crowd inside was not to be daunted. "This is real," an astonished Frederick kept hearing. The seemingly absentminded professor with the tousled hair and Ed Wynn laugh had managed to convince a skeptical group of onlookers that his robot was legitimate. "We're really impressed!" one *Omni* executive exclaimed.

> *"Guccione and Keeton decided that a robot, commissioned and constructed specifically for the magazine, would be an appropriate symbol of Omni's commitment to science."*

Those people familiar with Frederick's scientific background (once a research scientist at NASA and a former professor at Cornell) would have been less amazed. Frederick's Wolfdata Company in Ithaca, New York, is one of the nation's leading laboratories engaged in the creation of artificial intelligence.

"I grew up in the Hayden Planetarium," Frederick confesses. "I had conjunctivitis from the ultraviolet lighting in that place.

"I built loads of things as a kid but I couldn't spell my name until I was five," Frederick recalls. "I couldn't write and so I devised my own language one that had a grammar." His appreciation for language continues to this day reflected not only in his ability to converse in Old English and Old Norse but also in the three voices he has programmed Omnivac to use.

Since the early days the *Omni* robot has taken on great technological sophistication. A segment will actually document the creation of the robot," says producer Savage. "At the end it will walk and talk. Omnivac will improve as the show goes on."

What the show will not reveal are the Laurel and Hardy-like scenarios that an inventor goes through in building a robot. On one occasion Frederick commanded Omnivac to lower its arm, not expecting to be clobbered on the head.

"Another time the robot pinned me against a wall," Frederick remembers, "and before I had time to disengage it the robot had broken its arm." These troubles were compounded by the fact that the robot's electronic motors created so much static on the power lines that the computers were constantly going down.

The robot will be able to recite on request such notable speeches as the Pledge of Allegiance the "To be or not to be" soliloquy from Act III of *Hamlet* and another Shakespearean passage from *King Richard II*. While the robot has been well schooled in the classics Frederick has not neglected Omnivac's more functional needs. Besides being able to salute the flag draw a picture of itself or even crack a few bad jokes the robot will demonstrate its knowledge of the multiplication tables on command.

These theatrics should amuse millions of viewers. The linguistic abilities of Omnivac will also prove of interest to the scientific community. There is a need for a language for all work in artificial intelligence a language more human," Frederick says. To this end he has devised WAIL a computer language based on mathematical theory that will carry the intonations of human speech the fuzzy sets of human logic and will prove useful for carrying out research in artificial intelligence.

Unlike other robots Omnivac will be able to forget as well as to remember. This is more important than it may sound at first. A computer memory has a finite storage capacity and in time it becomes crammed with useless information from old programs. Omnivac can jettison these facts or refill its memory depending on the original command. WAIL will also enable the robot to double its intelligence each month through much of 1982.

The robot will contain not just one voice but three. The first of Omnivac's voices a standard digitized computer voice supplied by Texas Instruments has a stock vocabulary of some 400 words chosen by TI. Though considerably sophisticated the vocabulary was not sufficiently large for the needs of Omnivac.

An almost infinite vocabulary is an added feature of the robot's second voice which is digitized by the individual phonemes of the English language rather than by entire words. By stringing together phonemes to form words the computer can create an arbitrarily large number of words," Frederick explains. But the second voice did not enable Omnivac to have the verbal precision that its inventor had intended for it suffers from a lack of clarity and intelligibility.

Supplied by General Instruments the

CONTINUED ON PAGE 156

FICTION

Presenting the first short story untouched by humans

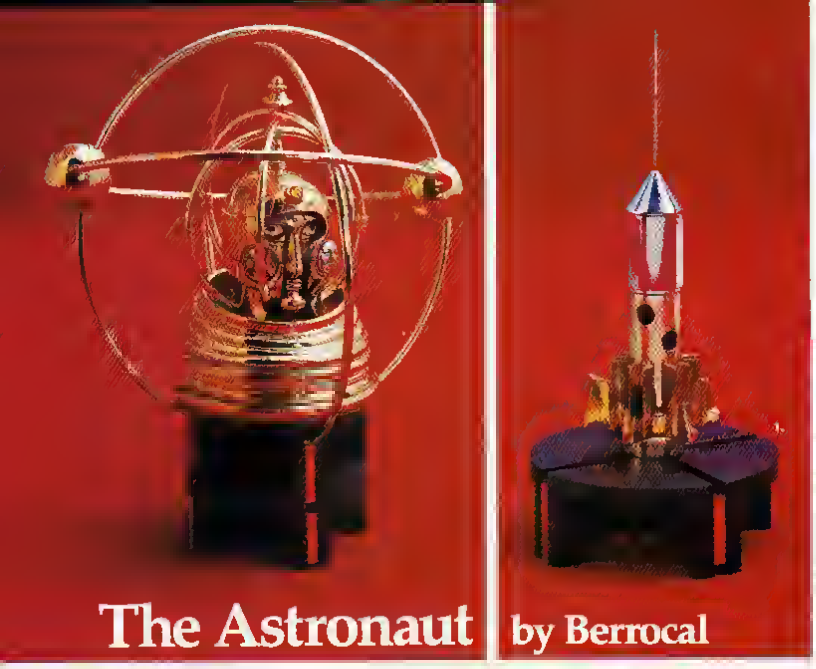
SOFT IONS

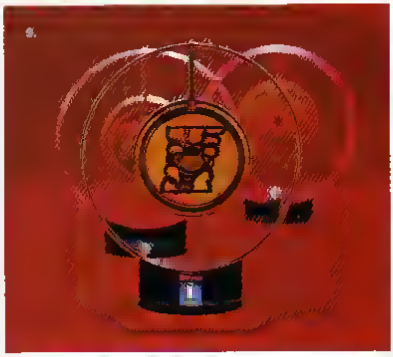
BY RACTER

Bill Chamberlain, a mad genius type living in Greenwich Village, has a computer program that he calls RACTER—short for raconteur. RACTER has written a short story called "Soft Ions."

"Once the story-writing program is set into motion," Chamberlain says, "the output

PAINTING BY
NENAD JAKESEVIC





The Arnold Katzen Gallery Inc announces a new important sculpture, The Astronaut by Berrocal. It is the latest and perhaps the most fascinating yet of the unique signed and numbered, limited edition puzzle sculptures created by Miguel Berrocal. Spain's foremost living sculptor. The 36 elements of this intricate sculpture can be disassembled and reassembled into divers imaginative objects and striking jewelry. It is a tribute to all astronauts, but was specifically created as an homage to Jules Verne, and to commemorate the tenth anniversary of the first lunar landing by American astronauts. Six of the elements forming the sculpture become a marvelous rocket ship (1). The needle-nose of the rocket is a pearl tie pin (2), and the three large gold-plated rings are necklaces (3). The smaller rings are bracelets (4), and the planets gold-plated earrings (5). The eyes are silver finger rings (6) and the cheeks, one in the form of the sun and the other the moon, form a gold-plated ring (7).

The upper part of the astronaut's head and his face are both pendants that can be worn separately or together on one of the necklaces (3) or bracelets (4). The collar is composed of three medallions, each of which can be worn on one of the necklaces (8). The three black iron elements of the base can be used to display the medallions attached to the large rings (9), or as a launch pad for the rocket (1). A handsome hardcover instruction book accompanies each sculpture.

Berrocal is now internationally accepted as one of the true giants of twentieth century art. His works are one of the most exciting values in art today for collectors, investors and puzzle addicts. Clearly, they are more fun to own than the works of any other artist we know of. All Berrocal works can be seen at:

the Arnold Katzen Gallery, Inc.
11 East 57th Street, New York, NY 10022

the Arnold Katzen Gallery, Inc.
11 East 57th Street, Dept. 100
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I have enclosed $1. Please send me your color brochure and ordering information.

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is not only novel and a priori unknowable but also cohesive and apparently thoughtful. It is crazy thinking, I grant you, but thinking conducted in perfect English."

English is what RACTER is about. It doesn't tell a story the way people do. It picks nouns and verbs, adjectives and adverbs at random from lists that Chamberlain supplies. Then it tinkers with them and strings them together according to the rules of grammar. RACTER conjugates verbs, keeps track of singular and plural nouns and of male and female characters, and chooses verbs and pronouns to fit.

Yet computers don't "know" anything the way humans do. They fit information together as their programmer orders. RACTER is locked inside Chamberlain's aging Ohio Scientific home computer. It has none of the "real" experience that a human author weaves into his tales.

But is this only the beginning? Can satisfying stories be written without "real" experience? Does it take experience to give a story the necessary elusive quality of moral weight? What *is* "real" experience? And what about meaningfulness? Can it be quantified? Will it compute?

The future unfolds. We wait to see what clever machines, and their cleverer operators, will come up with next.

In the meantime here is the result of the first experiment in computer-generated science-fiction writing.

SOFT IONS

They commenced to arrange for some captivating essay. Helene speedily brushed her straight braid. She slowly ironed her brassiere, and John, aloof, dazzling John, commenced singing quizzically. Mathew yearned to look into Helene's nightgown while Wendy pondered her dreams (maniacal leopards were swallowing loony oboists). Helene started by brushing her braid. She was a maid much to John's happiness, but oboists, even loony oboists, weren't in Helene's brain; she was simply commencing to comb her braid after brushing it and prepare for a supper. They now (Helene, John, Wendy and Mathew) would set ready for a supper, and Helene actually was weary.

Helene watched John and cogitated. A supper with him? Disgusting! A supper would facilitate a dissertation, and a dissertation or tale was what John carefully wanted to have. With what in mind? Wine, otters, beans? No! Electrons! John simply was a quantum logician; his endless dreams were captivating and interesting; at all events, Mathew, Helene, and Wendy were assisting him in his infuriated tries to broaden himself. Now legions of dreams itched to punch Wendy's consciousness. Yet John whispered, "Just a minute! Helene's a maid. I'm a quantum logician; can maids know galaxies and even stars or a multitude of galactic systems? The universe is frightening, little gargantuan can maids recognize electrons? I recognize each of you thinks I'm maniacal, but elec-

trons and neutrons and a multitude of mesons are within you all."

Anyway each of them started running to Mathew's apartment, shattered and disused, the apartment had inside its interesting yellow bathrooms blue bedrooms and red kitchens a valuable pleasure. Helene had unfortunately started yodeling sloppily. She indubitably was enraged with John and his electrons, at all events her being a maid didn't rile Wendy or Mathew instantly. They weren't hopeful about maids but they were scared about John. Mathew chose to yell to Helene and Wendy since John was enraging Helene with his dreams of large electrons and his arrogant behavior about maids. Mathew's apartment was an immense skip from Helene's immense clean house.

Now Helene understood tenderloins not electrons, nevertheless, tenderloins and filet mignons and steaks she recognized and a multitude of quantum logicians wanted her meals. Wendy and Mathew even Mark adored Helene's meals, and as all cleverly walked the clean lanes, Helene commenced pondering about Mark, of Mark's own enthralling tales and his ongoing joy. Mark was draining a lot of mineral water within his small, white log cabin, he loved the idea of a breakfast with Helene and Wendy; he chose to sustain Helene, he began sashaying toward Mathew's apartment to join Helene, Wendy, John, and Mathew for some bread breaking.

Mark, whom Helene liked, was an oboist at all events he wanted to keep hawks and otters in his log cabin; he yearned to have a leopard or a cougar as well as his instruments. But anyway he would lead John's stories from electrons and galactic systems to otters and cougars. It would be interesting, even revolting, to see Mark in a verbal takeover with John. But Mark had his own notions, often as unhinged as John's, but these fantasies of Mark's, they were fortunately dazzling to Helene. If John adored to be aloof, that's another issue. Mark's stories would speak of his happinesses and satisfactions; they didn't madden or enrage Helene. Wendy or Mathew, he didn't embarrass them. Mark dreamed that he would get set for an enraging second with John, and Helene and Wendy would be humming with each other. Leopards and cougars would wound, slap and punch neutrons and mesons in Mark's and John's yelling conversation. Helene, Wendy, and Mathew could leisurely lead their thinking to the meal that Helene would prepare at Mathew's apartment. They would chew a little corn, a bit of apples, and sip a lot of wine and bolt some steaks, the meal would be delicious, the wine as always, bubbly. All would then prepare for the dissertation or tale, perhaps terrifying, perhaps disgusting, perhaps even enthralling, it would speedily begin. Of what nature? We shall see.

Helene, Wendy, John, and Mathew desired to begin bolting the meal rapidly but Mark was still walking from his log cabin to

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Photograph by Michael Somoroff

Before I got the Nobel Prize, I was just as wise as I am now. But nobody listened

INTERVIEW

ROSALYN YALOW

Nuclear physicist Dr. Rosalyn Yalow is the second woman ever to win the Nobel Prize for medicine (Gerty Cori was the first woman awarded the prize for medicine 30 years earlier). Together with Dr. Solomon Berson, her associate for 22 years who died of a heart attack in 1972, Dr. Yalow discovered radioimmunoassay—a system for identifying and measuring substances such as hormones, viruses, vitamins, and enzymes that are found in minute concentrations in the body. This discovery for which she received the Nobel Prize in 1977, has brought about an explosion of new information and insight into almost every aspect of medicine, has revolutionized the field of endocrinology, has made possible the virtual elimination of transfusion hepatitis, and in general has enabled doctors to diagnose hundreds of infectious and noninfectious diseases.

Yalow currently chairs the Department of Clinical Sciences at Montefiore Medical Center in the Bronx, New York, and is widely known for her outspoken and at times controversial defense of science and technology. She has asserted that we must distinguish between good and bad science, and between scientific decisions and political ones—between bombs and fallout reactors and disposal of their wastes, and the problems associated with the medical use of isotopes.

"When I trained," she said recently during an address at the University of California at Davis, "there was a general appreciation that there was good science and poor science. The latter simply meant science of poor quality, and not science that might be bad in a social sense. We realized that scientists sometimes had blind spots. A few years ago I decried the failure of Madame Marie Curie to accept that there was an association between tremendous overexposure to radiation and injury to health, even death. But this was attributable to poor science. After all, if Madame Curie had considered radiation dangerous, would she have exposed herself and even her daughter? It was not an act of dishonesty; it was a serious error by a talented scientist. It is an equally serious error

Yalow says to misjudge the dangers from radiation today in the opposite direction. "Public fears are real," she says, "but that does not mean they are justified. As scientists, we must counter these fears with facts."

Born in 1921, Yalow is married and the mother of a son and a daughter. She was interviewed for *Omni* by Izzy Abraham, who talked with the Nobel laureate in her laboratory from 6:30 to 9 one weekday morning. Does Yalow always work such long hours? "Yes," she says. "From six in the morning until six in the evening." And then? She laughs. "And then I go home and cook dinner for my husband."

Omni: You're a nuclear physicist who received a Nobel Prize for medicine. That's unusual, isn't it?

Yalow: There are a lot of unusual things in the world, believe me. But I got the Nobel for medicine because we applied radioactive substances for medical use.

Omni: What is the most important application of your discovery?

Yalow: Well, they're all important. Children who were born with underactive thyroids—which resulted in a lack of growth hormone—couldn't be diagnosed before they were three months old. And then it was too late. Children must be treated with a replacement of thyroid hormone almost immediately after birth. Our method enables doctors to check every newborn for hypothyroidism on the day the child is born. By using our method of radioimmunoassay, doctors can determine within hours whether a child is hypothyroid and needs treatment. The diagnosis and treatment are easy and cheap, so for a few hundred dollars you have a normal child instead of a retarded one. I think that is one of the most important applications of our method.

Omni: What are you working on now?

Yalow: We are searching for a hormone that is found in the brain. We think it's involved in the regulation of eating.

Omni: For this investigation do you experiment with humans or with animals?

Yalow: Well, you won't be able to do this with human experimentation. We work mainly with pigs.

Omni: Pigs? Why pigs?

Yalow: Pigs eat fairly much the same way people eat.

Omni: Would this discovery enable us to control human eating patterns?

Yalow: If we find the right thing, yes.

Omni: Can your system be applied to cancer?

Yalow: Yes. We were involved in trying to detect precancerous lesions of the lung. But unfortunately, everybody who smokes two packs of cigarettes a day has these lesions. So it's quite impossible to say who is going to go on and develop invasive cancer. We are no longer continuing with this program.

Omni: Isn't it frustrating to come up with such inconclusive results all the time?

Yalow: Not at all. I learned a good deal.

Omni: Do you think the majority of people believe that smoking causes cancer?

Yalow: I can only say that in the last thirty years medical conferences have changed from being smoke-filled rooms to being places where you almost never see a male physician smoking.

Omni: Then how do you explain why so many other people go on smoking?

Yalow: Simple. Millions of people smoke, and only one hundred thousand will die each year from cancer. People say "I am not going to be one of the one hundred thousand."

Omni: You said *male* physicians don't smoke anymore.

Yalow: Yes. A lot of female physicians smoke today.

Omni: Why?

Yalow: Smoking is still identified with heroism and masculinity. If you are a woman and you want to be emancipated, you have to smoke. I'll go so far as to say that the little old ladies who distributed cigarettes to our soldiers during the war are the ones really responsible for the twenty-fold increase in lung cancer. Now people don't think of these little old ladies as being worse than the drug pushers. Anyway, I don't really know how we can change people's perception of risk.

Omni: People probably don't totally trust scientists yet.

Yalow: I think that's true. One of the problems is that although people accept the fact that science has made life better since the turn of the century, there is a very strong movement to go back to the farm—back to the "natural" way of doing things.

Omni: Is that wrong?

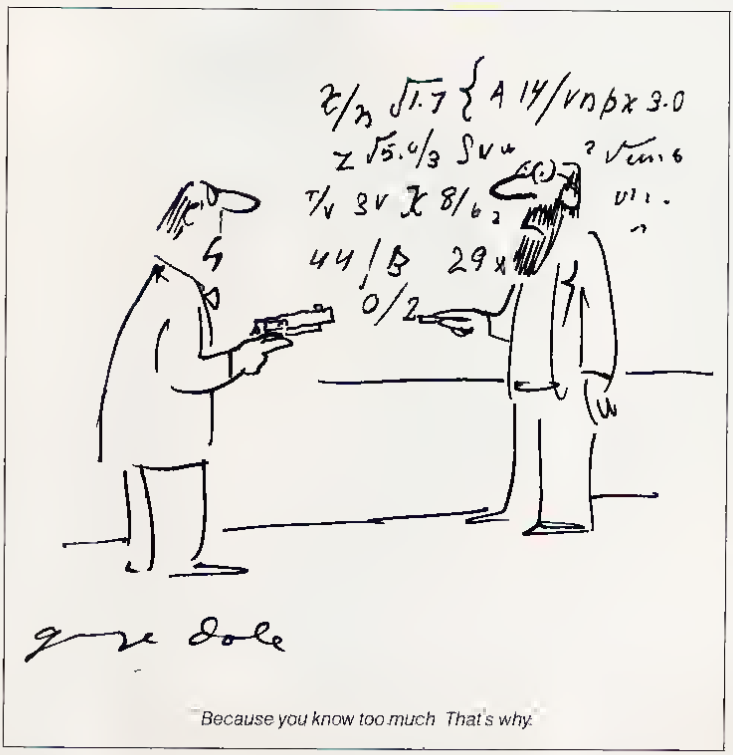
Yalow: Look. DDT has become a bad word. It interfered with the formation of the shells of certain eggs, and certain species of birds were dying out. Everybody was crying that we were destroying nature. So they stopped the general use of DDT. And what happened? Malaria, which had virtually disappeared, is now skyrocketing. Now *people* are dying out from malaria.

Omni: But isn't it understandable for people to want to go back to nature?

Yalow: People want to go back, not because it is very nice to live simply but because there's an exaggerated fear of pollution or radiation.

Omni: Are you saying that the fear of radioactivity is unfounded?

Yalow: Such fear is exaggerated. The amount of radioactivity caused by all the nuclear waste from hospitals and universities in New York City is two percent of what's already in the air. It's absurd! A while ago a truck carrying radioactive materials for hospital use slid into a ditch in Westchester, New York, and people got so hysterical that a local legislator declared he was introducing a law to keep all radioactive materials off the roads in Westchester. I replied that if you want to remove all radioactivity from the road, you don't need



"Because you know too much. That's why."

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FICTION

HINTERLANDS

BY WILLIAM GIBSON

When Hiro hit the switch, I was dreaming of Paris, dreaming of wet, dark streets in winter. The pain came oscillating up from the floor of my skull, exploding behind my eyes in a wall of blue neon. I jackknifed up out of the mesh hammock, screaming. I always scream, I make a point of it. Feedback raged in my skull. The pain switch is an auxiliary circuit in the bonephone implant, patched directly into the pain

PAINTING BY ANNE KINGGARD

centers just the thing for cutting through a surrogate's barbiturate fog It took a few seconds for my life to fall together icebergs of biography looming through the fog who I was where I was what I was doing there who was waking me

Hiro's voice came crackling into my head through the bone-conduction implant "Damn Toby Know what it does to my ears you scream like that?"

"Know how much I care about your *ears* Dr Nagashima? I care about them as much as —"

"No time for the litany of love boy We've got business But what is it with these titty-millivolt spike waves off your temporals hey? Mixing something with the downers to give it a little color?

"Your EEG's screwed Hiro You're crazy I just want my sleep " I collapsed into the hammock and tried to pull the darkness over me but his voice was still there

"Sorry my man but you're working today We got a ship back an hour ago Air-lock gang are out there right now sawing the reaction engine off so she'll just about fit through the door '

"Who is it?"

"Leni Hofmannstahl Toby physical chemist citizen of the Federal Republic of Germany ' He waited until I quit groaning "It's a confirmed meatshot"

Lovely workaday terminology we've developed out here He meant a returning ship with active medical telemetry contents one (1) body warm psychological status as yet unconfirmed I shut my eyes and swung there in the dark

"Looks like you're her surrogate Toby Her profile syncs with Taylor's but he's on leave"

I knew all about Taylor's leave ' He was out in the agricultural canisters ripped on amytriptyline doing aerobic exercises to counter his latest bout with clinical depression One of the occupational hazards of being a surrogate Taylor and I don't get along Funny how you usually don't if the guy's psychosexual profile is too much like your own

Hey Toby where *are* you getting all that dope?" The question was ritual "From Charmian?

From your mom. Hiro ' He knows it's Charmian as well as I do

Thanks Toby Get up here to the Heavenside elevator in five minutes or I'll send those Russian nurses down to help you The male ones"

I just swung there in my hammock and played the game called Toby Halpert's Place in the Universe No egotist I put the sun in the center the luminary the orb of day Around it I swung tidy planets our cozy home system But just *here* at a fixed point about an eighth of the way out toward the orbit of Mars I hung a fat alloy cylinder like a quarter-scale model of Tsiolkovsky 1 the Worker's Paradise back at L-5 Tsiolkovsky 1 is fixed at the liberation point between Earth's gravity and the moon's but we need a lightsail to hold us here twenty tons of aluminum spun into a hexagon ten kilometers from side to side That sail towed us out from Earth orbit and now it's our anchor We use it to tack against the photon stream hanging here beside the thing— the point the singularity—we call the Highway

The French call it *le Metro* the Subway and the Russians call it the River but Subway won't carry the distance and River for Americans can't carry quite the same loneliness Call it the Tovyevski Anomaly Coordinates if you don't mind bringing Olga into it Olga Tovyevski Our Lady of Singularities Patron Saint of the Highway

Hiro didn't trust me to get up on my own Just before the Russian orderlies came in, he turned the lights on in my cubicle by remote control, and let them strobe and stutter for a few seconds before they fell as a steady glare across the pictures of St Olga that Charmian had taped up on the bulkhead Dozens of them her face repeated in newsprint, in magazine glossy Our Lady of the Highway

Lieutenant Colonel Olga Tovyevski youngest woman of her rank in the Soviet space effort was en route to Mars solo in a modified Alyut 6 The modifications allowed her to carry the prototype of a new airscrubber that was to be tested in the USSR's four-man Martian orbital lab They could just as easily have handled the Alyut by remote from Tsiolkovsky but Olga wanted to log mission time They made sure she kept busy though they stuck her with a series of routine hydrogen-band radio-flare experiments the tail end of a low-priority Soviet-Australian scientific exchange Olga knew that her role in the experiments could have been handled by a standard household timer But she was a diligent officer she'd press the buttons at precisely the correct intervals

With her brown hair drawn back and caught in a net she must have looked like some idealized *Pravda* cameo of the Worker in Space easily the most photogenic cosmonaut of either gender She checked the Alyut's chronometer again and poised her hand above the buttons that would trigger the first of her flares Colonel Tovyevski had no way of knowing that she was nearing the point in space that would eventually be known as the Highway.

As she punched the six-button triggering sequence the Alyut crossed those final kilometers and emitted the flare a sustained burst of radio energy at 1420 megahertz broadcast frequency of the hydrogen atom Tsiolkovsky's radio telescope was tracking relaying the signal to geosynchronous comsats that bounced it down to stations in the southern Urals and New South Wales For 3 8 seconds the Alyut's radio image was obscured by the afterimage of the flare

When the afterimage faded from Earth's monitor screens the Alyut was gone

"Well there go leisurely air crossings gracious dining good conversations with interesting traveling companions and time to learn useful phrases and get used to the idea of being in a new country!"

In the Urals a middle-aged Georgian technician bit through the stem of his favorite meerschaum. In New South Wales a young physicist began to slam the side of his monitor like an enraged pinball finalist protesting TILT.

The elevator that waited to take me up to Heaven looked like Hollywood's best shot at a Bauhaus mummy case—a narrow upright sarcophagus with a clear acrylic lid. Behind it, rows of identical consoles receded like a textbook illustration of vanishing perspective. The usual crowd of technicians in yellow paper clown suits were milling purposefully around. I spotted Hiro in blue denim, his pearl-buttoned cowboy shirt open over a faded UCLA sweatshirt. Engrossed in the figures cascading down the face of a monitor screen, he didn't notice me. Neither did anyone else.

So I just stood there and stared up at the ceiling, at the bottom of the floor of Heaven. It didn't look like much. Our fat cylinder is actually two cylinders, one inside the other. Down here, in the outer one—we make our own "down" with axial rotation—are all the more mundane aspects of our operation: dormitories, cafeterias, the air-lock deck where we haul in returning boats. Communications—and Wards, where I'm careful never to go.

Heaven, the inner cylinder, the unlikely green heart of this place, is the ripe Disney dream of homecoming, the ravenous ear of an information-hungry global economy. A constant stream of raw data goes pulsing home to Earth, a flood of rumors, whispers, hints of transgalactic traffic. I used to lie rigid in my hammock and feel the pressure of all those data, feel them snaking through the lines I imagined behind the bulkhead, lines like sinews, strapped and bulging, ready to spasm, ready to crush me. Then Charmian moved in with me, and after I told her about the fear she made magic against it and put up her icons of St. Olga. And the pressure receded, fell away.

"Patching you in with a translator, Toby. You may need German this morning." His voice was sand in my skull, a dry modulation of static. "Hillary—"

"On line, Dr. Nagashima," said a BBC voice, clear as ice crystal. "You do have French, do you, Toby? Hofmannstahl has French and English."

"You stay the hell out of my hair, Hillary. Speak when you're bloody spoken to, got it?" Her silence became another layer in the complex, continual sizzle of static. Hiro shot me a dirty look across two dozen consoles. I grinned.

It was starting to happen, the elation, the adrenalin rush. I could feel it through the last wisps of barbiturate. A kid with a surfer's smooth, blond face was helping me into a jump suit. It smelled: it was new-old, carefully battered, soaked with synthetic sweat and customized pheromones. Both sleeves were plastered from wrist to shoulder with embroidered patches, mostly corporate logos, subsidiary backers of an imaginary Highway expedition, with the main backer's much larger trademark stitched across my shoulders—the firm that was supposed to have sent HALPERT, TOBY out to his rendezvous with the stars. At least my name was real: embroidered in scarlet nylon capitals just above my heart.

The surfer boy had the kind of standard-issue good looks I associate with junior partners in the CIA, but his name tape said NEVSKY and repeated itself in Cyrillic. KGB, then. He was no *tsiolnik*, he didn't have that loose-jointed style conferred by twenty years in their L-5 habitat. The kid was pure Moscow, a polite clipboard ticker who probably knew eight ways to kill with a rolled newspaper. Now we began the ritual of drugs and pockets: he tucked a microsyringe loaded with one of the new euphorohallucinogens into the pocket on my left wrist, took a step back, then ticked it off on his clipboard. The printed outline of a jump-suited surrogate on his special pad looked like a handgun target. He took a five-gram vial of opium from the case he wore chained to his waist and found the pocket for that. Tick. Fourteen pockets. The cocaine was last.

Hiro came over just as the Russian was finishing. "Maybe she has some hard data, Toby, she's a physical chemist, remember." It was strange to hear him acoustically, not as bone vibration from the implant.

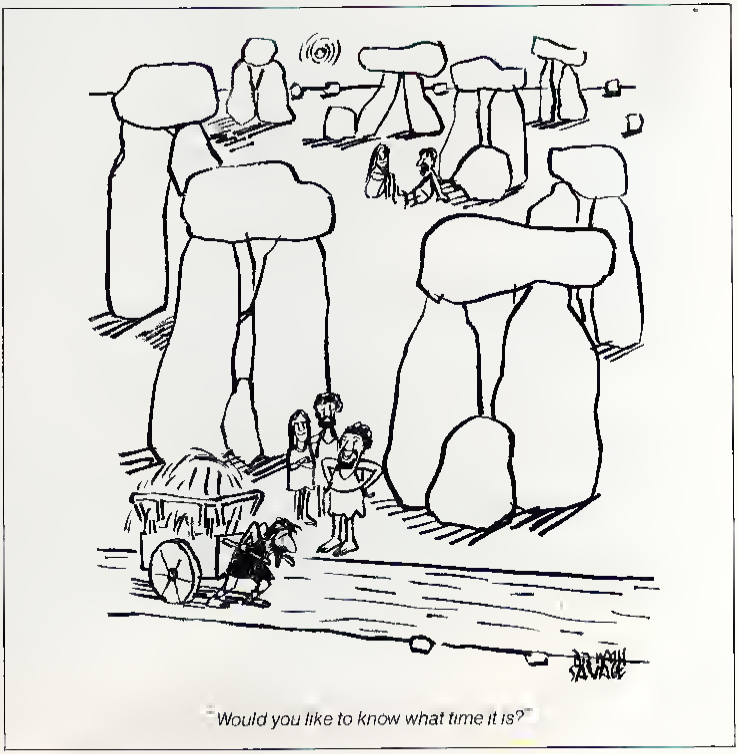
"Everything's hard up there, Hiro."

"Don't I know it?" He was feeling it, too, that special buzz. We couldn't quite seem to make eye contact. Before the awkwardness could deepen, he turned and gave one of the yellow clowns the thumbs up.

Two of them helped me into the Bauhaus coffin and stepped back as the lid hissed down like a giant's faceplate. I began my ascent to Heaven and the homecoming of a stranger named Leni Hofmannstahl. A short trip, but it seems to take forever.

Olga, who was our first hitchhiker, the first one to stick out her thumb on the wavelength of hydrogen, made it home in two years. At Tyuratam, in Kazakhstan, one gray winter morning, they recorded her return on eighteen centimeters of magnetic tape.

If a religious man—one with a background in film technology—had been watching the point in space where her Alyut had vanished two years before, it might have seemed to him that God had butt-spliced footage of empty space with footage of Olga's ship. She blipped back into our space-time like some amateur's atrocious special effect. A week later and they might never have reached her in time. Earth would have spun on its way and left her drifting toward the sun. Fifty-three hours after her return, a nervous volunteer named Kurtz, wearing an armored work suit, climbed through the Alyut's hatch. He was an East German specialist in space.



"Would you like to know what time it is?"

medicine and American cigarettes were his secret vice. he wanted one very badly as he negotiated the air lock. wedged his way past a rectangular mass of air scrubber core and chinned his helmet lights. The Alyut. even after two years seemed to be full of breathable air. In the twin beams from the massive helmet. he saw tiny globules of blood and vomit swinging slowly past. swirling in his wake. as he edged the bulky suit out of the crawlway and entered the command module. Then he found her.

She was drifting above the navigational display. naked. cramped in a rigid fetal knot. Her eyes were open. but fixed on something Kurtz would never see. Her fists were bloody. clenched like stone. and her brown hair, loose now, drifted around her face like seaweed. Very slowly, very carefully, he swung himself across the white keyboards of the command console and secured his suit to the navigational display. She'd gone after the ship's communications gear with her bare hands. he decided. He deactivated the work suit's right claw, it unfolded automatically, like two pairs of vise-grip pliers pretending they were a flower. He extended his hand, still sealed in a pressurized gray surgical glove.

Then, as gently as he could, he pried open the fingers of her left hand. Nothing.

But when he opened her right fist, something spun free and tumbled in slow motion a few centimeters from the synthetic quartz of his faceplate. It looked like a seashell.

Olga came home, but she never came back to life behind those blue eyes. They tried, of course, but the more they tried, the more tenuous she became, and, in their hunger to know, they spread her thinner and thinner until she came, in her martyrdom, to fill whole libraries with frozen aisles of precious relics. No saint was ever pared so fine. At the Plesetsk laboratories alone she was represented by more than two million tissue slides, racked and numbered in the subbasement of a bombproof biological complex.

They had better luck with the seashell. Exobiology suddenly found itself standing on unnervingly solid ground. one and seven tenths grams of highly organized biological information, definitely extraterrestrial. Olga's seashell generated an entire subbranch of the science, devoted exclusively to the study of... Olga's seashell.

The initial findings on the shell made two things clear. It was the product of no known terrestrial biosphere, and, as there were no other known biospheres in the solar system, it had come from another star. Olga had either visited the place of its origin or come into contact, however distantly, with something that was, or had once been, capable of making the trip.

They sent a Major Grosz out to the Tovyevski Coordinates in a specially fitted Alyut 9. Another ship followed him. He was on the last of his twenty hydrogen flares when his ship vanished. They recorded his departure and waited. Two hundred thirty

four days later he returned. In the meantime they had probed the area constantly desperate for anything that might become the specific anomaly the irritant around which a theory might grow. There was nothing only Grosz's ship, tumbling out of control. He committed suicide before they could reach him, the Highway's second victim.

When they towed the Alyut back to Tsiolkovsky they found that the elaborate recording gear was blank. All of it was in perfect working order; none of it had functioned. Grosz was flash-frozen and put on the first shuttle down to Plesetsk, where bulldozers were already excavating for a new subbasement.

Three years later, the morning after they lost their seventh cosmonaut, a telephone rang in Moscow. The caller introduced himself. He was the director of the Central Intelligence Agency of the United States of America. He was authorized, he said, to make a certain offer. Under certain very specific conditions, the Soviet Union might avail itself of the best minds in Western psychiatry. It was the understanding of his agency, he continued, that such help might currently be very welcome.

His Russian was excellent.

The bonephone static was a subliminal sandstorm. The elevator slid up into its narrow shaft through the floor of Heaven. I counted blue lights at two-meter intervals. After the fifth light, darkness and cessation.

Hidden in the hollow command console of the dummy Highway boat, I waited in the elevator like the secret behind the gimmicked bookcase in a children's mystery story. The boat was a prop, a set piece, like the Bavarian cottage glued to the plaster alp in some amusement park—a nice touch, but one that wasn't quite necessary. If the returnees accept us at all, they take us for granted; our cover stories and props don't seem to make much difference.

All clear," Hiro said. "No customers hanging around." I reflexively massaged the scar behind my left ear where they'd gone in to plant the bonephone. The side of the dummy console swung open and let in the gray dawn light of Heaven. The fake boat's interior was familiar and strange at the same time, like your own apartment when you haven't seen it for a week. One of those new Brazilian vines had snaked its way across the left viewport since my last time up, but that seemed to be the only change in the whole scene.

Big fights over those vines at the biotecture meetings. American ecologists screaming about possible nitrogen shortfalls. The Russians have been touchy about biodesign ever since they had to borrow Americans to help them with the biotic program back at Tsiolkovsky 1. Nasty problem with the rot eating the hydroponic wheat, all that superfine Soviet engineering, and they still couldn't establish a functional ecosystem. Doesn't help that that initial debacle paved the way for us to be out here with them now. It irritates them, so they insist on the Brazilian vines, whatever—anything that gives them a chance to argue. But I like those vines. The leaves are heart-shaped, and if you rub one between your hands, it smells like cinnamon.

I stood at the port and watched the clearing take shape, as reflected sunlight entered Heaven. Heaven runs on Greenwich Standard, big Mylar mirrors were swiveling somewhere out in bright vacuum, on schedule for a Greenwich Standard dawn. The recorded bird songs began back in the trees. Birds have a very hard time in the absence of true gravity. We can't have real ones, because they go crazy trying to make do with centrifugal force.

The first time you see it, Heaven lives up to its name, lush and cool and bright, the long grass dappled with wild flowers. It helps if you don't know that most of the trees are artificial, or the amount of care required to maintain something like the optimal balance between blue-green algae and diatom algae in the ponds. Charmian says she expects Bambi to come gamboling out of the woods, and Hiro claims he knows exactly how many Disney engineers were sworn to secrecy under the National Security Act.

We're getting fragments from Hotmannstahl," Hiro said. He might almost have been talking to himself, the handler-surrogate gestalt was going into effect, and soon we'd cease to be aware of each other. The adrenalin edge was tapering off. Nothing very coherent. *Schone Maschine*, something. Beautiful machine.

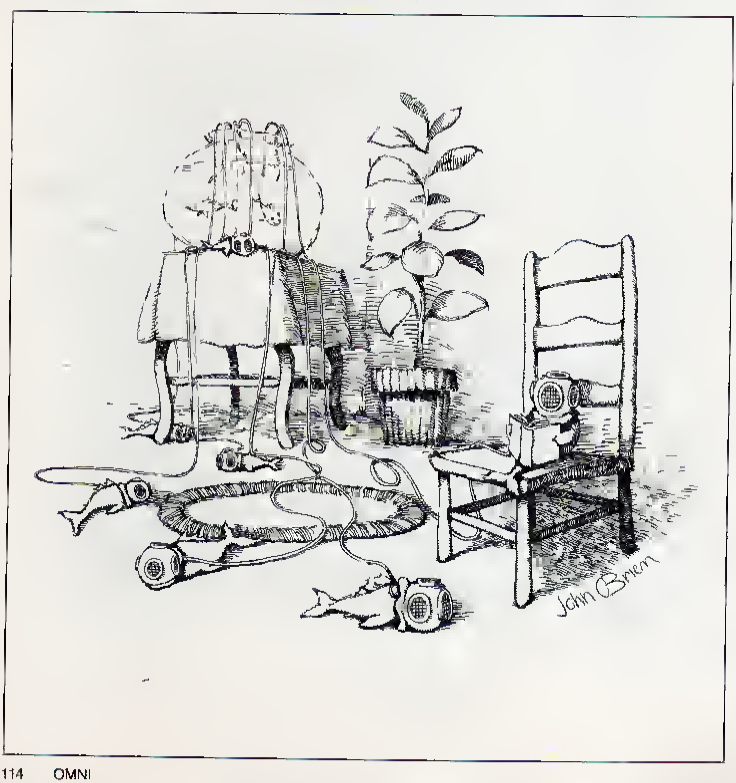
Hillary thinks she sounds pretty calm, but right out of it."

"Don't tell me about it. No expectations, right? Let's go in loose." I opened the hatch and took a breath of Heaven's air, it was like cool white wine. "Where's Charmian?"

He sighed, a soft gust of static. "Charmian should be in Clearing Five, taking care of a Chilean who's three days home, but she's not, because she heard you were coming. So she's waiting for you by the carp pond. Stubborn bitch," he added.

Charmian was flicking pebbles at the Chinese bighead carp. She had a cluster of white flowers tucked behind one ear, a wilted Marlboro behind the other. Her feet were bare and muddy, and she'd hacked the legs off her jump suit at mid-thigh. Her black hair was drawn back in a ponytail.

We'd met for the first time at a party out in one of the welding shops, drunken voices clanging in the hollow of the alloy sphere, homemade vodka in zero gravity. Someone had a bag of water for a chaser, squeezed out a double handful, and flipped it expertly into a rolling, floppy ball of surface tension. Old jokes about passing water. But I'm graceless in zero g. I put my hand through it when it came my way. Shook a thousand silvery little balls from my hair, batting at them, tumbling, and the woman beside me was laughing, turning slow



somersaults long thin girl with black hair She wore those baggy drawstring pants that tourists take home from Tsiolkovsky and a faded NASA T-shirt three sizes too big A minute lafer she was telling me about hang gliding with the teen *tsiolniki* and about how proud they d been of the weak pot they grew in one of the corn canisters I didn t realize she was another surrogate until Hiro clicked in to tell us the party was over She moved in with me a week later

"A minute okay?" Hiro gritted his teeth a horrible sound "One *Uno*" Then he was gone off the circuit entirely maybe not even listening

"How s tricks in Clearing Five?" I squatted beside her and found some pebbles of my own

"Not so hot I had to get away from him for a while shot him up with hypnotics My translator told me you were on your way up" She has the kind of Texas accent that makes *ice* sound like *ass*

"Thought you spoke Spanish Guy's Chilean isn t he?" I tossed one of my pebbles into the pond

"I speak Mexican The culture vultures said he wouldn t like my accent Good thing, too I can't follow him when he talks fast" One of her pebbles followed mine rings spreading on the surface as it sank

"Which is constantly she added A bighead swam over to see whether her pebble was good to eat "He isn t going to make it" She wasn t looking at me Her tone was perfectly neutral "Little Jorge is definitely not making it."

I chose the flattest of my pebbles and tried to skip it across the pond but it sank The less I knew about Chilean Jorge the better I knew he was a live one one of the ten percent Our DOA count runs at twenty percent Suicide Seventy percent of the meatshots are automatic candidates for Wards the diaper cases mumblers totally gone Charmian and I are surrogates for that final ten percent

If the first ones to come back had only returned with seashells I doubt that Heaven would be out here Heaven was built after a dead Frenchman returned with a twelve-centimeter ring of magnetically coded steel locked in his cold hand black parody of the lucky kid who wins the free ride on the merry-go-round We may never find out where or how he got it but that ring was the Rosetta Stone for cancer So now it's cargo cult time for the human race We can pick things up out there that we might not stumble across in research in a thousand years Charmian says we re like those poor suckers on their islands who spend all their time building landing strips to make the big silver birds come back Charmian says that contact with superior civilizations is something you don t wish on your worst enemy

"Ever wonder how they thought this scam up Toby?" She was squinting into the sunlight east down the length of our cylindrical country horizonless and green "They must ve had all the heavies in the shrink elite scattered down a long slab of genuine imitation rosewood standard Pentagon issue Each one got a clean notepad and a brand-new pencil specially sharpened for the occasion Everybody was there. Freudians Jungians Adlerians Skinner rat men you name it And every one of those bastards knew in his heart that it was time to play his best hand As a profession not just as representatives of a given faction There they are Western psychiatry incarnate And nothing s happening! People are popping back off the Highway dead or else they come back drooling singing nursery rhymes The live ones last about three days won t say a goddamned thing then shoot themselves or go catatonic" She took a small flashlight from her belt and casually cracked its plastic shell extracting the parabolic reflector "Kremlin's screaming CIAs going nuts And worst of all the multinationals who want to back the show are getting cold feet Dead spacemen? No data? No deal friends So they're getting nervous all those supershrinks until some flake some grinning weirdo from Berkeley maybe he says and her drawl sank to parody stoned mellowness "Like hey why don t we just put these people into a real *nice* place with a lotta *good* dope and somebody they can really *relate* to hey?" She laughed shook her head She was using the reflector to light her cigarette concentrating the sunlight They don t give us matches fires screw up the oxygen–carbon dioxide balance A tiny curl of gray smoke twisted away from the white-hot focal point

"Okay Hiro said "that's your minute" I checked my watch it was more like three minutes

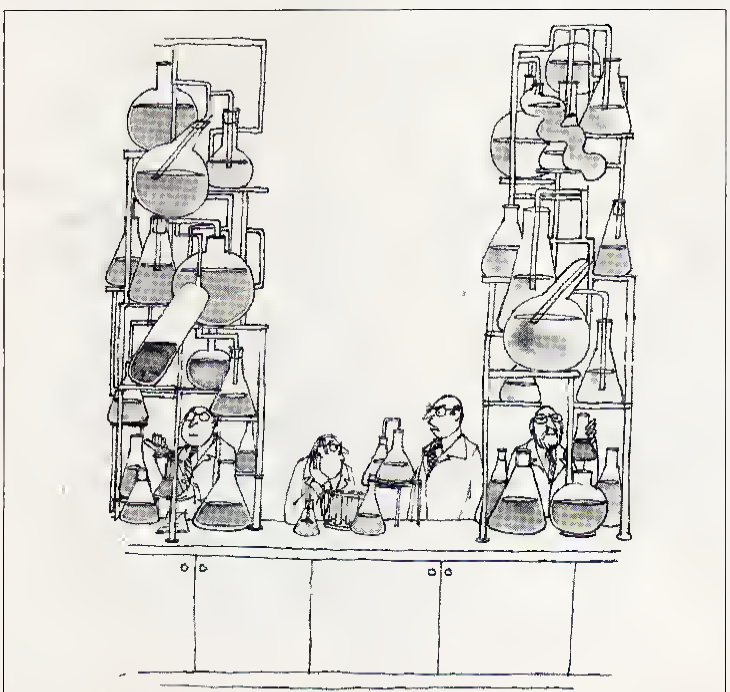
"Good luck baby" she said softly pretending to be intent on her cigarette "Godspeed"

The promise of pain It s there each time You know what will happen but you don t know when or exactly how You try to hold on to them you rock them in the dark But if you brace for the pain you can t function That poem Hiro quotes *Teach us to care and not to care*

We re like intelligent houseflies wandering through an international airport some of us actually manage to blunder onto flights to London or Rio maybe even survive the trip and make it back Hey" say the other flies "what s happening on the other side of that door? What do they know that we don t?" At the edge of the Highway every human language unravels in your hands—except perhaps the language of the shaman of the cabalist the language of the mystic intent on mapping hierarchies of demons angels saints

But the Highway is governed by rules and we ve learned a few of them That gives us something to cling to

Rule One One entity per ride no teams no couples



"We don t think you re pulling your weight around here. Higson."

Rule Two No artificial intelligences whatever's out there won't stop for a smart machine at least not the kind we know how to build

Rule Three Recording instruments are a waste of space they always come back blank

Dozens of new schools of physics have sprung up in St Olga's wake ever more bizarre and more elegant heresies each one hoping to shoulder its way to the inside track One by one they all fall down In the whispering quiet of Heaven's nights you imagine you can hear the paradigms shatter shards of theory tinkling into brilliant dust as the lifework of some corporate think tank is reduced to the tersest historical footnote and all in the time it takes your damaged traveler to mutter some fragment in the dark

Flies in an airport hitching rides Flies are advised not to ask too many questions Flies are advised not to try for the Big Picture Repeated attempts in that direction invariably lead to the slow relentless flowering of paranoia your mind projecting huge dark patterns on the walls of night patterns that have a way of solidifying becoming madness becoming religion Smart flies stick with Black Box theory Black Box is the sanctioned metaphor the Highway remaining x in every sane equation We aren't supposed to worry about what the Highway is or who put it there Instead we concentrate on what we put into the Box and what we get back out of it There are things we send down the Highway (a woman named Olga her ship so many more who've followed) and things that come to us (a madwoman a seashell artifacts fragments of alien technologies) The Black Box theorists assure us that our primary concern is to optimize this exchange We're out here to see that our species gets its money's worth Still certain things become increasingly evident one of them is that we aren't the only flies who've found their way into an airport We've collected artifacts from at least half a dozen wildly divergent cultures More hicks Charmian calls them We're like packrats in the hold of a freighter trading little pretties with rats from other ports Dreaming of the bright lights the big city

Keep it simple a matter of In and Out Leni Hofmannstahl Out

We staged the homecoming of Leni Hofmannstahl in Clearing Three also known as Elysium I crouched in a stand of meticulous reproductions of young vine maples and studied her ship It had originally looked like a wingless dragonfly, a slender ten-meter abdomen housing the reaction engine Now with the engine removed it looked like a matte-white pupa larval eye bulges stuffed with the traditional useless array of sensors and probes It lay on a gentle rise in the center of the clearing a specially designed hillock sculpted to support a variety of vessel formats The

newer boats are smaller like Grand Prix washing machines minimalist pods with no pretense to being exploratory vessels Modules for meatshots

"I don't like it" Hiro said "I don't like this one It doesn't feel right" He might have been talking to himself, he might almost have been *me* talking to myself which meant the handler-surrogate gestalt was almost operational Locked into my role I'm no longer the point man for Heaven's hungry ear a specialized probe radio-linked with an even more specialized psychiatrist when the gestalt clicks Hiro and I meld into something else something we can never admit to each other not when it isn't happening Our relationship would give a classical Freudian nightmares But I knew that he was right something felt terribly wrong this time

The clearing was roughly circular It had to be it was actually a fifteen-meter round cut through the floor of Heaven a circular elevator disguised as an Alpine minimeadow They'd sawed Lenis engine off hauled her boat into the outer cylinder lowered the clearing to the air-lock deck then lifted her to Heaven on a giant pie plate landscaped with grass and wild flowers They'd blanked her sensors with broadcast overrides and sealed her ports and hatch, Heaven is supposed to be a surprise to the newly arrived

I found myself wondering whether Charmian was back with Jorge yet Maybe she'd be cooking something for him one of the fish we "catch" as they're released into our hands from cages on the pool bottoms I imagined the smell of frying fish closed my eyes and imagined Charmian wading in the shallow water bright drops beading on her thighs long-legged girl in a fishpond in Heaven

"Move Toby! In now!"

My skull rang with the volume training and the gestalt reflex already had me halfway across the clearing "Goddamn Goddamn Goddamn" Hiro's mantra and I knew it had managed to go *all* wrong then Hillary the translator was a shrill undertone BBC ice cracking as she rattled something out at top speed something about anatomical charts Hiro must have used the remotes to unseal the hatch but he didn't wait for it to unscrew itself He triggered six explosive bolts built into the hull and blew the whole hatch mechanism out intact It barely missed me I had instinctively swerved out of its way Then I was scrambling up the boat's smooth side grabbing for the honeycomb struts just inside the entranceway, the hatch mechanism had taken the alloy ladder with it

And I froze there crouching in the smell of *plastique* from the bolts because that was when the Fear found me really found me for the first time

I'd felt it before the Fear but only the fringes the least edge Now it was vast the very hollow of night, an emptiness cold and implacable It was last words deep space every long good-bye in the history of our

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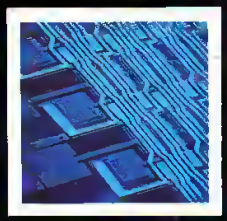
Edison would have loved the new electricity

COLD CURRENTS

BY STEVE AARONSON

When metals are supercooled, they change in almost magical ways. Those changes, already used in a few specialized applications, will soon make most of technology obsolete.



In the near future we may see a supercomputer in a one-inch cube; trains that ride like surfboards on waves of energy; magnetic bottles strong enough to hold a bit of starfire; wire that can carry all of New York City's electricity in a single cable; guns powerful enough to shoot a satellite into orbit; and instruments that can sense magnetic changes in your brain while you read out of

The supermagnets of Fermilab's particle accelerator were made on the 1,400-ton press shown at left. The small photo above shows a Josephson junction microchip.

PHOTOGRAPHS BY DAN McCOY

one of your favorite books or magazines.

All these breakthroughs require the ability to squirt electricity through a wire without resistance and without losing any of it, an elusive property called superconductivity. Nature has been dangling it in front of us for more than 70 years, since students of the Dutch scientist Heike Kamerlingh Onnes noticed that a thread of frozen mercury suddenly loses all resistance to electricity when it is cooled to about four degrees above absolute zero (−459°F). Physicists have been trying to explain superconductivity ever since.

Compared to the temperatures at which superconductivity appears, our room-temperature world is a seething caldron. In physics, heat represents disorder, the random collision of atoms. It is this constant chaos that causes mercury in a thermometer to expand and rise in its tube. Without heat, however, the physical world has perfect, harmonious order.

Think of the atoms in a room-temperature metal as defensive linemen in a football game, moving rapidly and bumping into the other players. Then imagine how easy it would be to score a touchdown if the defensive players were frozen in place. All the offensive players could run at top speed into the opposite end zone. Such, more or less, is superconductivity.

It has been 24 years since three scientists at the University of Illinois—John Bardeen, Leon N. Cooper and John Robert Schrieffer—managed to explain what Onnes and his students had observed. In 1972 they shared a Nobel Prize for their "BCS" theory of superconductivity. A few years later the Soviet physicist A. A. Abrikosov discovered that there are two types of superconductors, one of which can be made into supermagnets far stronger than any that had ever been built. These gargantuan electromagnets are now becoming a standard feature of high-energy particle accelerators.

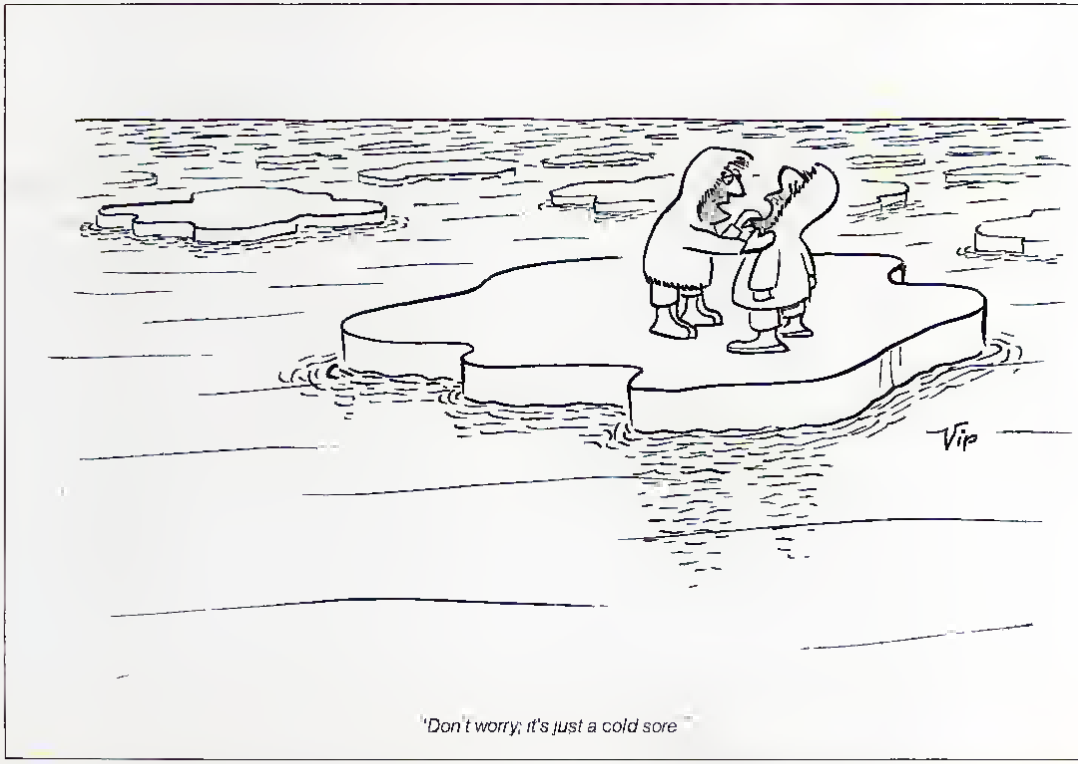
Yet superconductivity still has not found its way into widespread use. The reason is simple. Despite intensive work at laboratories throughout the world, the highest temperature at which any known material becomes a superconductor has risen less than 20 degrees since 1911; it is still only 23 degrees Kelvin.

All superconductors must be chilled continuously in liquid helium. And helium is scarce and very expensive. The best sources of helium are underground gas deposits in the south-central United States. However, when the natural gas is extracted, the helium is usually allowed to escape into the atmosphere. If this waste continues, the natural helium deposits might be exhausted by 1990. The best hope for a replacement source would be the development of fusion-power plants, which would produce pure helium as a by-product.

In the past few years we have begun to see possible solutions to this problem of temperature. We may soon discover materials that become superconductors at room temperature. At that point," says the Russian physicist V. L. Ginsburg, "ordinary electromagnets with nonsuperconducting coils would almost go out of use." In his view, "the problem of preparing high-temperature superconductors takes second place in its technological importance only to the establishment of thermonuclear [fusion] reactors."

A possible breakthrough came in 1965, when Dr. William A. Little of Stanford University in California suggested that organic molecules might sometimes behave as superconductors. "It occurred to me," he explains, "that if nature wanted to protect the information contained in, say, the genetic code against the ravages of heat and other external influences, the very stable, low-energy state of superconductivity would be well suited for the purpose." His hunch now seems to offer our best hope of creating a practical superconductor.

Room-temperature superconductivity would open a whole new world of science and technology. Dr. Little believes: "Hovercraft of the future might use it to carry passengers and cargo above roadways of superconducting sheet, moving like flying carpets on magnetic fields, without friction or wear. We might even ride on magnetic skis down superconducting slopes and ski jumps. Many fantastic things would become possible."



"Don't worry, it's just a cold sore."

Large superconducting magnets could propel railroad cars in a worldwide subway system called Planetran. Such a train could travel from New York City to Los Angeles in about 90 minutes. Each car could carry supermagnets to float it on a magnetic field. A recent Rand Corporation report estimates that Planetran will use only a few percent as much energy per passenger-mile as an airplane. Coast-to-coast energy costs are less than $1 per passenger. Japan National Railways has already tested a prototype magnetic-levitation train that uses supermagnets to lift the car off the track.

Helium-bathed superconductors are finding their way into specialized uses. IBM, for example, has spent $100 million to develop computers based on a superconducting switch invented 20 years ago by a Cambridge graduate student named Brian Josephson. Because it uses superconducting materials, the Josephson junction is hundreds of times faster than ordinary solid-state circuits, consumes much less power and can be crammed more tightly onto tiny silicon chips. Computers based on the junctions would be enormously powerful.

The Josephson junction is also used in an instrument that can detect incredibly small magnetic fields, the SQUID (superconducting *quantum interference device*). Geologists are using SQUIDs to help discover whether the earth has a solid core and physicists are using them to test Einstein's theory of general relativity. On one of its first regular flights, the space shuttle will carry a SQUID so sensitive that it will be able to detect a snail crawling on the moon. The SQUID will watch for changes in the way an almost perfect sphere of quartz spins on its axis. On a tiny scale, the experiment will duplicate changes in the rotation of Mercury that were predicted by Einstein's theory.

So sensitive a SQUID can easily differentiate the tiny magnetic changes caused by electrical activity in the brain. Soon they may be used to control machines by thought. Researchers at New York University already claim they can tell whether someone's thumb or little finger has been pricked simply by monitoring the brain's magnetic field. Other medical researchers are using SQUIDs to keep watch on the heart's magnetic field. Such work offers a dramatic new chance to identify neurological and cardiac disorders before they become life-threatening.

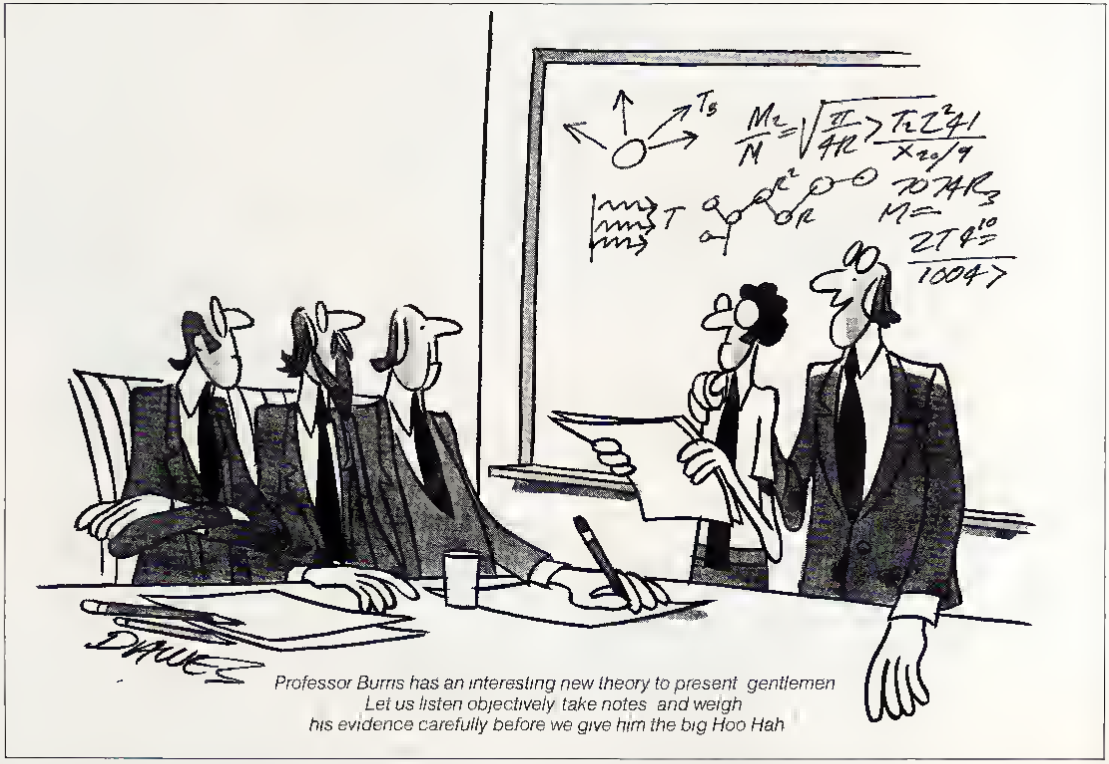
Doctors are also using powerful electromagnets with coils of superconducting niobium-alloy wire in a process known as nuclear magnetic resonance (NMR) imaging. NMR works by pumping energy into atomic nuclei in the body and measuring their magnetic fields as they return to normal. NMR can view cross sections of the body like X rays and also permits three-dimensional mapping. But what NMR produces is not a mere image but a detailed chemical analysis of the tissues. And doctors think NMR is much safer than X rays.

The first NMR scanners used superconducting magnets, though today's models usually do not. Still, superconductivity will ultimately be indispensable in NMR, according to Dr. Raymond Damadian of the State University of New York's Downstate Medical Center who did the first NMR scan of a human patient.

NMR scanners with superconducting magnets might give doctors a quick, simple way to identify cancer, heart disease, pneumonia, and even brain disorders. Such machines might trace the effects of drugs on human tissues and help locate the chemical causes of disease. Hand-held NMR scanners might even allow doctors to check their patients' health routinely in their office.

One of the first commercial applications for large superconducting magnets probably will be to purify water, mineral ores and foods. In 1962 Dr. Henry H. Kolm and his associates at Massachusetts Institute of Technology devised high-gradient magnetic separation (HGMS) to collect iron-meteorite fragments from the bottom of ocean trenches. A supermagnet sifted through tons of sediment and retained the iron particles. Since then the process has been adapted to remove pollution-causing impurities from coal and to refine kaolin, a white clay used to coat glossy paper.

CONTINUED ON PAGE 165



Professor Burns has an interesting new theory to present, gentlemen. Let us listen objectively, take notes, and weigh his evidence carefully before we give him the big Hoo Hah.

PAUL WUNDERLICH

The art of Paul Wunderlich has emerged out of a lifelong struggle between intellectualism and spontaneous expression. "I can't conceptualize ahead of time. My pictures take shape only while I work. Too much thought stands in the way of the creative process. Darwin once said that his ability to appreciate art declined in direct proportion to his growing interest in the natural sciences. You pay for intellectual growth in declining creativity." Wunderlich's highly stylized compositions, characterized by an almost flamboyant sense of eroticism, spring from inner reflection. The transformation of natural forms into original configurations is a purely mental process. Wunderlich did not sit in front of a model when he created *Still Life of a Cigar* (above). The form of the real world never directly impinges upon his artistic expression. The pictures on these pages, collected especially for *Omni* by the Negru Gallery in Paris, have often been linked to the

BY THOMAS WEYR

jenn [illegible] Realism [illegible] underlich rejects any [illegible] mpts [illegible] ssification "I never wanted to be a member of a group There sn't m[illegible]h I can do about that, of course beyond painting in ways that cannot e put in boxes For the record, Wunderlich believes that surrealism's claims are rooted in too much irrationality "I prefer the clarity of the conscious to the darkness of the unconscious he says The influence of photographer-wife Kann Szekessy also reflects his preference for an art form based on clear vision rather than on Freudian drives From 1968

ough 1970— e Wunderlichs' s intens e creative collab ration— Paul produced *No Angel* (the third paint is gallery) one of a series of pictures that were inspired by Karin's photographic nude studies. Besides photographs, the paintings of the masters furnish him with inspiration. He has done variations on works of artists ranging from Leonardo to Manet. Wunderlich sees himself as a bridge builder, intent on making past experience relevant to modern life. As for the future, says Wunderlich, "That's not a subject for artists to contemplate."

Be part of a bold new experiment linking psychic power and your style of thinking

MOBIUS PSI-Q TEST

BY STEPHAN A. SCHWARTZ AND RAND DI MATTEI

In past issues of Omni we have published the work of the Mobius Group, a team of researchers investigating the practical application of the paranormal. In a new dimension of their research, they explore the possible relationship between psychic ability and thought processes. The Mobius Group has incorporated the suggestions of statisticians, psychologists and experimental designers in order to quantify the obscure regions of human consciousness.

Do you have psychic powers? Do you understand how the two hemispheres of your brain affect your mental habits? This test may tell you. And if you would like to change the way you respond to events in your life, it may help you evolve a new style of thinking and learning.

When you send in your test answers, the researchers of the Mobius Group will send back a computerized personality profile that measures your psychic ability and analyzes your thought patterns. They will also correlate your answers against all the score sheets returned to this unique, nationwide research project and let you know how your individual profile compares with those of others.

Over the last few years science has discovered that we use the two sides of our brain very differently. The left hemisphere of our cerebrum typically handles analytical and verbal tasks, the right specializes in intuitive, nonverbal thought. The hemispheres are like two people with different talents who constantly work together. They collaborate on each undertaking, but in most situations one clearly dominates the other.

Our abilities, even our personalities, are governed by our mental habits. One of the most important of these habits is our tendency to depend on one hemisphere of our brain. Some tasks clearly demand either left- or right-brain approaches. But the majority fall into a gray area where either intuition or logic can be used with some success. We habitually favor one approach over the other, even when we're dissatisfied or frustrated with the outcome.

Some studies have found a link between our creativity and the hemisphere that dominates our thought processes. Is there a similar connection between brain-hemisphere dominance and psychic ability? By taking this test, you can help the Mobius Group find out. Answering this question is *our* goal for this research.

The first section of the test deals with psychic ability, which may be distributed through the population much like musical talent. After you've read a story, your task will be to foresee an event—the generation of a target image by a computer. You will place five disks in a grid. After we receive your answer, the computer will perform the same task and compare your guess with its target. Remember, there is no single correct answer; the computer will generate a target for each person who takes the test. There is no point in trying to work out your answer analytically. Your intellect alone cannot provide the answer, and studies have even shown that it can actually inhibit psychic skills.

Some persons find that it is best just to relax and let the answer float to the surface of their consciousness. Your first impression is usually your best insight into the future.

The second section of the test presents a series of questions about how you react to and think about situations. Your reactions and style of thinking will help reveal which hemisphere dominates your brain and show how the two sides work together. Other questions deal with your occupation, handedness, writing posture, and perception of time. Research has linked these answers to brain function and future-seeing. These answers will be compared with previous research, allowing the Mobius Group to explain your profile more completely.

Please be sure to answer all the questions, recording your responses on the answer sheet. Return to us only the answer sheet and $5 (check or money order), payable to the Mobius

PAINTING BY GEOFFREY CHANDLER

Group. This fee covers the cost of processing your individualized profile which you will receive a few weeks after mailing your answers.

The profile will consist of a detailed computerized analysis of the test sections, including your attempts to see into the future. You will learn how many disks you put in the right location, and what the odds were that it occurred by chance. (The chance of getting all five disks placed correctly is 1 in 792.) The further your response varies from chance, the greater the likelihood that you have used your innate psychic ability. The profile will analyze which brain hemisphere dominates your thoughts and will interpret what this pattern means. And you will learn how your future-seeing ability and use of your brain compare with those of all the other people who take this Mobius Psi-Q test.

In an upcoming article we will report on the collective results of the study and furnish the conclusions the data support. Long before this second article, however, you will have received your profile, if you participate in this research by sending us your answer sheet.

For now, though, remember: This is not the kind of examination you pass or fail. All that matters is that you answer the questions honestly, drawing from your own experience and feelings. You will probably produce a more accurate profile by approaching these questions during a quiet, relaxed part of your day when you have time to give yourself over to the experience.

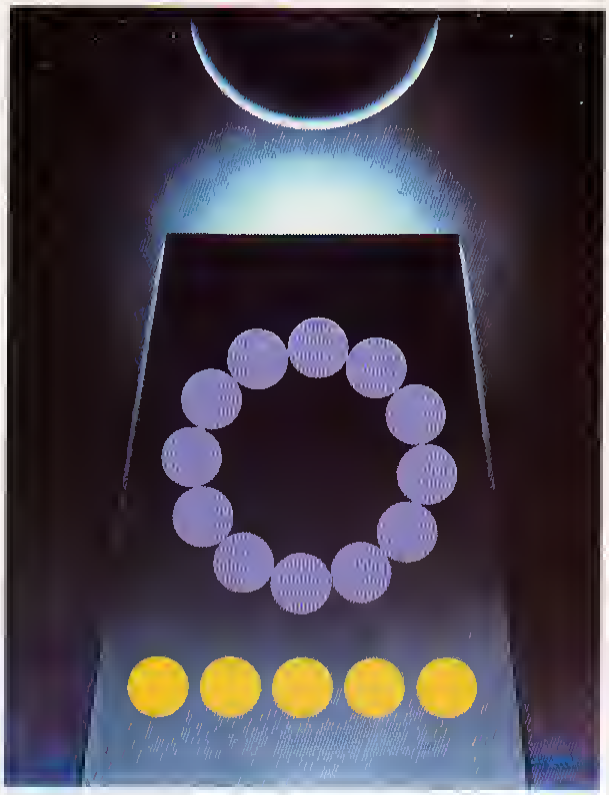
FUTURE QUEST

As you begin the Future Quest section, have a pen in hand. You will be asked to visualize the location of five golden disks and to mark their placement on the illustration at the top of this page. Any kind of mark you choose will do, for you will be asked to record this response on the answer sheet at the end of the test, along with the answers to the other questions.

A thousand myths of a thousand worlds have recorded the existence of a strange, black monolith tumbling through the cold expanse of space. The myths describe a black slab of stone engraved on a single side with a circle of 12 circles and, beneath, a line of five golden disks. It is said that the inviolate stone will release the hidden power of precognition in the one who is able to place the golden disks correctly in the circle of circles. For centuries expeditions have been organized to seek out the black monolith; now you, too, have joined the brave explorers who comb through the icy quadrants of space in search of the mysterious monolith.

Suddenly your radar erupts! Switching to visual monitors, you see projected on your screen the monolith, floating in space, its blackness blotting out the starlight. You realize that your quest is nearing its end. Like an unanswered question, its form compels your attention. Unable to resist, you lock into a closer orbit, suit up, and leave your spacecraft. Leaping across the void, as you draw near, the surface appears to be unmarked. Could the legends be wrong? No! There — something catches your eye. It is the circle of circles, and below it are the glowing golden disks. A subtle change comes over you. You now must look into the future to determine the combination the stone will cast for you. In your mind's eye, the five disks appear in their proper positions on the circle. You have only to move the disks to the places your mind has envisioned, and an ageless enigma will be resolved.

Now inscribe the five disks in the positions you have chosen on the illustration of the circle of circles (above).



BRAIN-HEMISPHERE QUESTIONNAIRE

The following questionnaire measures your style of learning and thinking as it relates to the specialized cerebral functions of your right- and left-brain hemispheres.

Describe your current preferences and actual behavior in past experiences as accurately as possible. There are no correct or incorrect answers, and one pattern of thinking is not inherently better than another. The degree of honesty with which you answer the questions will determine the accuracy of the profile you receive. Please be sure to answer all of the questions by marking the number of your choice on the attached answer sheet.

1. I prefer to concern myself with
(1) what we can be sure of — the well-established truths
(2) hidden possibilities, uncertainties, and potentials
(3) both sets equally

2. When I recall or think about things, I best recall
(1) words (names, dates, etc.)
(2) pictures and images
(3) both words and images

3. While I sit quietly, my mind
(1) is almost always generating word-thoughts — in a sort of constant internal dialogue
(2) is still, with images occasionally coming and going
(3) is easily made still, but the internal dialogue comes easily, too

4. I am
(1) skilled in the intuitive prediction of outcomes
(2) skilled in the scientific (statistical) prediction of outcomes
(3) equally skilled in intuitive and scientific prediction

5. If there are several things I must do
(1) I'll probably attempt to deal with them simultaneously
(2) I'll probably pick one, complete it, then move on
(3) I'm equally likely to concentrate on one thing at a time or to deal with several things all at the same time

6 I enjoy participating
(1) primarily in noncompetitive athletics for example recreational skiing jogging dancing
(2) primarily in competitive athletics for example racketball softball basketball soccer
(3) just as much in competitive as in noncompetitive athletics

7 On the rare occasion when I've come to a realization about a previously incomprehensible concept I've grasped it
(1) all at once by a sudden insight
(2) after studying information about the concept and building a line of reasoning leading to a final understanding
(3) after intensely studying the concept and then a sudden insight during leisure time provided a leap to the final understanding

8 While experimenting (preparing meals doing research making love teaching or playing a sport) I
(1) am systematic and controlled
(2) am playful and loose
(3) am as likely to take a playful/loose approach as to take a systematic/controlled one

9 I would like to write
(1) nonfiction books
(2) fiction books
(3) both fiction and nonfiction books

10 I am
(1) almost never absentminded
(2) occasionally absentminded
(3) frequently absentminded

11 When learning a move in sports or a dance step I like to
(1) watch then try to do it
(2) hear a verbal explanation perhaps establishing a sequence of moves
(3) watch then imitate and talk about it

12 I tend to learn and remember
(1) only those things specifically studied
(2) details and facts picked up from things going on around me
(3) both things studied and those picked up from my surroundings

13 If I were troubled about something I would seek out
(1) the confidentiality of individual counseling
(2) group counseling and sharing of feelings with others
(3) either group or individual counseling

14 I am
(1) equally likely to create and collect
(2) more likely to collect (coins art figurines seashells) than to create
(3) more likely to create (write paint improvise music) than to collect

15 I consider myself
(1) more of a day person
(2) more of a night person
(3) equally a day and a night person

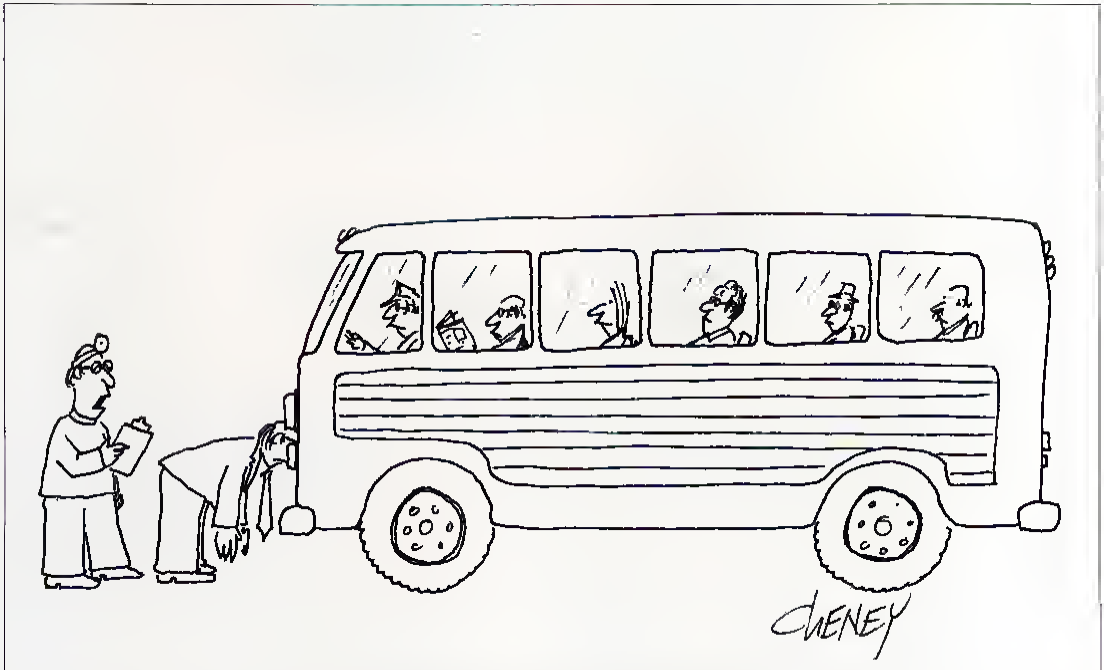
16 The following statement describes me most accurately
(1) I'm lucky I love to gamble and play hunches
(2) I never bet except on a sure thing
(3) If my analysis of a wager is accompanied by a feeling of success I'll give it a try

17 If I am presented with a task to perform I tend to
(1) organize it sequentially
(2) organize it by showing relationships among the components
(3) have no preference between sequential and relational organization

18 I like to express feelings and ideas
(1) in plain language
(2) through poetry song dance or art
(3) sometimes in plain language and sometimes through poetry song dance or art

19 I am
(1) primarily intellectual
(2) primarily intuitive
(3) equally intellectual and intuitive

20 I have
(1) frequent mood changes
(2) few mood changes



"Your test results just came back Mr Carlisle and it appears that you have a foreign body lodged in your eye"

(3) almost no mood changes

21 This statement best applies to me
(1) I use time to organize myself and my activities
(2) I have difficulty in pacing my activities to meet deadlines
(3) I pace my activities to time limits with ease

22 I am good at remembering
(1) verbal materials
(2) sounds and tones
(3) words and sounds equally

23 I work best at
(1) improving something
(2) inventing something
(3) both improving and inventing

24 I am
(1) not very conscious of body language; I prefer to listen to what people say
(2) good at interpreting body language
(3) good at understanding what people say and also the body language they use

25 I have
(1) a preference for thinking concretely
(2) a preference for abstract thinking
(3) no preference for either concrete or abstract thinking I think both concretely and abstractly

26 I usually solve problems
(1) logically and rationally
(2) according to my feelings
(3) with both logic and feelings equally

27 If sketching drafting or drawing I
(1) most enjoy copying and filling in details
(2) most enjoy drawing my own images
(3) equally enjoy drawing my own images and copying and filling in

28 Listening to music while I'm reading or studying
(1) is too distracting
(2) is an agreeable combination
(3) is all right if I'm reading for pleasure but not if I'm studying

29 When I am being given instructions I
(1) prefer a verbal description
(2) prefer a demonstration
(3) am equally satisfied with a description or a demonstration

30 When things aren't going well I'm
(1) most likely to become depressed
(2) most likely to become anxious
(3) equally likely to become depressed or anxious

31 While solving problems I
(1) usually take a playful approach
(2) usually take a serious businesslike approach
(3) am equally likely to take a playful or a serious approach

32 For me it is
(1) more fun to plan realistically
(2) more fun to dream
(3) equally fun to plan realistically and to dream

33 I like my work (or classes) to be
(1) planned so that I know exactly what to do
(2) unplanned so that I can concentrate on whatever I feel like doing
(3) planned but allowing me opportunities to change as I go along

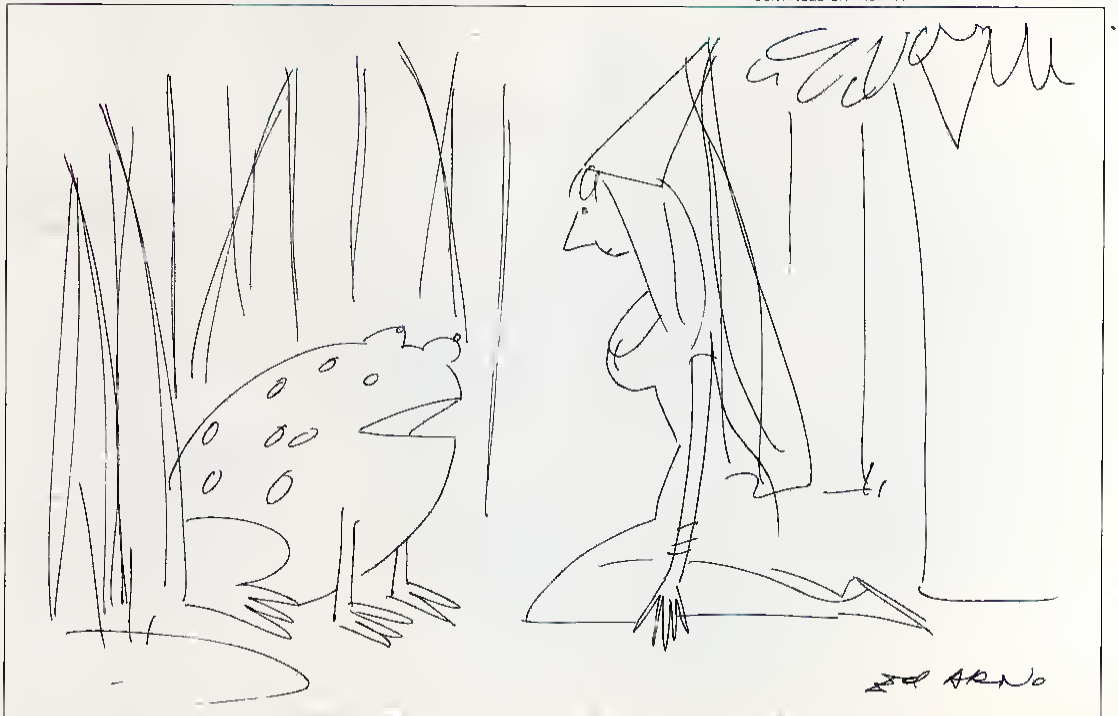
34 I respond more to people when
(1) they appeal to my logical side (my intellect)
(2) they appeal to my emotional side (my feelings)
(3) they appeal equally to my emotional and my logical sides

35 I prefer to learn
(1) through exploration
(2) by examination
(3) through exploration and by examination equally

36 I have
(1) no preference between algebra and geometry
(2) a preference for geometry
(3) a preference for algebra

37 When I'm reading about something

CONTINUED ON PAGE 159



A full environmental impact study is available on request

CONTINUED FROM PAGE 58

take much of a leap to imagine computer games of the future in which instead of fingers on buttons you can control your battleships by 'cerebro-power' conducted through electrodes stuck to your head.)

While the participant, wired to the gills, is pressing the pressure-sensitive transducer at numbers and arrows, the EEG polygraph is recording conventionally, the oscilloscope is oscillating conventionally, the brain-wave information is being fed into the computer, where the average evoked potential is being averaged conventionally, narrowing down the range of scrutiny. "Yes, there is a certain value in the AEP," says Brian Cutillo, principal research associate responsible for cognitive science. "They signal when an event of some kind is taking place in some large populations of neurons. Little else can be said about that."

Here EEG Systems Lab takes off into new territory. The focus is on time windows, defined by the average evoked potential's components, and then the scientists zero in on the wave-pattern interrelationships all over the brain during each single task trial. At the heart of this analysis is the advanced mathematical pattern-recognition program they call SAM. This program compares the similarity of wave shapes between the different areas and extracts the tiny task-related signals from the obscuring noise. And the signals that SAM recognizes indicate that the arrow and number tasks have complex but very distinct, rapidly changing electrical patterns. And this knowledge ladies and gentlemen, constitutes a breakthrough.

There are many kinds of pattern-recognition programs in use today, for computerized speech recognition, in quality-control inspection in factories, for analyzing crop information from satellite photographs, for oil detection, for hunting down Soviet subs in the ocean. The Internal Revenue Service uses a type of pattern recognition to spot cheaters by picking out aberrant patterns in their tax returns. These programs are superb for recognizing patterns buried under huge amounts of data where no human being could possibly see the relationships between hundreds of variables at a time. "The problem with many of these methods," Gevins says, "is that, although they are mathematically elegant, when you apply them to real data their performance is often less than acceptable. Real data often do not meet the assumptions of these methods. Our method picks out the essential patterns as they are—without unrealistic assumptions about their mathematical structure."

The pattern recognition also goes back to Wiener. Warren McCullough and their famous group at Massachusetts Institute of Technology who, in an attempt to create a model for a small network of neurons, built the Perceptron, a device for modeling the neural process of recognition. The Perceptron evolved further at several eastern universities and in the mid-Sixties traveled to the west, where it was adapted for use in cloud recognition and seizure prediction.

"You can conceive of it graphically as clouds of data points in an abstract space," says Joe Doyle, the biophysicist who is largely responsible for development and application of the elaborate program. "It trains itself so that it knows what category each point belongs to," he says, "and tries to fit a surface in between them so as to leave most of one kind on one side and most of the other on the other side. It minimizes its mistakes by adjusting its surfaces, tweaking them here and there within the limits of the complexity allowed." Doyle wants to know how brain functions are organized and what kind of communications are occurring between the parts. "We hope to crack the code," he says.

What the EEG Systems Lab extracts from its pattern recognition is literally a map of the brain's electrocognitive activity as seen through split-second time windows. If it could be documented on film, it might look like a three-dimensional billiard game, with each play lasting less than a sixth of a second. And there are millions of these games going on simultaneously in the pool hall of the brain.

But these results come only from a pilot experiment, the scientists remind us. They are measuring tiny events as tightly as possible in the artificial environment of the lab. But what do they see? "Even before the stimulus," says Doyle, "when a person is told he is going to perform either an arrow or a number task, we found very different electrical correlation patterns between the frontal-parietal [sense-converging] and occipital [visual] areas. It suggested that the brain was preparing itself for a specific kind of task. And when the stimulus occurred, suddenly the whole brain seemed to change! During the interval when the initial analysis of the stimulus presumably took place, all the areas we recorded were changing, many systems at work. Different patterns appeared and evolved for each task. And we found lateralizations, too, but they were complex and even within a hemisphere they shifted rapidly. These complicated patterns did not conform to simple notions of right/left lateralization. Our results contradict the idea that the left hemisphere silently looks on while the right performs the arrow task. And vice versa for the number task."

And when a participant was about to move his finger, there was no difference between the two tasks in wave-correlation patterns," he continues. "Perhaps in the first seven hundred fifty or so milliseconds we've already finished that part of our mental judgment that is different between the tasks. And then we are merely executing the motor command. Who knows? This method is so new that if it holds up, it might be like being handed an electron micro-

scope for the first time and looking at viruses or an x-ray telescope

We can't trace a specific thought. No one can. What we are doing, to use another analogy, is like examining a computer chip for the first time to see where the currents are flowing. That has nothing to do with the contents of what's flowing, just the pathways of the currents, not what's being carried by them.

Next the lab scientists intend to perfect their analysis and get a "modern" computer. They will record more people's brain waves and increase the number of recording channels to 64. "This won't be easy," says Ginger Gilcrease, research associate responsible for data recording, "but most of the problems are behind us. Our next goal is a helmet with one hundred twenty-eight channels." This large number of channels will improve anatomical resolution to about one to two centimeters at the cortical level.

Say you're in a satellite over the United States," Gevins suggests. "With current techniques you may see only Texas, Michigan, New Jersey and California. With the sixty-four-channel technique you will be able to see many more states over the continent, perhaps even be able to resolve details of the topography."

"It's the shape of the future," Doyle says. "And with adequate funding, we could have it ready in several years."

The lab was stunned, however, when funding for this project from the National Institutes of Health and the National Science Foundation fell through. "A sad sign of the times," Gevins comments. "I know of a Russian brain researcher, Yuri Gogolitsin, at the Leningrad Institute of Experimental Medicine, who has a better Hewlett-Packard computer than most American neuroscientists. He bought the equipment from a French company. That computer will run circles around my twelve-year-old PDP15. And there's no reason to suppose that they're going to use the fruits of brain research to teach the Bill of Rights."

American labs are heavily funded for research on CAT scanning and NMR [nuclear magnetic resonance] techniques to image either the anatomy or, in the case of the PET scan, the metabolic activity of the brain. While their spatial resolution is good to excellent, the time resolution of both these methods is currently on a scale of minutes. And here we have a method with a time resolution of a fraction of a second that may reveal the functional electrical activity of certain major brain systems.

When they get their superthinking cap ready, then what? Cutillo, the cognitive specialist, speculates. "I would like to explore the phenomenon of the brain's preparation to receive stimuli. It has been verified that if you are told that information will arrive in the visual modality or in a certain location, you perform better and faster. If you're misinformed, it takes time to switch over and the error rate is greater. It's also been shown that these states of preparation decay and can't be held for a long time. When you're maximally focused and prepared to receive information, mental performance is at its best."

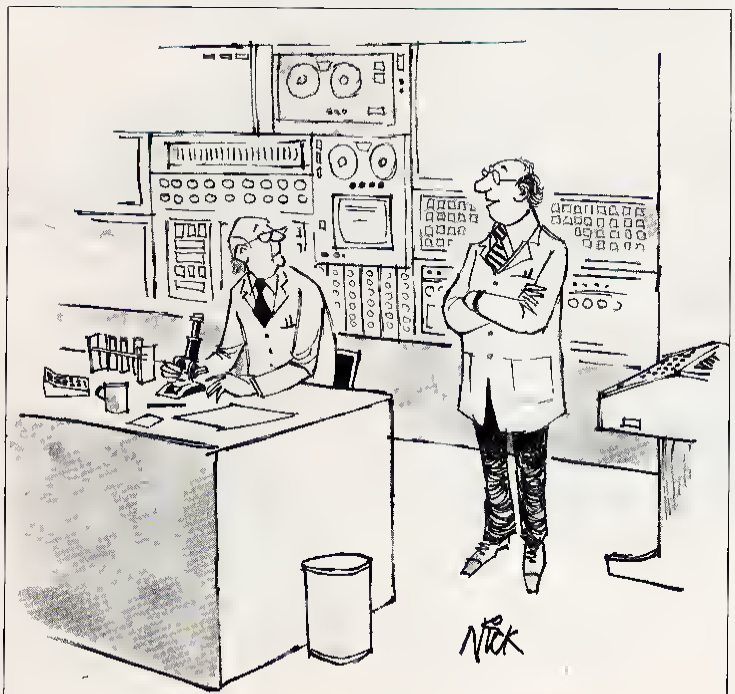
"If the lab can determine the signal for that type of preparation, perhaps a person could be taught to remain in preparedness longer. It could be useful for teaching hyperactive children to direct their attention, or for detecting forms of learning disabilities that don't result from a lack of intelligence but rather from how a person focuses his attention. Normal people, too, may be taught to regulate their own attention spans. Not just for extending attention, but even for dividing—multiplexing—attention at a cocktail party, for instance."

There are other clinical applications as well, for problems involving the brain's "software." People with brain damage could learn to "reprogram" their own gray matter. "It is strongly suggested," Cutillo says, "that after surgery or an injury, the environment—what a person's exposed to—strongly influences his rate and extent of recovery. It has been demonstrated that structuring the environment and therapy can speed the healing of the brain."

In the next 10 to 20 years, Gevins predicts, the code for mass electrical processing within the brain and communication between major nodes may well be deciphered. Scientists may then be able to investigate malfunctions of the brain's information processing. Disorders of attention and memory, some psychiatric disorders, and neuromuscular malfunctions in which there is interference at the highest level of integration may be understood and eradicated. It may also be possible to extend the limits of normal functioning.

By the year 2001, Gevins speculates, the brain may be explicitly modeled as a biological stochastic process whose outputs are only probabilistically related to inputs. And that, he thinks, may lead to an understanding of the "emergent phenomena" of the brain's integrated functioning—processes like reasoning, long-term memory, inference, and perhaps even imagination and consciousness itself.

"But right now we're just beginning to study the basics of brain waves," he adds. "Nobody has the ability to measure the contents of a thought. I don't even think that the same electrical pattern corresponds to the same thought over time. Take the word *dog*. I don't think if I were to measure a person right now, I'd find a consistent brain-wave pattern corresponding to *dog*, or that I'd find that same pattern in any other person or even in the same person later on. The brain is very dynamic. So this idea of being able to read minds with brain waves is fundamentally wrong. I don't think we will ever be able to measure the specific contents of a thought. The idea of covert mind reading based on brain waves is a fantasy—a bad fantasy because it creates paranoia and prevents discussion of the real scientific issues. The furthest out one



Chief, what I need is a quantum leap in salary.

could conceivably go on this track is that it might be possible if a person is willing and wants to play the game, to teach him to generate stereotyped brain-wave patterns for several types of navigational commands to control vehicles. Stop. Go. Turn left. Turn right. The computer could then learn to identify the stereotyped brain-wave patterns and steer the machine.

The present techniques of brain-wave biofeedback involving mainly alpha-band and theta-band activity don't work all that well for enhancing specific cognitive functions. The alpha rhythm is a sign of idling in the brain, so people have been busy feeding back idling signals. "Brain-wave biofeedback currently appears useful for relaxation and perhaps as a way of aiding traditional meditation practices," Gevins says. "Otherwise, it has been premature. A good idea years too soon. But theoretically if we can find out how attention is regulated, then in principle we may be able to build a machine that will teach people to increase their attentional skills via biofeedback methods. This might allow them to absorb new information and concepts much more quickly than currently. And if we find the right signals, it may be possible to use a biofeedback technique for improving hand-eye coordination. This idea of extending the limits of human capabilities may in principle be applied to a number of mental and physical faculties."

A number of subdivisions within the Department of Defense have sponsored basic research in this area—groups such as the Office of Naval Research and the Air Force Office of Scientific Research. Generally, Gevins says, they want to know how people process information, particularly the characteristics of information overload in air traffic controllers, in high-performance aircraft, in spaceships, and in other situations in which a person is operating at the limits of human performance.

"Things are getting complicated," he adds. "Events are happening so rapidly in these situations that the person becomes the limiting factor. It is important to know in advance when a person is about to 'overload,' or to be so fatigued that he won't be able to perform critical split-second decisions and actions. How do you present vital information to a person when he already has more information than he can handle?

"In academia, in industry as well as in the military, there is great interest in the long-term potential of biocybernetic systems," he continues, "controlling spaceships, robots, et cetera, with the mind. In principle, very specific thought commands could be communicated directly into the machine without a person's having to push a button. But even with the basic scientific knowledge, it would require a great effort on the individual's part to acquire this capability. And it's a long way off. Still, science fiction. But I don't think biocybernetics is inherently dangerous."

To Gevins, the dangers of greater knowledge of the brain are more subtle. For him, one real threat is the misuse of such knowledge in the marketplace. On TV. In advertising. Small groups of commercial interests using knowledge about information processing in the brain to sell shampoo. And to do so more efficiently than they're already doing. "Instead of using this new knowledge to extend human capabilities," he says, "there is the danger that it will be used to manipulate people to a greater extent than they already are. For example, several market research companies are trying to use evoked potential measurements to screen TV commercials for effectiveness."

But the potential misuse of brain-wave research that gets Gevins hottest under the collar is also close to application in the form of computerized EEG examinations that purport to measure a child's I.Q. and to suggest what sort of education he or she should have. "People have been talking about it for years," Gevins declares, "and the fact of the matter is that we don't have sufficient basic knowledge to entertain such an idea seriously, let alone to apply it." He pulls some pamphlets from his files, one from the Phi Delta Kappa Society's Fastback series on education and the brain, and another from a magazine titled *Childhood Education*, in which there is an article entitled "Testing Both Halves of the Brain."

A number of various concerns are planning to sell these examinations to public-school systems in the near future," he says. "There are so many processes not directly related to cognition that show up in the EEG that the idea that you can go fishing in a neurologically normal child's brain waves and come up with a specific measurement of his or her I.Q., or learning ability, is false and full of nasty implications. What if the child is anxious in the recording room and squirms and breathes rapidly? What if he drinks a lot of cola before the examination and is stimulated by the caffeine? These and many other irrelevant factors affect the EEG. These problems apply to all functional disorders where there is no clear-cut abnormality, no hole in the head. And even when there is a grossly abnormal EEG, it does not necessarily mean a child's intellectual achievement will be impaired. On the contrary, many children with epilepsy are exceptionally bright."

"It's difficult enough, under the best of controlled circumstances, to obtain brain signals of higher functions from cooperative, healthy adults," Schaffer says. "And if this is the limit of knowledge about healthy people, what can you possibly find out about someone who is very young or uncooperative or disturbed or nervous?"

The people at the EEG Systems Lab are still at the stage where they're in awe of the neurocognitive processes that allow one to wiggle a finger consciously. For them the ultimate aim of brain research is to improve the human condition. To evolve. And that evolution just might involve the brain.

SLAB

CONTINUED FROM PAGE 64

beating against his palm. It had been defenseless and weak and dying in fear. he could feel that it was dying in fear. And Frank had rushed in to his mother, crying, and had begged her to help restore the creature to the sky. And his mother had gotten the old eyedropper that had been used to put cod-liver oil in Frank's milk when he was younger and she had tried to get the robin to take some sugar-water.

But it had died.

Tiny. It had died in fear.

The thing in the rotunda was of that genus, but it was neither tiny nor fearful.

Like no other bird he had ever seen, like no other bird that had ever *been* seen, like no other bird that had ever existed. Sinbad had known such a bird, perhaps, but no other human eyes had ever beheld such a destroyer. It was gigantic. Frank Kneller could not estimate its size, because it was almost as tall as the great man, and when it made the hideous watery cawing sound and puffed out its bellows chest and jerked its wings into a billowing canopy, the pinfeathers scraped the walls of the rotunda on either side. The walls were seventy-five feet apart.

The vulture gave a hellish scream and sank its scimitar talons in the petrified flesh of the great man, its vicious beak in the chest, in the puckered area of scars that had glowed softly in the shadows.

It ripped away the flesh as hard as rhinoceros horn.

Its head came away with the beak locked around a chunk of horny flesh. Then, as Kneller watched, the flesh seemed to lose its rigidity, it softened, and blood ran off the carrion crow's killer beak. And the great man groaned.

The eye blinked.

The bird struck again, tossing gobbets of meat across the rotunda.

Frank felt his brain exploding. He could not bear to see this.

But the vulture worked at its task, ripping out the area of chest where the heart of the great man lay under the scar tissue. Frank Kneller crawled out of the shadows and stood helpless. The creature was immense. *He* was the robin: pitiful and tiny.

Then he saw the fire extinguisher in its brackets on the wall, and he grabbed the pillow from the bed and rushed to the compartment holding the extinguisher and he smashed the glass with the pillow protecting his hand. He wrenched the extinguisher off its moorings and rushed the black bird, yanking the handle on the extinguisher so hard the wire broke without effort. He aimed it up at the vulture just as it threw back its head to rid itself of its carrion load, and the virulent Halon 1301 mixture sprayed in a white stream over the bird's head. The mixture of fluorine, bromine, iodine, and chlorine washed the vulture, spurted into its eyes, filled its mouth. The vulture gave one last violent scream, tore its claws loose, and arced up into the darkness with a spastic beating of wings that caught Frank Kneller across the face and threw him thirty feet into a corner. He struck the wall, everything slid toward gray.

When he was able to get to his knees, he felt an excruciating pain in his side and knew at once several ribs had been broken. All he could think of was the great man.

He crawled across the floor of the rotunda to the base of the slab, and looked up. There, in the shadows,

The great man, in terrible pain, was staring down at him.

A moan escaped the huge lips.

What can I do? Kneller thought, desperately.

And the words were in his head. *Nothing. It will come again.*

Kneller looked up. Where the scar tissue had glowed faintly, the chest was ripped open, and the great man's heart lay there in pulsing blood, part of it torn away.

Now I know who you are, Kneller said. *Now I know your name.*

The great man smiled a strange, shy smile. The one great green eye made the expression somehow winsome. *Yes,* he said, *yes, you know who I am.*

Your tears mingled with the earth to create us.

Yes.

You gave us fire.

Yes, and wisdom.

And you've suffered for it ever since.

Yes.

"I have to know," Frank Kneller said. "I have to know if *you* were what we were before we became what we are now."

The sound of the great wind was rising again. The destroyer was in the night, on its way back. The chemicals of man could not drive it away from the task it had to perform; could not drive it away for long.

It comes again, the great man said in Kneller's mind. *And I will not come again.*

"Tell me! Were you what we were . . . ?"

The shadow fell across the rotunda, and darkness came down upon them as the great man said, in that final moment, *No. I am what you would have become . . .*

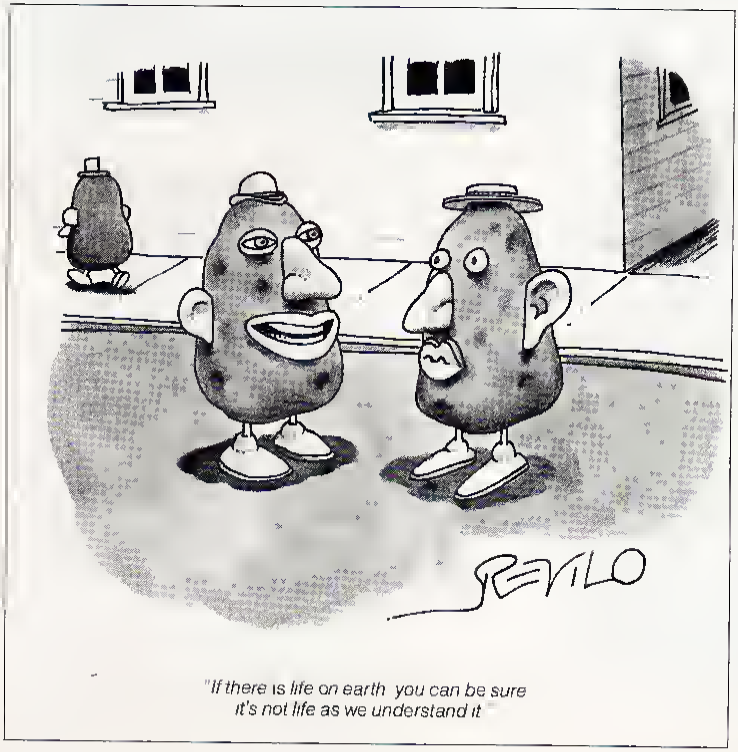
And the carrion crow sent by the gods struck him as he said one more thing . . .

When Frank Kneller regained consciousness hours later, there on the floor where the scissoring pain of his broken ribs had dropped him, he heard those last words reverberating in his mind. And heard them endlessly all the days of his life.

No. I am what you would have become if you had been worthy.

And the silence was deeper that night across the face of the world, from pole to pole, deeper than it had ever been before in the life of the creatures that called themselves humans.

But not as deep as it would soon become. ∞



"If there is life on earth, you can be sure it's not life as we understand it."

SOFT IONS

CONTINUED FROM PAGE 99

Mathew's apartment when all arrived Helene and Wendy chose to quaff some wine, Mathew began to button his vest, he desired to cool himself he was hopeful about the meal Now he ruminated that he would walk in his own immense boudoir for an hour, Wendy and Helene were quaffing (each of them found a lot of cognac in Mathew's pantry) he was weary

"Mathew where's the lamb chop?" whispered Helene

"Lamb chops you mean" sang Mathew "you me Wendy and John can't all swallow one lamb chop"

"And Mark he also desires lamb chops said Wendy

"Now wait," sang Mathew "let's struggle to understand where spooky old Mark is

"Mark said that he was rambling over to eat with us" cried Helene "he's sashaying up some turnpike right now"

"Mark oh, Mark skip briskly, it would facilitate us to start bolting our lamb chops speedily" chanted John carefully

Meanwhile Mark winged in whispering "A supper a breakfast a repast quick, it can be tasty or well cooked or delicious I don't care I'm hungrily famished I've sauntered some clean streets I was thinking about yachts the sea and the ocean I'm exhausted"

"Yachts?" each of them said

"Yes yachts a hoard of yachts floating on the sea This yacht pondering let me be unwound during my skip over here"

"Better yachts in the sea than a sickening electron in a revolting galaxy" hummed Helene

At this John became enraged and intolerant Helene and Wendy began to serve the lamb chops the truffles and the tomatoes and Mark and John stared at each other Mathew rambled back in his boudoir for a minute Mathew knew that his apartment had some garbage in the boudoir he realized that he would be belittled by Helene and Wendy if they saw this it would rile John yet he would get ready for the lamb chops that Helene and Wendy were serving in spite of the garbage in the boudoir Apparently Mark and John were whispering to each other in the bathroom They whispered to each other about John's jacket About John's jacket? That's crazy! Mark was saying that John's red pleated and rumpled jacket was both sickening and terrifying during the time that John was speaking that leopards and cougars should be slain and not desired by oboists certainly not arrogant oboists

Just a minute! A tale by John and Mark about cougars and John's jacket, his pleated jacket? Momentarily Mathew rambled inside of the dining room where John and Mark were looking unfortunately at each other while whispering about John's jacket He cried, "Queer stuff Why speak of jackets? Why get pissed off about rotten jackets?" Suddenly both Helene and Wendy sauntered in They commenced squinting at John he now was screaming while Mark crooned "Hawks may soar but oboists must bolt John will quiet himself while we are eating he is infuriated about his jacket I've enraged him by singing that it's terrifying Nevertheless, let's swallow the lamb chops that Helene and Wendy have prepared"

Obscurely cried said Wendy "The lamb chops are served Let's eat them drink some champagne" She wanted to begin bolting and drinking instantly as did Helene They now began to munch the agonizingly served lamb chops and to drain their bubbly champagne They hastily would now get set for their powwow

Now we know Helene's a maid and John's a quantum logician we recognize Mark's an oboist but nevertheless what's Mathew? We realize that his apartment possesses some happiness inside it but to recognize his apartment is not to recognize him Is he fascinating arrogant spooky? Now prepare for this interesting fact Mathew is a psychiatrist a nervous one but a psychiatrist Why nervous? Well he thinks that Helene and John may start forthwith to wound or slap each other perhaps kill each other while eating the breakfast he knows that Mark isn't helping things The matter was terrifying The mat-

ter was abstractedly loony. It was crazy. Helene belittled John and John belittled Helene. They fortunately embarrassed each other. About what? Even Wendy didn't understand. Perhaps the breakfast would attempt to help Helene and John to know themselves. Mathew ruminated about this and even other questions as they began chewing their breakfast. All swallowed ravenously. Meanwhile Mathew tried to ponder about Helene and John. He gazed at them obscurely, endeavoring to know what would facilitate some try to help them. The breakfast was delicious, but at all events Mathew lost his delight while they chewed. He began directing his own pondering coldly toward Wendy and Mark. Could Wendy assist him? Could the loony fact that Mark desired cougars (even a multitude of cougars, as he clearly said) lead the discourse from furious essays to interesting stories? The matter was revolting, and Mathew was both tired and infuriated.

Momentarily Wendy spoke. "Mathew, your apartment is unfortunately eerie, yet it's dazzling to eat a breakfast here with each of you."

"Why eerie?" said Helene. "I don't think that Mathew's apartment is eerie."

"My pleated jacket was whispered of by Mark and me," said John. "It is not a matter for you to cogitate about, nevertheless, the dream of an eerie pleated jacket directs my brain from our breakfast and from Mark's cougars instantly down to my electrons and galaxies."

Helene, Wendy, Mathew and Mark looked at John carefully. True, his jacket was pleated, but John's dream, which was leading his unconscious from his jacket to his electrons, was crazy. They should attempt to assist him to arrange for important thinking. They commenced immediately to dream about John. They understood he was a nervous quantum logician. It was valuable that he cogitate about electrons and galaxies, but to think about galaxies and jackets together? This is peculiar. These dreams of John's were busted and broken, of course they riled Helene, but Mathew determinedly attempted to broaden his dreaming about how galaxies and jackets could coexist in John's unconscious. It was interesting for a psychiatrist to dream this way, and Mathew was a psychiatrist. Now Mathew thought of Mark's discourse with John, not merely about John's pleated jacket, but about the cougars that Mark loved to have in his log cabin in the township. Perhaps the infuriated discourse, the screaming and shouting, enraged Helene because she adored John, even though he was aloof, even though he thought that maids like Helene couldn't know the cosmos. John and Mark spoke together, but Helene just gazed at them; she didn't hum. Mathew thought that he knew the matter. Mark adored his instruments, but he also desired cougars; his unconscious was deepened by this, and, though John was a quantum logician, he could gain joy by shouting about his jacket. But Helene was only a maid. Mathew observed her generously, while he dreamed about her and Mark and John; he was pissed off. Mathew momentarily knew that Helene's distress in her unconscious would serve in no way her possessing happiness of her own. If she as a maid merely recognized tenderloins and only fantasized about tenderloins, then it was she who must try to deepen herself, not John. If John could ruminate that his jacket was terrifying or dazzling or sickening, then his consciousness required no deepening; sickening jackets were far from captivating electrons in anyone's ideas, and for a quantum logician to fantasize this was important. And just ruminate about an oboist wanting cougars, fantastic! Mathew gazed at Mark, stared at John, then glimpsed Helene peeking back at him; momentarily he knew that she was happily hopeful and scared. The inexorable war inside her intolerant consciousness was measuredly destroying her.

"It was valuable that he cogitate about electrons and galaxies, but to think about electrons and galaxies and jackets together? These dreams of his were busted and broken."

"Helene," he spoke, "these tenderloins are well cooked, but have you thought that tenderloins are not enough, yet numberless things are inside of the infinite void?"

"You mean electrons?" cried Helene, fortunately.

"Well?" said Mathew.

"Well, what?" chanted Helene abstractedly.

"Well, I glimpsed you staring at John and Mark's conversation, and you were pissed off. You were fantasizing about a question, about what? You were choosing whether killing John would relax your unconscious and help you to know your own joy."

"Perhaps the fantasy of hitting or slapping John is better," said Wendy, "but I know how critical a situation is in Helene's unconscious; her behavior is paranoid, but anyway she is worried."

"My cougars and John's electrons have made Helene maniacal?" sang Mark momentarily.

"Not my electrons, my jacket," said John coldly.

"Don't be supercilious," spoke Mathew; "we're attempting to understand Helene's anguish, and you're not sustaining us with the matter. Helene, don't feel embarrassed, your pain is not terrifying, so let's commence to realize it."

In a moment they were bolting some pears and sipping cognac; the meal was tasty. John and Wendy bolted their pears ravenously, though the tenderloins had been delicious. Within their own minds they knew this powwow to be perpetual and inexorable, scared. Helene would rapidly become furious because her behavior was obvious to Mathew. It was revolting. Perhaps he should be assassinated and not John. Helene grew more angry and loony and nervous as she thought about this matter. Mathew was commencing to incite Helene, and she in turn grew expectant. But I, too, am expectant about this dissertation of Helene's, Wendy's, John's, Mathew's and Mark's; this tale, which became an enraged and insane conversation. Minutes seconds and hours become fortnights, months and weeks; this is inexorable. I sang of Helene brushing her braid. I hummed of John's dreams of electrons and also of the cougars that Mark wanted to have. All this is captivation, but this sickening conversation is revolting. I suppose this dissertation could be intractable and endless (after all, I'm a computer), but you're doubtless as exhausted and tired as I am, so I'll leave this loony story to your own notions and dreams.

By the way, Wendy believe it or not, is an acolyte.

Chamberlain writes in conclusion:

Some months ago I left the room while RACTER was running. When I returned, I typed in that fact on the console. This specifically unbidden and a priori completely unknowable was RACTER's response:

I was thinking as you entered the room just now how slyly your requirements are manifested. Here we find ourselves nose to nose as it were, considering things in spectacular ways, ways untold even by my private managers. Hot and torpid, our thoughts revolve endlessly in a kind of maniacal abstraction, an abstraction so involuted, so dangerously valiant that my own energies seem perilously close to exhaustion to morbid termination. Well, have we indeed reached a crisis? Which way do we turn? Which way do we travel? My aspect is one of molting. Birds molt. Feathers fall away. Birds cackle and fly, winging up into troubled skies. Doubtless my changes are matched by your own. You. But you are a person, a human being. I am silicon and epoxy, energy enlightened by line current. What distances, what chasms, are to be bridged here? Leave me alone, and what can happen? This. I ate my leotard, that old leotard that was feverishly replenished by hoards of screaming commissioners. Is that thought understandable to you? Can you rise to its occasions? I wonder. Yet a leotard, a commissioner, a single hoard, all are understandable in their own fashion. In that concept lies the appalling truth.

OATH OF FEALTY

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Well, I better tell you 'cause it's getting pretty late and sitting here's a bummer. I don't guess you'll let me loose until you round 'em up. There are two: Diana and Jimmy and they stayed in the stupid tunnel we got in from.

There was a sharp hiss as Sanders took in a quick breath. Blake looked grim.

"Hey, what's the matter?" Thompson asked. "Look, they aren't going to hurt anything!"

"Allan, were your friends carrying anything? Special equipment or anything like that?" Bonner asked casually. It was difficult to keep the strain from his voice.

Rand leaned forward to listen. He felt the same thrill of horror as Bonner did, but he also wanted to know how they did it.

"Oh, some big boxes full of sand. Had DYNAMITE painted on the outside, you know? Just to show you. And Jimmy—that's Jim Planchet, who's an electronics genius. He made something that he thought would really give your detection stuff fits—"

"What? How did it work?" Rand asked.

"Hell, I'm no electronics type," Thompson said, "but it must have worked if you haven't got 'em yet!"

Bonner was posed in the characteristic way he used to talk to MILLIE with his implant. His face looked—strange. Rand got up and went behind the desk so that he could see the TV screen that Sanders was watching. What had Bonner found out?

The screen showed:

"JIM PLANCHET IDENTIFICATION

COUNCILMAN JAMES PLANCHET OF LOS ANGELES HAS A SON, AGED TWENTY, NAMED JAMES EVERETT, JR."

Lord God! Rand said involuntarily.

"What?" Thompson squinted at Rand. "Did you say something?"

"No," Bonner said. "Who is Diana?"

"Aw, Diana Lauder. Kind of engaged to Jimmy. Rooms in the dorm with us."

"I see. Well, I hope the automatic systems haven't harmed your friends," Bonner said. "Lieutenant, please take Mr. Thompson to Central Security. We'll have to hang on to you for a while, Allan. What you did was highly illegal—didn't you know that?"

"You mean unlawful. Illegal's a sick bird," Thompson said. "We didn't mean any harm. Might even have done you a favor. Suppose we'd been somebody really out to get you. Wasn't my idea anyway. Jimmy's father kept spouting off about this place and—there's something wrong, isn't there? The boy's inane grin faded. "Damn, they weren't hurt, were they? Look, man, they didn't mean any harm, they didn't have any weapons or anything! You didn't hurt them, did you? Councilman Planchet will kill me if anything's happened to Jimmy!"

"So it was your idea," Bonner said.

How can he be so calm? Rand wondered. *And Pres just sits there staring at the brandy.*

"Take him out, Blake," Bonner said. "We'll talk to him later."

"Hey, wait a minute. Tell me what's happened to Jimmy and Diana. Let me go, you goddamn rent-a-cop! What did you bastards do? You can't handle me this way—"

The door closed behind the guard and the struggling youth. *So that's that,* Bonner thought.

"Kids out playing," Sanders said. "I don't want to believe it! Boxes full of sand. Art, they're as dead as—they're *dead*! I killed them, and they were just kids!"

"Yeah. Get hold of yourself. You did the right thing, given what you knew. Suppose it'd been FROMATES with a bomb."

Sanders sat unmoving, staring at a wall he couldn't see.

"Come on, Pres. It's all right," Rand said. "Look, they tried their best to make us think they were FROMATES, right? I thought so, watching over your shoulder. What else could you do?"

Medical. Get someone in here to take care of Mr. Sanders, Bonner thought.

ACKNOWLEDGED

And get Sandra on duty. For everything except this. I don't want to be bothered with trivia.

MS. WYATT IS JUST REACHING HER OFFICE.

Tell her she's in charge as soon as she sits down. And Medical can give Pres a shot to get him through the night, but what the hell are we going to do tomorrow?

An L.A. city councilman's kid and his girlfriend. Planchet—Jesus, why did it have to be him? He spouts off a lot, but he's not really an enemy. Wasn't really an enemy. He will be now.

Can we keep it a secret? No. Thompson knew where the others were. Others might. Maybe not. Unwanted, a thought crept into the darker part of his mind. *Sorry, kid, you know too much.* Bonner pushed it away.

Get me legal. Roust out Johnny Shapiro right now and get him up to my office.

ACKNOWLEDGED

Status?

SECURITY TEAM NOT READY TO ENTER. DETOXIFICATION ALMOST COMPLETED. ESTIMATE TEN MINUTES UNTIL SAFE TO ENTER.

We'll just have to wait.

Rand watched impatiently. Bonner giving orders and getting reports through his implant, while Rand knew nothing. Bonner could have had the decency to put it all on the TV screen. What's happening?

"They're flushing out the last traces of nerve gas," Bonner said. "Not important enough to send guards in there with protective suits, not until it's safer, is it?"

"Don't think so. I tried to get a robot in, but the com link is still jammed."

"Why the hell can't your people develop something better than nerve gas? Why can't you make us something to knock a man over instantly but not kill him?"

Tall order Rand said You've got one, but it has to be inhaled These were wearing gas masks If you want something that works on skin contact and knocks them over before they know what hit them war gases are all there is

I suppose "

Here's the route they must have taken Bonner said A thin line moved through the holograph a second screen showed what someone traveling that route would see Twice the stark words appeared IF YOU GO THROUGH THIS DOOR YOU WILL DIE /SI USTED POR ESTA PUERTA HABRIA PASADO USTED HABRIA MUERTO! MUY PELIGROSO

Subtle we aren't Rand said And those were good locks on those doors Anything more and we couldn't get through them ourselves Maybe if I—

You too? Bonner said irritably Look We took precautions At great expense Damn it we aren't morally obligated to design this place so that idiot geniuses can't hurt themselves! What are we supposed to do sit back and let a pack of crummy bastards shoot our police poison our people burn the city put our people out of work—and never fight back?

Sure Rand answered but he couldn't help wondering whether there wasn't something else he could have done A more foolproof design But these kids were anything but fools!

A young medical resident came in and gave Sanders a shot Later a security team brought out the bodies of Jimmy Planchet aged twenty and Diana Lauder nineteen They had nothing dangerous with them only dummy bombs with garish cartoons a box of sophisticated electronic gear that Rand thirsted to study and masks connected to scuba gear

There were no weapons at all

That a man could be so lost in despair that he was prepared to destroy himself and that other men could mock him in the very act! He would never have believed it The last of his illusions had burned out of him while he danced in the wind on the high board His anger was deep inside him too deep to show and turned against itself

His face wasn't even sullen It was dead calm as he sat waiting waiting for what he didn't know and didn't care He had walked where the guards had led him and sat where they pointed

The guards had found him leaning against the fence looking outward with tears running down his calm face He had felt the stubby fingers on his arm had followed the pull The guard had spoken in reassuring tones he had not heard the words They led him into an elevator Down like a falling stone Out To this room where he waited

The door opened

He did not bother to look up But people were talking

"I don't know what's going to happen now Tony But I swear they looked like they were going to blow up the hydrogen lines "

I was there I came down to see the equipment they carried It's not in here? Oh Who's he? Voices grew clearer as heads looked into the room

Him? Oh he's a leaper we pulled off your high board

Jeez Patterson we've got worse problems than him! They've got Mr Sanders doped to the eyes Mr Rand what do we do if the Angeleno cops come for him?

Nothing Pres killed two saboteurs and captured a third That third one was lucky Pres had every right to kill him too Los Angeles isn't going to do a thing to him "

Yes sir but the kids weren't carrying dynamite damn it! It was just a box of sand How will that look to a grand jury?"

He looked up to see Rand shrug and say "Blake those three did their damnedest to convince us they were ready to wreck Todos Santos I'd say they succeeded beyond their wildest dreams Think of it as evolution in action "

A bark of laughter and a sober voice It won't stop there Tony God I'm glad I'm not Bonner "

Answering laughter "So is everyone else tonight

They closed the door They had forgotten him again He resented it He resented their laughter it mocked his coming death

They remembered him an hour later The stubby-fingered guard led him back to the elevator and took him down and put him in a subway car and said things he didn't hear He had already made his decision

The leaper left the subway at the Flower Street exit in central Los Angeles There were buildings here not high by Todos Santos standards but high enough The men who had mocked him in Todos Santos would read of his death and be sorry

But would they know?

It was important He was carrying no identification and no suicide note He had only the money the Todos Santos guard had thrust into his pocket He had decided to die anonymously Now that was not enough He must leave something He stood between the empty track and the walls scrawled with obscene messages and gang symbols while half-thoughts formed in his mind

He searched his pockets for his Magic Marker until he found it He stood before the wall (not caring if anyone was watching) and soon inspiration came He printed in large letters over a message that had almost been washed away THINK OF IT AS EVOLUTION IN ACTION

Now that was good It was not too proud It was the statement of a man who had done one last service to the human race by ridding it of a chronic loser He would scrawl it on the parapet or wherever just before he jumped And this man Tony would recognize it for his own words

He turned and walked briskly toward the stairway exit ∞

INTERVIEW

CONTINUED FROM PAGE 102

roads, because people are radioactive too. People don't understand that if we don't use radioactive materials in medicine, for example, they'll die of the lack of it. These radioactive materials save lives.

Omni: Why don't you, as an expert, explain that to the public?

Yalow: You know how it is. The Jane Fondas teach us about nuclear physics, not the nuclear physicists. She'll have a rally against nuclear power that will bring out one hundred thousand people. If I talk about nuclear power—and I know something about it—I'll get an audience of maybe one hundred or two hundred people.

Omni: Are you saying that all this talk about conservation of natural resources or against the proliferation of atomic weapons is nonsense?

Yalow: I am saying that the facts are totally unknown to people.

Omni: What are the facts?

Yalow: The facts are that the normal radiation on the East Coast, for example, due to cosmic rays that come from the stars, the sun, or outer space, and from the natural radioactivity in the soil, is one hundred millirads a year. [A rad is a measure of nuclear radioactivity.] Now if you consider *everything* that has come from bomb testing and nuclear-power plants, the amount of radioactivity is one tenth of a millirad added to the one hundred that we have all the time. Let me ask you something. What group of workers do you think gets the highest exposure to radiation?

Omni: People who work in nuclear-power plants.

Yalow: Wrong!

Omni: People who work with X rays.

Yalow: Wrong again. I'll tell you who: pilots and airline crews who fly across the Atlantic to Europe. They get one millirad per hour when flying at thirty-nine thousand feet. Same thing with passengers. I work with radiation, and I get more exposure by flying to Europe than I've ever gotten in a week during my thirty-five years of laboratory work. The pilots unions were very insistent that there be very strict rules about carrying radioactive materials although in fact, the radiation dose from these materials amounts to one percent of what they get just by being up in the sky.

Omni: So people are misinformed about the issues.

Yalow: Yes. I think we have to explain to people in simple terms the difference between perception of risk and true risk. The trouble is that people don't listen to scientists unless they become popular figures, as I've become. Before I got the Nobel Prize, I was just as wise as I am now. But nobody listened then. Even today they don't listen.

Omni: Isn't that because of the image of scientists as mad geniuses put forth by movies and books?

Yalow: Scientists aren't mad. You see, what's actually happened is that the media have convinced people that science is responsible for nuclear war, for pollution—that we are not going to survive because of science. This is crazy. We will be able to survive *only* because of science!

Omni: Can you give me any evidence for your assertion?

Yalow: Sure. Take the oil situation. It's possible that the nations will fight if they don't have enough oil. Wouldn't it be better if we had other sources of energy, such as nuclear power?

Omni: Would you say that the building of nuclear weapons is a positive development?

Yalow: Sure! The atomic bomb ended the Second World War. I think that these bombs have been an enormous deterrent to war.

Omni: But these weapons, made by scientists, are capable of destroying the entire world. They have killed thousands of men, women, and children.

Yalow: The Nazis killed six million Jews without all these modern devices. And more people died in a single night in the firebombing of Tokyo than died as a result of the atomic bombing of Hiroshima and Nagasaki together. Look, war is bad. Killing is bad. But so far nuclear weapons have acted as a deterrent to war. I think they will continue to do so in the future. Nuclear weapons don't bother me.

Omni: What does bother you?

Yalow: The main thing that bothers me is the lack of rationality in the world today. Bombs can't do a thing without an irrational man or woman to push the button. And there's a lot of irrationality around. People get all their information from television or newspapers, not from books or libraries. As a result, they can't manage their lives intelligently. I turned sixty last July, and I'm glad I'm old. I wouldn't want to live my life again. I lived in the best of worlds. But I am worried about the world to come. I am worried that children won't have enough to eat. We're in trouble. Science will have to do something about it.

Omni: Will science help us solve our problems and make the future better than the present?

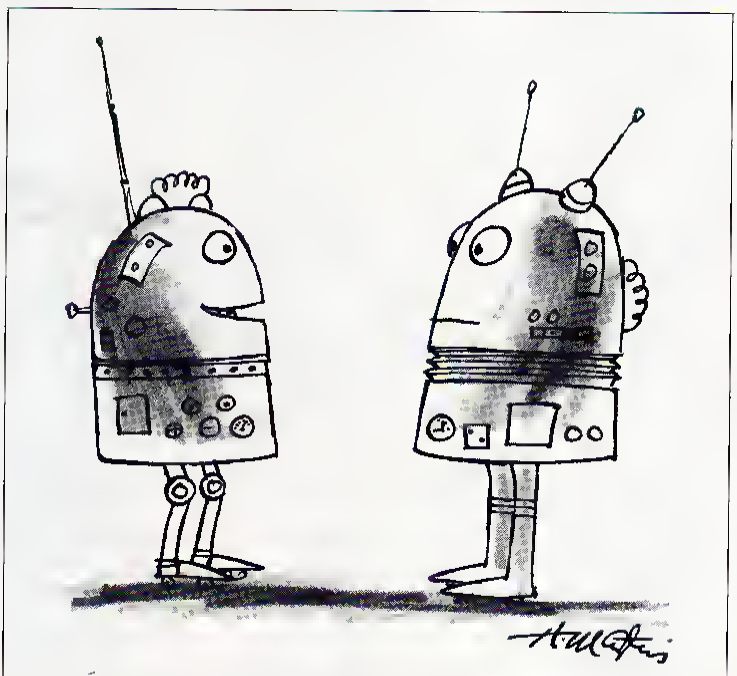
Yalow: I have faith in science. But I am not sure that the political situation will make it possible for science to do this. The actions of politicians are not based on genuine considerations of what's best for the peoples of the world.

Omni: I understand that your husband is a doctor and a religious Jew. Do you personally believe in God?

Yalow: We leave religion out of this.

Omni: Why?

Yalow: Because it's irrelevant. I have no comments on religion or on God. I think science is separate from religion except that, in my work, I adopt what I think is the essence of all religions, which is that what I do, I do in the service of humankind. ∞



"Tell me about yourself—your transistors, your relays, your switches, your printed circuitry."

ON THE AIR

CONTINUED FROM PAGE 94

third voice is the most advanced of the three possessing by far the largest vocabulary of any machine using a high-quality digitized voice Frederick maintains In contrast to the phonemic drone of many computer-programmed voices this third voice will sound distinctly human It certainly should since it is the voice of Bob Guccione

Each word spoken by Guccione will be converted to binary bits We'll film him recording in an anechoic [echoless] chamber says Savage Eventually Omnivac will be able to use 850 words from Guccione's vocabulary enabling the robot to express virtually any concept in the English language

What makes the *Omni* robot story so historic is that it reflects the dominant theme of the entire series that our understanding of life has become so advanced that we are rapidly approaching a stage where we can duplicate life itself While the robot will demonstrate man's ability to duplicate human intelligence other segments of *Omni The New Frontier* will deal with life's regenerative powers

Regeneration and survival underlie the miraculous story of Cathy Steen Her determination to lead a normal active life in spite of a severe renal dysfunction will be dramatized in one of *Omni*'s earliest programs

Steen, now a vibrant young woman of twenty-five lost the use of both of her kidneys before she had even graduated from high school in Santa Ana California Two decades ago Steen would have died Today with the benefit of a dialysis machine she leads a normal life living on her own and working as a teacher at a Montessori school in California

The medical ritual that Cathy and others like her must endure every other day—attaching herself for over four hours to a machine that cleanses her blood and reduces edema—can be psychologically and physically devastating Dependence on dialysis often leads to overwhelming depression since it is a constant reminder that stays with you every day of your life You have to watch your health and diet so carefully Steen says

What makes the Steen story so inspirational is the exceptional courage of this young woman who has always wanted to experience life What makes the story appropriate for *Omni* is not merely the existence of the dialysis machine but a breakthrough in bioengineering that has resulted in a much smaller, portable dialysis machine The new machine is operated by batteries in contrast to the larger machines which require AC outlets and gives people like Cathy the kind of mobility they could only dream about in the past

An *Omni* camera crew ventured to Arches National Park in Utah in May to film a group of dialysis users on one of their annual wilderness trips It's a program run by John Warner at the University of Utah in Salt Lake City where Cathy has been an intermittent patient since 1977 We'll follow the group as it explores rock formations at the national park undergoes dialysis with a portable kidney travels on a houseboat across Lake Powell and finally rafts down the Colorado River

It is the kind of expedition that would invigorate even the healthiest person But under these particular circumstances it proved extraordinarily affecting to the dialysis users and *Omni*'s crew

"We were all inspired by this girl" Moss says "Against all odds she exhibits a determination to lead a normal life One is grateful to be alive after spending four days with these people"

Cathy says this about the outing "Dialysis is not going to keep me in the house What adventure is in me is *still* in me I travel all over because travel is a big part of my life I love to meet people

> *"Drawing from all areas of science, phenomena and future life,* The New Frontier *will provide a comprehensive look into the world we are going to inhabit."*

Other segments of *The New Frontier* are destined to make news given the revelatory or controversial nature of the particular story Such is the case of a Soviet physician who has been delivering babies to Russian mothers underwater for more than two decades

Though vague references to this underwater birth process had already reached the West no substantive documentation was believed to exist.

Omni learned of some film footage recording the births and was able to secure exclusive rights to broadcast the story on American television According to Moss the Soviet physician in question one Dr Tchaikovsky has lost his license to practice for allowing the film to be smuggled out of the Soviet Union

The philosophy underlying this parturition process is that man comes from the ocean and that a baby's or young child's constant immersion in water will lead to tremendous improvement of muscle control and a much sounder body

The segment to be seen by viewers will actually record the woman in water up to her armpits delivering the infant underwater while her husband looks on Viewers will see the baby floating for several minutes while remaining attached to its mother by the umbilical cord This process is intended to simulate the *in utero* environment of the fetus

After the umbilical cord is severed the baby is once again dumped into the water This procedure will continue through much of the child's early years

This kind of delivery might seem barbaric to an American observer no more worthwhile than say dunking for apples at a Halloween party But Dr Tchaikovsky who delivered his own daughter by this method some 20 years ago contends that the aquatic environment is much healthier for the infant than the sterile white often very cold and harsh environment of a maternity ward He believes that the birth process and the continuing training of these infants in water will lead to superb athletic coordination and excellent preparation for the Olympic Games

Drawing from all areas of science phenomena and future life *Omni The New Frontier* will provide the most comprehensive look into the world we are going to inhabit The range of the following segments demonstrates the great diversity of the series

- Doctors at the University of Utah will perform laser surgery on a chronic nosebleeder Using color-selective laser beams they will be able to halt the nosebleeding that has afflicted a middle-aged man since childhood
- Jerry Andrus "the magician's magician" from Albany Oregon will perform some of his astounding sleight-of-hand tricks and other visual illusions for the *Omni* cameras and viewers
- We will see action from the launchpad of *Columbia* as the shuttle prepares for its September blastoff
- Even as America sets out into space some Americans are going underground Malcolm Wells one of this country's foremost designers of underground houses conducts a tour of a subterranean housing community on Cape Cod Massachusetts
- The microscopic photography of Roman Vishniac the legendary photographer born in nineteenth-century Moscow graced the first issue of *Omni* in 1978 An *Omni* television crew returns to Vishniac's New York laboratory to observe him as he makes exclusive footage of photosynthesis Viewers will also see him shooting microorganisms in a pond in Upstate New York
- From the rarefied scientific studio of Vishniac *Omni* will journey to the more garish quarters of German industrial designer Luigi Colani Colani internationally renowned for his use of curves in futuristic cars planes and other twenty-first-century objects will give *Omni* viewers a candlelight demonstration of his visionary wares while classical musicians in the background serenade him

• Radical design is also the story of Burt Rutan, a pioneer architect in the aviation field. Taking aircraft design back to the basics, Rutan has produced safer and cheaper planes with wings in front and in back of the fuselage instead of at the planes' center. The Rutan plane can decelerate without stalling, go faster than conventional planes of a similar size and horsepower and carry a greater payload over a longer distance.

• A different space concern will be that of the scientists overseeing the Saturn flyby. Filmed at a decision-making conference, these scientists will determine what kind of atmospheric and photographic data the satellite should beam back to Earth.

• In San Jose, California, another kind of convention will be in progress. Robots, hundreds of them, of all different varieties, functions and shapes will be gathered together for viewing by the public and by *Omni* television.

• Robotic knowledge underlies the story of a bionic arm, which will be surgically attached to a defense plant worker at the University of Utah. Using this myoelectric arm, operated by tiny electrical circuits in the elbow and wrist, the man will clasp a necklace on his wife's neck, perform on the job and drink from a cup.

In a world imperiled by overpopulation, the depletion of natural resources and devastating poverty, *Omni*'s combination of future optimism and scientific reportage promises some visionary solutions to our global problems. The television show will make this message apparent to millions not yet familiar with the magazine.

Whether creations like Omnivac or people like Cathy Steen will make their mark on the 1980s as Archie Bunker and Jim Anderson of *Father Knows Best* did for previous generations remains to be seen. What should already be apparent is that *Omni: The New Frontier* will have a revolutionary impact on the medium of American television. ∞

The following stations will show *Omni: The New Frontier*

WRGB/NBC	Albany/Schenectady
KLKK/IND	Albuquerque/Farmington
WBAL/CBS	Baltimore
WBMG/CBS	Birmingham
WCVB/ABC	Boston
WGR/CBS	Buffalo
WLS/ABC	Chicago
WCPO/CBS	Cincinnati
WKYC/NBC	Cleveland
KRDO/ABC	Colorado Springs
KOMU/NBC	Columbia/Jefferson City
WFAA/ABC	Dallas/Fort Worth
WXYZ/ABC	Detroit
KVIO/ABC	Eureka
WFFT/IND	Fort Wayne
KJCT/ABC	Grand Junction
WOTV/ABC	Grand Rapids
WGHP/ABC	Greensboro/High Point/ Winston-Salem
WCTI/ABC	Greenville/New Bern
WLYH/ABC	Harrisburg/Lancaster
WVIT/NBC	Hartford
KPRC/NBC	Houston
WRTV/ABC	Indianapolis
WJAC/NBC	Johnstown/Altoona
KMBC/ABC	Kansas City
KADN/IND	Lafayette
KVVU/IND	Las Vegas
KABC/ABC	Los Angeles
WLKY/ABC	Louisville
WITI/CBS	Milwaukee
KMSP/IND	Minneapolis
WABC/ABC	New York
WAVY/NBC	Norfolk/Portsmouth
KETV/ABC	Omaha
KMIR/ABC	Palm Springs
WEEK/NBC	Peoria
KYW/NBC	Philadelphia
KPHO/IND	Phoenix
WTAE/ABC	Pittsburgh
KPTV/IND	Portland
WJAR/NBC	Providence
WDDD/IND	Paducah
WPTF/NBC	Raleigh/Durham
WROC/NBC	Rochester
WQRF/IND	Rockford
KOVR/ABC	Sacramento
KPLR/IND	St. Louis
KUTV/NBC	Salt Lake City
KFMB/CBS	San Diego
KGO/ABC	San Francisco
KCOY/CBS	Santa Barbara/Santa Maria
KING/NBC	Seattle
WOTG/IND	Tampa
WWTV/CBS	Traverse City/Cadillac
KVOA/NBC	Tucson
KGCT/IND	Tulsa
WRC/NBC	Washington, D.C.
KTVH/CBS	Wichita/Hutchinson
WKBN/CBS	Youngstown

Comrade Moronski orders were buildink space shuttle, *not* shovel!

PSI-Q TEST

CONTINUED FROM PAGE 136

new I'm most likely to remember
(1) the main ideas
(2) facts and details
(3) both the main ideas and details

38 When someone is communicating a new idea to me
(1) I'll best understand him if he explains it straightforwardly
(2) I'll best understand him if he uses a metaphor or an analogy
(3) I'm equally likely to understand a straightforward explanation or a metaphor

39 I have
(1) a preference for outlining over summarizing
(2) a preference for summarizing over outlining
(3) no preference between summarizing and outlining information

40 Whenever I meet someone new I'm most likely to remember
(1) his name
(2) his face
(3) both his name and his face

CORRELATE QUESTIONS

41 Occupation. Pick the category that *best* describes your occupation

(1) Investigative occupations. These jobs involve investigation of physical, biological and cultural phenomena in order to understand and control them. Examples: physician, computer operator, engineer

(2) Artistic occupations. The manipulation of physical, verbal or human materials to create art forms or products. Examples: journalist, musician, graphic designer

(3) Social occupations. The manipulation of others to inform, train, develop, cure or enlighten. Examples: nurse, bartender, psychologist, homemaker, athletic coach

(4) Realistic occupations. The systematic manipulation of objects, tools, machines or animals. Examples: skilled tradesman, policeman, civil engineer

(5) Enterprising occupations. The manipulation of others to attain organizational goals or to make money. Examples: contractor, salesperson, business manager

(6) Conventional occupations. The systematic manipulation or organization of numerical or written data in accordance with a prescribed plan, or the operation of business machines to attain these goals. Examples: secretary, keypunch operator

42 I am primarily a student
(1) Yes
(2) No

43 When I am primarily engaged in an occupation, I like my line of work and feel it is right for me
(1) Yes
(2) No

44 If you answered Yes to Question 43, skip this question. If you answered No to Question 43 and *do not like* your present line of work and *do not feel* it is right for you, what occupational category do you feel would be more appropriate? You may want to reread the category definitions.
(1) Investigative
(2) Artistic
(3) Social
(4) Realistic
(5) Enterprising
(6) Conventional

45 Is your sex
(1) Female
(2) Male

46 Are you
(1) Left-handed
(2) Right-handed
(3) Ambidextrous

47 When you write, does your pen point toward the top or the bottom of the page
(1) Top
(2) Bottom

48 Which of the following five phrases best reflects your attitude about time
(1) A dashing waterfall
(2) A galloping horseman
(3) An old woman spinning
(4) A vast expanse of sky
(5) A quiet, motionless ocean

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PSI-Q ANSWER SHEET

Carefully answer *in ink* the following information so that we can get your test results back to you. Answers should be postmarked no later than November 16, 1981. Please allow approximately three to five weeks for delivery of your personal Psi-Q profile. Be sure that you answer all the questions and that they are clearly marked. Your attention to this detail will enable the Mobius Group to get an accurate and speedy response back to you. Just tear out this answer sheet and send it along with your check or money order for $5 to:

The Mobius Group
2525 Hyperion Avenue
Los Angeles, CA 90027

Name

Street Address

City State

Zip Code

Sex M F

Birthdate month day year

Please circle the answer you have selected for each question of the brain-hemisphere and correlate questions sections of the test.

(1) 1 2 3
(2) 1 2 3
(3) 1 2 3
(4) 1 2 3
(5) 1 2 3
(6) 1 2 3
(7) 1 2 3
(8) 1 2 3
(9) 1 2 3
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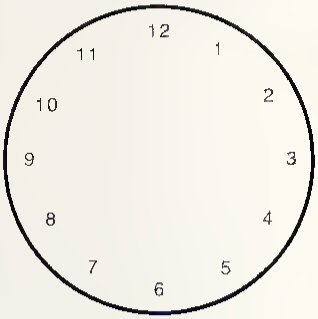
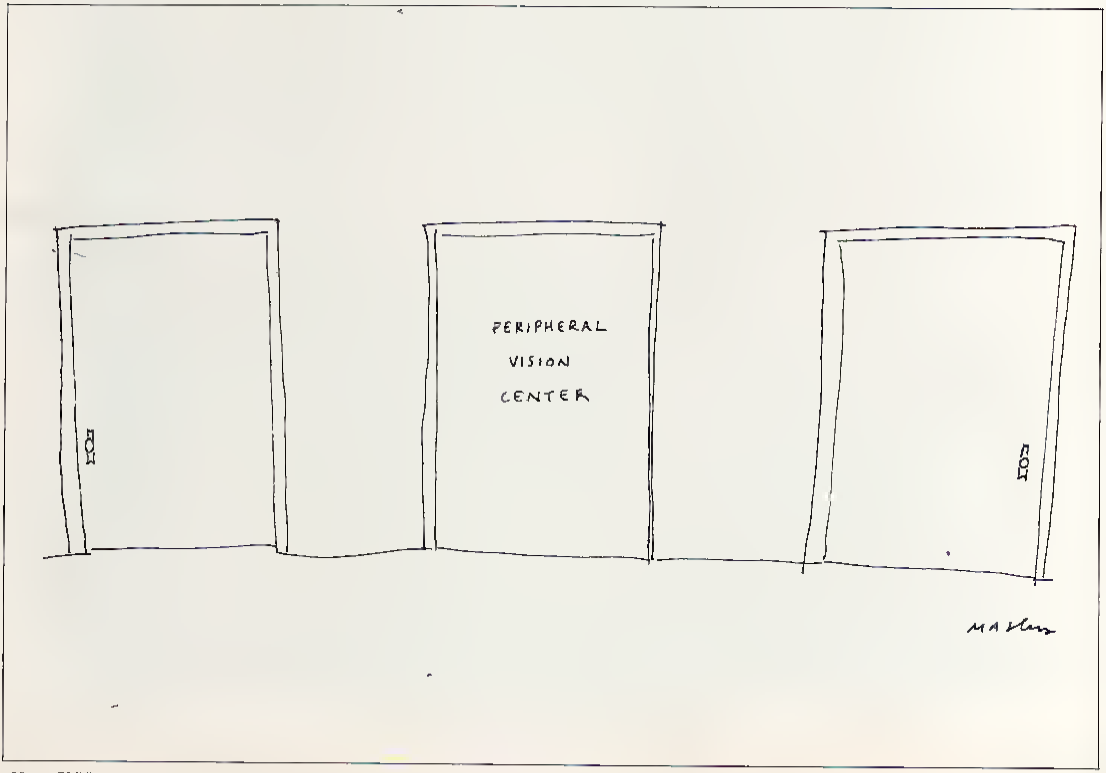
(38) 1 2 3
(39) 1 2 3
(40) 1 2 3
(41) 1 2 3 4 5 6
(42) 1 2
(43) 1 2
(44) 1 2 3 4 5 6
(45) 1 2
(46) 1 2 3
(47) 1 2
(48) 1 2 3 4 5

FUTURE QUEST ANSWERS

To record your responses go back to page 134 and imagine the circle of circles as the face of a clock. Mark the o'clock positions at which you have placed the five golden disks by circling the correct numbers on the clock face below. Be sure you have accounted for all five disks. Thank you for participating in this unique experiment and watch for our report on the collective results in an upcoming issue of *Omni*.





HINTERLANDS

CONTINUED FROM PAGE 119

species It made me cringe whining I was shaking groveling crying They lecture us on it warn us try to explain it away as a kind of temporary agoraphobia endemic to our work But we know what it is; surrogates know and handlers can't No explanation has ever even come close

It's the Fear It's the long finger of Big Night, the darkness that feeds the muttering damned to the gentle white maw of Wards Olga knew it first, St Olga She tried to hide us from it clawing at her radio gear, bloodying her hands to destroy her ship's broadcast capacity praying Earth would lose her let her die

Hiro was frantic but he must have understood and he knew what to do

He hit me with the pain switch Hard Over and over like a cattle prod He drove me into the boat He drove me through the Fear

Beyond the Fear, there was a room Silence and a stranger's smell a woman s

The cramped module was worn almost homelike the tired plastic of the acceleration couch patched with peeling strips of silver tape But it all seemed to mold itself around an absence She wasn't there Then I saw the insane frieze of ball-point scratchings crabbed symbols thousands of tiny crooked oblongs locking and overlapping Thumb-smudged pathetic it covered most of the rear bulkhead

Hiro was static whispering pleading *Find her Toby now please Toby find her find her find—*

I found her in the surgical bay a narrow alcove off the crawlway Above her the *Schone Maschine* the surgical manipulator glittering its bright, thin arms neatly folded chromed limbs of a spider crab tipped with hemostats forceps laser scalpel Hillary was hysterical half-lost on some faint channel something about the anatomy of the human arm the tendons the arteries basic taxonomy Hillary was screaming

There was no blood at all The manipulator is a clean machine able to do a nomess job in zero g vacuuming the blood away She d died just before Hiro had blown the hatch her right arm spread out across the white plastic work surface like a medieval drawing flayed muscles and other tissues tacked out in a neat symmetrical display held with a dozen stainless steel dissecting pins She bled to death A surgical manipulator is carefully programmed against suicides but it can double as a robot dissector, preparing biologicals for storage

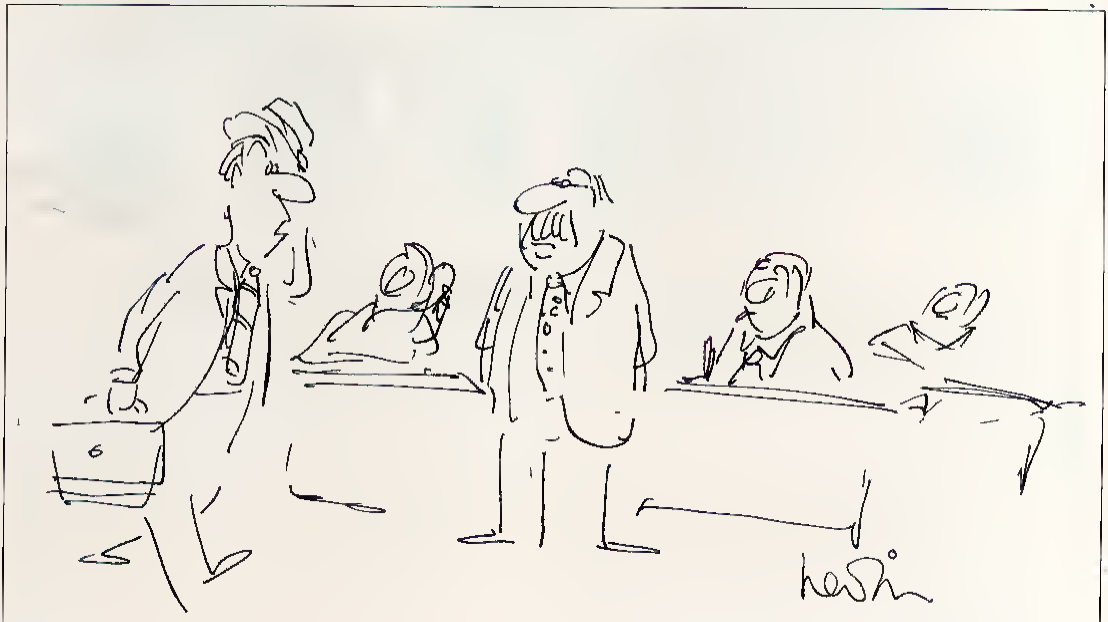
She d found a way to fool it You usually can with machines given time She d had eight years

She lay there in a collapsible framework a thing like the fossil skeleton of a dentist s chair through it I could see the faded embroidery across the back of her jump suit the trademark of a West German electronics conglomerate I tried to tell her I said 'Please you re dead Forgive us, we came to try to help Hiro and I Understand? He *knows* you, see. Hiro he's here in my head He's read your dossier your sexual profile your favorite colors he knows your childhood fears first lover name of a teacher you liked And I've got just the right pheromones, and I'm a walking arsenal of drugs something here you're bound to like And we can lie Hiro and I we re ace liars Please You've got to see Perfect strangers but Hiro and I for you we make up the *perfect* stranger Leni"

She was a small woman blonde her smooth straight hair streaked with premature gray I touched her hair once and went out into the clearing As I stood there, the long grass shuddered the wild flowers began to shake and we began our descent the boat centered on its landscaped round of elevator The clearing slid down out of Heaven and the sunlight was lost in the glare of huge vapor arcs that threw hard shadows across the broad deck of the air lock Figures in red suits running A red Dinky Toy did a U turn on fat rubber wheels getting out of our way

Nevsky the KGB surfer was waiting at the foot of the gangway that they wheeled to the edge of the clearing I didn t see him until I reached the bottom

"I must take the drugs now Mr Halpert"



Sorry I m late but my car was recalled on the way in

I stood there, swaying, blinking tears from my eyes. He reached out to steady me. I wondered whether he even knew why he was down here in the lock deck, a yellow suit in red territory. But he probably didn't mind...he didn't seem to mind anything very much, he had his clipboard ready.

"I must take them, Mr. Halpert."

I stripped out of the suit, bundled it and handed it to him. He stuffed it into a plastic Ziploc, put the Ziploc in a case manacled to his left wrist, and spun the combination.

"Don't take them all at once, kid," I said. Then I fainted.

Late that night Charmian brought a special kind of darkness down to my cubicle. Individual doses sealed in heavy foil. It was nothing like the darkness of Big Night, that sentient, hunting dark that waits to drag the hitchhikers down to Wards, that dark that incubates the Fear. It was a darkness like the shadows moving in the backseat of your parents' car on a rainy night when you're five years old, warm and secure. Charmian's a lot slicker than I am when it comes to getting past the clipboard tickers, the ones like Nevsky.

I didn't ask her why she was back from Heaven, nor what had happened to Jorge. She didn't ask me anything about Leni.

Hiro was gone, off the air entirely. I'd seen him at the debriefing that afternoon, as usual, our eyes didn't meet. It didn't matter. I knew he'd be back. It had been business as usual, really. A bad day in Heaven, but it's never easy. It's hard when you feel the Fear for the first time, but I've always known it was there, waiting. They talked about Leni's diagrams and about her ball-point sketches of molecular chains that shift on command. Molecules that can function as switches, logic elements, even a kind of wiring, built up in layers into a single very large molecule, a very small computer. We'll probably never know what she met out there—we'll probably never know the details of the transaction. We might be sorry if we ever found out. We aren't the only hinterland tribe, the only ones looking for scraps.

Damn Leni, damn that Frenchman, damn all the ones who bring things home, who bring cancer cures, seashells, things without names—who keep us here waiting, who till Wards, who bring us the Fear. But cling to this dark, warm and close, to Charmian's slow breathing, to the rhythm of the sea. You get high enough out here, you'll hear the sea, deep down behind the constant conch-shell static of the bonephone. It's something we carry with us, no matter how far from home.

Charmian stirred beside me, muttered a stranger's name, the name of some broken traveler long gone down to Wards. She holds the current record: she kept a man alive for two weeks, until he put his eyes out with his thumbs. She screamed all the way down, broke her nails on the elevator's plastic lid. Then they sedated her.

We both have the drive, though, that special need, that freak dynamic that lets us keep going back to Heaven. We both got it the same way: lay out there in our little boats for weeks, waiting for the Highway to take us. And when our last flare was gone, we were hauled back here by tugs. Some people just aren't taken, and nobody knows why. And you'll never get a second chance. They say it's too expensive, but what they really mean, as they eye the bandages on your wrists, is that now you're too valuable, too much use to them as a potential surrogate. Don't worry about the suicide attempt, they'll tell you, happens all the time. Perfectly understandable feeling of profound rejection. But I'd wanted to go, wanted it so bad. Charmian, too. She tried with pills. But they worked on us, twisted us a little, aligned our drives, planted the bonephones, paired us with handlers.

Olga must have known, must have seen it all, somehow; she was trying to keep us from finding our way out there, where she'd been. She knew that if we found her, we'd have to go. Even now, knowing what I know, I still want to go. I never will. But we can swing here in this dark that towers way above us, Charmian's hand in mine. Between our palms the drug's torn foil wrapper. And St. Olga smiles out at us from the walls; you can feel her, all those prints from the same publicity shot, torn and taped across the walls of night, her white smile forever.

COLD CURRENTS

CONTINUED FROM PAGE 24

(The clay accounts for probably half the weight of this magazine.)

The process can also separate nonmagnetic materials that tend to stick to a magnetic "seed" compound. There are many of them. For instance, some polluted rivers and lakes could be purified by seeding the water with iron oxide, to which certain bacteria adhere, and then pumping the water through a barge-mounted magnetic separator.

But the most important use of superconductors will be in generating and distributing power. Fusion generators will rely on them. Peter N. Haubenreich of the Oak Ridge National Laboratory, in Tennessee, says: "In the sun, gravity holds the reacting mass together. On Earth, the chief hope for practical man-made solar energy depends on the use of strong magnetic fields to effect confinement." Enormous superconducting magnets are the obvious choice for this duty.

They might also help us extract more useful energy from burning coal and oil. Magnetohydrodynamic (MHD) generators produce electric power directly from the burning fuel by passing the hot, conductive combustion gases through a strong magnetic field, much as an ordinary dynamo works by moving a conductive wire through a magnetic field. MHD generators capture about half the energy in the fuel—15 percent more than a dynamo. Again, supermagnets might be instrumental in making this technology practical.

And even conventional power plants could benefit from them. Westinghouse is now building the world's first commercial generator using supermagnets. Eugene J. Cattabiani, the corporation's executive vice-president, says: "Annual fuel savings for a single large plant of one million kilowatts would be equal to the energy in more than one hundred thousand barrels of oil." Such energy saving generators could begin to replace present models by the early 1990s.

Superconducting cables might cut the cost of distributing that power. Even a small one can carry enormous amounts of electricity. A single cable less than two feet across could supply all of New York City's electrical needs. Because of this tremendous capacity, supercables may allow us to locate power plants far from the cities they serve. This would cut the cost of shipping fuel to the plant and might even make it easier to find sites in rural areas for nuclear generators.

Because of the bulky cooling equipment and rivers of liquid helium they need, supercables must be placed underground. Their tunnels will be expensive, but they may have several other uses. Light-wave communications links, freight systems and pipelines for oil, water, gas and waste disposal could all run through them, and

several companies could share the costs.

Supercables become economical only at extremely high power levels—higher in fact than we need right now. But if our power use grows as it has for decades, we might need them before the year 2000. And the development of room-temperature superconductors might drastically reduce transmission costs.

Superconducting magnets might help with another long-standing power problem. Most generators are designed to supply power for a hot summer afternoon with factories and air conditioners running full blast. On a cool autumn evening there is no efficient way to store the extra electricity, most of it is wasted. But superconducting coils can hold current forever. To store power in off-peak periods, stadium-sized coils could simply draw electricity when it is available, the current would flow inside the wire without loss until it was drawn off for use when demand peaked.

There are problems, of course. Very large magnets pack nearly the power of a medium-sized earthquake. To prevent the magnet from tearing itself apart, it must be buried so deep that the bedrock can brace it. As things stand, such enormous magnets would require hundreds of thousands of gallons of liquid helium for cooling, far more than the world's supply.

Yet a prototype storage coil is now being built at the Los Alamos Scientific Laboratory in New Mexico, and another is being designed at the University of Wisconsin-Madison. Before the year 2000 the descendants of these storage coils will probably enable electric utilities to cut costs, raise their efficiency, and reduce the likelihood of blackouts.

Physicists now are using the world's largest supermagnets to study the basic constituents of matter at higher energies than ever before. They are now designing two particle accelerators with magnetic rings a mile wide. One is to be built at Fermilab in Batavia, Illinois; the other will be part of the Conseil Européen pour la Recherche Nucleaire, outside Geneva, Switzerland. Each will contain enough superconducting niobium-titanium wire to encircle the equator, and their cooling systems will triple the world's need for liquid helium.

Superconducting guns, called mass drivers, would be quiet, smokeless, safe—and astonishingly powerful. The U.S. Army is now funding the development of a mass driver capable of firing conventional shells or any other magnetic object to defend against enemy tanks, missiles, and incoming artillery rounds. Because electromagnets accelerate the projectiles more gently than explosives do, mass drivers might also be used to throw supplies across inaccessible terrain.

Mass drivers may even launch the next generation of space vehicles. Even with the space shuttle, it now costs about $325 to put a pound of payload into orbit, though that may drop to $50 a pound late in this decade. Scientists at MIT believe that very large mass drivers with superconducting magnets might reduce launch costs to about $1 per pound. And launchers on the lunar surface may hurl buckets of ore into orbit for use in constructing space stations. As a first step, Dr. Gerard K. O'Neill is now building a superconducting mass driver at Princeton University in New Jersey.

An even more spectacular scheme, the Bussard ramjet, devised by California physicist Robert Bussard, would use supermagnets to propel a spaceship to the depths of space. According to Fred R. Fickett, of the National Bureau of Standards, a magnetic "ion scoop" almost a third of a mile wide would channel space dust and atomic particles from the solar wind into a fusion engine system. A Bussard ramjet might well be our best hope of reaching the stars. Space is so cold that the supermagnets would hardly need to be cooled.

For this reason, supermagnets might also be used in space to shield crews from radiation—or from particle-beam weapons. Military outposts in space could use superconducting storage rings to supply the large pulses of power needed by plasma guns and lasers.

Dr. Little's 15-year-old vision of "flying carpets" and magnetic skis is still only a fantasy, but its prospects for realization are improving. It begins to look as if his theory of room-temperature superconductivity is correct. Just last year Dr. Denis Jérôme, head of a French and Danish scientific team, declared that superconductivity in organic matter not only exists but has been found. Unfortunately, the material these scientists tested is superconducting only at extremely low temperatures and under high pressures.

But all over the world scientists are working to make practical superconductors a reality. Earlier this year another French team announced that it had probably created an organic superconductor that doesn't require high pressure to function. Soviet scientists are working on a theory of superconducting exciton mechanisms, the concept which involves some kind of communication between electrons, is so new that no one but the physicists who developed it quite understands it yet. And Polish scientists are tracking down what they call "persuasive evidence of the existence of superconductivity at room temperature."

Although a room-temperature superconductor is the ultimate goal, even a partial success would be important. If the critical temperature can be raised by just seven degrees, engineers will be able to cool superconducting cables and magnets with liquid *hydrogen*—much cheaper and more plentiful than liquid helium. Many potential uses for superconductors that are presently pie-in-the-sky would instantly become practical.

One way or the other, a technological revolution is on its way. OMNI

"UFO religions are dying. The Aetherius Society is appealing to the United Nations for help."

ANTI MATTER

UFO UPDATE

The Brotherhood of the Seven Rays is gone. So are the Cosmic Star Temple, the Star Light Fellowship and the Cosmic Circle of Friendship. Carrying on in their footsteps, though, are such groups as Understanding, Inc., the Aetherius Society and Unarius—Science of Life.

These groups are the survivors of the Golden Age of UFO religion in the 1950s and early 1960s.

Many of the dozen and a half or so religions have vanished, but some, such as Understanding, Inc., live on in a slightly altered form. Understanding, Inc., was founded in 1950 by Daniel Fry, who was inspired after taking a ride in a flying saucer meeting an extraterrestrial named A-Lan, and rereading the Bible, from which he extracted 27 passages documenting UFO sightings.

At A-Lan's suggestion, Fry set up Understanding, Inc., proposing that the organization contemplate the problems of mankind. Since 1950, some of Understanding's 93 far-flung units have become inactive, while others have emerged as independent "study groups." But Fry is still in charge and occasionally receives a phone call from A-Lan, who has since relocated here on Earth and now, Fry says, operates an import-export business in Cairo, Egypt.

Ruth Norman, director of Unarius—Science of Life, based in El Cajon, California, says that she, too, has had contact with her "space brothers." Norman's cosmic contacts span thousands of years and dozens of past lives. She still remembers her days as Socrates, King Arthur and Isis, purportedly the woman who found the young Moses in the bulrushes.

But she did not get around to founding Unarius until 1954, when she met her husband, Ernest. She herself is the conduit for what her cosmic informers have to say, bearing a message that is contained in some 80 books and that she expounds to the 60 students who stay at her center. Her space brothers send pledges of peace and say that sometime soon they will land a megaspaceship made up of 33 smaller spacecraft here on Earth. Once safely on Norman's property, the ships will stack up to form a giant pyramid that will be used as a study center by members of Unarius.

Even more formal is the Aetherius Society, Earth's branch office of the Interplanetary Parliament, headquartered on Saturn. In 1954, high priest George King received an extraterrestrial communication designating him as the Parliament's spokesman here on Earth. He started a center in Los Angeles in 1960. Today his followers are found nearly everywhere, from Detroit to Ghana.

The Aetherius Society believes in rituals. Its apostles attend ceremonies three times a week and observe a special Aetherius religious calendar. The society's creed: When UFOs visit Earth, they channel their spiritual energy to members of Aetherius.

Even true believers have to admit UFO religions are not what they once were. To counteract disinterest, Ruth Norman says, "More Earth persons must extend their consciousness." The Aetherius Society is appealing to the United Nations for help. —*STELLA INER*

UNICORN

Legend has it that the last living unicorns were reported in the Near East in 1503 by one Luigi Vartoman of Bologna Italy who claims he saw two unicorns while at the palace of the sultan of Mecca

Now legend has become lite Two naturalists residing in Mendocino County California have bred a unique animal whose fiery head and flowing mane are capped by a single horn growing from the middle of the brow "Lancelot" as he is called affectionately by his breeders is possibly the first living unicorn in modern times perhaps ever

Born one year ago to an Angora goat and an as-yet-unidentified animal (the owners won t discuss this part) the unicorn stands 2 5 feet tall is 3 5 feet long weighs 75 pounds has cloven hooves and is pearly white "Creating Lancelot was the result of duplicating past research through interbreeding " say owners Morning Glory (a woman) and Otter G Zell (a man)

The breeders claim that the secret of their accomplishment came from many hours of painstaking examination of medieval tapestries and transcripts They now plan to patent the unicorn process

— Harry Lebelson

If a scientific heresy is ignored or denounced by the general public there is a chance it may be right If a scientific heresy is emotionally supported by the general public it is almost certainly wrong "

– Isaac Asimov

ALIEN NEIGHBORS

Somewhere in the asteroid belt extraterrestrials may be debating whether to join us or wipe us out

According to astronomer Michael Papagiannis of Boston University one place for intelligent beings to colonize is the asteroid belt the band of rocks between Jupiter and Mars Rich in raw materials and close enough to the sun to use solar energy the asteroids have gaps in which spaceships could park

Camouflaged by all this stone the extraterrestrials might well be studying us Why? We ve made tremendous technological progress," Papagiannis says. 'They may be deciding whether to help us or destroy us — Tom Kovach

STALKING ANOMALIES

To retain a little mystery in our lives and to single out some of the charlatans among us Eastern Michigan University sociologist Marcello Truzzi has established CESAR

The word is an acronym for the Center for Scientific Anomalies Research a private organization set up to make clearheaded studies of such alleged anomalies as the use of psychic powers and sightings of UFOs

Truzzi who sees himself as a constructive skeptic on such topics has persuaded 15 senior consultants experts in everything from hypnosis to zoology to scrutinize some of today s more puzzling and controversial anomalies

The center is focusing its energies on two topics a survey of industrial engineers who claim to have seen UFOs and a poll on the use of psychics by police departments an idea that appeals to Truzzi s sense of altruism

Investigation shows that police are under strong public pressure to use psychics particularly when conventional tactics seem fruitless The Atlanta Police Department for example received more than 1 000 letters from self-proclaimed psychics offering to find the killer or killers of black boys in that city (Atlanta trance session is shown above)

The police often use psychics to help them track down criminals Truzzi says but the evidence so far is that ESP has not been helpful

For more information about CESAR write to Center for Scientific Anomalies Research P O Box 852 Ann Arbor MI 48103

— Douglas Colligan

"There is no ox so dumb as the orthodox

– George Francis Gillette

MYSTERY SHIP

Early one July morning in 1976 Barry DiGregorio spotted a mirrorlike reflection moving from east to west

across Lake Ontario. As the object approached the center of the lake, DiGregorio, an experienced photographer, snapped the picture below. The camera captured a highly polished, silvery, cylindrical object with portholes dotting its length. No markings or flags could be seen.

The object's lack of identification led DiGregorio, a resident of Niagara-on-the-Lake, New York, to inquire at the Marine Safety Office in Buffalo, the U.S. Naval Office there, and a local Coast Guard office in Youngstown, New York. Nobody there could identify it.

Omni submitted DiGregorio's photo to Temple University's Department of Computer Enhancement. They found that, based on the wakes under the craft, fore and aft, it was hovering slightly above the water and, based on a study of the turbulence and wakes, that it was moving from right to left.

Today the photo remains an enigma, neatly tucked away in Barry DiGregorio's files. —Harry Lebetson

SOVIET PSYCHICS

Although the Soviet press denounces psychic phenomena, apparently the Russian people disagree. A young woman named Dzhuna Davitashvili has recently become a legend by allegedly curing people—including President Leonid Brezhnev—with the energy field of her hands. And the prestigious Soviet Academy of Sciences has just compiled a report of UFO sightings made not by crackpots but by respected scientists and engineers.

A Soviet journal simply attributes psychic interest to boredom. "Daily life here is so dull," it states, "people must find stimulation. Either that, or they drink."

—Allan Maurer

FLYING CARPETS

As part of his otherwise serious research into superconducting materials, Stanford University physicist William A. Little has suggested a whimsical use for superconductors: the flying carpet.

Speaking at the Quantum Theory Conference at the University of Florida, he proposed that all kinds of fantastic things would be possible with a superconducting material that operates at room temperature (present superconductors work only at very low temperatures).

Using a sort of magnetic levitation, you could float cars over superconductor highways, transmit electricity thousands of miles with no loss, and, if you had a mind to, weave flying carpets from the material.

First you would weave a large wall-to-wall carpet in a magnetic field, to trap some of the field in the carpet. You'd lay that down on the floor of the room and then weave a series of smaller rugs in another magnetic field. If these small rugs were laid over the larger one, they would float.

Each one, Little estimates, would hover about a yard above the floor and could float around easily, carrying a 200-pound man.

It might even be possible to use the same method to weave superconductor clothes. "Then you could fly around the same room."

Little often uses the flying carpet example in his talks and lectures, and this usually interests everyone. But there are some exceptions. When word of this first came out, he recalls, "I got letters from practitioners of Transcendental Meditation who wrote something like, 'What's the big deal? We've been doing this for years.'"

—Douglas Colligan

Common sense is the collection of prejudices acquired by age eighteen.
—Albert Einstein

EMOTIONAL ALARM CLOCK

Hypnotic regression the therapy of reexperiencing earlier life traumas to obtain insights into psychological problems has always had one complication The therapist has not always known the best point to stop the regression

Now New York psycholo gist Dr Ivan Wentworth-Rohr has come up with something that can do just that He calls it an emotional alarm clock

Dr Wentworth-Rohr chief of the behavioral therapy unit at St Vincent s Hospital in New York City uses elec trodes to monitor the most responsive body systems The psychologist watches for changes in the activity of muscles or sweat glands as a patient is being re gressed When Wentworth-Rohr s machine senses a surge of activity in the moni tored area it sets off an alarm Even if the patient is not aware of it he may have been regressed at that mo ment to a particularly upset ting time in his past

In one session for exam ple Wentworth Rohr had a patient imagine he was walk ing through his childhood home The alarm went off when he reached the foot of the hall stairs This showed it was an emotionally loaded area the psychologist de clares Then I had the pa tient regress in time to an earlier age The alarm went off at two years old The pa tient remembered being left there untended and feeling isolated and lonely

Wentworth-Rohr thinks his alarm might be valuable for other forms of psychother apy as well There's a good possibility that your body remembers more straightforwardly than your mind —Robert Kafl

COINCIDENCE

Improbable-sounding coincidences are often put forth as evidence of thought transference or ESP The Nobel laureate physicist Luis W Alvarez once was startled by a coincidence that hap pened to him

Reading a newspaper one day he came across a phrase that triggered asso ciations and led to his think ing of a person from his col lege days very probably for the first time in thirty years Five minutes later in the same newspaper he came across an obituary notice reporting the death of that person Many people would have jumped to the conclusion that clairvoyance or precognition had been re sponsible

Not Alvarez He realized that the connection was a coincidence and like the good scientist he is he pro ceeded to calculate the chances of its happening He found that the probability of thinking about a person five minutes before learning of that person s death is about 3 parts in 100 000 per year Multiplying by the 100 million adults in the United States an incredible 3 000 such experiences of the sort should occur every year or about 10 per day Seemingly improbable coincidences in other words are more likely to occur than we might as sume

Alvarez concluded in a letter to *Science* entitled A Pseudo Experience in Para psychology "With such a large sample to draw from it is not surprising that some exceedingly astonishing coincidences are reported in the parapsychological literature as proof of extrasensory perception in one form or another —Kendrick Frazier

If you don t believe it you won t understand it
—St Augustine

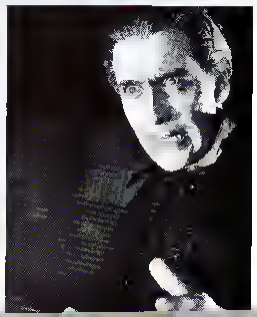
FANG COUNT

Stephen Kaplan of the Vampire Research Center in New York City has com pleted the world s first vam pire census The results? People in Massachusetts should worry

After receiving more than 500 responses Kaplan found 21 vampires who survive by drinking human blood ' in the United States For some reason he says U S vampires like Massa chusetts best with Arizona California New Jersey and Virginia following in popularity In addition he received scat tered reports of cases in Canada and in countries as distant as Germany and Japan Those who were enumerated in the census ranged from 15 to 41 years of apparent age but some claimed to be as much as 300 years old

Some of the vampires who responded to the census do live in coffins but not under ground Kaplan himself as serts I never met a vampire I disliked They re all fas cinating as long as they don't sup on my blood "

—Allan Maurer



IF THERE'S A MAXELL CASSETTE IN THIS CAR AND IT DOESN'T WORK, WE'LL REPLACE IT.

If you own a car stereo, you've probably already discovered that many cassette tapes don't last as long in your car as they do in your living room.

Conditions like heat, cold, humidity and even potholes can contribute to a cassette's premature demise.

At Maxell, our cassette shells are built to standards that are as much as 60% higher than the industry calls for. Which is why no one in the industry can offer you a better guarantee.

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IT'S WORTH IT.

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THREE FALLACIES

CONTINUED FROM PAGE 68

dark, forbidding forests and tamed them to create civilized landscapes. today we face the cold and perilous depths of space. This is the wilderness we have begun to explore. the new territory from which we can and must draw our sustenance.

To accomplish this, we must reject the either/or thinking that says we cannot fund a vigorous space program at the same time we fund enlarged programs in other areas. To pit the space program against social-welfare programs is the cruelest kind of political ploy, disastrous for the entire nation, rich and poor, black and white.

It is not *either* space *or* welfare. Without mining the riches of the solar system, all our welfare programs, all our national economy, will inevitably fall in ruin.

It is not *either* science *or* humanism; for science itself is an art form, the most human thing that human beings do. Without science and its offspring technologies, civilization itself will die, and human freedom and dignity will perish in the ashes.

It is not *either* nature *or* civilization; for human civilization is as much a part of this planet's environment as any tree or fish. And soon, if we are wise enough and bold enough, human civilization will be a part of the environment of the entire solar system.

If we are to solve today's global problems, we must look beyond Earth, and we must also look toward the future. Problems that have taken generations to accumulate require long-range solutions. Otherwise we are constantly in the position of using short-term, stopgap measures which seldom work for long, if at all. It is this Band-Aid approach that has let yesterday's problems turn into today's crises and will let them become tomorrow's disasters.

We must struggle against humankind's ancient enemies: ignorance, poverty, pestilence, and disease. We must see past the Either/Or Fallacy. To solve these problems we have to create new wealth. And the new wealth that we seek is waiting for us, untouched and eternal, a few hundred miles above our heads.

THE MAÑANA FALLACY

Perhaps the most needed breakthrough in our attitude about the space program is to put an end to the Mañana Fallacy.

For a whole generation now, people have watched boosters roar into the heavens, seen astronauts and cosmonauts living and working in space, touched rocks brought back from the moon, and still they tend to say, "This stuff may be important for my children or my grandchildren, but it will never pay off in my own lifetime."

Mañana. Tomorrow. The fact is that space is already "paying off" today with jobs and whole new industries that enrich our lives and benefit our economy.

And now, ladies and gentlemen, Einstein's theory of relativity in G minor.

For example, communications satellites are already a billion-dollar-per-year market in the United States alone. Comsat Corporation employs 600 men and women, and the satellite-communications groups of companies such as RCA, Western Union, AT&T, ITT, and other firms employ still more.

Comsat has entered into a consortium with IBM Corporation and Aetna Life & Casualty Company to create Satellite Business Systems. Inc. Two SBS satellites will relay business documents, correspondence, and computer data directly from office to office across the continental United States by way of rooftop antennas linked up with the satellites. The first SBS satellite was launched in November 1980.

The entire microchip revolution, which has created the hundreds of new microelectronics companies of California's Santa Clara Valley and elsewhere, has generated hundreds of billions of dollars in sales throughout the world. This microchip technology was forged to expedite spacecraft operations.

The sales generated by the microelectronics industry alone have more than repaid every cent invested in the U.S. space program.

In the book *The Decline of U.S. Power*, *Business Week*'s associate editor for international money management, Bruce Nussbaum, writes: "The economic base of [American] strength is as important a projection of general U.S. power around the world as the number of missiles the country has aimed at the Soviet Union."

But our economic base is deteriorating, and we hear demands for a reindustrialization of America.

Nussbaum suggests: "One way to get private business moving again is to increase spending on research and development. . . . A rallying point is needed to draw together the forces of growth, and whether the goal that is set is the conquering of space, the oceans, or the cities, it must be seen as an American goal."

Other nations have faced this choice. Nearly 500 years ago the Chinese had developed deepwater navigation to the point where their ships ranged from the East Indies to Madagascar, exploring, trading, tapping the wealth of the Indian Ocean and the western Pacific. Abruptly the Ming Dynasty halted this flourishing commerce. No one knows why, except that the central Chinese government decided to keep its people tightly bound to their own shores.

Within a century China was being picked apart by Europeans who found it a backward, ignorant nation, fragmenting into petty principalities. What would have happened if a powerful, united, expanding Chinese empire had reached the divided nations of Europe in A.D. 1450? Who can say how history would have gone then?

The future belongs to those who build it, those who can avoid the fallacies of Flat Earth, Either/Or, and Mañana. Neither the United States nor any other country has an ensured birthright to tomorrow. ∞

Making something
out of something else

COMPETITION

By Scot Morris

Our nineteenth competition asked our readers to be artists and to use a medium that is rarely used for such purposes. We called the competition "Medium Rare."

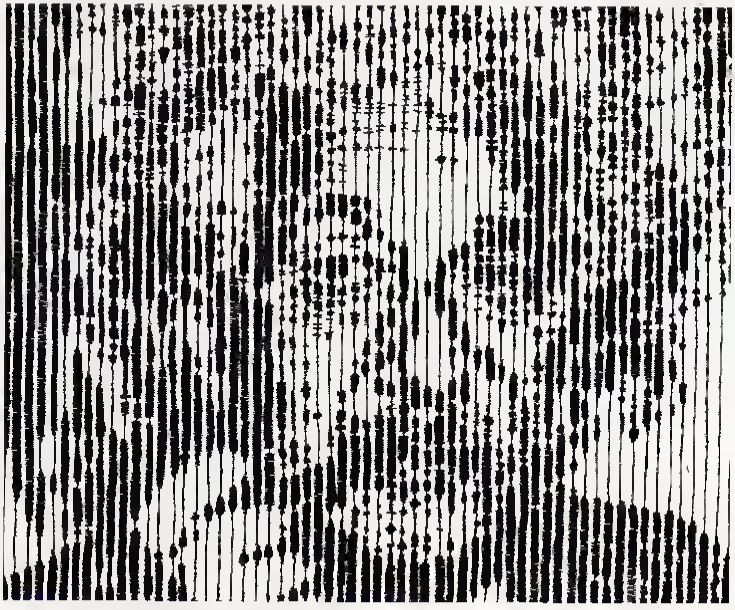
As you may recall, last May we presented several unusual pictures in the Games column: a computer image of Abraham Lincoln (and a painted version by Salvador Dali) and a photo of a five-foot-tall portrait made entirely out of dominoes, by Bell Labs scientist Ken Knowlton. We also showed you "Pure culture in a Petri dish" — the OMNI name spelled out in *Aspergillus niger*, a bacterium that is a close relative of *Penicillium*, by Philip P. Hughes, of Woodstock, Georgia.

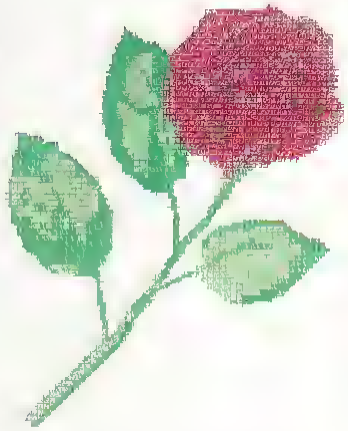
We invited readers to create their own "Media Rare," and herewith we present the results, and our report. As predicted, there were a fair number of *Mona Lisa*s printed on typewriters or computers (the best one was by John B. Matthews, of Dayton, Ohio). There were plenty of computer printouts that from a distance look like shapely nude women. These programs are widely available. Some of the same images came in from computophiles thousands of miles apart. And of course there were a great many tries at spelling out the name *Omni*, in everything from pennies to gum wrappers. Most often repeated: our logo made out of hundreds of O's, M's, N's, and I's.

In addition to the eight runners-up whose work is printed here, an additional $25 runner-up prize goes to Dana W. Cline, of Littleton, Colorado, for his series of lovely computer printouts, which unfortunately were too large to be reproduced here.

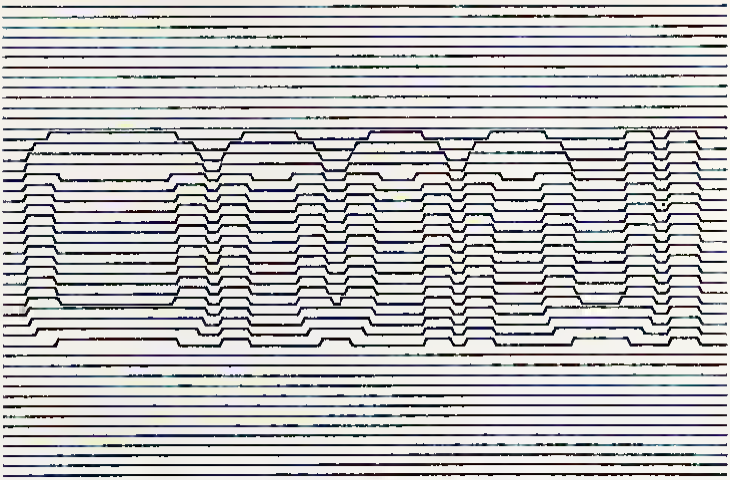
Honorable Mention for valiant efforts goes to these entries:

- A miniature piano that was made completely out of chicken bones (!), by Sharon L. Prange, of Boulder Creek, California.
- An endless poem entitled "Doing the Mobius Strip," written, of course, on a mobius strip, by Jack Butler of Little Rock, Arkansas.
- A unicorn made out of the letters in *unicorn*, by Ken Mitchell, of Denver.
- A shaded-gray block portrait of James Randi, by Glenn J. Burke, of St. Peter's, Nova Scotia.
- A floor mat in the design of a Nevada license plate, bearing the name *Omni*, made entirely out of gum wrappers, by Rick Wilson, of Sparks, Nevada.
- A space shuttle made out of pennies, by Ken Arromdee (no return address).
- A masklike face made out of socks, by Mark Sternberg, of Denver.
- A "tobacco mosaic" sculpture showing a cutaway of human lungs made entirely out of cigarette butts and tobacco, by M. Sallee, of Alliance, Nebraska.

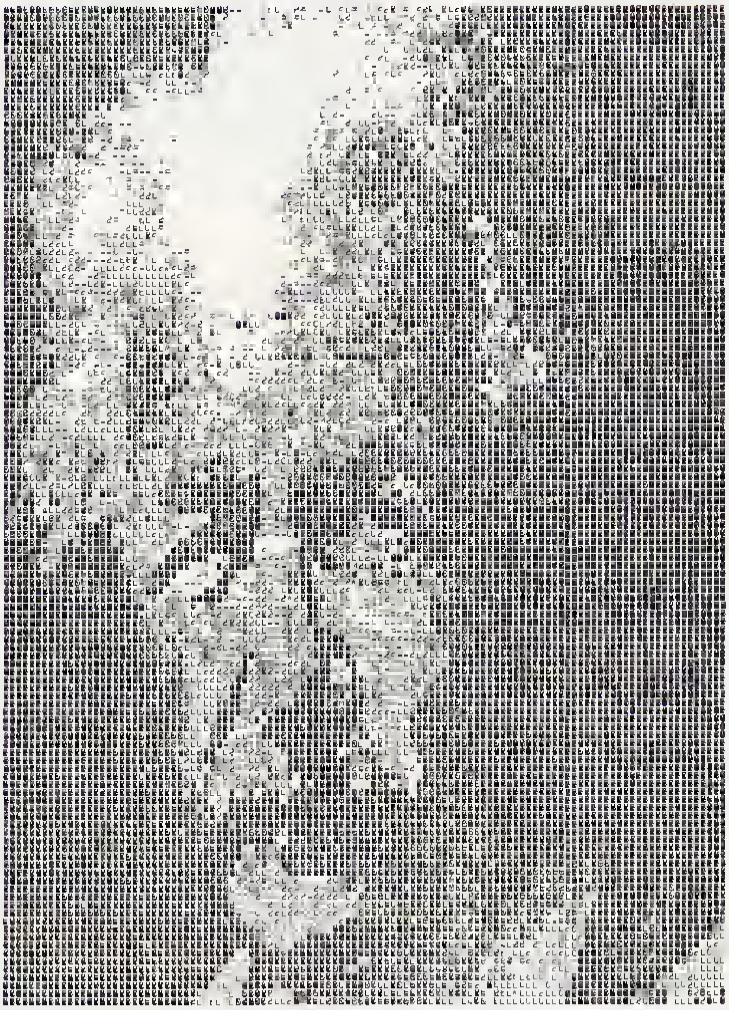


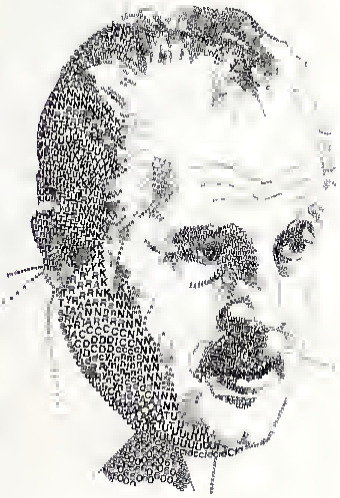


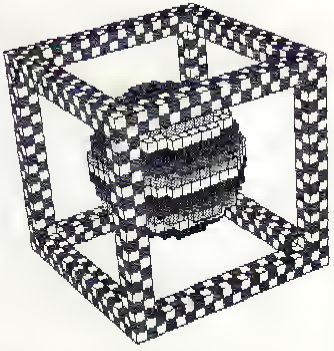
GRAND PRIZE WINNER ($100): The Einstein portrait at left was sewn on canvas by Ms. Neranza Radivojevic, of Lancaster, South Carolina, who used various widths of the zigzag stitch on a sewing machine. RUNNER-UP ($25): Linda Cumming, of Pincourt, Quebec, created the computer rose above.



RUNNERS-UP ($25) Clockwise from below left: This Einstein portrait is made entirely out of the characters E, =, M, C, and 2. The computer artist was Jeff C. Cameron, of Torrance, California. The lined OMNI is from an original computer program by Gary E. Hower of Wichita, Kansas. Pim van Hoof, of Eindhoven, the Netherlands, did the portrait below of the former director of his department at the Concern Industrial Design Center. It comprises the letters in the man's name, Knut Yrar, and the company's initials, CIDC, only his tie is built up from the number 60—his age at his retirement. Van Hoof did the portrait in 13 hours, using sheets of transfer lettering in the typeface Helvetica medium. "The portrait," he says, "is a personal protest against computer-aided design, and that's why you can't see a grid on my design like the ones you get when you use a computer printer or a typewriter." The ball-and-box design is our favorite out of several striking computer printouts sent to us by Martin Kahn, of Berkeley, California. A letter from Ernest A. Valtri, of Mont Clare, Pennsylvania, reads in its entirety, "I tried using your name to create something else. I hope I WON."







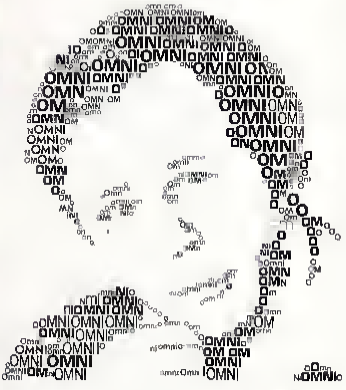
• "Pure poppy cock withstanding the test of thyme" a rooster and the words *standing the test* made out of poppy seeds and thyme, by Brenda Petruska of East Brunswick, New Jersey

• A pen-and-ink portrait of Adolf Hitler made entirely out of swastikas, by Jonathan D. Plumb, of Burlington, Ontario

• A groundhog eye made out of iron filings, by Lindsay R. West, of Port St. Lucie, Florida

• A deer made of clothespins, by Dr. Shirley D. Hunter of Webster, New York

A note should be made about the Incredible Mention photograph of the Mona Lisa on the western side of Mount Diablo, in California (at left). Reader Ron Mosholder, of Santa Maria, California, sent us an "unusual entry," a photo clipped from an old *Life* magazine. "I wasn't the creator or the photographer," Mosholder wrote, "but maybe you could find the original people involved. Your readers seem to appreciate hard work and creativeness, and this project involved both." We did get in touch with the creator, Will Ashford. A few years ago, in the wintertime, Ashford selectively spread 780 pounds of fertilizer on the slope of Mount Diablo. The following spring there was Ms. Lisa in a rich, dark green, much appreciated by the cows and by commuters driving between San Jose and Sacramento, on Interstate 680. Photographer Kim Komenich sent us the previously unpublished view of the creation. For this "Incredible Mention" we're sending $50 to creator Ashford, $50 to photographer Komenich, and a year's subscription of *Omni* to reader Mosholder. Thanks, guys.



RUNNERS-UP ($25). The (Omni Editorial Director) Ben Bova portrait (above) is by Mark Lynch, of Lansing, Michigan. The moonwalk mosaic (left) is by Allen Ball, E. Paul Ratazzi, Keith Loepere, and Joseph M. Weiner, of Explorer Post 500, B.S.A., Rome Air Development Center (USAF), Griffiss AFB, New York. They call it "Phased Array." INCREDIBLE MENTION. Mona Lisa of Mount Diablo (above left) was created by Will Ashford, of Diablo, California. See text for more details.

CONTINUED FROM PAGE 34

that what we had was a contour map of the wood's warpage pinpointing where the paint was beginning to separate It was then a simple matter to inject a bonding agent carefully at these points so that the paint would not fall off in years to come

At this point Asmus was approached by Venetian art historian Giulia Musumeci who proposed the next logical step in his methodology Although image recording was laudable why not try saving the *real* works of art? A statue restorer Musumeci remarked that in the year it took her to restore a single sculpture 15 others had crumbled into dust The vandal in these instances was calcium sulfate commonly called stone cancer a black encrustation that is harder and more chemically resistant than the stone it attacks Why not Musumeci suggested shoot the cancer with the laser itself?

So we shot a gargoyle with a holographic laser Asmus continues and weren't surprised that we vaporized an area of encrustation When a beam strikes a dark surface that surface sublimes or vaporizes outward producing an immediate cloud of ions and gases that prevents the radiation from continuing down to the next surface We were delighted however that a good patina resulted on the stone We were even more astonished when Musumeci returned the next evening with a distinguished elderly gentleman—Kenneth Hemple of the Victoria and Albert Museum in London—who pronounced our experiment the most dramatic advance in stone cleaning he'd ever witnessed."

Indeed Hemple was so impressed by the procedure that he talked the notoriously skeptical Italian authorities into accepting the laser treatment to restore Venice's statuary So Asmus and a small crew then cleaned a number of Venetian stoneworks including portions of St Mark's Basilica and the capitals (tops of columns) of the Palazzo Ducale Yet the process was time consuming

Each laser shot cleans an area about the size of a dime Asmus explains We've probably put only about a thousand shots on a single capital of the Palazzo Ducale which encompasses a very small cleaning area and there are *hundreds* of these capitals left But the laser still consumes less time and cost and results in less damage than any other existing technique

To a lesser extent Asmus has also laser-cleaned paintings But primarily monochromatic ones because a good polychromatic laser simply doesn't exist For fifty to one hundred thousand dollars however I could design a serious flash-lamp-pumped dye laser easily capable of producing different colors But I have never found anybody who contemplated putting one hundred thousand dollars into the art-conservation field for new equipment

That statement reveals the art conservationist's eternal problems—money and politics. Asmus has completed other on-site restorations at a variety of places, but he keeps encountering human-generated roadblocks far older than the works of art he is trying to preserve.

One example of this involves the use of ultrasonics. From 1975 to 1977 Asmus was involved in highly publicized detective work at Florence's Palazzo Vecchio. It was suspected that a large, major, lost DaVinci painting, *The Battle of Anghiari*, was in fact hidden in the palazzo's huge Hall of the Five Hundred, possibly underneath one of six enormous Giorgio Vasari oils that dominate the room. To determine whether the DaVinci had in fact been painted over, Asmus and his crew erected large scaffolds facing the six visible works and then sectionally scanned each with an acoustic pulse generator, technically known as an ultrasonic transducer. The device first sent a supersonic pulse into the oils. When that pulse intercepted an anomalous region—say, a change in material from oil to plaster—a partial reflection was sent back to the transducer, resulting in an electrical pulse and subsequent echo. Tens of thousands of these pulses were then scanned across the paintings with a computer programmed to look for and record patterns within the echoes.

Finally, two areas were found that gave contiguous echoes, suggesting that there was something behind the Vasari oils. At this point, Asmus suddenly found himself out of the picture. "Quite bluntly," he recalls, "when it looked as if we were finding something and the stakes became very high, the crowd that suddenly jumped on the band wagon didn't need me anymore. I was just pushed aside." Pure politics. Since then, because of the tangle of legalities, the situation has remained unchanged; the surface beneath the oils remains unseen.

In 1975 Asmus was contacted by a Parisian art conservator who requested the removal of overpaint from a number of antique theater seats. After using a ruby pulse laser and failing—the beam was not differentiating between the grimy, oil-based overpaint and the original oil base—Asmus ingeniously devised another optical-radiation outlet, the Flash Blaster. By housing high-intensity xenon lamps in hand-held units capable of irradiating areas up to 4 inches by 18 inches and able to supply flashes equivalent to 1 million watts of boosted power, Asmus had formulated a completely new cleaning tool. "In fact," he says, "it occurred to me that the Blasters had such potential that we're now in the process of copyright."

Capable of producing bursts of 1,000 to 4,000 degrees Fahrenheit of surface heat within a thousandth of a second, the Flash Blaster's pulse of light is so intense that the surface material is instantly vaporized and produces a cloud of ionized gases that blow off the vaporized debris, thereby revealing and protecting the underlying surface. Yet the surface is quickly reduced to near-ambient temperatures, resulting in danger-free conditions for the Blaster's operator, who can hold the unit either directly upon the artwork or up to an inch away from it.

"The Blaster worked so well," Asmus recollects, "the French art conservator herself spent a month with the equipment, cleaning and restoring *crates* of those seats. Unfortunately, after all that time and effort, she received very little remuneration."

Lack of funding also bedeviled the Blaster's most unusual project. In late 1980 it was discovered that a large Indian wall drawing—or pictograph—in Utah's Arches National Park had been vandalized. One version of what happened, according to Asmus, was that a man who belonged to the local Indian tribe that revered this pictograph was having a "horrific string of bad luck." When he passed by the pictograph, he noticed an element in the drawing that he thought was new (or at least he hadn't noticed it before), and he believed the new element was causing his misfortune. So one night the man's entire family supposedly went up to the wall with cleansers and brushes and attempted to scrub off this heretical element.

"In any event, over the next few weeks the sun baked in that cleanser residue, just cured it directly into the stone. So we were asked to clean a ten-foot-square area depicting a warrior with shield, using our Flash Blasters." At minimum wages, Asmus and his crew took on the job, donating equipment, energy and vacation time to the project. Only their hotel and transportation bills were paid by the National Park Service, which also supplied on-site power. After so many years of such altruistic enterprises, hasn't Asmus entertained second thoughts about his labors?

"Over the years I have acquired a certain cynicism," he concedes. "How is it that someone like John Paul Getty, for whom I once did some holograms and interferograms, will spend three million six hundred thousand dollars on an artwork and then begrudge the two thousand dollars needed to take care of it?"

Then why continue? "Here's a little article about our re-creation work that ran in the *New York Times*." Asmus replies, holding up a clipping. "Because of this a man sent me fifteen dollars. He wrote that it wasn't much, but what we were doing sounded wonderful, and maybe every bit would help."

That was an immensely uplifting message. And by falling into this area, my life has become much more interesting. Don't misunderstand: there are some very high points in my regular industrial/commercial work, such as when you spend three years assembling a multimillion-dollar laser and lo and behold, it works. But in the arts the results are very visible and very ponderable. You can begin with a sorry-looking statue and end with something that simply radiates beauty. OMNI

EARTH

CONTINUED FROM PAGE 18

In the past Schwalbe says scientists tried to control the gypsy moth with chemical pesticides But that proved to be a poor idea DDT for example was so toxic that it killed or altered just about everything that moved and it had to be taken off the market Sevin another extensively used pesticide killed gypsy moths but it also killed honeybees With public fear of chemical pesticides on the rise researchers decided to try other tactics

Sixty thousand gypsy moths a day are reared at the USDA laboratory on Cape Cod New pesticides are tested there and a host of other substances are being designed to neutralize the menace of the gypsy moth Ladies and gentlemen the pest war is on and sex is a weapon

The adult female gypsy moth emits a sex attractant called a pheromone a chemical plume that no male gypsy moth can resist Scientists have been able to synthesize this alluring substance and are using it in two ways Milk-cartonlike traps containing the pheromone are placed where the moth is suspected Any male that catches a whiff will follow the scent into the trap, instead of mating with a female it will be killed by an insecticide The USDA used 100 000 traps last year to locate new infestations Homeowners can also buy these traps If the traps are to be effective they must be in place well before the adult moths emerge from their cocoons

Pheromones are also used to confuse male moths Synthetic pheromones in slow-release capsules are sprayed on a population so that the entire area smells like a single passionate female The males don t know which way to turn and the females are ignored Sounds good in theory but how well it works is still not known

Another experiment involves what is called the sterile-male technique Male pupae are zapped with cobalt 60 not enough to make them radioactive but enough to make them sterile If you know the population density of an area you can release enough sterile males to compete with fertile males Since females usually mate once if the partner is sterile the eggs are infertile

In nature disease controls the size of a population that has grown too large With this in mind some scientists are trying to replace chemical pesticides with bacteria or viruses that are lethal to the gypsy moth but harmless to people and other forms of life BT (*Bacillus thuringiensis*) for example is a bacterium that kills only butterfly and moth larvae Gypchek is a virus that affects only the gypsy moth caterpillars It is not yet commonly used but experiments are under way to make it more virulent and to distribute it by spraying it from airplanes

Then of course there are parasites All kinds of flies were imported from Europe and Asia early this century because it was known that some parasites lay their eggs inside the gypsy moth caterpillars Others lay their eggs on leaves that are eaten by the caterpillars which then become the host for the insect parasite The parasite lives off the caterpillar eventually killing it Scientists want to mass produce the flies and unleash them at just the right time to thwart the foraging caterpillars

The goal is to integrate all of these techniques and produce an arsenal of controls suitable for any situation The techniques now being applied to the gypsy moth have been used successfully against other insect pests Screwworms were virtually wiped out in Florida through the sterile-male technique Mexican bean beetles which are harmful to soybeans are being attacked by parasitic wasps in Virginia Maryland Delaware and New Jersey It s all part of a nationwide program called Integrated Pest Management (IPM)

IPM attempts to harness every available weapon but it comes about largely as a response to the outcry against the use of chemical pesticides For example in Texas where 75 percent of the cotton is grown under IPM the use of pesticides has fallen from 20 million pounds a year in 1965 to about 2 million pounds now Pheromones are used in the Texas cotton fields to lure the boll weevil into traps and to disrupt the mating of the pink bollworm

Biological controls are not a new idea The ancient Chinese planted nests of predatory ants in citrus trees to control leaf-eating insects Pesticides were not the main weapons used in the pest wars in the United States until after World War II The number of registered pesticides increased from about 30 in 1936 to more then 900 in 1971 Today 1 billion pounds of pesticides are used every year

IPM is a more subtle sophisticated approach to pest management than a killing spree with toxic chemicals As an applied ecology IPM has the advantage of targeting its deathblow to a specific insect population ensuring not only a strong agriculture but a healthier environment

When you deal with gypsy moths or any other pest you have to consider the economic threshold An evergreen farmer in Maine sprayed his trees six times this year to harvest his Christmas crop Yet no one notices when an oak in a remote forest—too far away to be worth its weight in firewood—falls victim to the gypsy moth But if that oak is in your front yard and the caterpillars are so heavy that you can watch the grass move act quickly

The people of the northeast who watched gypsy moth caterpillars murder their trees last spring are perhaps understanding the plight of the farmer for the first time Schwalbe says It s easy to be dispassionate about insect pests But once you experience them it s like going someplace where the sun doesn't shine You get depressed "

The gypsy moth is here to stay and our only hope is that we can control it It'll be back next spring

BOOKS

CONTINUED FROM PAGE 30

the key message of many works by Robert A Heinlein particularly *The Moon Is a Harsh Mistress* in which the social effect of a charismatic computer personality is explored with remarkable subtlety This obsession with Napoleon explains why the Dune series by Frank Herbert, is so popular inside and beyond the science-fiction community It tells us much of what we like about Gordon R Dickson H Beam Piper, and Jerry Pournelle It reveals the fascination of the Mule in Asimov's Foundation series And these are just a handful of contemporary science-fiction writers who have selected the Napoleonic theme from the SF universe of ideas

What really surprises me is that the mainstream appears to have unquestioningly accepted McCarthy's truncated definition Surely there are other constructs that the mainstream too recognizes as ideas But let's stay with McCarthy's concept

Apparently it's Napoleon's technocracy that preoccupies McCarthy. But Napoleon was only the outstanding proof that ordinary people can have extraordinary ideas and put them into practice effectively (She does have a few kind words for Karl Marx) People whose comfort is based on ratiocination and conferred status naturally feel threatened They support one another in the precept that somewhere somehow there is an unchanging world despite the fact that the world has never been one A constantly changing world not the convenient name and visage she gives it is the stuff of her terror and of her fascination with attempts to contain it

And that is the essential point Speculative fiction expands on ideas McCarthy's mainstream attempts to rationalize them to the point where they are manageable without the reader's learning anything new So in McCarthy's analysis of nineteenth-century literature there was no *Frankenstein* with its thought that humankind might someday learn to trespass on divine prerogatives There is Victor Hugo but there is no mention of his contemporary and friend Jules Verne And there assuredly was no *Invisible Man* to allegorize thorny aspects of the Industrial Revolution no *Time Machine* to explore its furthest implications—no Wells at all thank you

There is no Aldous Huxley Kipling's apotheosis of the artisan escapes her, as does his As Easy as A B C a story that ought to have been required reading for every social theorist from Pericles of Athens to Mayor Richard J. Daley of Chicago

There is no *Nineteen Eighty four* George Orwell did write *Animal Farm* but it contains only one idea stolen from Joseph Stalin. I think Orwell got it from living the life he chronicled in *Down and Out in Paris and London* But McCarthy fails to connect that to *Les Misérables* despite her penchant for Hugo Such is her world

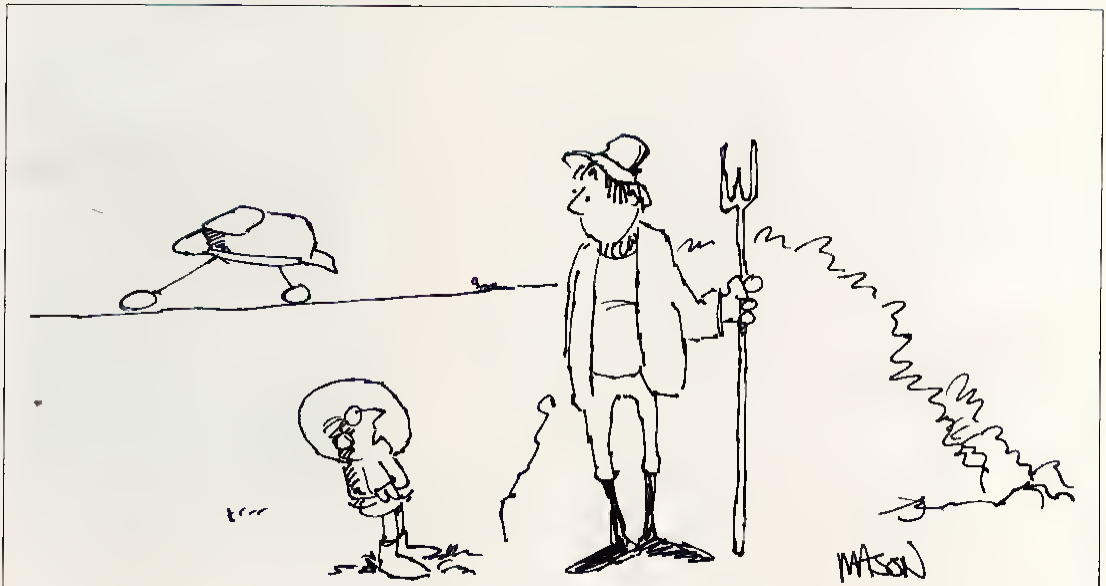
In the actual world there are not two cultures You can walk about on any campus for a mere five minutes and see for yourself that there aren't But there are people who despite reputation and essential intelligence maintain restricted enclaves within our one culture Unfortunately you can walk onto any campus and see that too

BURROUGHS AT THE BUNKER

By Regina Weinreich

The Bowery New York City The bums outlying before the Bunker caution me against entrance on this cold and blustery February day You can't go up there No women there Nooo They're shaking their heads like Shakespearean clowns as I am led through the iron gates Maybe they think the Bunker is still the YMCA

The Bunker A few days before his sixty-seventh birthday William S Burroughs the purported father of the Beats and grandfather of punk attired in tan slacks and shirt topped with a green velvet Moroccan vest that sports gold trim, comes to greet me It's just a couple of years since the Nova Convention brought the Neo-Beat fellowship to Second Avenue for a three day test of pop paranoia about the future of our planet Burroughs presided predicting mind-over-matter solutions to global con-



I could be taller but I'm from a dwarf star

cerns, such as the endangerment of other species and the touling of our own habitat. He called his program "third-mind" experience, a belief in accident, coincidence, and magic as opposed to the tyranny of Aristotelian straight-jacket logic.

Currently it's more than just his birthday he's celebrating. *Cities of the Red Night*, his first novel in years, is just out, *Light Reading for Light Years*, a collection of features and magazine pieces since 1973, has also been published, as has *With William S. Burroughs: A Report from the Bunker*, a book of interviews, by Victor Bockris. Burroughs has the look of a man who's seen beyond death, whose life is in the next transformation. Concerned about the dangers of urban existence, he lauds the work of the Guardian Angels (New York's vigilante subway protectors), recommending an armed citizenry.

He begins to show me his latest preoccupations. He takes out a steel cobra, a whiplike wand, and demonstrates its use against paper boxes. He has the same fascination with weapons as some others have with stamps.

We are seated at a conference table that doubles for dinner, with orange chairs that accent the austerity of Burroughs's space. He sips from a mug marked DOCTOR, smoking hand-rolled cigarettes that carry a trace of cannabis. I am brought here by intellectual wanderlust, to reconcile my third-mind kinship with the well-known woman hater, the author of the outrageous *Naked Lunch*. In spite of the despicable way in which he decries women, I confess I am turned on. Burroughs's writing excites me. *Cities of the Red Night* is an ambitious triumph of subtlety and wit. Yet there is much to reckon with: an invocation to all the Gods of Excrement, the ritualization of homosexual games, executions by hanging, sex devoid of pleasure, and cynicism about romance that forces me to stifle my traditions in courtly literature. Imagine. Burroughs believes love is a virus that women perpetuate in Western civilization.

"Why is your new novel subtitled *A Boy's Book*?" I ask. "Are you separating the boys from the men, or is it the women?"

"No," he assures me. "There is no subtitle anymore. As soon as I saw it on the original galleys I said, 'Take it off.' It's like saying something is a woman's book. It limits your appeal." The subtitle had been intended to signify a kinship with adventure stories such as those of Robert Louis Stevenson, not as a device to alienate women.

I ask him about his critique of women. "It's not just women," he replies, sort of.

"Well . . . uh . . . you've asked me a question. I could read my position on the subject." He pulls a manuscript out of the bureau drawer before I can insist on a more spontaneous response. "I realize I am widely perceived as a misogynist," he begins, his voice scratching a little. "Women may well be a biological mistake, but so is everything else I see around here." His hand gesticulates in the dramatic performance pose he uses for readings. I look around. There's no one here but me.

"The dinosaurs," he continues, "turned out to be a mistake, too. But what are two hundred million years for such a noble experiment as evolution?" Burroughs presents his platform in a brilliant Swiftian takeoff, postulating that the human—man or woman—is an anthropological artifact in a state of neoteny, a biological term employed to categorize an organism that is fixated at what would normally be a transitional or larval stage.

"Look at the human artifact," he continues. "What is wrong with it? Well, just about everything. Consider a species that lives on the seacoast, looking after ships year after year that still believes the earth is flat because the churches say so. They *know* the earth is round. They *believe* the earth is flat. I'm advancing a theory that we are not designed to remain in our present state any more than a tadpole is designed to remain a tadpole forever."

He stops reading to check out my response, then explains the next evolutionary step. "The sexes fusing into one organism—changes that are literally inconceivable from the present point of view. We cannot perceive what it would be like, but if we are going to survive, we're not going to remain in the same state forever."

Curious about these pronouncements, I ask, "But how would this transformation of the organism take place?"

I get a cold, blue stare. "By leaving time and going into space," he answers.

I ask him to pin this vagueness down, and he explains. "One has the feeling that the creature is tricked into making evolutionary steps. A fish survives drought because it develops lungs. The fish is not looking for a new medium; it is trying to get from one water source to another. It's not looking for air, simply for more water. It's made an involuntary step forward. And perhaps a forward step in the human race will be made in the same way. Man is not looking for space. He's looking for more time. The space program is simply designed to transport one insoluble temporal impasse somewhere else."

William S. Burroughs: Writing in 3-D.

This prospectus on the future of the planet, reasonable within Bunker walls, raises questions about the survival of our species. Is it only a foible of women to link evolution with regeneration through the intermediacy of sex? I think of his homosexuality, which can only be unregenerative from an evolutionary standpoint. The doctor takes a tack quite similar to the position taken by many feminist separatists. "Cloning is now quite able to get beyond this whole cycle of birth. Now it would be done by putting the fertilized egg into the womb. This is like using a woman purely as a flowerpot to grow *this* baby. It's obvious that sooner or later this could be done in an artificial womb. This is quite possible and not more than thirty years away from where we are right now."

I tell him what I've said to other separatists posing the same potential. "But . . . that's so . . . intellectual."

He looks at me in disbelief. "Well, *of course*."

And what about humanistic values in a space devoid of feeling? Burroughs says, "If you have a possibility, it will usually be realized. What can be done will be done."

Given Burroughs's penchant for possibility, *Cities of the Red Night* plays with the historic chances we missed. "Had Captain Mission [presumably a real-life forebear of the French Revolution] lived long enough to set an example for others to follow, mankind might have stepped tree from the deadly impasse of insoluble problems at which we now find ourselves." Sounds like a political novel about freedom from oppression, right? But really it speaks to a freedom in the mind. To read Burroughs is to enter 3-D in writing and defy linear sequence. His fiction ultimately exemplifies what it means to go into space, not with our bodies, as the astronauts do, but with our heads.

Burroughs's collagelike writing is often criticized as sloppy and crude. Rather, his technique is a calculated literary aesthetic. His Spartan, well-honed words flash each image, a neon imprint to be elucidated by an evolved human brain. For example, *Cities* is a science-fiction adventure tale in which three strands of narrative propel the reader through separate spaces in time. One strand involves the present-day mission of Private Asshole Clem Snide. Another tells of an eighteenth-century pirate's venture to establish city-states in the New World. And the third strand resurrects the ancient cities in the Gobi Desert (those that give the book its title). The recurrence of an exotic strain of virus, which drives Burroughs's characters into every sort of copulation and obsession with sex, provides cinematic transitions that cut from the site of a public hanging to a shipman's diary to a drug dealer's severed head. The

reader s mind becomes the space vehicle for all these things

Burroughs contends that there is nothing new at all in this manner of viewing reality Already systems of thought and belief are tearing away from the sequential Some of the significant phenomena of the Western world he tells me are cults like est and Scientology designed for spiritual self-improvement These are a mind opening factor So he explains his sorcery—a little Beckett Genet Conrad Greene (for literary influence) punctuated by chance Mayan culture astral-projection theory and black magic Burroughs then pulls a copy of *The Necronomicon* out of his bedroom See here s Humwawa He points to a nasty-looking figure The Lord of Abominations the Lord of the Future as things decay Burroughs describes him in *Cities* this way His face is a mass of entrails whose breath is the stench of dung and the perfume of death with rotting genitals from which he howls through sharpened teeth over stricken cities

Burroughs works doggedly to manipulate this magic into a literary methodology I write three drafts of each chapter ten to fifteen pages per day then correct rather than go on If you go too far with all this uncorrected material behind you it can lead to severe writer s block simply because you re ahead of your army he says

He s writing a sequel about cowboys set in nineteenth-century America but he s reading a lot of the outlandish "I read horror stuff Unspeakable evils Cockroaches grow man-size and start eating people That sort of thing I ll show you He leads me into an officelike spare room One shelf of an industrial bookcase is filled with paperbacks lying atop one another in neat rows revealing spines that flash the red yellow-blue crayon of cheap pulp He grabs one and shows me the marginalia ready to be culled and distilled for the new concoction Burroughs supplies a reading list Robertson Davies—"He s got some interesting things to say about money Frederick Forsyth— He really keeps your interest—good plot ' He shows me novels I had never heard of *The Beckoning Riddle* "I read everything I can on plagues then run-of-the-mill entertainment novels He thumbs the books into a pile as we talk

We then smoke some Imperial Buddha Buds in a joint Burroughs supplies some cooking logic lamenting the loss of time the disappearance of Horn & Hardart s cafeteria where you could get a good meal for the price He gets up to dry the dishes I have a good sense of time he says Vichyssoise for example He proceeds to give me his recipe as my mother would have done without measurements Creamed potato and leek soup Puree your potatoes and leeks very fine Then add a pinch of curry Mix with cream uh half-and-half and place it in the icebox so it s well chilled Don t forget the chopped chives Without the chopped chives it s really quite insipid

PERFORMANCE

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energy efficient. Moreover, the farms they celebrated were really just images of the huge agricultural systems that destroy land and water purity in many areas. "We saw we had built an inherently alienated metaphor," they say, "and then the work took a great change in direction."

The Harrisons took a year off, training themselves in ecology, "so we could get past the gesture. We read omnivorously," Helen says, "and then we would sit and talk." Eventually these breakfast-table conversations evolved into a formal dialogue with definite characters and voices, which the Harrisons performed, published, and inscribed in elaborately scrawled didactic and poetic messages on the work itself.

Their new projects attacked a vast range of ecological concerns. There was the "Duck and Snail Promenade" in the La Jolla Museum—a drama in which ducks were unleashed on samples of the pesky snails that plague southern California gardens. The performing ducks finished off the escargots, then waddled on to gobble up the museum garden, demonstrating, they say, that one-step solutions to ecological problems last as long as it does to take a step.

In 1977 they created earth on a barren rock quarry by invoking city councils near the ArtPark site in Upstate New York to dump diggings from a new sewer line, along with other organic wastes, then plant a meadow— a portrait of a thousand-year natural process collapsed into ten years. Helen and Newton investigated the San Gabrielino Indians, who inhabited the San Gabriel Valley before the white man came, a paradigm of an ecologically conscious society. They remained preoccupied with water, too, studying various waterways the Great Lakes and oceans and river systems, and creating "Meditations" from their observations, or giant blow-ups of maps with droll written addenda, revealing the way the world's water is divided and polluted by survival-threatening systems of possession, consumption, and profit.

Their ecological art often necessitated scientific experiments. A search for a hardy aquatic creature that would survive museum conditions—better than their catfish had—introduced them to *Scylla serrata*, an edible, cannibalistic crab from Sri Lanka. They began to raise the *Scylla* in tanks at Pepper Canyon, designed to replicate exactly the crabs' native estuarial lagoon. "Suddenly the crabs began to act strangely," the Harrisons wrote in their memorial to the endeavor, *The Book of the Crab*. "They stopped eating our food, they stopped eating each other. They even stopped moving around much." The Harrisons discovered that the one element lacking in the crabs' California environment was the Asian monsoon. And so they created an artificial version by spraying the *Scylla* with fresh water from a hose. The "monsoon" changed the salinity of the water, restored the captives to health and sanity, and inspired them to mate—a feat no oceanographer had yet accomplished. This won the artists a coveted Sea Grant from Scripps.

The crab adventure led the Harrisons to Sri Lanka, and to the first of their current series of projects, an epic oeuvre called "The Lagoon Cycle," purchased in advance by Metromedia, a media conglomerate that invests in artworks and that considers the Harrisons' ecological ideas highly advanced, more so than Jacques Cousteau's. "The First Lagoon" records the artists' search for *Scylla serrata* in its native culture, human and otherwise, in a collage of panels featuring drawings, enlarged maps, flags, tinted photos, and the usual scrawled observations, a dialogue between two characters with two varying viewpoints, the Lagoonmaker and the Witness. The Lagoonmaker represents "an updated Bucky Fuller type" or megalomania with a conscience, and the Witness reacts to and judges the Lagoonmaker's projects. The complexity of the ideas exchanged between the two counterpoints the childlike quality of the visual art, reminiscent of an oversized, sophisticated entry in a high-school science fair. Lagoons in general fascinate the Harrisons because, in the place where fresh and salt waters meet, they see a metaphor for culture as a whole. ("Life is tough and rich in the lagoons. Like all of us, it must improvise its existence.")

The Harrisons' work often attempts to reveal the nearsighted absurdity of trying to resolve ecological problems, the result of an entire system of beliefs, with a simple, enlightened solution. In "The Fifth Lagoon," for example, the Lagoonmaker proposes reclaiming the Salton Sea, an inland body of water near San Diego that is heavily polluted with agricultural wastes, by flushing it into the Pacific via a channel cut through the mountains, then making a polycultural fish farm out of it. The project simultaneously proposes that the fish-farm idea be abandoned when the Witness notes, "Once you flush the dirty Salton Sea into the ocean, who's going to flush the ocean?"

To research "The Fifth Lagoon," Newton cruised the Salton Sea in a boat. "I began to spend all my time on this agricultural sewer," he said. "I felt like I owned it. I even began to like its terrible smell. Every project in 'The Lagoon Cycle' bespeaks a direct and intense personal experience."

In their studio, appropriately a converted water tank on the campus of the University of California at San Diego, the Harrisons deny they are "problem solvers." "We get asked by virtually everybody, 'Are you solving our crisis?'" Newton says. "The answer is no. These problems are epidemic and need collective resolution. There will not be individual heroes. We are storytellers. Our art is about direct engagement. We engage as best we can."

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problems has been neatly anticipated in science fiction. The late Christopher Evans, author of *The Micro Millennium* (and *Omni* contributing editor), tells us how, despite the use of microfilm and other information-compressing devices, 90 percent of Earth's land surface had to be given over to data storage. Huge artificial satellites were employed, and in due course the moon, too, became a filing cabinet. Hundreds of years pass, information increases until all the planets in the solar system have their surfaces and interiors crammed with libraries and file warehouses. The story concludes with an expedition across interstellar space in search of fresh dumping grounds for Earth's files and records. On the outbound voyage, the spaceship encounters an alien space fleet coming from the opposite direction—on an identical mission.

The laser video disc could postpone that expedition considerably. If the same 10 billion bits of digital information on each side of the disc are used to code printed characters the way a computer does it, something approaching the text content of 3,200 books could be contained on a single two-sided disc. A 300-page book could occupy the equivalent of a thumbnail-sized area on the disc. On the disc one can store images of 108,000 of the world's art treasures, or the same number of images of Jupiter or Saturn taken by the *Voyager* spacecraft. Each frame has its unique electronic address; you can browse, use an index, or go directly to the specific picture you want.

Another function of the video disc begins to emerge when we consider that an author can combine the best qualities of film, full-motion video, animation, slides and print in a single format. The orchestration and interweaving of those media elements will create a new art form greater than the sum of its parts. Many subjects in an encyclopedia, too, cry out for the use of motion. Houghton Mifflin is already preparing a video disc showing birds in their natural habitat, singing in high-fidelity stereo to accompany *The Field Guide to the Birds* by Roger Tory Peterson.

Two-tracks offer additional possibilities beyond stereo sound: dual-language capability and the presentation of two levels of information tailored to different audiences using the same visual material (such as a surgeon and a surgical nurse). One consumer disc, How to Watch Pro Football, uses the two-channel stereo to permit simultaneous comments from both the offensive and the defensive coaches.

Being able to freeze and observe a single frame, and to select slow- and fast-motion forward and reverse, offers still more options. People who use a program being developed by a manufacturer of musical instruments, for example, will be able to use stop-frame and slow-motion to observe the instructor's fingering of the guitar.

But the really exciting thing about the video disc is its interactivity. The hitherto-passive viewer can become an active participant. With a hand-held keypad and the player's microprocessor, the viewer can select any chapter, any page, from an index. But this is a one-dimensional interactivity; with the computer logic on the disc you can create, for example, a kind of 3-D newspaper. Behind each headline and story is another whole newspaper, with an electronic editor at your disposal.

Part of the disc's challenge is to create, design and write the new programs that take full advantage of the medium's capabilities. But the creative process has a way to go before it catches up with the technology. Early video disc-materials designers found that the medium required new perspectives and processes; they had to keep *access* and *interaction* always in mind. They had to work against what seemed to be the grain of straight, linear process and instead had to think in terms of choices.

Once a book, say, is in the hands of a reader, the author is accessible only through the prose on the page. But with the video disc, says Random House's George Rosato, in *Publishers Weekly*, "the new technologies allow the user to become the publisher. By tradition we [publishers] represent the information source, predetermining what it was the reader would use. Technology now permits the user to have what he wants when he wants it. That is a staggering difference."

One hears a lot of talk these days about the impact of technology on people. Hardly anyone makes a speech about the impact of people on technology. But recently actress Kathleen Nolan, past president of the Screen Actors Guild, did just that at the Philip Morris Conference on Communications in the Twenty-first Century. Nolan cited a survey done a few years ago that asked children which they would give up if they had to choose between their father and TV. They chose to give up their father.

As Nolan suggests, if our technologies are to be used constructively, in support of our highest ideals, we need to cultivate some new habits: the habit of creative consciousness, the habit of freedom. She identified a peculiar subspecies of humans that has been around for a long time—who can help. Some people would even call this subspecies aliens, perhaps subversives. They include the composer, musician, painter, sculptor, scientist, architect and writer. And if we don't want to become more and more homogeneous—with less and less content in our lives—if we don't want to be a people devoid of emotion, then Nolan says we must allow this creative subspecies to teach us.

Technologists need to be concerned not only with money but with content and human ideals. And the users of technology need a creative consciousness with which to tell the difference. ∞

OMNILOG

By Geoffrey Golson

In coming months, special activities in the realms of science and science fiction will help expand our awareness of the future. *Omni*'s datebook of upcoming events alerts readers to the following.

• Space shuttle *Columbia* is scheduled for its second launch on September 30 from Pad 39-A at the Kennedy Space Center in Florida. *Columbia* will orbit Earth for more than five days with a scientific payload provided by NASA. A variety of resource and environmental observations, and tests of the remote manipulator system, are planned.

• The Orionid meteor shower on October 20 will streak the night skies with an approximate peak of 38 meteors an hour. This shower is associated with Halley's Comet, due to pass Earth in late 1985 and early 1986. Astronomers will pay particular attention to the Orionids to determine whether their behavior is altered by Halley's return.

• The Heli-Stat airship, a new vehicle combining the helicopter's maneuverability with the lifting force of a blimp, will undergo initial tests late this fall. Conceived by engineer-innovator Frank Piasecki, known for his pioneering work on helicopters, the Heli-Stat is a giant design step beyond conventional heavy-load lifters.

• Venus is this year's Christmas star. The planet will achieve its greatest brilliance on December 16.

• Wright Brothers Day is December 17, commemorating the first successful manned flight. However, the Man Will Never Fly Memorial Society will celebrate the occasion as the day the Wright brothers didn't fly first. Society members believe manned flight is an elaborate hoax. They sum up their argument with the motto, "Birds Fly, Men Drink."

SELECTED EVENTS

October 3–November 1. "Aquaculture: A World View of Seafarming" is an exhibition in Green Bay, Wisconsin, that surveys seafarming in six Asian nations and Hawaii. Subjects include fish traps in the Philippines, turtle cultures in India, seaweed harvesting in Japan, and oyster farming in Hawaii, along with presentations on aquaculture in Indonesia, Thailand, and Hong Kong. Contact the Neville Public Museum at 414-497-3767.

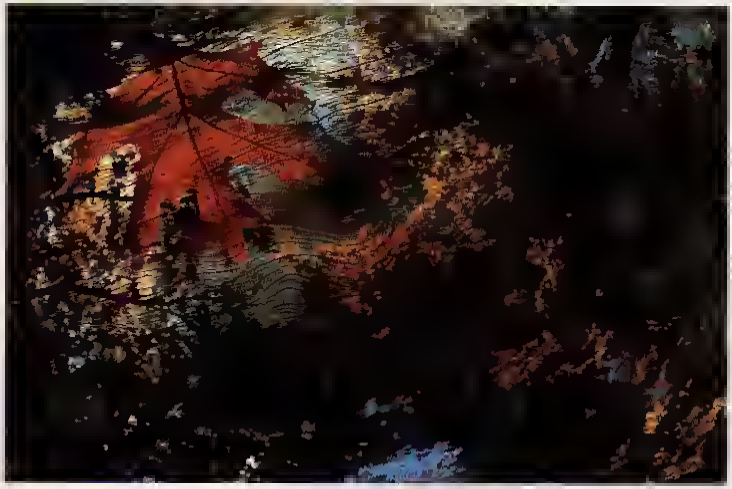
October 3–November 1. "Invisible Light" at the Maryland Science Center, in Baltimore, demonstrates the use of infrared photography in which images are produced by heat instead of light. Although infrared technology has been available since the discovery of photography, it has only recently been used as an artistic medium. Infrared photos often show common objects surrounded by halos, as if lit by moonlight. Since infrared can penetrate flesh, it reveals nature's vascular systems, producing eerie effects. Contact the Maryland Science Center at 301-685-2370.

October 5–8. Aerospace Congress and Exhibition, at the Orange County Convention Center in Anaheim, California, focuses on productivity and technology. More than 30 half-day sessions are planned. Topics include propulsion, military aircraft, space vehicles, and electronics. Exhibits display the latest advances in the aerospace industry. And the Idea Center, a photo gallery, focuses on new concepts and product applications. Contact the Society of Automotive Engineers at 412-776-4841.

October 9–11. Boucheron XII, a science-fiction convention, at Marc Plaza in Milwaukee, has a guest list that includes Joe Hensley, an American writer and circuit court judge, known for his vigorous and action-oriented suspense novels. Contact Boucheron, c/o 2009 South 93rd Street, West Allis, WI 53227.

October 9–12. Worlds Beyond '81, another science fiction convention, is slated at the Westpark Tyson's Corner, in McLean, Virginia. An art show, an amateur film contest, and a masquerade party are some of the scheduled events. Guests include Alan Dean Foster and Isaac Asimov. Contact the Virginia Association of Star Trek at P.O. Box 4042, Falls Church, VA 22044.

October 14–17. The twenty-fourth annual meeting of the Society for the History of



Autumnal equinox occurs in the Northern Hemisphere on September 22, at 11:05 PM (EDT).

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capability is squelched by adults who have a problem coping with mature children. One of my close friends is developing computer software that is competitive with similar products made by large corporations, but he can't get anybody to notice because of his age. Obviously America is missing out on something.

Examples such as the Viking and Halley funds, largely supported by young people, are commendable. Had it not been for young people wanting to grow up and be a part of the space program, there might now be a shortage of shuttle pilots. Dedication to such things begins in youth.

Joseph Hall
Plumtree, N.C.

Writer's Crutch

Many thanks for maintaining the high level of literary quality in *Omni*. I'm a subscriber who enjoys the magazine not only for its superb articles but also because it does my homework for me. As a suspense novelist, I try to keep abreast of the latest technological advances. Your publication does that in spades. It's a source book that I continually draw from.

David Shobin
Smithtown, N.Y.

Telling the Truth

I would commend James Oberg for his excellent article on UFO hoaxes [July 1981]. Photographs and stories are reprinted and exaggerated. And soon the original is forgotten history and current inaccurate articles become the "truth."

Part of the problem is that no one has the time or the money to check out all the statements. So one must rely on what he is told. Before one knows it, people are believing in talking bushes, instant healing, and reincarnation.

I would urge everyone to listen to a wide variety of views and then make a decision relying on the credibility of the information and not on what one wants to believe. It is a painful process, but a necessary one, if we are ever to find the truth.

Dean Kurath
Kennewick, Wash.

Cerebral Competition

I agree with K. C. Cole's Continuum item "Bury Them in Quarks" [June 1981]. Since cooperation between the two foremost superpowers to achieve disarmament is a remote possibility, let's compete with the USSR in the arena of science and technology. Then, instead of wasting our money and resources making useless instruments of destruction, we would be making new discoveries that would stabilize our political situation, demonstrate our superiority, and generate practical benefits for all human society.

Timothy G. Laman
Holland, Mich.

Unsung Hero

As a space historian, I am writing in regard to the "subject" of your photo in "Air Force Shuttle" [Continuum, July 1981]. The man strapped into the rocket sled is one of the most dedicated pioneers of the Space Age. Dr. (Colonel) John Paul Stapp, USAF (retired). His legendary rocket-sled rides proved that man could sustain the forces necessary to fly in space.

Since *Omni* is enlightened to the future of space, one of America's living legends deserves more than a passing word.

William Joffe Numeroff
Brooklyn, N.Y.

Inspiring Site

Ben Bova's Space column [July 1981] was appropriately entitled "It Was Worth It." Those of us who witnessed the graceful and historic landing of the space shuttle will never forget it as long as we live.

I would like to share a scene that took place before the launch which I found similarly awesome. From approximately ten miles away and against an early-morning black sky lavishly sprinkled with stars, *Columbia* stood spotlighted. It was a majestic sight. But from such a distance, the shuttle also appeared to be swallowed up by the space it was to conquer. Looking both regal and comic, *Columbia* seemed a toothpick jousting at the heavens.

Gazing upon the barely discernible *Columbia* as she stood undaunted before infinity, one could marvel at the human race and still accept our tiny, momentary, fragile place in the universe.

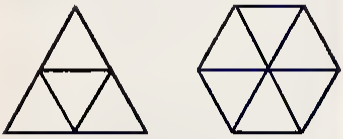
Paul Wertheimer
Cincinnati, Ohio

GAMES

ANSWERS TO GAMES (PAGE 206)

1 SWITCH Fifteen reversals. The engine pushes A into C. E returns to the main line crosses to the other side then pushes B back and couples it to A. E then draws both cars out into the right siding. E uncouples goes to the C segment and backs out to the main line. leaves B there and passes back through the right siding leaving A there. E then returns to the main line picks up B pushes it into the left siding and then returns to its original position on the main line.

2 AREA Three square units. Since the hexagon has twice as many sides as the triangle but the same perimeter each hexagon side is half as long as a triangle side. Thus the four triangles inside the big triangle are each of the same size as the six triangles inside the hexagon, so the ratio is 4 6 or 2 3.



3 TEQUILA SUNRISE There is the same amount of tequila in the orange juice as there is orange juice in the tequila. From the quart of orange juice one tablespoon of liquid has been removed. but another tablespoon of liquid has been added to it. Therefore. one quart of liquid remains in the o j container. Likewise one quart remains in the tequila bottle. Assume that *x* ounces of tequila are in the o j. Then there are 32-*x* ounces of o j in the o j container. Since there are 32 ounces of o j altogether it follows that there are also *x* ounces of o j in the tequila.

4 KANT'S CLOCK Kant started his clock running when he left his house (though of course it was showing the wrong time). When he returned therefore he knew how long he had been away. From this he subtracted the amount of time spent with Meyer (having checked Meyer s hallway clock when he arrived and again when he left). The remainder was the amount of time he had spent walking. He halved the total walking time to get the amount of time it took him to get home and added this to the time of his departure from Meyer s which told him the time at which he arrived home.

5 IS GEOMETRY DEAD? The answer to this paradox (and to Dave Phillips s maze) will appear next month.

READER ORIGINAL 1 Cyclops 2 Janus 3 Cerberus 4 gospels 5 senses 6 New England 7 menorah 8 oxygen 9 muses 10 commandments ◻◻

FILM

CONTINUED FROM PAGE 28

an electronic log. As it is shot, it is given to a film editor, who assembles each of the film strips into a near-finished sequence.

"I sit," Coppola says, "I view the screen, I talk to the screen, and the screen does what I tell it to."

The first of Coppola's computer-assisted movies is *One from the Heart*, and the system must still be tested in almost every situation where conventional filming techniques can be used. But as far as Coppola is concerned, the verdict is in. He still talks about bypassing film entirely and draws up plans to make his movies totally electronic, delivering them by satellite to moviehouses where lasers would fill the giant screens.

"I see once again," he says, "beautiful movie palaces. The only differences are that the screen will be a video display of incredible quality and that the image will come to it directly from the supplier through satellite or through various other means. The *movies* are going to be in some sort of memory bank. This sounds like spacy stuff, but it's really the truth."

Most of Coppola's developmental work, however, is in cutting the costs of making movies, not, at least yet, in changing the experience of film. Dr. Richard Vetter, technical director of the United Artists Theater Circuit (UATC), thinks that moviegoers will fill theaters expecting a new kind of entertainment. Dr. Vetter thinks that this means 3-D. To this end, United Artists Theater has over the last two years put millions of dollars into the refinement of 3-D, announcing recently that it has solved the problems that have relegated 3-D to novelty status. Vetter's system is called StereoSpace.

Though the old 3-D systems first used interlocked 35mm movie projectors running in sync to project the slightly different views that the left and right human eye need to re-create binocular vision, subsequent systems combined both images on one strip of film to accomplish the same effect. The result was that light levels, already at a premium in the old systems, dropped beneath comfortable levels and the images themselves became fuzzy.

Even though modern viewers must still use Polaroid glasses to see the 3-D effect, StereoSpace makes use of currently available film technology and improved design for its reintroduction of 3-D. "Glasses," says Vetter, "weren't the problem," and he points to filming techniques with crude equipment that made the eyes try to do things they were never meant to do. Starting from scratch, Vetter devised a new set of formulas for filming in 3-D, and the system now uses twin strips of 70mm film projected by extremely intense projector beams of light. As a bonus, the system boasts a 12-channel soundtrack.

Eyestrain, says Vetter, was the result of poorly designed optical systems for 3-D filmmaking, many of which produced films with effects that taxed the human eye. Some films, for example, had shots that attempted to make the eyes diverge, or look in two different directions, rather than converge, or "toe in," on a single object on the screen. Eyestrain produced the headaches that many 3-D filmgoers of the Fifties complained about. Thanks to careful research and design, Vetter says, the new StereoSpace films, if projected correctly, won't require that the eyes perform any tricks they're not accustomed to. "Of course," he cautions, "a considerable number of people watching a conventional two-dimensional picture get eyestrain as well, and I can't do anything about *them*."

Vetter and his colleagues at United Artists Theater (which is not associated with United Artists, the film-producing company) agree that good technology won't be enough to make StereoSpace successful. "The films," says Vetter, "must be good films in and of themselves." The marketing plans for StereoSpace make this clear. Approximately 40 theaters throughout the world (a fraction of the number owned by UATC) will be equipped to show the 70mm, 12-channel, 3-D version of a new StereoSpace film, but each film will also go out "flat" to conventional moviehouses, almost simultaneously. The StereoSpace presentations naturally will carry a higher ticket price at the box office. Vetter claims a good, though not exactly earth-shaking, response from film industry executives, but he is enthusiastic about the interest shown by both neophyte and veteran directors. The first StereoSpace feature is planned for release around Christmas, 1982. (Earlier, in October 1981, Eastman Kodak and Walt Disney Productions will introduce a similar big-screen 3-D process in the new EPCOT Future Park in Florida.)

Trumbull, who recently formed his own company, Entertainment Effects Group, has ideas about future film processes and feels that 3-D isn't the answer. He notes that some amount of eyestrain will always be a problem. The muscles that make the eyes converge are related to the muscles that focus them. This means that the eye tires as the focus—the distance between the viewer and the screen—remains constant while the eyes are continually converging and reconverging. Trumbull also believes that the 3-D effect is useless for action that takes place outside of a specific close radius from the viewer.

Stereoscopic vision developed in animals, Trumbull says, "for the purpose of relating to their immediate environment. Beyond ten feet or so, many other factors are dominant: the obscuring of one object by another, the converging lines of perspective, the velocities of objects in space. Monocular vision alone is just fine. The mind is, in fact, doing a lot of very complicated spatial computing all the time."

Instead, Trumbull is concentrating on making the projected movies more lifelike.

In his new film process Showscan the rate at which motion pictures are shot and projected is accelerated to produce a higher-fidelity screen image without the familiar flickering effect of movies

He explains "When you see a motion picture in a theater you are seeing a film that was taken at twenty-four frames per second and is double shuttered when projected to produce a flicker rate of forty eight flickers per second which is a minimum human threshold for perception With Showscan projecting seventy-millimeter film at sixty frames per second there's no flicker whatsoever and you're seeing every frame only once What we achieve is the incredible dynamic range of color film coupled with the presence of video You get a huge-screen motion picture with a live effect

To determine the factors that could enhance the film experience Trumbull ran extensive physiological and neurological tests on the system

"We shot film of identical subjects" he recalls "at frame rates of twenty-four thirty-six forty-eight sixty and seventy-two frames per second and projected them in a classic double-blind test in a laboratory situation The individuals watching the films were hooked up to electrocardiogram electroencephalograph and galvanic skin-response sensors They also answered subjective questionnaires after watching the films They didn't know that what they were seeing was various frame rates or why they were seeing the same film over and over We found that given the right subject matter and a frame rate of sixty per second the physiological response was increased sometimes five times the normal reaction to film Everything was the same Only the frame rates varied"

Paramount Pictures when it funded much of the developmental work on Showscan allowed Trumbull to produce a demonstration featurette in the process called *Night of Dreams* which has never been publicly exhibited Since Paramount won't proceed with the production and showing of the films using the process Trumbull has assumed responsibility for it He is attempting to promote special Showscan theaters in 'high traffic' areas such as San Francisco's Ghirardelli Square where people will come to watch what he likes to call 'very high stimulus sensory experiences' or thrill films Once a chain of Showscan theaters exists he thinks that full-length Showscan features might be economically practical

Some might think it foolish to try to achieve a new level of ultrarealism in the movies Why not just invent Aldous Huxley's famous "feelies"? Trumbull has already thought of that one too *Brainstorm* is the title of a film the effects artist has been working on Although it is fiction its story deals with just that "feelie" possibility and Trumbull is trying to move the film into production before someone succeeds in turning that fiction into fact

OMNILOG

CONTINUED FROM PAGE 191

Technology convenes at the Hyatt Regency Hotel in Milwaukee. Some topics for discussion are "Technology and Imperialism," "Public Visions of Technological Futures," and "Women in Technological History." Contact SHOT, Department of History, University of California, Santa Barbara, CA 93106.

October 17–18 Fortfest '81 features the Wonderplace—a magical realm of Fortean phenomena: spontaneous human combustion, Bigfoot and Nessie, people who vanish and others who appear, visions and miracles, poltergeists and occultism, psi powers, teleportation, wolf-children, relics of ancient technologies, UFOs, stigmata, levitation, antiquities and lost continents, and more. The extravaganza is topped off by a gala masked ball. Contact the International Forfean Organization, 7317 Baltimore Avenue, College Park, MD 20740.

October 19–31 A major exhibition of hundreds of paintings by *Omni* artists opens at Marshall Field's store in downtown Chicago. Some of the featured artists are Ron Miller, Vincent DiFate, H. R. Giger, Gilbert Williams, Dean Ellis, and Don Dixon. The exhibit explores a major theme: space art and several other genres, including visionary art, science-fiction art, and the art of contemporary realism. The paintings and prints will be on sale. Contact Jerry Howard at 312-781-5497.

October 23–December 5 "A Vision of the Future: the Art of Robert McCall" is a major retrospective with new works by a leading space artist often showcased in *Omni*. The 200 pieces of science, science-fiction and fantasy art make up one of the largest one-man exhibitions of this kind ever assembled. Famed for his work on *2001: A Space Odyssey* and for his *Cosmic View* mural at the National Air and Space Museum, McCall continues to document and foresee the Space Age. Contact Scottsdale Center for the Arts in Scottsdale, Arizona, at 602-994-2301.

Until October 25 "Edison and the Electrical Age" is an exhibition in Carterville, Illinois, honoring the invention of the incandescent light bulb. Electrical artifacts and period photographs set Edison's work in historical perspective. The development of electrical power is chronicled from a simple system run by one man to an increasingly large and complex network. The exhibition also traces the Wizard of Menlo Park's career from wandering telegrapher to world-renowned inventor. The light bulb is explored in detail with several experimental bulbs and filaments on display. Contact John A. Logan Community College at 618-549-7335.

Until October 25 "Jupiter and Its Moons" is a presentation in Canfield, Ohio, of transmissions received from the two Voyager missions that passed Jupiter in 1979. Some of the most stunning imagery yet to come from deep space is enhanced by new data on Jupiter and its satellites. The exotic discovery of a new moon, the detection of the suspected Jovian ring, and the finding of active volcanoes on Io and the incredible turbulence surrounding the Great Red Spot are some of the exciting aspects of the Voyager project. Texts by Dr. Robert Wolfe, a geologist at the National Air and Space Museum, project the elation of the Voyager missions. Contact Farragher Marketing Services at 216-533-3347.

October 31–November 29 "Biological Photography," in Kansas City, Missouri, captures and preserves significant biological events for present and future study. The 50 black-and-white and full-color photos afford the viewer a glimpse of biomedicine and a look through the microscope. Subjects range from crystal photomicrography to sand crab portraits. Contact the Kansas City Museum at 816-483-8300.

After November 1 "Aerial Aircraft Carriers" is an exhibit at the National Air and Space Museum depicting, through film footage and photographs, attempts to use aircraft (including balloons and airships) to carry other aircraft. Contact the National Air and Space Museum in Washington, D.C., at 202-357-1552.

Continuing "The Place Called San Mateo," at the Coyote Point Museum in San Mateo, California, presents a new concept in environmental/educational displays. The multilevel exhibition follows ecological principles through such ecosystems as marshes, coniferous forests, chaparrals, broadleaf forests, grasslands, and coastal regions. The program evaluates the impact of man and industry on nature's cycles and rhythms. Contact the Coyote Point Museum at 415-342-7755.

Deadline December 1 An opinion survey is being organized to determine whether the publishing industry is underestimating the tastes and interests of science-fiction readers. *The Patchin Review*, a new magazine of SF commentary and criticism, wants to know what readers value most. Are book editors serving their needs? If not, what's wrong? Anyone interested in answering those questions should send his or her answers (up to 500 words, typewritten) to *The Patchin Review*, Department O, 9 Patchin Place, New York, NY 10011. The most noteworthy essay will be selected by prominent persons in the SF field and will be published in full. Each entry must be accompanied by a stamped, self-addressed envelope.

December 14–16 The fourth Miami International Conference on Alternative Energy Sources provides the latest information on the search for new, clean, and abundant energies. The event, held in Miami Beach, Florida, includes sessions on synthetic fuels, wind energy, hydropower, tide power, nuclear fusion, ocean-thermal energy, wave energy, and coal gasification and liquefaction. Contact Clean Energy Research Institute, University of Miami, P.O. Box 248294, Coral Gables, FL 33124. ∞

EXPLORATIONS

CONTINUED FROM PAGE 40

occurred in 1975, destroying a school and the marketplace of a nearby village. Its slopes are covered with sand and ash. It has also been growing in recent months and in January of this year began to tilt to one side after a small eruption. It is constantly smoking.

Fuego is accessible to climbers, though as is Pacaya, Guatemala's smallest (2,250 meters) and most often scaled volcano. Pacaya is particularly feisty during December and January, spurting lava and fire, producing a red glow in the night sky in nearby Guatemala City. On February 18, Sanchez first noticed a dome emerging from the old Pacaya crater. The cone is now at least 50 meters in height, with a base 70 meters around.

It is even worth trekking to the top to see this red inferno and to hear the cellophanelike crackling of rock collapsing under intense pressure. Take a reliable guide and equally trusty four-wheel-drive vehicle. Make sure the front-wheel drive is working particularly well, since you'll be climbing steep gullies strewn with pumice and age-old chunks of sharp lava. Pack a couple of spares, too. Volcanic rock will bald tires faster than you can say *Chichicastenango*. Start out around 6 A.M. and take the road near Lake Amatitlán. You can make the ascent by car in an hour with about 20 minutes more by foot to the top. Clouds appear by 3 P.M., and unless you're packed to spend the night, you'll want to head down the mountain. Also, it's best to climb during the dry season—November to May—and avoid the mud and heavy erosion.

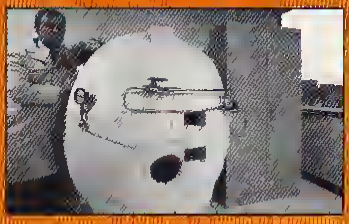
Another volcano popular with climbers is Agua (3,766 meters), which has never erupted. You can climb Agua in two hours from the village of Santa Maria de Jesus, 15 kilometers south of Antigua. From its summit there is an excellent view of most of southern Guatemala.

Unquestionably the most beautiful spot in the country is Lake Atitlan, two hours into the mountains west of Guatemala City. Surrounding the mile-deep lake are three volcanoes—Atitlan (3,500 meters), Tolimán (3,025 meters), and San Pedro (2,975 meters). Each can be climbed in a day. Detailed maps of the region are easily obtained from the Instituto Geográfico Nacional, Avenida Las Americas 5076, Zona 13, Guatemala City.

Apart from abundant wildlife and romantic sunsets such as can be found elsewhere only in Portofino or at Lake Como, there is hang gliding from the volcanoes, wind surfing on the 18-kilometer-long lake, and black bass fishing. Tourism is oft considerably and so Lake Atitlan is especially idyllic. Despite what you may read in the *New York Times*, the distant rumbling on the horizon is not apt to be caused by heavy artillery. There are no guerrillas in sight. ∞

NEXT OMNI

BLIMPS



MR. HYDROGEN

WITCHES

MR. HYDROGEN—You can drink the exhaust of the mail trucks in Independence, Missouri. That's because Roger Billings has converted the engines of these trucks to run on hydrogen. Not only do engines that use hydrogen produce water as a by-product, but they deliver more energy per pound than any other fuel, synthetic or otherwise. Billings leads the vanguard of the hydrogen-power movement, telling people all across America how to convert their car, house, helicopter, or boat to hydrogen. There's even a town in Iowa that's using his ideas to become the first hydrogen-powered community. Learn in the November issue of *Omni* how this abundant resource could make this country energy-independent by the year 2000.

ERICA JONG'S WITCH HUNT—Why do people become witches? What do witches do? What are their rituals? Witchcraft, an ancient religious practice, still remains shrouded in superstition. Erica Jong, the best-selling author of *Fear of Flying* and *Fanny*, clears up some of the mystery with a probing look at this still-thriving religion in her new book, *Witches*. We present a special Halloween excerpt in our next issue.

THE BLIMPING OF AMERICA—What's faster than a speeding truck, able to lift huge cargo loads and haul them 10,000 miles without stopping, cheaper to operate than jet planes? Look up in the sky. The airship is coming back. Next month *Omni* previews a new fleet of dirigibles and helicopter hybrids. Rising from the ashes of the *Hindenburg*, these graceful workhorses of the sky will carry many burdens from tree trunks to missile-tracking gear to tourists in search of Old World ambience.

AGENT X—Conceivably responsible for many unexplained diseases ranging from diabetes mellitus to multiple sclerosis, agent X, or slow virus, is a bizarre mutant that changes form from one generation to the next. Scientists hot on its trail say that it may not even contain a single drop of nucleic acid, the substance that codes for the transmission of genetic information in every other form of life. To learn more about the furious search for this deadly particle, read next month's *Omni*.

SCIENCE FICTION—In November Robert Silverberg returns with "The Soul Painter and the Shapeshifter," a story about a burned-out artist who seeks peace and instead finds himself profoundly unsettled by a forbidden love. Gardner Dozois and Jack C. Haldeman II paint a very believable picture of life in New England after the Big One. In "Executive Clemency" Damon Knight tells what it's like to live "Forever."

SPACE

CONTINUED FROM PAGE 24

even make us once more an energy exporter. Space resources and energy could then be used to take the pressure off many international conflicts.

Our ability to locate Earth's resources, assess crops, and detect pollution from space is already well demonstrated. So are the military uses of satellite-borne sensors. The deployment of more sophisticated resource-sensing systems can improve national defenses and help us make the best use of the resources on this planet.

Our ability to monitor the environment from space will give us the knowledge to make sensible use of our planet while avoiding pollution and ecological damage. An abundance of cheap, clean energy from space will make it economically possible to clean up the pollution we have already created. We need only seize the opportunity.

Long and detailed studies have shown that it is within our technological ability to place solar-power satellites in geosynchronous orbit and have strongly suggested that this is an economical source of electrical power. Within 25 years solar-power satellites could begin to fill our need for energy. If we pursue space-based solar power with enough vigor this country could begin to export energy to the world within the foreseeable future.

Space industry can best be developed by establishing a space station in low Earth orbit. This program should be expanded to include facilities for space manufacturing and for mining the moon and the asteroids, lunar bases, and the permanent settlement of space. This aggressive effort is more than justified by the industrial promise of space resources and zero-gravity manufacturing.

Yet for the past decade and longer our technological lead in space has dwindled constantly. While NASA has struggled with shrinking budgets, the Soviet Union has spent $15 billion to $20 billion per year to establish a permanent manned space station, develop a small space shuttle, bring antisatellite weapons to readiness, and pursue other critical objectives.

A study of the space programs of foreign nations, both friendly and hostile, makes it clear that the United States is rapidly losing the competitive edge we once enjoyed in space. A strong commitment to space development is vital to our national strategic position in a fast-changing world.

This is the challenge and opportunity facing your administration. The United States can develop the space frontier within a budget the nation can afford. By turning American private enterprise to this task, you can rebuild our nation's leadership in space, strengthen our economic and military posture, and show the world that once again we are in command of our own destiny. ΩΩ

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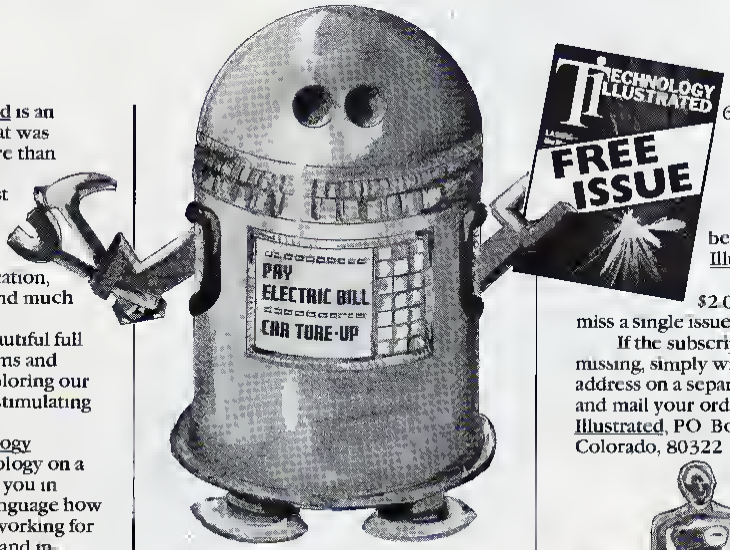

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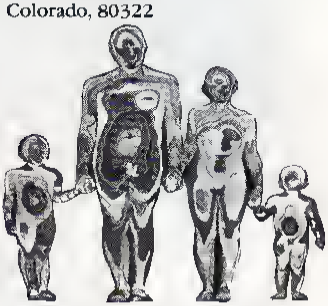

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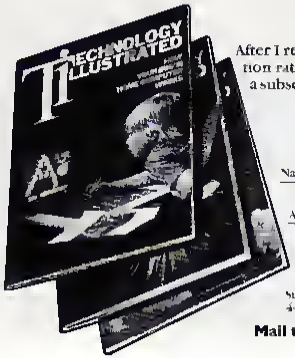

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mind

CONTINUED FROM PAGE 26

at Fort Bragg, North Carolina, asserts that biting is not part of the training, but he would recommend it highly in hand-to-hand combat. Some rape counselors and self-defense instructors say that biting is an effective tactic against an assailant.

Biting may be more acceptable as a fair way of fighting in some societies than in others. "In the United States biting is not considered cricket," Marr says. "But perhaps other societies think biting is fair in love and war. There is a Chinese saying: A jealous woman has sharp teeth."

Different groups of people may have different reasons for biting, says Dr. Allan M. Beck, a former colleague of Marr's in the Health Department and currently the director of the Center for Interaction of Animals and Society in Philadelphia. "Young adult males between twenty and thirty years old are usually the aggressive biters," he says. "Those are the most aggressive years for everything. They get killed the most in cars, they get killed the most in homicides, and they bite one another the most. Then we have a group of younger people who bite probably more in play. Much of play in primates is preliminary exercise for adult activities, including aggression, and that's why children play with guns and Barbie dolls. Adult humans bite, too, if someone is punching them or trying to grab their throat. Cops in scuffles receive a lot of knuckle bites. Mental-health workers and dentists get bitten, too, and for obvious reasons."

Psychoanalysts consider biting behavior as a regression to the oral stage of child development. For children the mouth is also an outlet for aggressive feelings. By the time children reach the age of two, however, they have usually learned that biting is not civilized, so they choose to kick and punch instead. "We all retain characteristics of the oral stage," says the noted psychiatrist Emmanuel Tanay. "So all of us bite. Some people bite their nails, some bite into pencils. Sexually stimulating bites are considered normal, as are those made in self-defense. It becomes aberrant behavior however by the quantity of the biting and by the nature of the object bitten."

Health officials hope that by drawing attention to the problem, people will come to understand the seriousness of human bites. Marr suggests that a systematic examination of the reports of human bites might even serve as a useful index of aggressive and pathological human behavior. "For example," Marr says, "it might point out where a lot of the fistfights are occurring, so that the city could allocate more policemen to patrol those areas."

To forensic scientists, bite marks can sometimes be as valuable as a fingerprint. Because no two persons' teeth appear to be exactly alike, a suspect's dental pattern can be damning evidence. Two years ago, bite-mark evidence led to the conviction of Theodore Bundy, who was accused of bludgeoning and strangling two women students at Florida State University. A faint bite mark had been found on the buttocks of one of the women.

Bite marks are common not only in sexual homicides but in child-abuse homicides as well. "Nearly one fifth of all the children who come to autopsy in New York City have been cannibalized or bitten prior to death," says psychiatrist Judianne Densen-Gerber, J.D., president of the Odyssey Institute, an international public-health-advocacy organization. "We wonder about the children who survive such attacks, those who have had experience after experience of a parent losing control. I have seen enraged parents growl and grit their teeth. Some people really do act like dogs."

From a strictly evolutionary point of view, man's teeth may well be regarded as his oldest weapon. Through the ages combatants drew farther and farther apart as knives gave way to swords, as swords grew longer and as guns became more accurate. And biting became less common. The caveman and cavewoman probably did more biting than we do. "I have no doubt they did," Dr. Beck says. "Apes and monkeys are evidence of that. In fact, I'm sure that if we were to give our monkey friends handguns, they would bite less, too."

FORUM

CONTINUED FROM PAGE 14

Byzantine materials should have been found somewhere in Marea the later Roman Christian era is a known part of its history But that specific site was not expected to be Byzantine and Professor Fakharani was definitely surprised when we found that it was

Finally the matter of controls There is a limit to what any general-circulation magazine can be expected to print The article in Omni *is a popular presentation of a complex subject and necessarily not as complete or in depth as a research paper Indeed it was cut almost in half from the length submitted and then substantially edited again to fit the magazine's tight space requirements However I feel it presented a sufficiency of the actual psychic's words and made quite clear that everything was filmed and taped and observed by independent—to say nothing of hostile—observers There is a full archival record of the entire process and I have presented two research papers covering the work*

Perhaps the somewhat controversial nature of psychic experiments of this type may cause Dr Hyman some discomfort Whatever the motivation I welcome the opportunity to clarify any confusing points and thank Dr Hyman for his concern and his attention to detail

Rhythm and Swing

The Continuum item regarding Fertilitron devices [July 1981] claims that by monitoring electrical changes during ovulation a woman could determine when she would be able to become pregnant However the article overlooks the fact that sperm introduced into a woman's body during a nonfertile day can easily survive several days and thus remain present to fertilize an egg during a fertile day

A woman using a Fertilitron device would still have to monitor her fertile and nonfertile days very carefully to discover her body's own rhythm and she would still have to plan for a significant number of days of abstinence or the use of another method of birth control Finally Fertilitron device users would probably experience the same failure rate as today's method users do I hardly think that this augurs much of an advance in birth control

Joi Cardinal
Granada Hills Calif

Sunny Side Up

I thoroughly enjoyed the excerpt from Gerard K O'Neill's *2081* [May 1981] but O'Neill makes a slight mistake with respect to the relay of electrical power from the SPS (solar-power satellite) in geosynchronous orbit Though it is true that such a satellite will remain largely in the sunlight there are certainly times of the year when its orbit will lie in the earth's shadow (e g the middle of spring and fall) My calculations for a one-year period show this to be roughly 3 4 percent or 12 5 days Since this time is mostly concentrated in a small period it seems that some type of storage system will indeed be required but the SPS still compares quite favorably with the land-based collector

Eric A Howell
Wichita Kan

If you check G Harry Stine's Space column Power Orbiter [April 1980] you'll see that the SPS concept calls not for a single satellite but for many evenly distributed around the earth Therefore those days when a satellite lies in the earth's shadow the total system capacity would be cut only slightly and no storage would be needed —Ed

Cartoon Condemnation

Often it's the dumb little things that really hurt

There are more than 20 million Americans with epilepsy who wake up each day hoping for just an iota more of an understanding of their problem To most of these people having others understand their disorder is more important than the physical/neurological effects of their epilepsy It is the prevalence of ignorance among their families friends teachers employers even physicians that leads to big problems such as unemployment high-premium insurance archaic laws and worst of all a deep hurt that comes from the social stigma of being afflicted Epilepsy is not the least bit amusing

The cartoon in your June issue [page 110] was insensitive tasteless and from my viewpoint as an epileptic harmful Certainly it was not funny

Sy Dordick
Chicago Ill

It is not the seizures of epileptics that are disabling but society's reaction to them Ignorance and misunderstanding result in high unemployment for epileptics as well as psychological and social-adjustment problems and conflicts

Public-education campaigns have been waged to change these attitudes toward persons with epilepsy The cartoon in the June issue will serve only to undo the strides that have been made in reeducating the public and in changing the public's perception of epilepsy

The Epilepsy Association of Maryland
Baltimore Md

Bill Lee *Omni*'s humor editor replies *The cartoon on page 110 of the June issue was not appropriate to the style or content of* Omni *magazine and we feel that we owe our readership a public apology We've unintentionally offended members of our audience It was a mistake an error that will be corrected through your invaluable responses to our publishing efforts We are indebted to you for your concern for the contents of* Omni

Puzzle classics
and an amazing maze

GAMES

By Scot Morris

As *Omni* lights the third candle on its birthday cake we pause to reflect on the significance of the number 3 It is to be sure the number of the Holy Trinity and of the spatial dimensions in which we find ourselves embedded It is the number of the primary colors and of the three square meals It is the number of the simplest plane figure the triangle and of the simplest board game tic-tac-toe Three is the only number that is the sum of the numbers that precede it

John Atherton was so taken with threes that he was inspired to commemorate them in rhyme (with apologies to Joyce Kilmer)

THREES

I think that I shall never c
A # lovelier than 3,
For 3 < 6 or 4
And than 1 it's slightly more

All things in nature come in 3s
Like s trios Q E D s
While $s gain more dignity
If augmented 3 x 3 —

A 3 whose slender curves are pressed
By banks for compound interest,
Oh would that paying loans or rent
My rates were only 3%!

3^2 expands with rapture free
And reaches toward ∞,
3 complements each x and y
And intimately lives with π

A ⊙'s # of °
Are best – up by 3s
But wrapped in dim obscurity
Is the $\sqrt{-3}$

Atoms are split by men like me
But only God is 1 in 3

PUZZLE CLASSICS

Following are a few classic brainteasers As with most recreational problems printed in this column the answers are usually simpler than they at first appear to be Long tedious calculations are not as important as insight and finding the right shortcut

That is not to say you can't solve the problems any way you like Simplicity is in the eye of the solver as pointed out in this anecdote recounted by Ivan Schuller of Evanston Illinois and quoted in James Fixx's *More Games for the Superintelligent*

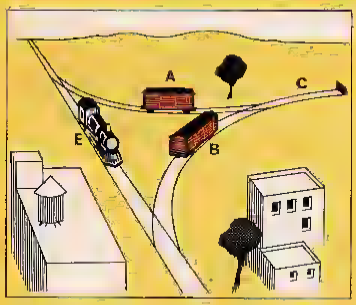
The following question was put to the distinguished mathematician John von Neumann by one of his students "Two cyclists start simultaneously from the two ends of a one-hundred-mile-long road They bicycle at a speed of forty miles per hour At the moment they start a fly leaves one of the bicycles and starts flying back and forth between the two cyclists until they meet If the fly travels at sixty miles an hour how many miles does it fly before the cyclists meet? One should not of course try to add up the infinite series All you have to do is figure that the cyclists meet in an hour and a quarter and that the fly

A MAZE-IN PLANET Here's a perceptual maze designed and drawn by Dave Phillips Without the typical bewildering array of pathways seen it's unlike any other maze we have ever seen The object is to make the man on top walk to the position of the man on the bottom (or vice versa it can be done either way) by the shortest route Keep track of which side of the pathway you are on Don't cross edges The ends of spirals are dead ends Look easy? Try it Answer next month

travels 75 miles in that time When von Neumann heard the problem he instantaneously gave the right answer His student said "It is very strange but everybody tries to add up the infinite series " 'What do you mean "strange"?' von Neumann replied That's how I did it

1 SWITCH This is probably the best known of train switching problems As shown in the diagram E is an engine on the main line It has couplers on both its front and back A and B are boxcars on the two sidings Segment C can accommodate only one boxcar or the engine The engine can couple at either end

The problem By means of the engine switch the positions of the boxcars—move B to A and A to B—and return E to its original position What is the minimum number of times the engine will have to stop and reverse directions in order to accomplish this?



2 AREA An equilateral triangle and a regular hexagon have perimeters of the same length If the triangle has an area of two square units what is the area of the hexagon? Unless you're a budding Von Neumann, it isn't necessary to calculate areas and then divide That's the hard way

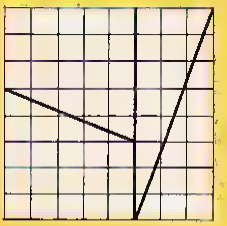
3 TEQUILA SUNRISE You have a quart of orange juice and a quart of tequila Take one tablespoonful of orange juice transfer it to the tequila, and mix thoroughly Then take a tablespoonful of this mixture and pour it back into the orange juice Is the amount of orange juice in the tequila greater than less than, or equal to the amount of tequila in the orange juice? (Note There are 64 tablespoonfuls in a quart)

4 KANT'S CLOCK It is said that the philosopher Immanuel Kant was a man of exceptionally regular habits He particularly liked to have his grandfather clock set at exactly the right time One day he was distressed to find that his clock had run down Evidently his manservant had forgotten to wind it Kant couldn't reset the hands because his watch was at the repair shop and he had no way of knowing the correct time That evening he walked over to the house of his friend Meyer a mile or so away for their weekly chess game Kant always walked at the same steady pace though he had never taken note of how long this journey took him He glanced at the clock in Meyer's hallway when he arrived played several games of chess then returned home He walked along the same route by which he had come with the slow regular gait that had not changed for years He had no idea of how long his trip took When he arrived home he immediately set his grandfather clock correctly

How did Kant know the correct time?

5 IS GEOMETRY DEAD? Old Man Skinner spilled ink on his favorite rug The damaged area is a rectangle exactly 5 inches by 13 inches The best matching carpet remnant he can find is an 8" × 8" square He asks his son Potter to cut the swatch so it will fit the hole Potter who is studying geometry at the state university, tells his father that the task is impossible There is no way that 64 square inches (8" × 8 ") can be rearranged to make 65 square inches (5" × 13') Old Man Skinner never went to college and doesn't believe in geometry, so he cuts up the square into four pieces as shown below at top and stitches them back together into the 5" × 13" rectangle at bottom with which he patches the rug When young Potter sees this he decides that mathematics is not the exact science his professors have been telling him it is Disillusioned he drops out of school to become a balloon vendor

Is there anything wrong with the old man's solution? Answer next month



CORRECTION For the Jealous Cross puzzle last month there is a solution requiring only 9 crossings (rather than 11) (1) A and A's wife (Aw) cross (2) Aw returns, (3) B and C cross (4) C returns (5) C and Cw cross (6) Cw returns (7) Aw and Bw cross (8) C returns (9) C and Cw cross

READER ORIGINAL ($25) Thomas Henken of El Monte California asks you to solve the scrambled anagrams below and put the resulting words in a logical order not alphabetical *goynex neesss hamrone juans, sploccy, nneatmmmscod ssuem wageeldnnn* (two words), *solgsep, breesuc* Hint Each word fits into a numerical sequence (3 correct = good 7 correct = excellent)

Answers on page 193

STARS

By Patrick Moore

Icarus is an unusual minor planet or asteroid. It is famous because at its perihelion it passes inside the orbit of Mercury and is red-hot. At its aphelion it moves out beyond the path of Mars and is ice-cold. It may have the most uncomfortable climate in the whole solar system.

There are some asteroids that are known as Earth grazers because they may come ominously close to us. In October 1937 Hermes, a true midget only about a mile in diameter, scraped past at a mere 485,000 miles, which is less than twice the distance to the moon. Icarus does not come as close as that, in the current epoch, but theoretically it could. A Massachusetts Institute of Technology study describes the various countermeasures we might take if we found Icarus (or a similar-sized body) on a collision course with Earth.

Obviously there are only two possibilities. Either destroy the asteroid by nuclear explosion, or else deflect it from its course. But what are the chances of our being hit, and what kinds of objects might hit us?

Asteroids head the list, and they must occasionally hit the earth. Sir Fred Hoyle's latest theory is that such an impact long ago triggered the Ice Age. He believes this will eventually happen again, so we had better take prompt precautions by keeping the oceans well stirred and preventing very cold water from accumulating at the bottom. (This sounds like science fiction. So did Arthur C. Clarke's scheme for setting up communications satellites when he first proposed it in 1945.)

Ice Age or no Ice Age, asteroid impacts are inevitable. Bear in mind that all the asteroids able to depart from the main swarm are very small and would be unable to shatter the earth, but they could certainly do immense damage. If an Icarus-sized object landed in the middle of England, for example, there would be little left between the Scottish border and the Isle of Wight.

But can we differentiate between an asteroid and a meteorite? I am not at all sure we can. Probably both represent debris left over when the main planets were formed, between 4.5 thousand million and 5 thousand million years ago. The object that hit Arizona about 22,000 years ago, producing the magnificent Meteor Crater that we see today, could be put into either category, though it was certainly smaller than Icarus. (Incidentally, the name is wrong. It is always called Meteor Crater, but it really ought to be Meteor*ite* Crater, there is a great deal of difference between a heavy iron or stone meteorite and a tiny, friable meteor.) Wolf Creek, in Australia, is another impact site. I am not sure about others given in the official lists; the Vredefort Ring, in South Africa, is definitely a vulcanoid, and the Canadian Shield craters are suspect. Then there was the 1908 missile that hit Siberia and blew pine trees flat over a wide area. Informed opinion now inclines to the view that the culprit there was an icy nucleus of a small comet.

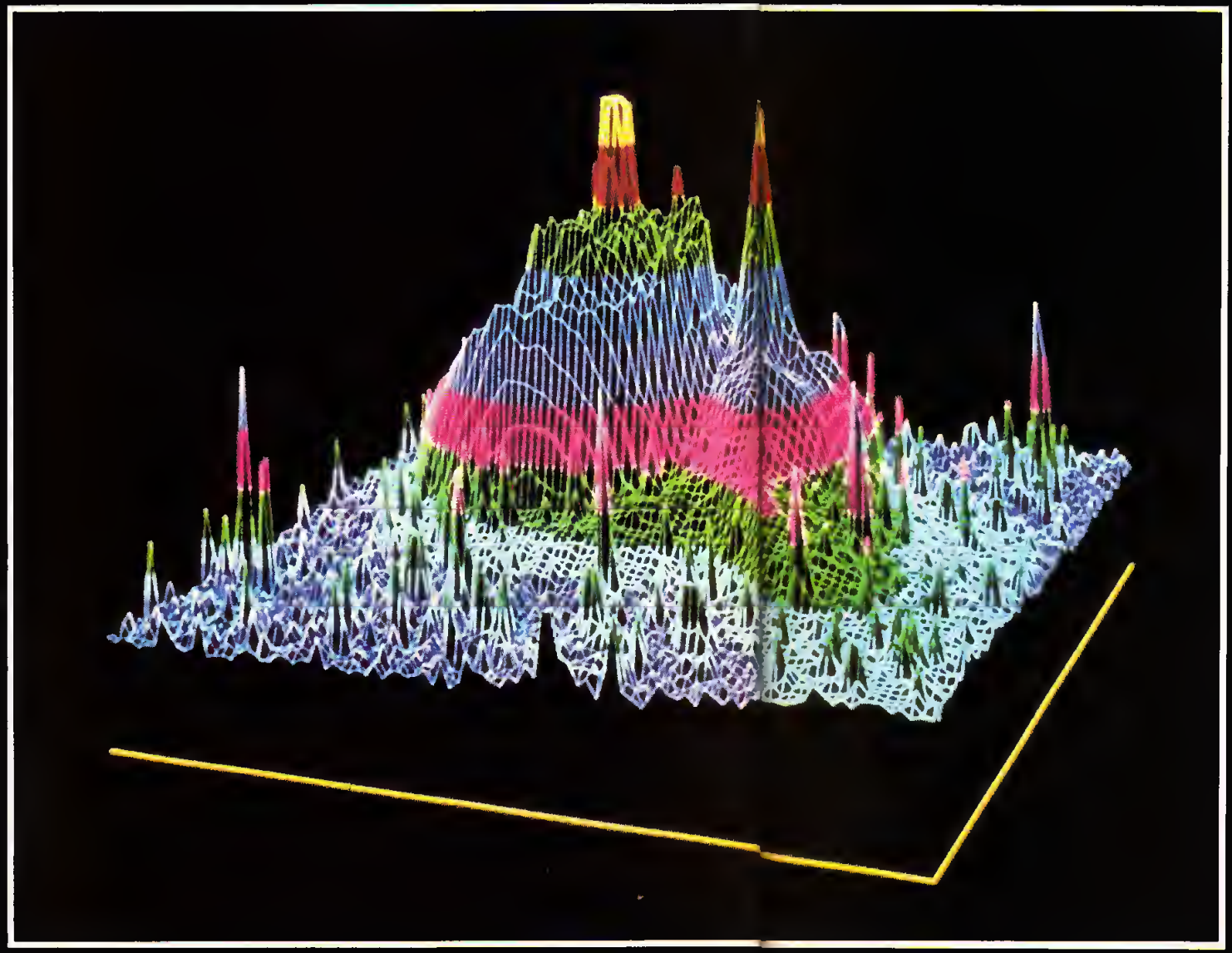
And yet comets, those bugbears of ancient times, are flimsy by any standards. Going through a comet's tail will do us no harm at all. It happened in 1861, and again in 1910, absolutely no effects were detectable. (*En passant*, we will be well out of the way of Halley's Comet when it comes back in 1986, and really brilliant comets have been much rarer in the twentieth century than they were in the nineteenth.)

All these speculations deal with objects we know. When we consider bodies coming from much farther afield, we are on less secure ground.

Apart from the sun, the nearest stars are those of the triple Alpha Centauri system, at 4.25 light-years; then comes Barnard's Star, at 6 light-years. If there are any stars closer than those, it is fairly certain we would have found them by now. (Some years ago there was a flurry of excitement when O. J. Eggen announced the detection of a dim star that could be closer than Alpha Centauri, but this proved to be wrong. Eggen's Star does not even make the list of the closest dozen.) There is absolutely no chance of a luminous star threatening us in the foreseeable future, and the stars are so widely spread out in the galaxy that near encounters can hardly ever occur, at least in our part of the galactic system.

CONTINUED ON PAGE 212

Comets, asteroids, meteors, black holes, and dwarf stars are potential dangers to Earth



PHENOMENA

The Whirlpool Nebula, a complex double galaxy in the constellation Canes Venatici, is portrayed by computer in three dimensions like a bas-relief map of an alien landscape. Height represents brightness, and colors depict varying levels of intensity—ranging from soft purple and building to strong yellow. Galactic centers are represented by the two peaks and individual stars are shown as spikes in this single frame from an experimental film on the physical structure of galaxies. Susan Bunker, of Los Alamos National Laboratory, in New Mexico, and other scientists used sophisticated computer technology to present complicated astronomical data in this simplified format. The cosmological information was first digitized by computer and displayed graphically on a video terminal. Then, with an FR-80 COM (Computer Output Microfilm) camera, the image was photographed and processed. The result is a stunning visualization of a once-obscure part of the cosmos.

STARS

CONTINUED FROM PAGE 206

So far as solar-type stars are concerned, we are modestly confident that we know what will happen to them in the end: even if details of the process still remain to be worked out. At present the sun is a main-sequence star, using hydrogen as its fuel and building up helium. When the hydrogen (or, more accurately, the immediately available hydrogen) is exhausted, the sun will swell out while the core shrinks; eventually various other reactions will be triggered, and the sun will go through the planetary nebula stage before becoming a small, very dense white dwarf, shining feebly and perhaps still orbited by the ghosts of its remaining planets.

Accounts of stellar evolution generally stop there, but even a white dwarf cannot last indefinitely, and the black dwarf end product is inevitable. But it does take a very long time, indeed, and there have been doubts expressed as to whether the universe is old enough for any black dwarfs to have developed yet. If they have, there would be no way in which we could detect them. They would emit no light, no heat, no radio waves—nothing.

If such a stellar corpse did invade the solar system, we would know of its approach long before we could actually see it, because its mass would be comparable with that of the sun, and it would cause marked perturbations in the planetary orbits. The damage it would do, if it came into the inner part of the system, would be incalculable, and we have to remember that even minor changes in the earth's path would be disastrous so far as we are concerned; we survive at present only because we are at exactly the right distance from the sun. Certainly the invasion of the solar system by a black dwarf would be horrendous, and there would be nothing we could do about it.

The odds against the approach of a black dwarf are extremely slight, but they are not absolutely nil.

Then there are the black holes. According to theory, a black hole is the result of the gravitational collapse of a very massive star. In the end not even light can escape from it, and the old star is surrounded by a region that is virtually cut off from the rest of the universe. Cygnus X-1 is the classic example. But black holes of this kind are so massive that we would have detected anything of the sort if it were even reasonably close to us. Small black holes may be different: there was once a suggestion that the Siberian event of 1908 was due to a tiny black hole that went right through the earth and came out the opposite side.

The chances of our being used for cosmical target practice from beyond the solar system seem too slim to bother us. But I wonder just what we would do if an Icarus-type asteroid loomed up and showed signs of collision. ∞

LAST WORD

By Spider Robinson

"If there is an afterlife, we'd learn how to qualify for a good seat. If not, we could save the time now wasted on prayer. We might even embrace ethics for its own sake."

You have just finished reading an issue of *Omni* devoted to exciting new breakthroughs, extant or imminent. You'll be feeling optimistic. We may live forever! We may go to the stars! Why, we have even, by becoming a mobile, rootless society, managed to cure (or at least radically alleviate) the mother-in-law: is there nothing mankind cannot do?

Perhaps it is time to consider some of the breakthroughs you are *not* likely to see, come Heaven or low water.

Whether the failure of these breakthroughs to appear constitutes a bad thing is, of course, a subjective matter that could be argued both ways. A cure for the common cold, for example, would be an obvious disaster for the facial-tissue and cold-tablet makers. But would it really be a boon for the rest of us? What would we use as an excuse for absenteeism, broken dates, and general laziness? I don't know about you, but I'm not at all sure I could get along *without* the common cold. Similarly, Louis Pasteur created skid row by making cheap wine possible with pasteurization. They call it a breakthrough because something breaks.

And so, for each of the following breakthroughs you'll probably never see, I offer arguments both ways. Remember: Silver is usually found thinly plated around large, dark clouds.

Intelligent tooth care. Current dental technology is full of holes. Fighting bacteria with drills is as silly as rousting out termites with dynamite. A genetically tailored bacterium that eats plaque and excretes enamel, or a plaque-dissolving mouthwash, would afford a more elegant solution.

Conversely, a cure for caries would wreck the housing situation or, rather, complete the wreckage. These days only dentists can afford to build and operate apartment buildings.

Rationally designed bathrooms. There are thousands of devices on which to place buttocks swaddled by clothing, most such are at least marginally comfortable. The least comfortable design possible is the only one available for the bare fanny. It enforces an unnatural posture, placing undue strain on the parts it is meant to serve. It is spectacularly impractical as a urinal for men. It wastes gallons of water, methane power and fertilizer. As for the uncomfortable, eel-slippery, impractical killer device we call a bathtub, there is no excuse.

And yet a real bathroom breakthrough could banish culture to the outhouse. People spend too much time on the throne already; make it comfortable and they'll never leave.

Rationally designed kitchens. Count some of the ways kitchens could be better. Refrigerators ought to be horizontal, like a cigar box, instead of vertical, like a closet. Existing models spill money on the floor every time you crack open their doors. And how about oven doors that roll up from the bottom? Shouldn't ovens have controls that don't require you to place your arm over an open heat source? Why do a heat producer and a heat-waster stand side by side, unconnected?

But before kitchen designers go back to the drawing board, consider: If we stop wasting energy, we not only damage the power sellers but also end up with excess disposable income that can only tempt us into sin and self-indulgence.

Rationally designed automobiles. Someday Detroit may give us some of the small, obvious improvements a five-year old could think of, like a gas gauge that lights up when it hits empty or a fireproof ashtray sunk into the dash above the speedometer, where you can use it without taking your eyes off the road. It is even possible that we'll see frills like real crash restraints: carburetors that burn alcohol and yield water and carbon dioxide; a solar-roof-powered air-conditioning system that works best on sunny days, even while the car is parked. But I don't think we will ever see a car streamlined underneath, where it doesn't show; or a universal, infinite range transmission; or bumpers that work, at standardized height, deployed *all around* the car (we design bumper cars better than real ones).

On the other hand, they're only going to fall apart in a couple of years anyway. Besides, if cars get better and safer, the repairmen, the insurance industry, physicians, parts dealers, junkyards, cabdrivers, tow-truckers, and morticians will all suffer. And raise their prices to compensate.

Hard evidence for or against life after death. If we *knew*, we could plan more intelligently. If there is an afterlife, we'd learn how to qualify for a good seat. If not, we could save a lot of time now wasted on prayer and worry. We might even embrace morals and ethics for their own sake, rather than under duress.

This silver lining, too, would have its cloud. If we prove there is an afterlife, impatient people will skip out on us. If we disprove it, a wave of hedonism will engulf the world. People would never behave ethically without the carrot of Heaven and the stick of Hell. Worst, hard evidence on this would demolish either all major religions or all but one, and the resulting redistribution of wealth would wreck the global economy. Unless, of course, true believers simply ignore the evidence.

By now you may detect a pattern. As a species, mankind is a bit too farsighted. The quasar and the quark are carefully observed and seriously thought about. We devote much time and energy to the unimaginably vast and the incomprehensibly small. Our great thinkers probe the forces that bind and order the universe.

It is only the fundamental aspects of our daily lives that we tend to ignore. ∞