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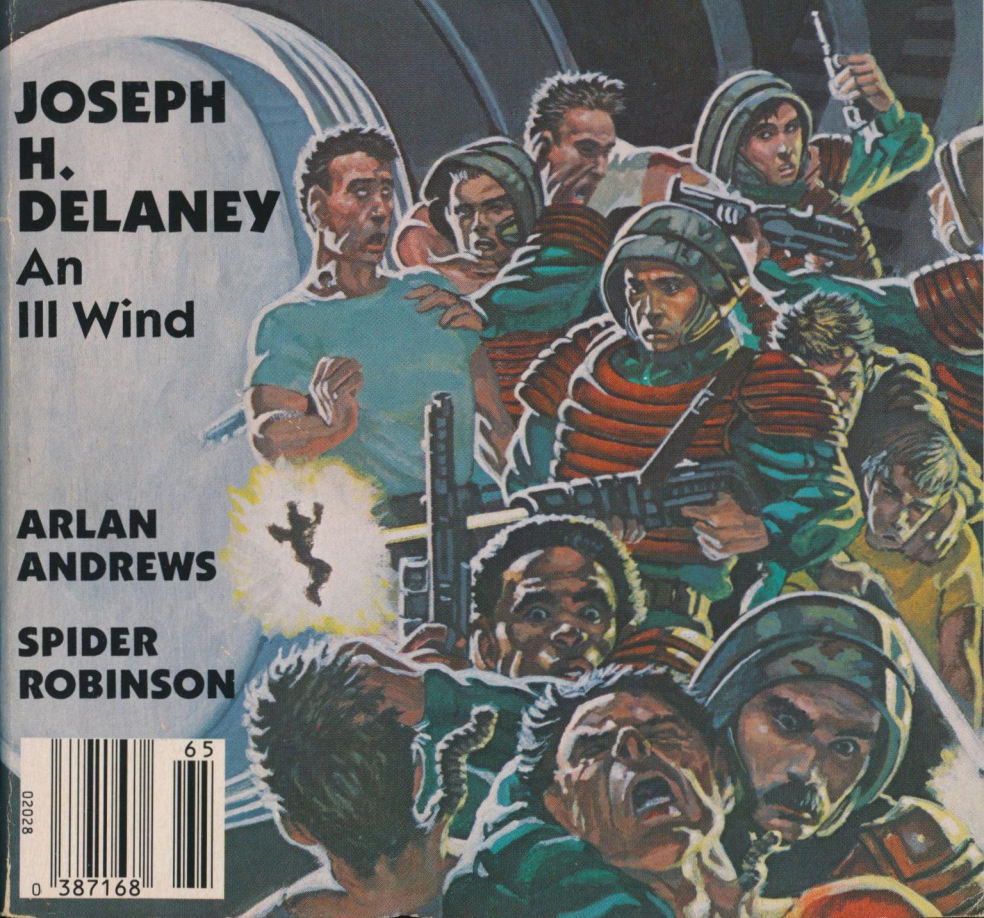

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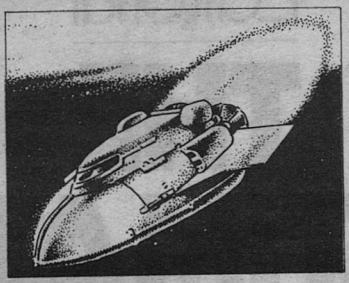

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Editorial

THE ULTIMATE RECYCLABLE

Stanley Schmidt

About fifteen years ago this country experienced a wave of popular concern for environmental issues like pollution, resource depletion, and ecological disruption through habitat destruction. Not everyone understood the issues, of course—in all fairness, they're so complex that in many cases even the "experts" don't fully understand them, even now. But for a while, a sizable portion of the population perceived at least dimly that these issues were actual problems, and tried to do something about them. Among other things, recycling centers sprang up all over the country, inspired by the hope that people would take thing like glass and paper and scrap metal for reuse, thereby reducing the need for new mining and lumbering operations. Coupled with this was a fairly popular movement to buy goods sold in minimal and easily reusable packaging, instead of the flashy but wasteful concoctions of plastic and foil that had become so prevalent in supermarkets.

Like most fads, the ecology fad eventually faded. You don't hear much now about buying things in bulk, but you do hear a lot about convenient plastic wraps and freshness-preserving inner liners. It's true that several states have passed laws requiring returnable containers for some beverages, with a cash deposit as incentive for actually returning them,

and these do seem to have somewhat reduced roadside littering. But overall the fact remains that per capita trash production is now nearly twice what it was in 1960—and not much of that is being recycled. Many of the recycling centers have closed, so it's now harder to find a place to take newspapers or glass or aluminum to ensure reuse, and few people are bothering. It's hard to sort out the chickens and eggs in all this: are fewer people recycling because there are fewer centers, or are there fewer centers because fewer people are recycling? Probably some of both, plus positive feedback. Certainly part of it is just a waning of interest—the fashion has long since passed its peak, and fashion was many people's strongest motivation. Even if a recycling center is just down the street (and most aren't), it's significantly more trouble to haul things there than just to put them out on the curb for the garbageman to worry about.

But there's another factor, too. Recycling involves more than just consumers' taking things to a place with a sign over the door that says RECYCLING. After that, somebody has to do the actual work of converting trash back to usable materials. That takes tools, energy, and effort; and in general, nobody's going to bother unless he can make a profit at it. So far, relatively few industries have been very interested in recycling or in using recycled materials. Existing factories (and mindsets) are set up to work with ores and trees rather than old cans and newspapers, and managers are reluctant to retool—especially when there are special tax incentives for the use of "virgin" materials but not recycled scrap. With few exceptions, business decisions are determined far more by the bottom line than by anything else: will doing this increase or decrease profits? So far, in general, it's still cheaper to get materials from conventional sources than from recycling (or at least it appears that way to most businesses). Even if a businessman agrees in principle that recycling is a good thing and that eventually somebody's going to have to do more of it, *he's* not going to rush into it until it becomes more profitable or less costly than the alternatives. So a lot of the stuff that now gets sent to recycling centers ultimately winds up at the county dump anyway, for want of somebody to reuse it.

I think that will change, eventually—but I no longer think that the primary impetus for the change will be a need for glass or aluminum so desperate that it must be satisfied from trash cans rather than from the ground. It increasingly seems to me that the recyclable whose need will become acute enough to force more use of *all* recyclables is one I've seldom heard referred to as such: *space*.

No, not *that* kind of space. I'm well aware that the Moon and asteroids are a vast potential of new raw materials. If and when it becomes cheap to mine those places and bring the products, such as iron, back to Earth, there will be *less* incentive than before to recycle low-grade Earthly scrap for the sake of getting those materials.

But what's to be done with the things

made from those newly cheap materials when they've worn out or people are finished with them? If there are lots more raw materials Out There, and it's cheap and easy to bring them In Here, who will want to bother scavenging them from worn-out merchandise? So much merchandise will wind up in the county dump.

And *that's* what the ultimate recyclable is: *dumping space*.

Communities all over the country are already feeling a critical shortage of places to put their trash. Some are using burnable garbage to generate electricity, but many of those are finding such operations hard to run profitably, and in any case there are still residues to be disposed of. There are enough environmental problems associated with any sort of dump that people don't want them near where *they* live. Many areas

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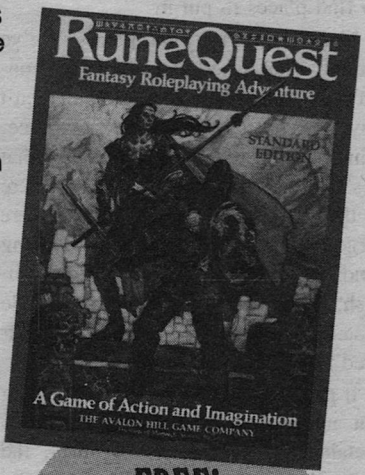

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are finding that their existing dumps are full or very nearly so, and that they have no place to put new ones. Some have taken to hauling their rubbish to quite distant sites, as a stopgap—but a stopgap is all it is.

What happens when there are no more places to put refuse, but refuse is still being generated?

Answer: the incentive may then be strong to make more people think seriously about reducing the amount of waste they generate—but they won't be able to reduce it to zero. So they'll *have* to find places to put it.

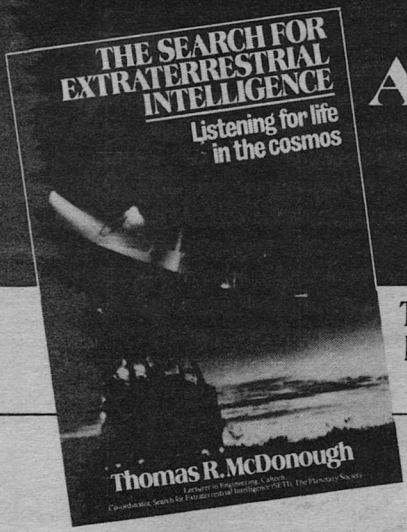
Notice I didn't say *new* places. We've already established that, under the conditions I'm talking about, there aren't any. (Except that other kind of space, which has the sizable disadvantage that it's a lot harder to get things from here to there than vice versa.) But there are large expanses of *old* places—existing landfills—already packed with old rubbish, much of it containing recyclable materials which nobody has yet bothered to recycle.

If people made a serious effort to dig out and reuse those buried reserves of metals and glasses and organics, the space they now occupy would then be available for the new generation of trash. Not as a final resting place, but as a temporary storage site—for by then, we may be forced to regard *everything* as recyclable. Our present dumps are *already* temporary storage sites; the difference between us and our descendants is that most of us haven't realized that yet, while they will accept it as a basic fact of life.

I submit that what will finally produce that reorientation of thinking is not the need for recycled glass or aluminum or steel, but the need for recycled storage space. The only way to get that space will be to dig out the things occupying it and get them back into circulation. It won't be particularly easy or efficient, at first—the stuff in present-day dumps has been stored haphazardly, with all kinds of materials needing different kinds of processing mixed randomly together. The first efforts to salvage them will be cumbersome and costly, but with experience improved methods should evolve. And those will very likely lead in turn to improved methods of storage, so that the next round of retrieval will be easier.

In other words, recycling—on a real, general, large scale—will become an integral part of the routine handling of materials.

But that will take time. Meanwhile, on the way there, I predict a time when "trash miner" will be an essential and highly respected profession. What's a trash miner? Just what it sounds like, but without the disparaging connotations terms like "garbageman" or "ragpicker" have today. The trash miner of the future will, of necessity, be viewed not as a lowly ragpicker, but as an essential technologist skilled in getting maximum yield of useful materials, at minimum expense, from the chaotic stockpiles we're now leaving our posterity. ■



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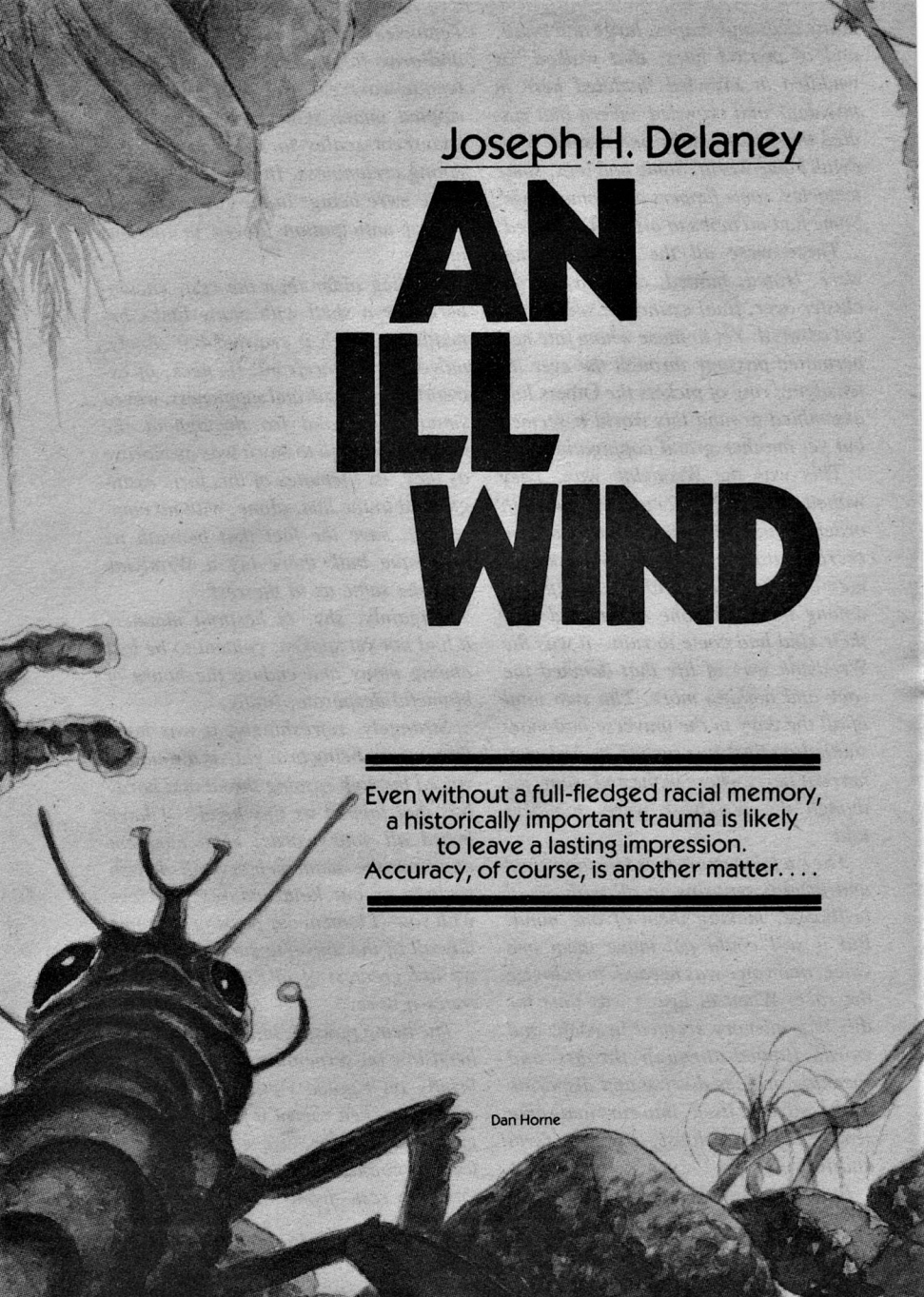


Joseph H. Delaney

AN ILL WIND

Even without a full-fledged racial memory, a historically important trauma is likely to leave a lasting impression. Accuracy, of course, is another matter. . . .

Dan Horne

Many sizes and shapes, large and small, and of myriad hues, that walked, or waddled or crawled, huddled here in this dank and crowded cavern that riddled the equally dank and dismal Wrodylak home world. Some had legs, some tentacles, some flippers and some wings. Some had no limbs at all, and slithered.

These were all the Wrodylak that were. Hated, hunted, and harried the cluster over, final extinction seemed all but assured. Yet to those whom fate had permitted passage through the ever-intensifying ring of pickets the Others *had assembled around this world it seemed but yet another grand conjugation.*

This was the Wrodylak way. They waited, not in pandemonium but with order. Without leaders to castigate, no recriminations flittered. With racial memory updated and disseminated among them all none questioned why their kind had come to ruin—it was the Wrodylak way of life that damned the race and nothing more. The sum total of all the envy in the universe had marshalled against it, crushed it, and cornered it here, where in the end, superior though the Wrodylak were, numbers told.

The racial memory was long and vivid and bright, reposing in all with equal brilliance, making them of one mind. But it still could not make them one voice, and voice was needed, to eulogize the race. When at last it was time for this that memory seethed in each, and words flowed through throats and speaking orifices diverse and disparate as the universe itself, into ears and sonic sensors of marvelously unlikely form and function.

In turn each spoke, and each listened. Tentacles writhed and worried. Legs and arms fidgeted. Claws clacked, antennae wavered, eyes blinked. Muscles rippled under skins that ranged from iridescent scales to slime-coated glistening creaminess. In as many ways as there were beings in the cavern the agony of anticipation flowed in torrents of woe.

A being older than the rest, encumbered by a shell with many limbs beneath on which it crawled but slowly, moved to the forefront. Its neck, of extraordinary length and suppleness, waved sinuously to and fro throughout the dirge, as though to say it was as morose as they, its lifemates of this form extinguished to the last, alone, with no community, save the fact that beneath its grotesque bulk there lay a Wrodylak soul the same as in the rest.

Ungainly, shy, of hesitant manner, it had not yet spoken, content to be last among many and endure the hours of blameful desperate, litany.

Strangely, refreshingly, it was hope this curious being brought, as ultimately voiced through rasping throat and horny lips that topped its tiny head. "I have heard all your words; each eloquent utterance the racial memory will cherish so long as our kind endures. I grieve with you—I lament our passing, as some day all of the universe surely shall, for we are greatest of all out of the many races it bore."

The being paused, blinked, dipped its head low on serpentine neck, resting it briefly on rippled ridges of its upper carapace, then raised it fortified by the gesture. "I came," it said, "too late for the conjugation, and from farther than the rest—from the firey marches

—from the very rim of all creation—from where one can see that something lies beyond. There *I was safe." It paused, and dipped its head again in gesture, toward voices silent, and eyes glazed, and limbs held motionless and tense.*

"I might have remained until the Others *found and smashed the world on which I dwelt, but I came here instead, to our home world, ancient and abandoned since the memory of our race gained sensorium to match; since we developed the powers we now enjoy. I came because I knew that in the end there was no more hope of continued existence for me than there is for you—that we here, or the cluster over, wherever within it we might hide must all surely die—as individuals, because we failed.*

"We failed not only because we disdained the Others, *whom we called 'cattle,' and allowed them to perceive our true nature, but because we lacked the will to go beyond this cluster. I tell you now we inhabit only a tiny part of all the universe there is. Because that is so the race need not die—the race can live."*

Acclimation came, coupled with a roar of skepticism. Torrents of words assaulted it, but the shelled member did not flinch. It stiffened its long neck and craned its tiny head above the crowd.

A voice, stronger than the rest, pierced the roar by the sheer enormity of the creature which possessed it, whose bellowed lungs shook the conclave and brought quietus. It was a heavy planet form, six columnar legs sturdily placed beneath a squat cylindrical body, edges fringed with long, delicately formed tentacles. "I too, would receive such news gladly, if *true. But it cannot be. I have searched the memory. I find there this perception, and a yearning that a vast void be somehow crossed, but not a way.*

"Conversely, I do not need the memory to see the Others, *whose ships pin our own few pitiful vessels to the surface. Eyes alone are enough to tell me that when they have brought sufficient weaponry here this world will burn in radioactive fire. How can you say we will live?"*

The long-necked member held its pose. Unable to match the challenger's volume it answered softly, so that the audience must strain itself to hear. "Not we—not any of us—but the race in elemental form—our spawn, our basic structure, the memory—that alone, if that, can my plan preserve."

"How?" The giant member demanded. The voice erupted from an orifice on one end, amid a ring of eyes and ears, each mobile in a bony socket.

"As I related—we occupy but a cluster of tightly packed stars, tiny by comparison to that which lies beyond—a mass of suns so stupendously large, the swiftest vessel ever built would consume the bulk of a normal stellar lifespan just to cross. Yet—it can be crossed."

"How? Because you yearn to do so?"

"No, because we were deceived, along with our slow witted prey, who believed, not irrationally, that the key to space is speed. My hosts believed otherwise, now so do I. The real barrier is not space, but time, and it was time these beings sought to conquer.

"Moreover, they had tested a method before we infested—before, in our ob-

tuseness we overwhelmed them, content to consume them as seems to be our nature, and as we had all others before them. With this, all development naturally ceased. The lone remaining exponent of their vehicle reposed in an antiquary, unrecognized for what it was until I found it and examined it. And, I do not—I repeat, do not *understand its workings, and so cannot add the knowledge of the racial memory our spawn will carry. At most, I can determine the mechanics of function, nothing more. But—I brought this vessel with me.''*

''Vessel? Here? On the surface? You fool. Why did you wait so long to speak?''

''No! It is tiny, a mere model. It is in the cavern. It can carry little, but our spawn are also tiny. It will serve.''

''It will burn when we do.''

''Only if we tarry. We must work, and make it ready before the attack comes.''

''They will pursue it—destroy it.''

''Perhaps; but in such smallness there is advantage—they may believe it is a simple missile, which it will in fact resemble both in form and behavior. Our larvae can endure very high accelleration, and when it streaks past the Others, *directly into the sun, they will not pursue it very far.''*

''The sun!'' someone groaned. ''The sun is death.''

''True. There is *risk, but we can gain all, and lose nothing. If we break out, into that vast sea of stars the race can never again be cornered as it is now. But, we need this sun—this much of the theory I know—that time is a balanced force. My host form conceived it as two streams, equal and opposite, flowing past one another, and separated by a thin, neutral barrier which is weaker where stars traverse than it is at other points. Here, with the aid of a star's great mass it may be broken through, and a vessel then move from one to the other or within the streams themselves, riding on the backs of passing stars. But to enter, this little vessel must pass very near our sun where the stellar mass slackens the flow of the streams, and its orbit must be without major perturbations.''*

''Risky? I say foolhardy, to wager the life of the race on the daydreams of inferior beings.''

''Risky or foolhardy?'' The serpent-necked form did not even bother to locate the speaker. ''What does it matter to we who are already dead? To those who might otherwise never be? It is this talk of risk which is foolish.''

Muttering rose, becoming a roar. The massive form glanced about, snorting disdainfully. But consensus was against it, and it knew it, and it sulked thereafter in silence.

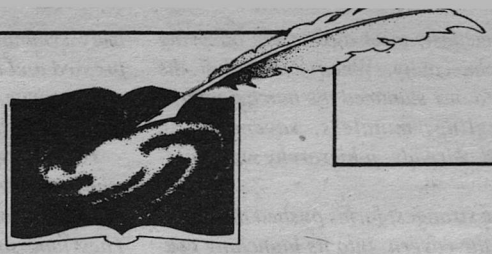
Slitering slowly, painfully, the shelled form led the others to the cavern's mouth, where it must hold its neck sinuously bent. The vessel lay there, smaller than half the Wrodylak forms present, its cargo hold open and tinier yet.

''The rest is engine,'' the shelled being said, voice reeking regret. ''One each we can allow. We must select the fittest spawn and kill the rest.''

''What of sustenance? If the journey be a long one, what will they eat?''

''Each other. After that, the strongest must fast.''

The act appeared futile, yet none declined to spawn, and each flung its larg-



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Writers of the Future Contest

by Algis Budrys

The Writers of the Future contest substantially rewards at least twelve talented new speculative fiction writers each year. With no strings, every three months it confers prizes of $500, $750 and $1,000 for short stories or novelettes. In addition, there's an annual Master Prize of $4,000. All awards are symbolized by trophies or framed certificates, so there's something for the mantelpiece too.

There's also a Writers of the Future anthology, which I edit. (There was one last year, and there's another one just out as you read this.) It offers top rates for limited rights in the stories. These payments are in addition to any contest winnings. The anthology is distributed through top paperback book retailers everywhere, and is kept in print and on sale continually. All that's required to win or to be a finalist is a good new story, any kind of fantasy or science fiction, no more than 17,000 words long, by writers whose published fiction has been no more than three short stories or one novelette. Entry is free.

The contest deadlines in 1986 are March 31, June 30, and September 30, and there are First, Second and Third prizes for each three-month quarter. At the end of our year, a separate panel of judges awards a Master Prize to the best of the four quarterly winners. So one person will win a total of $5,000. Judging panels include or have included Gregory Benford, Stephen Goldin, Frank Herbert, Anne McCaffrey, C.L. Moore, Larry Niven, Frederik Pohl, Robert Silverberg, Theodore Sturgeon, Jack Williamson, Gene Wolfe and Roger Zelazny, as well as me. Matters are administered so that the judges are totally independent and have the final say.

It seems hardly necessary to embellish the above facts with any enthusiastic adjectives. This contest was created and sponsored by L. Ron Hubbard and the project will continue in 1986 and try to do some realistic good for people whose talent earns them this consideration. For complete entry rules, and answers to any questions you might have, write to the address given below:

Don't Delay! Send Your Entry To:

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Or, you can find the rules—and examples of winning stories, plus informative essays by some of the judges—in either of the Writers of the Future anthologies. They're original paperbacks and cost $3.95 each.

Good luck.

—Algis Budrys

est, feistiest, most aggressive offspring into the cavity. When it was full the shelled one slammed the hatch upon the struggling, mindless, ravenous life within. Already, a hierarchy was building.

The strongest forms pushed the vessel from the cavern, into its launching cradle. Overhead, like whirling stars, the ships of the Others *continued their vigil of death above the mounds of ruined ships in which had come the dregs of the race, smitten mortally on the journey inward, burned-out hulks with all within them carbonized to decks and bulkheads where they died.*

Below, from those few which had managed softer landings, armament was shipped. Beam weapons, useless through vapor-laden atmosphere but spectacular none the less, sighted on targets and began tracking. Missile tubes, hopelessly outranged, turned on pivots and pointed at the sky, impotently, as the Wrodylak knew, but perhaps they could convince the Others *the Wrodylak had chosen to fight the last hopeless battle at a time of their own selection.*

Being inferior, the Others *would not fathom the real Wrodylak purpose. Some were clever, true, but their intellects were clouded by the need to learn anew with every generation, while the Wrodylak emerged from the larval form impressed with all the knowledge the race had accumulated to the moment it was spawned.*

The Others *did not appreciate this advantage, and called the Wrodylak parasites.*

Sometimes they were, but this was rare. Most often the relationship was truly symbiotic, with only the will supressed and the sapience fully intact—a co-existence, a sharing, a concept nobly intended to best fullfill both beings.

Yet, strangely, it was these very forms who struggled hardest. The Wrodylak were truly saddened by this ingratitude. They took so little, after all, and gave so much—the very things to which most life aspired: monumental wisdom and virtual immortality.

The Wrodylak opened fire, first with beamers, then with missiles. Their batteries drew fire from equally impotent weapons out in space. Then, as missiles leapt upward on tails of fire, with a mighty roar that broke eardrums in forms that had them and left them writhing on the ground, one trail separated from the rest and did not seek a target. Instead, leaping outward as though off course, darting swiftly among flashes of exploding missiles and piercing beams, it raced toward the sun and toward freedom from this awful din.

The enemy gunners were at first confused, and responded with promiscuous fire, but when they realized resistance came only from a tiny point below them they found the range; and each ship, as it hove into position, launched its salvo of missiles. They had come to kill an entire planet. There were not yet enough of them for that but the rocks near the cavern were quickly vaporized, and magma from the core below oozed through and set this hated world afire.

In bare moments, the cavern vanished, the Wrodylak in it dead, crisped, and vaporized. After a time, the assault waned, as the world below the Others' *ships began to run slag. The last Wrodylak form that died there died quietly,*

without despair, secure in the belief that they had won the only battle that really mattered.

Outside the heavily shielded port on TSN *von Braun's* cradle deck the local sun blazed with unbridled fury, its rays blasting the mirrored surface of the artificial world, Synwheel. For the most part only a blindingly featureless blur resulted. But edge-on in its tight orbit around this stable but otherwise worldless star, Synwheel presented some surface which did not receive the direct force of its sun, and from this, as though it were floating in empty space beside the real ship, the reflection of *von Braun* grew steadily smaller as it drifted slowly away.

From any direction *von Braun* was impressive. The entire 350 meters of bulbous cylinder that made up her temporal and spatial components was plated with 24 carat gold. She and the four spacegoing dropships clustered at the ring-shaped docking cradle just aft of the two partially joined 100 meter bulbs gleamed as brightly as Synwheel. They had to. They, too, must be intimate with suns, to reach the boundary where stasis separated the two opposite streams of time, and flutter between them like a sailing ship tacking on the wind.

Inside the port stood a solitary man, peering out, wondering at *von Braun*'s apparent emptiness. Under normal circumstances an occasion such as this would have found him rubbing shoulders with a dozen rubbernecking troopers. This time there weren't any, and their absence bothered him.

Chief Petty Officer Joseph Maggio, like the human race itself, was mature. He was also regular navy, a common man of the empire, the same as those who built these ships, the same as his comrades who sailed them. However much he moaned and groaned that things were boring, inside he still preferred that surroundings be intimate and familiar and that life be predictable.

That was how things were at Synwheel. Synwheel—'Sinwheel' to the troops and spacers who called it home port. Many times before Joe had stood at this or some other convenient portal to watch her as *von Braun* docked or departed. Always it had been an emotional adventure, but never before had he watched alone. Alone, the experience seemed eerie.

It was, therefore, both a relief and a surprise when out of the corner of his eye he caught sight of another man, emerging from one of the hatches that led aft to the staging decks.

He turned at the sight, allowing his eyes a moment to accustom themselves to the change in light levels before making any attempt at identification. Even when he could see it was impossible to do this—the man was a stranger and was wearing civilian dress, not a uniform, so that Joe could not even determine his rank.

Maggio counted this a bad omen, especially since the man was a contemporary, and hard looking, who walked up with such easy confidence as to suggest he too had spent his wilder years in military life. Joe resolved to be careful. The rumor of a flag officer coming secretly aboard from Syn was fresh in his mind, and Joe, like most of his shipmates, was uncomfortable around offi-

cers of exalted rank and unknown temperament.

If this was the admiral coming at him Joe intended to force him to make the first move. That was the only logical stance for him, so he turned his gaze back to the spectacle outside, knowing that out of uniform it would be the admiral's obligation to identify himself to the ship's company if he meant to exact a salute. Thus, Joe ignored the man until he spoke, and when this happened all his apprehension instantly left him.

"Corps Sergeant Angiano, Chief," the stranger drawled, extending a horny hand after first having thumped Maggio on the back with it. "My friends call me Julio. Can you spare a little window space?"

Relief washed over Maggio, now that he knew the man was neither officer nor spacer. The word 'window' grated in his ear, but not enough so that he couldn't let it pass. He shuffled aside, and leaned against the bulkhead, out of the too-warm area in the center of the portal. Even with all that gold on the glass the heat still wiggled through. He did not speak to the man though he shook the hand.

Sgt. Angiano was undeterred. Also, it seemed, he was himself a talker, and needed no priming. "I just came up on *Challenger*, Chief—uh—"

" . . . Maggio—Joe Maggio." Joe did not turn again. Instead, his eyes searched the reflection for the form of the dropship to which the newcomer had just referred. It was a useless gesture, since printing a name on a dropship would have been equivalent to touching a match to it, and they bore no visual markings.

Meanwhile, the sergeant gazed at Joe, giving him the once over, taking his measure. Being what he was, this operation was a brief one. A lifer always recognized another lifer and easily identified with him. They would understand each other. "Got any idea where we're going?" He asked when that task was finished.

Well now, Maggio thought. *How's that for a switch?* Between them, *von Braun*'s dropships carried a battalion of marine ground pounders. These pods had spatial but not temporal capability. They rode the timestreams on *von Braun*'s back, of course, but occasionally detached to sortie by themselves, descending upon such hapless worlds as were suspected of making trouble for the empire.

The spacemen of the temporal module were never near enough to see what was actually happening, and necessarily depended upon the embellished tales of returning troops for the bulk of their news; certainly not a very reliable source. Now, to the chief's utter amazement, here was a marine NCO, a very senior one at that, begging news from him. Maggio decided it was a golden opportunity to even the score for all the bragging and lies the navy had been forced to suffer in the past.

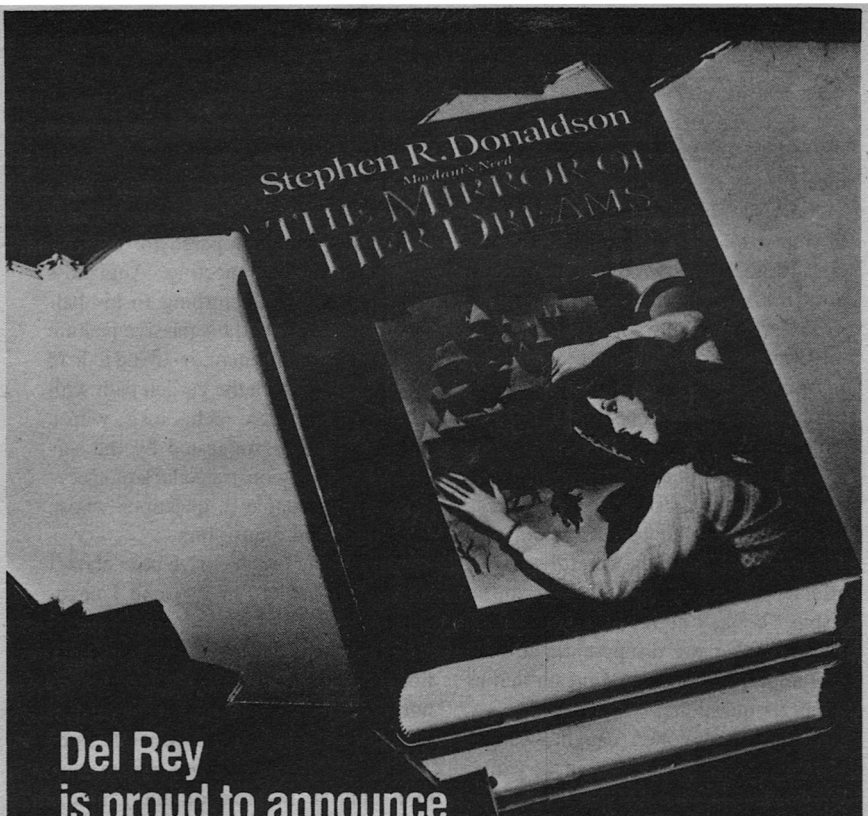
"Are you kidding?" he responded, in his most incredulous sounding tone. "You mean you really don't know?"

"Know what?"

"What your own mission is?"

"Yeh, I know—sure; what else? Training, like always. What I don't know is where."

"Listen," Maggio whispered, trying to sound wise, and having taken the



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other man's last remark as hedging, "we got us an admiral this trip. Know what that means?"

"No," the sergeant replied, a bewildered look on his face. "What does it mean?"

Joe cast furtive glances around, as though suspicious that he could be overheard, then whispered back behind his outstretched hand, "Combat. *von Braun*'s gonna fight—we're on a secret mission."

Angiano's attitude suddenly changed. He had apparently checked Maggio's uniform out in detail, paying careful attention to his patches, and it now appeared that he was one of those strange but knowledgeable people whom tedium had driven into the careful study of military insignia. "I thought so—you're a ship's cook," he muttered, then continued, with more disappointment than contempt in his voice. "I meant that as a serious question."

Maggio had gotten caught—caught easily and redhanded, early in the game; too early to have had any fun. He didn't like that, so he searched for a way to salvage something from the wreckage—and found it. "So?" Came his stinging riposte, "can you think of any better place to keep track of things than at the officers' mess? All I gotta do is hang around the Old Man's table and keep my eyes and ears open."

Apparently, this response made sense to Sgt. Angiano, though his voice retained a skeptical note. "You've seen this guy?"

"Not yet," Maggio piped, trying to sound confident, and hoping his credibility had now been re-established.

"What's his name?"

"Dunno—but he's real, all right. He's just keeping out of sight. The admiralty likes to keep important stuff like that secret—until we sail."

"Then how do you know what we're gonna do? We just barely left the dock."

Maggio was unprepared for the stiff resistance he was meeting. Angiano's terse quips were disturbing to his balance. He abandoned his passive posture and seized the initiative, resolved to lead his opponent down the garden path with some creative logic of his own; with a few subtle hints suggested by the sergeant's own demonstrated lack of spacelore; with a couple of questions whose answers might amuse him.

"Well," he began, "I've been aboard *von Braun* a hitch or two and I never yet saw the likes of this. We got restricted—the entire crew, mind you—no liberty for anybody on the ship—at our home port; not even the guys with dependents there; never happened before.

"Only the officers went ashore, and then only in the line of duty. That's reason number one.

"Number two: the ship was refueled, and we weren't scheduled for that until after our next patrol—to me that suggests extensive maneuvers, or maybe that we're gonna be chasing somebody.

"Reason number three: we resupplied—heavy. There's enough grub aboard to feed half the fleet—plus all kinds of other weird stuff, stuff we never stocked before. We've got so much in ship's stores we ran out of places to put it, and we've been working round the clock just to stow it.

"Fourth: our regular dropships disengaged, and then went someplace on

a space tug." He paused and glanced knowingly at Angiano. The implication was that Sgt. Angiano already knew all about that and should by now have come clean.

But Angiano's only response was a grudgingly muttered, "so?"

Maggio conceded. He would play out his string of reasoning. "*So*, the job was too hot for the outfit we had—*so* they brought yours in: specialists—shock troops. Admit it—I know a pro when I see one." He paused again, tried and failed to read the strange expression then washing over Angiano's face, then continued.

"What are shock troops doing aboard if there's not gonna be a fight?" Maggio stopped, and figuratively, stood back to assess the effects. He would have been better off not knowing.

When he gawked up at Angiano the marine sergeant's face was cracked wide open. It was without a doubt the nastiest, toothiest grin the chief had ever seen. He had to know why it was there—how he had failed, but the only way to do that was to ask, and he really didn't want to. But by and by his very hesitation became embarrassing, and so, gulping to clear his throat, he surrendered his ego and did just that. "What's so funny?"

"You are, Chief. You and your wild rumors. Shock troops, huh? Now that's the best one yet. Is that what you navy guys think?"

Maggio could find no escape from his reckless utterances. He knew he had to answer the question or risk coming off sounding even dumber. He answered it with a nod.

Again, the grin broke out, and the sergeant cut loose with a chuckle. There was nothing forced about the chuckle—it was real. He gazed at Maggio and said, "you wanta know know what I really got here, Chief? OK, I'll tell you: I got kids—green kids, fresh from the sand box at Camp Glenn; Eagle Scouts—and only four squads of them, one per pod. 'Course, maybe if you want to stretch that definition to cover a 2nd lieutenant who shaves every other day, three or four technical specialists, and some of us old-timers who got stuck in the training cadre I guess you got your shock troops, Chief." He stared back at Maggio and struggled to stifle frank laughter. The overall effect was brutal.

"You're k-k—"

" . . . No, I ain't kidding, Chief. It's a training mission, according to the Old—the Old, uh—" He snickered; couldn't bring himself to say "Old Man." He took a deep breath and tried again. This time he made a logical change—"according to Lt. Tor." He paused. "So what do you really know, Chief? Now's the time to open up."

Maggio knew funtime was over—he had to come clean and make peace. If he didn't this guy would have the tale spread all over the ship by evening mess, and Joe didn't need that kind of aggravation. It would be far better to make friends and establish some kind of useful relationship with the sergeant. "OK," he replied, though still reluctantly, "so far, all I've got is a rumor, but I believe there is a flag officer aboard. And, the part about restriction—uh, and all the supplies—that's true. Something strange *is* going on. Trouble is, I have yet to run into anybody who knows what. Even the bridge

crew's not talking, which means that they don't know either."

Angiano paused a moment, then added his own observations. "This is my first time out on a big ship," he admitted, looking genuinely worried. "I've got nothing to judge by. What's it gonna be like?"

"This voyage? Who knows? Regular patrol? Boring, Sarge; capital 'B'—if there's not gonna be any fighting you'll probably get a good accurate count of your fingers and toes while you're sitting around watching the same old entertainment tapes over and over again."

"That bad, huh?" The sergeant sounded somewhat reassured.

"Well," Maggio conceded, "maybe not for you guys, with training and all, but—"

"Speaking of training, Chief, it occurs to me there are certain traditional diversions the troops have yet to be taught, and that on occasion, this can be rewarding for the teachers." He looked up and grinned. "Now, did I mention that none of these kids have been anyplace lately where they could spend any money and that most of them've got at least six month's pay in the sock?"

"No, you didn't, Sarge," Maggio purred. "That *is* an interesting revelation."

"You see a certain potential?"

"I do indeed, Friend; I do indeed."

"Then shake, partner. I think we're about to go into business together."

The horny hand was out again, above it an even wider grin, and this time Maggio grabbed it eagerly, and shook it with great enthusiasm.

* * *

That first ship's day out they met the admiral, not in person, of course, but on the intercom screens scattered throughout the ship. With his introduction the rumors *von Braun* would see action ignominiously died.

"I am Rear Admiral Donald Dailey," the image said, then paused to give the men a chance to look at him, and take his measure. Among those who watched a galley screen with rapt attentiveness was Joseph Maggio.

The admiral's appearance differed markedly from Joe's preconceived image. He was far younger looking than his actual years, a tall, thin, moderately severe appearing person, with dark, crinkly hair and anachronistic wire-rimmed glasses perched across the bridge of his nose, yet he managed easily the imperious air the crew expected.

"Our mission is not a combat mission," he continued. "We are bound for Prometheus, a world of which I'm certain few of you have ever heard, that lies galactically opposite from Synwheel, near Earth. Most of you will have heard of Earth, I'm sure."

Again, he paused, to allow a moment for mirth, at his thinly veiled, and properly humorless joke. Then, sober-faced, he continued. "Our mission is the rescue of survivors of a colonial ship, down on that planet and ignorant of the fact that a wave front of radiation from a super-nova approaches their world. There are a couple of complications: first, this sun, Bova, went nova almost 35 standard years ago, and unfortunately is only a fraction more than thirty-five light-years from Prometheus. Thus our tardiness in discovering the presence of the Prometheans now limits our time to

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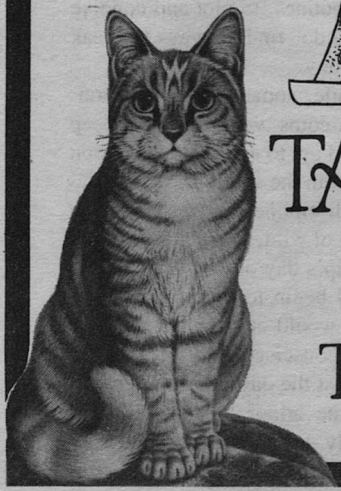

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complete their rescue. Second, the colonials, while human, are primitives. Their vessel was a multi-generation ship, launched from Earth over a millenia ago. Their descendants do not seem to understand our purpose, and may resist evacuation.

"We can expect some help from the contact team which was sent ahead and which will be meeting us there. Perhaps by the time we arrive they will have these people convinced of the danger and all *von Braun* will have to do is haul them to their new colony. Lt. Tor's 'special unit' will handle all necessary surface operations and maintain security enroute to the new colony."

So, Maggio thought; here was an explanation at last—the real reason for all the garbage and all the secrecy: secrecy was supposed to inject a sense of adventure into the operation and goose up the crew's morale.

Joe was certain that in actual fact the determinative reasons were far more mundane even than that; that the admiral had simply taken advantage of an opportunity to leave his desk and log a little spacetime on his personnel file. Maggio spent a moment or two trying to imagine what a desk job would be like, then decided he couldn't blame the admiral for ducking out. Whatever the rank, in this man's navy, resourcefulness was the only weapon a man had against boredom.

If that was Dailey's ploy it was an excellent choice—in the spirit of the adventure he was inviting *von Braun*'s company to share his fantasies and play the game with him, especially Tor, to whom the management of four podsful of unruly and probably unwashed colonists would represent a genuine professional challenge.

That, by itself, wouldn't have been the only reason the navy and not some civilian spaceline had gotten the job, of course. Even in a culture as large and far flung as the Terran Empire politics was still politics and money still talked. Flies always went wherever the honey was.

These colonists certainly would not have had any money, so the taxpayers would be picking up the tab for their rescue—and taxpayers rested easier when they *knew* this was what the navy was being paid to do *anyay*, that it somehow wasn't costing extra.

Daily droned on with the mission's details, but by then most of the crew, Maggio included, had lost interest. There is no great adventure in being the bus driver, therefore his audience quickly evaporated. Only officers and a few dedicated non-coms whose positions demanded it bothered to listen on, and the rest prepared to settle back into usual shipboard routines, to plot and connive as such men do, finding ways to break their monotony.

For a while, some of the more ambitious non-coms would try to keep things stirred up; to exploit the situation and polish both the ship's hardware and its crew's discipline, but following an initial flurry of wild, speculative rumors lasting a ship's day or two at most, the crew would begin to relax. Thereafter only a few would attend their duties a trifle more conscientiously on that account, against the day when they might encounter the admiral personally and unexpectedly. For the most part though, those of clear conscience would con-

tinue as before, and would not fret or worry over him.

Though by now his conscience was anything but clear Joe Maggio did relax a little, and in retrospect take stock of his new venture with Sgt. Angiano. He counted himself lucky that things were working out as well as they were, since he had come quite close to getting off on the wrong foot with his new partner.

In retrospect, Maggio realized how silly he must have sounded, suggesting that *von Braun* was about to go into action. No temporal man of war ever had. Probably none ever would unless and until some other race managed to crack the secret of temporal travel, now exclusively man's own, and that possibility was most unlikely. Temporal travel was man's prerogative and man was very jealous of it. He constantly scoured the galaxy for evidence of experiments by other races. He stood ready to obliterate any he found. Human discovery of the technique had been entirely serendipitous—a happy combination of the development of the temporal generator and a practical system of astrogation through megaparsecs of space and uncounted eons of time. For once in its existence the human race had done something right—having recognized that this capability made interstellar war possible man used the newfound power to establish the "Terran Empire" and impose peace.

The "Terran Empire" was actually both a misnomer and a myth—a convenient term to describe not political organization but behavior, and the peace established half a standard millennium ago remained unbroken. But from time to time even in this modern age there were isolated and feeble attempts by non-temporal races to gain the secret for themselves, so the vigil was never relaxed. Any activity which even hinted of such capability quickly attracted notice of the imperial navy, which crushed uprisings swiftly and ruthlessly, for the good of all. Thus the "Empire" had no enemies worthy of the name. None could grow strong enough to become a menace.

By and large, however loudly they might murmur, most other sapient races grudgingly conceded the human scepter rested lightly upon their backs and brought to them many advantages a truly fragmented galaxy would lack.

Every planet, every race the galaxy over, could enjoy trade. Temporal tugs, manned of course by human crews, plied the trade routes towing with them spatial dropships belonging to many diverse lifeforms, stuffed with all manner of goods. The "Empire" set fair rates, plotted standard courses, and protected the commerce from disasters, natural or contrived, with the imperial power—TSN *von Braun*, four other mighty men of war exactly like her, and a few auxiliary ships.

These were all that were needed, because the Terran Navy could pop up anywhere, anytime, emerging out of the static zone of any rebellious sun, dropping fighting craft and fighting men, or retreat beyond the reach of opponents possessing only spatial drives.

I guess I must have sounded pretty foolish, Maggio muttered under his breath as he recalled his words to Sgt. Angiano. *Von Braun's invincible—any fool knows that.*

"If she ever met a force she couldn't

outfight she could certainly outrun it." Those were the very words the instructor had spoken the day he first came aboard *von Braun*, during the orientation course that every new crewman, whatever his specialty or his rank, took when he began duty on a temporal warship.

In the shape he had been in at the time the temptation to sleep through the lectures had been considerable, but the proctors wouldn't let him do it. Consequently, Maggio had acquired a crude but useful understanding of how the whole thing worked—one employed to good advantage at various watering holes visited throughout the years in ports where *von Braun* had touched.

On many a rustic, unsophisticated world the mere sight of a naval uniform caused crowds to collect. A spacer could walk into a any tavern dead broke and drink the night away, provided he was reasonably sociable. Others might pay in coin of the realm—a spacer paid with tales.

Maggio had paid many such tabs, reciting by rote, sometimes even gaining greater personal understanding as he did so. He had done it often enough so that he felt he really did have an insight into temporal mechanics.

Up on bridge, at the astrogator's station, was a huge holotank. On those rare occasions when duty took him up there Maggio always tried to get a look at the permanent display, which was the dynamic image of the galaxy as the ship's astrogation computer thought it would appear, viewed from the outside, and if its shadow half were visible. Somehow, conception of the galaxy as an intertwined mass of colorcoded linguine with spaghettini for stars did not offend his reason. He felt he understood that part.

Beyond that, there was only the book, and the book said that what *von Braun*'s temporal generator did was open a portal into the static zone. Engineers described the static zone as a frictionless buffer between the counterflows within which time, in the traditional sense, did not exist and where only Murphy's law was 100% reliable.

Though they cursed it continually, they had to use it. But for stasis, large-scale interaction and therefore a large-scale energy exchange, which the system couldn't allow, would have taken place. Small scale exchanges were apparently all right, could occur, and constantly did occur, appearing as gravitational radiation with a different polarity for each timeflow; they kept the natural system in equilibrium. Theoretically, the same sort of damping should have occurred whenever a vessel made the transition. In practice it didn't, because these accumulated events were postponed until the end of the voyage, when one grand exchange took place.

In the meantime temporal momentum was conserved by reversing polarity of the ship's field simultaneous with each penetration, so that its direction through stasis didn't really matter. Maggio didn't quite see how that could be. It was one of the places where his grasp was a little slack. Fortunately, *von Braun*'s operation did not depend on him. All he had to do was feed his shipmates, not explain how the engines created thrust while in a so-called frictionless medium.

No matter; something drove *von Braun* down the timelines, in pursuit of her

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target stars, and through many orbits of galactic center until the right combination was found and the desired spatial orientation was achieved; until it paid its energy debt and balanced the temporal flow; until nature took over, and hurled it with unerring accuracy into now—the exact temporal relationship it would have occupied with respect to the system to which it was oriented, had it never left home. A successful temporal transit ended with the vessel snapped back like a yo-yo, into its own present, with only its spatial orientation changed.

The process was an involved one, but so far as time was concerned it was safe. For the same reason it was impossible to reorient totally to the "now" of the counterflow, it was impossible to get lost in it. And because temporal ships were never really in their own past, merely in a different present which—because of its orientation —operated as the functional equivalent of the past, causality could not be violated.

"Hey Chief! Telephone!" The voice was loud, as it had to be to overcome the din of rattling pots and pans, and the blaring volume of the P.A. system, on which the admiral continued to speak.

It rattled Maggio's daydreams off the track. He glanced abashedly down toward the countertop, then groped for something to wipe the chocolate syrup off his hands. He had been about to frost a cake, and somehow the stuff got all over while he was watching the admiral.

He finally used his apron, got off the worst of it, and yanked the receiver from the cradle—"CPO Maggio," he shouted.

"Chief? Julio. Listen, Old Buddy, got an idea—how about we throw a little party for the troops, so much a head, so much a hit? Whaddaya say?"

Little wheels started turning in Maggio's head. "Uh, well, I don't know quite how to answer—thing like that —it'd have to clear with the brass. But, I guess I could take a break and talk about it—the dayroom—ten minutes, OK?"

Angiano acknowledged with a grunt, after which Maggio hung the receiver back up and went to wash his hands. He had reached the point in his career where retirement had begun to loom. A little extra cash could certainly help that cause.

Chief Warrant Officer Charles Lisanti was *von Braun*'s Temporal Module Mess Officer—very, very good at what he did and very proud of it. Lisanti consistently served palatable food, despite the service's general reputation for mediocre fare and the vagaries of institutional cooking. Thus he kept naval crew happy, and the marine complement envious, and in turn his men provided him with a spotless galley and an immaculate main salon—which kept the high command happy.

Or always had, Lisanti thought, as he sat in his tiny office between the two compartments. He wasn't yet sure about the admiral, whom he had yet to meet.

He was busily poring over regulation menus for the rest of the voyage, making small changes in them, adjusting the proportions of ingredients, adding spices, and most important, those final personal instructions to the cooks which every experienced chef knows mean so much

to the final product, when trouble appeared.

Of course, Joe Maggio didn't look like trouble when Lisanti glanced up to investigate the shadow across his doorway. Joe looked like he always did, short, dumpy, overweight far beyond the standards of the service, and harried. He wore the usual cook's garb—white imitation cotton fatigues and mushroom hat, and on his upper arms and face were traces of his morning's work—flour, a rime of sugar crystals on one wrist, and the red streak of tomato paste across the chest where he had leaned over a bowl of something.

"Joe? Something wrong?"

Relieved, now that he knew the interruption was not resented, Maggio let loose. "I—sir, can we have a menu change?"

"Depends," Lisanti replied warily. "What kind?"

"Well, sir"—Maggio's head descended, and his fingers joined each other to begin a slight wringing across his ample stomach—"the guys down below have got a little party planned, and they're bugging me for some goodies." There—he had it out. He felt better.

"Uh-huh, uh, not for making booze, I hope?"

"Naw—no sir; nothing like that—just, well, you know, party stuff—maybe a few donuts, some chips; anything out of the ordinary—we've got the rations aboard, sir—all that extra stuff we took on at Syn for those colonists; sir, there's more than enough."

"Yes, well, the reason we have those supplies is that the colonists will need a stake when we land them on their new planet. *We* aren't supposed to use them. Uh, whose idea was this?"

"Well, I guess it was the marines, sir. And I guess their commandant will get the OK for it. Those guys are all kinda edgy, sir, and it *is* a matter of morale—"

"—And you've got a deal working to make a few credits?"

"NO! No Sir! Nothing like that—only, all us navy guys'll get to go, and, you know sir, that'd sure be good for inter-service relations—yes, sir, it would."

"I see." *Yes. I think I do—the grunts will supply the rotgut*—somehow, you could alway count on soldiers to get hold of that.

"Sir?"

Lisanti had hesitated an instant too long, and revived Maggio's apprehension. Lisanti wasn't at all certain that was bad, but he also knew he had to give his man an answer, else he'd wait there all day. And Lisanti really couldn't see any harm in the basic idea. "All right—provided Lt. Tor clears it with the Old Man?"

"Yes, sir, that's the deal." There was a definite tone of relief in the cook's voice.

"On that condition I guess I can authorize some food. Go ahead—but Maggio, I *do* want confirmation from Lt. Tor—you understand?"

"Yes, sir."

"*Before* you start."

"Yes, sir." Maggio's face had the beginnings of a smile as it disappeared.

Lisanti returned to work. Inwardly, he too smiled. What did Maggio take him for? He'd been in space a long, long time. He knew the score. A gambler would have bet Tor hadn't yet heard

even a whisper of this—wouldn't until Maggio reported success to whichever NCO the marines had working on him. This was the way things worked.

Oh well, as long as he was off the hook. All that mattered was his own clear conscience. Naturally, he'd be invited, and naturally he'd decline. Lisanti was no fool, and if there was any booze aboard he didn't want any part of it. Let others take chances with their careers—he wouldn't; never had and never would. He got back to his paperwork and forgot all about it.

Tor dropped in later, and talked a while over coffee, mentioning the impending party only briefly—only long enough to assure Lisanti of his gratitude, and give his guarantee there would be no liquor, nor any rowdiness.

Lisanti regarded that as especially reckless, though he didn't comment. He liked Tor, but he could see Tor was unschooled in the devious ways of the professional military; a typical young officer—a babe in the woods, no challenge at all to a spaceman with a few years service under his belt, or to his counterpart among the grunts. He plunged his nose into his coffee cup and drank long and deeply, to hide his blossoming grin.

Time zero arrived. It came, as always, with a jolt that seemed physical but really wasn't—a moment of vertigo, an instant of disorientation, which the human physique translated into terms its systems understood.

Once in every voyage this instant came, at the end, at the time of reckoning when the vessel pierced the barrier for the last time, re-oriented to its own present, and paid its energy debt. Left to herself, nature would have balanced the flow slowly and to perfection, but man had disturbed her and thus she punished him for his heavy hand.

Old spacehands knew what to do for this, of course, and did it almost out of habit. Grasping at handholds they fixed their gaze on something solid, which they knew would not move, and held on tightly. Greenhorns reeled about the decks, limbs flailing for purchase against the unresisting air, and promptly after it was over dived for latrines, or if not near enough the lucky ones found some convenient receptacle to hide their failings.

Lisanti did what he always did—cut rations for evening mess by 25%, and increased the breakfast menu by the same amount. As usual, Lisanti's guess was accurate, and his balance as fine as nature's.

Breakfast found *von Braun*, still integrated, in solar orbit around Prometheus's primary. Lisanti served the bridge crew at private mess, joining them for a time while making certain that everything was up to his usual standards. It was Lisanti's method of gathering intelligence. 28 years of service had taught him rumors were a poor substitute for facts—and only the bridge crew had facts.

This time he was especially lucky. The admiral himself was present, the guest of the Old Man, Captain Tinker, *von Braun*'s casual-appearing but thoroughly ruthless master. So, Lisanti set himself a place within easy earshot and poured himself a cup of coffee.

The admiral seemed distraught, and didn't try to hide it. "It bothers me,



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Tinker—bothers me a whole lot— 'civilians' trying to tell the Navy how to do its job.'' He used the word 'civilians' for an epithet. ''They've only been here three weeks, and already they know it all.''

Tinker was raising a bite of omelet on his fork. It stopped in deference to the admiral's remark and hovered dangerously near his beard. ''I agree, Admiral,'' he said. ''Nineteen days is not much time, and they *were* the ones who botched this.''

The admiral nodded, and took a contemplative sip of orange juice.

Lisanti paced him with coffee, careful not to sip too often, so it would last the meal. He knew what the Old Man meant—the failure of the civilian authorities to note discovery of the colonial vessel as it approached Prometheus. A passing merchantman had come upon it by chance, and her instruments duly made a routine log entry, but her soggy-brained master had not been sharp enough to report the incident.

Consequently, nothing had happened for almost two standard years, while the colonial ship had made planetfall, and until that same captain went before a Board of Inquiry on charges of mistreating his crew.

Furious action followed. His log was examined frame by frame, and the Admiralty's central records computer finally matched the object's trajectory and configuration with an ancient vessel, the *Halley*, which left Earth Standard Year 2109. The contact team hastily dropped, while *von Braun*, the only vessel in the sector large enough to take the colonists off in time, was diverted from her current patrol.

Discovery alone was a triumph. *Halley* had been off course for almost seven hundred years. Prometheus had not been her original target.

Soon afterward, the Bova route was closed, and a somewhat more circuitous detour substituted. Now, *von Braun* had nineteen days to get the colonials out before the radiation hit.

''. . . The trouble down there,'' the admiral was remarking, when Lisanti's consciousness surfaced again. ''They should've had time to gather everybody up. How far could they scatter in a couple of months?''

''I suspect it's because of the ruins. I think our contact crew is dragging its feet because it wants to nose around.''

Again, Lisanti silently concurred. Since leaving Syn there'd been a lot of talk about the ruins, which were reputed to be extensive, quite old, and still in a fair state of preservation. He could readily understand the contact crew's reluctance to leave with these unexplored—another opportunity would not appear until the radiation died down, and that would be a long time.

''For two cents,'' the admiral remarked angrily, ''I'd send our troops down, and yank them out of there at gunpoint if we had to. At least then we'd know what was going on.''

''If you so order, Admiral—'' The captain was being diplomatic, showing the admiral he concurred, but subtly reminding him that it would be contrary to orders.

The admiral was not, of course, deceived, though pleased at Tinker's display of loyalty. He changed the subject, and addressed the real challenge squarely. ''I'm counting on you, Tinker. You

have to back me up when they get here."

Get here? Who? Lisanti dived back into his cup and listened attentively. Very interesting—someone from the contact team coming up to *von Braun*—some civilian with a lot of clout and with whom Dailey expected to violently disagree; who might try, or maybe already had tried, to push the Navy around. There had to be some reason why the spatial pods were still mated to the temporal module, and not yet ferrying colonists up from the planet.

Lisanti was far too conscientious an officer to waste time in idle speculation. When the others departed he got back to his own work routine. He went to his office and got the clipboard with his inspection form, an old-fashioned device to which he was committed though it meant double work. Most mess officers would have taken a portable modem and logged observations directly into the ship's database, but that wasn't Lisanti's way. It was too permanent, and entries couldn't be changed—only updated. Mistakes, once recorded, were out of control.

So, Lisanti preferred his stylus and foil forms, from which data, after careful mental mastication, could be transferred. Many a messman serving under him during his many years in this galley had cause to be grateful for that system, none more than Maggio.

Maggio had been a great trial to Lisanti since coming aboard almost five standard years ago, skinny and rebellious, a disciplinary problem of the first water, suffering from a great thirst for strong drink. However dumb, however illogical it was, Maggio would do anything to get a drink. Dozens of chances to cash Maggio out had arisen in those early days, according to the book.

Lisanti had never regretted passing these up, thought half the gray hairs on his head had been put there by the Chief. With understanding, persuasion, a little bullying, and a lot of patience Maggio had conquered his thirst, and today, so long as he was moderately well watched and could avoid temptation, which was supposed to be easy on *von Braun*, he was as good or better than any subordinate Lisanti had. He'd even worked his way up to chief again, for at least the third time that Lisanti knew of.

That was probably why Maggio was always so nervous around him, Lisanti thought—worry that he might slip off the wagon and that this time Lisanti might not let it pass. In any event, whatever the occasion, Maggio always treated him with extreme respect.

Lisanti's tour next took him into the main galley. He entered through a dogged door, and closed it carefully behind him. Around the mess section closed hatches were mandatory, since it was a fruitful source of odors, and odors are notoriously troublesome to spacemen.

One struck Lisanti's generous nose as he entered—not unpleasant—just unusual: fresh dough, rising—and the smell of the growing yeast made his mouth water.

He stepped over to the array of broad tables in the center, where a mixing machine whined, and where Maggio bent over a slowly turning bowl. Around him were people in strange dress—marine fatigue uniforms. Some of them had

borrowed hats from naval members and wore them awkwardly.

One of them noticed Lisanti's approach and hastily poked Maggio in the ribs, whereupon Joe hastily turned.

" 'Morning Sir. Uh—Sir, uh, I know how you feel about getting meals out on time—uh, so I borrowed these guys from Lt. Tor—uh, sir, they're all experienced." *Well,* he added under his breath, *that's true enough; time on K.P. should certainly count as experience.*

This minor departure from the book did not greatly disturb Lisanti, though it meant Maggio's own crew was working without direct supervision. No matter though—Maggio's crew were also experienced pros. "What's all this?"

"Dough, Mr. Lisanti—real honest-to-god scratch-made dough, lika dey make ina d'olda country. We're whompin' up some real pizza. That prepacked dough we usually use'd be lousy for that."

"Where'd the yeast come from?"

"Uh, well, sir, it just sorta turned up—uh, in stores, sir—you remember we got all that stuff for the colonists—well, it was in there."

Lisanti smiled. He could have challenged Maggio to punch up the inventory and show him where it appeared, but decided not to. It was Tor's business if some of his marines smuggled yeast aboard to make jungle juice, not his. He made a mental note to mention this when he next saw Tor. In the meantime—"You're right, Joe. Listen, could you spare enough for a couple of fresh loaves for the officer's mess tonight? I'm sure the Old Man and the Admiral would appreciate it."

"You got it, sir. There's plenty. sir, you're coming, aren't you—to the party, I mean?"

"When is it?"

"Second watch, sir, figure eight, standard, down on staging."

Lisanti's eyebrows rose—staging, huh? Tor had really stuck his neck out. Staging was the roomiest part of the ship. It'd be a real bear to police. "I'll drop round if I can find the time. Don't fall off the wagon, Joe."

"Mr. Lisanti!" Maggio's tone managed to show hurt and guilt at the same time.

Lisanti's mind didn't dwell on the subject. Such invitations were routinely made, and routinely declined. Most officers never attended, because doing so intruded on on the crew's recreation, introducing formality into a situation intended to avoid it. Lisanti sometimes did go, because his situation was different. As a warrant officer, he more closely identified with the enlisted men, and they with him. He knew he would be genuinely welcome so long as he didn't stay too long.

He finished his normal extended watch and went to his quarters, where he lounged, read for a while, and tried to get interested in a video tape he vaguely recalled having seen before. He quit halfway through, bored to death when it was still far too early for sleep. And so, though intending his appearance to be both brief and unofficial, he got into proper uniform and descended to the staging deck.

Like other high risk areas of the ship, the staging deck was spacetight from the rest of the temporal module. It was located just aft of the docking ring where

there was always danger of collision with another of the ship's component sections. Normally off-limits to the naval crew, it was strictly marine territory—sensible, since when the entire battalion was aboard they were cramped even with that comparatively roomy compartment.

It was not crowded on the present voyage—wouldn't be even after the colonists were aboard, and even on the spatial pods people would rattle around like dried peas in a pod. *von Braun* was, it occurred to Lisanti, essentially empty, perhaps for the first time since being commissioned.

He used the central lock, biggest of four leading aft, and the only one with an elevator car. Despite its designation, it was not really central. For part of the way its course was a giant curve running around the enormous chamber that housed the temporal generator and the ship's power deck. There was a brief wait for the car, which was in use farther forward, but when it arrived Lisanti punched his deck and waited some more, while the lock cycled. This elevator lock was different from all the rest in that here the car depended on air pressure for movement. It was like a giant piston in its shaft.

Lisanti knew the instant the door opened that he had a disaster on his hands—not a little bitty one, either—a giant. His nose told the whole tale, in an instant, in a language where nothing was lost in translation. He gasped, not just from the overpowering odor, but from the realization that Tor had, in fact, been far more gullible than he had ever dreamed. Tor had been had.

So had he. And while Tor presumably knew no better, he did, and Maggio had—and this time Maggio was going to get what was coming to him. Lisanti's normally slow temper rose to a fever pitch, and holding his breath for as long as he could he stormed past the makeshift curtain that masked the lock and charged into the crowd of revelers.

When his gaze had pierced deeply enough into the knot of men huddled around the table in the middle he sent forth a bellow intended to bring instantaneous silence to all who heard it. "MAGGIO!"

It worked. Thereafter, the dropping of a pin would have been thunderous. Around the room bodies stood frozen in the exact positions they had held when Lisanti yelled—hands on their way to gaping mouths stopped short with whatever burden of gunk they carried upward; legs, an instant before hurling their owners toward the tables, poised in mid-air; lips, curled in conversational poses became like so much flesh-colored marble—and waited.

Lisanti's stride carried him to the center table in record time, up nearly to the spot where a chubby, sweating statue stood, spatula in one hand, a cup full of some suspicious beverage in the other.

Both hands fell, the spatula first and recklessly, the drinking hand slowly, and with more care. The fat statue moved, stiffened, straightened, sucking in its marble abdomen viciously, coming to rigid attention. A squeaky but still stentorian voice echoed throughout the silent chamber: "SIR!"

"Maggio, you idiot! Garlic? Garlic on a space vessel?"

Maggio did not answer, not because

he was not so disposed, but because Tor had also moved, his own long strides carrying him rapidly from someplace in the center of the crowd to a point in front of Lisanti. In his hand was a slab of hot pizza, dripping goop and olive oil, reeking of garlic.

"Something wrong, Mr. Lisanti?"

Lisanti glared at the young officer. He started to sputter, but the time was not ripe to say anything—not yet. Theoretically, Tor ranked him, being a commissioned officer while Lisanti held only a warrant, but that wouldn't save him. Lisanti was not only angry, but justly angry and had regulations on his side. He made Tor wait a full minute for his response, and when it came it was ferocious enough to tarnish the gold on his buttons. The epithets alone took two full minutes to exhaust, and then, stripped down to ordinary basic English Lisanti's formidibility was hardly muted.

"You authorized this?" The question was rhetorical—Lisanti neither expected nor would have tolerated a reply. "You'd better be thankful of two things, Mister—that the Old Man hasn't been here and that we have airlocks. And you'd better hope the admiral doesn't get a whiff of it." He glared at Tor.

When Tor continued to stare back dumbly, Lisanti's determination broke down. "Don't you realize what you've done? You've made a capital ship uninhabitable. You don't bring garlic aboard ship, except as sealed cargo, much less use it—this isn't a planet."

Tor was cowed, but he was no quitter, and he quickly sized the situation up. He was a combat officer, not a spaceman. All he'd done was authorize the party, after clearing with the ship's commander. He recovered quickly. "Wait a minute, Mister; Maggio's your man, and he used your supplies. My command had nothing to do with it."

"You dummy," Lisanti bellowed. "Don't you see what they're up to yet? Check out that stuff they're drinking. I'll guarantee it'll have a kick. They knew you'd never smell anything but the garlic."

"I'm drinking from the same bowl, Mister. This is grape juice. See for yourself." He raised his cup with a flourish.

"Sure! *Yours* is—try theirs. *They* gave Maggio the yeast for the pizza—you tell me what else marines are doing with yeast."

All around the room cups were hastily but surreptitiously being drained, the evidence flowing irretrievably away, into straining gullets. No doubt in the rear of the crowd someone was hurrying away with another bowl, intent on dumping it at the nearest head. Lisanti wasn't fooled by it, as Tor was. What's more, he still had an unadulterated sample.

"Joe—give me your cup." He gazed sternly at Maggio.

For an instant Maggio's hand was motionless, then, still rigidly at attention he groped for the cup, raised it from the table, and held it out.

Lisanti seized it roughly, brought it to his lips, and sipped contemplatively. His eyebrows rose. Not bad for jungle juice! Somewhere among the marines was a paisano who knew his stuff. It did indeed have a kick, at least 40 proof, which meant it was probably vacuum distilled, another no-no. In that, he detected the navy's hand—marines couldn't have pulled *that* off by themselves.

"Here," he said, handing it to Tor. "Try it. Hang onto something if you drink very much, though."

A sip converted Tor, instantly. "I apologize, Mr. Lisanti. You're right, of course." In more of a whisper than his normal tone he asked, "what do you suggest we do next?"

Lisanti sighed. He really didn't know, but he realized he had to figure out something. He sidestepped Tor's question for the moment and turned to Maggio. "Joe?"

"Yes, Sir!"

"Stand at ease, Joe, before your face turns blue. Joe, how much of that stuff have you got, and where is it?"

"Uh, Sir—lemme think—maybe forty-fifty pounds, most of it already baked. And, Sir, don't worry, we baked it all below."

"Below?"

"On the pods, Sir. They've got those great big microwaves in their galleys for cooking combat rations—"

Cattle feeders, Lisanti knew what the grunts called them. He turned to the young marine officer. "Hear that, Tor? I suggest you get your men back inside to button up the pods."

"Good idea," Tor agreed. He turned to find his senior non-com, and gave the order.

One by one the marines filed through the locks. In most instances they did not go empty-handed, so when there was no one left on the deck except Lt. Tor and the navy people the area was all but clear of food and drink.

Next, Lisanti gathered his own men, and gave them careful instructions on decontaminating the galley. "Get every scrap of garlic—bring it down here. We'll store it in the pods, and dump it on the planet. Don't spill any, and for God's sake, if you do, don't step on it. Got that?"

There was a chorus of "Yes, sir's," and a moment later Lisanti found himself standing alone with Tor and Maggio.

He turned to Tor. "I suggest you post reliable sentries on those locks, Lieutenant, and then I think maybe you and Chief Maggio had better come with me while I try to explain this to Captain Tinker. I've got a feeling he won't understand."

At first, Tor's mouth started to move wordlessly, as though he might be ready to protest that suggestion. But then he sighed and said, "OK—yes, of course. Any time you're ready." It sounded like he considered the worst inevitable and was resigned to getting it over with.

Lisanti had had a little time to think, and reflection had gone a way toward tempering his anger. Time always did that, and this annoyed him. Whenever he worked himself into a righteous, blistering lather along came Old Chief Softy, to spoil it. Actually, he thought, I caught this in time. Things aren't as bad as they might be.

And, they weren't—if the admiral didn't decide to inspect. So long as the staging deck was sealed the air purifiers would eventually rid that compartment of the odor, and the pods—well, they'd be down on the surface soon and could be flushed with planetary air. That was standard practice on earthtype worlds.

Lisanti could picture a far more serious scenario—the odor penetrating the temporal module. If it did, there would be no way to get it out except with fil-

ters, so it might remain for years. Not even Synwheel was equipped to replace the entire air supply of a vessel of *von Braun*'s enormous size, and of course, temporal modules were built in space and never landed. So, in confining the contamination to the pods, they had been fortunate.

He saw it that way. He hoped the Old Man would too, and wouldn't be too hard on them, especially on Maggio. But Maggio had something coming for this, not just because it was dumb but because he'd fibbed to a superior officer and a friend. Barring Lisanti's intervention, Joe would certainly have fallen off the wagon tonight, perhaps for good.

So, on the way up, much as he was temped to suggest to Tor that the two of them try to handle this as a section disciplinary problem, he overcame it. With resolve, with a will of iron, determined to do ths the navy way, he led the others into the sealed car.

As an extra precaution they purged the air at the aft terminus and intended to repeat the procedure at the lock below the command module. This still wouldn't totally decontaminate them, as both Tor and Maggio had indulged, and the breath of either could have knocked down a moose. The Old Man would notice at once.

If he's available, Lisanti said silently, as the car was cycling. He might not be, or might not have time to see them. At evening mess Lisanti had heard the contact team was coming up in a body to discuss the mechanics of the retrieval. He almost mentioned this to Tor—almost weakened at the last moment and suggested retreat. He knew he would have had little trouble in persuading Tor to that course.

Serendipity intervened—suddenly, though Lisanti was sure they were nowhere near the command module, the car stopped and the lock opened. Maggio, the first to exit, ran full face into the lock sentry.

Lock sentry? Before Lisanti had a chance to ask himself why Captain Tinker had the locks guarded he got another shock. The sentry wilted, and collapsed to the deck, his face contorted, as if in acute agony.

Maggio stood over him and gaped.

"Mr. Lisanti! Did you see that?"

Lisanti's voice was muted; "You hit him."

"N-no, Sir—bumped him, sure, but not in the head, and not that hard. 'Course, it knocked a belch out of me." This last remark was added contritely.

Tor was on the man at once, having some small skill at first aid, he thought he might help. But, something else caught his attention first, before he had done more than confirm the man was still breathing. He reached down and pried the hand weapon from the man's grasp, holding it up to the light. "Charged, and on maximum—killer beam. Why?"

Lisanti blanched. "I can't imagine."

"Who is this guy, Mr. Lisanti?"

"Harville," Lisanti muttered. "The Old Man's orderly." He bent down to examine the fallen spaceman, and instantly recoiled. Something was wrong with Harville's neck—it was pulsing, bulging under his collar, as though a giant vein were engorging and preparing to burst. He noticed for the first time

that Harville had a wound, a puncture just below his left ear.

"We gotta get him to sick bay," Maggio muttered, his voice shrill. "I liked old Harville—even got drunk with him a time or two—back in the old days," he hastened to add.

That instant, Harville's wound dilated. Something wiggled out—something sinuous, partically transparent, something that looked slimy. A foot of it emerged in that instant—its movement was that fast. The moment it hit the deck Maggio's foot stomped, bouncing oddly, as though off hard rubber. Whether or not it had a spine, and he broke it, they were never certain. The blow seemed to have glued it to the deck, and though it wiggled it got no further before Tor blasted it.

They were all stunned for the seconds it took for the after-image to clear. Gradually, vision returned, and Lisanti was stricken by the corridor's darkness. "Half the lights are out up here," he gasped.

There was no time to speculate about it, but clearly something was wrong. Harville obviously intended to stop anybody from coming through—and he'd been infested with some sort of parasite—one that for some reason had decided to abandon his body—why?

Without regard to the difference in their ranks Lisanti took the initiative, and said, "maybe we ought to find out what's beyond the next bulkhead. Get down to the end of the corridor and check it out."

Like a pet coon, Tor, with Harville's weapon clasped in his hand, its recharging cycle humming faintly, darted down the dark passageway.

While he was gone Lisanti joined Maggio for a closer check of Harville. Harville was not yet conscious, but showed signs of life—he was throwing up.

Lisanti flipped him over, so he wouldn't drown, and slapped him hard on the back every few seconds to help prevent choking.

"His eyes are opening, Sir," Maggio said, just as Tor returned.

Lisanti took a look. It was true—Harville's eyes were open—and filled with terror. Harville stared at Maggio and retched.

Tor squatted down and solemnly reported, "I can't tell for sure by sound, but I think the next hatch is guarded too. We'd better find an intercom station and call Captain Tinker?"

"NO!" The words echoed huskily through Harville's lips. He began to retch again, and to cough, but all the same he struggled to rise. He reached out roughly with one arm and shoved Maggio, who tumbled over backwards. "Sorry, Joe, but I've had all your breath I can take. Mr. Lisanti, something got the Old Man. Something got us all."

Lisanti eased Harville back down on the deck, noting that blood was starting to pour through the puncture. He pointed.

Almost as an afterthought Harville's hand rose, and blanched fingers clamped down on the wound. The flow ebbed, and that, it seemed, satisfied the spaceman. He paused. "I saw the flash. I guess you flamed it, huh, Lieutenant?"

"Nice and crispy." Tor's voice concealed a shudder. "W-what was it?"

"I never seen one, Lieutenant. But, somehow I know what they look like, even so. I remember it. I know it was

inside me, but I don't know how it got there. I couldn't seem to think for myself, and when the Old Man said 'get a beamer and kill anybody who opens that hatch,' I went and got one."

"Why would the captain give such an order?" Tor wanted to know.

"I don't know, but I'd have killed all of you."

"Why didn't you, then?"

Harville struggled to recall. He couldn't. "I don't know. I started feeling awfully sick—my head was swimming. I couldn't think but neither could it—it thinks! That's it—it thinks, but it used my head to do it—my head! God!" He was retching. "Lieutenant—no offense, but would you move? You stink as bad as Joe does."

"I do?" Tor was rising to his feet, in deference to Harville's request. Not until he was fully erect did he realize he had, in fact, taken offense.

Lisanti stepped forward, and knelt near Harville. "And how do I smell?"

"You, Mr. Lisanti? You—you're OK. You've got a little bit but you don't stink to high heaven like they do."

Lisanti then rose. "What do they smell like, Harville? Do you know? Have you ever smelled the odor before?"

"Awful, Mr. Lisanti—Like someting rotten; worst smell I ever smelled—like death, warmed over a couple of times and left out in the sun, but I can't place it. I never smelled it before."

"You know what garlic smells like, Harville?"

"Sure—sure I do, Mr. Lisanti. It ain't garlic, that I can say for sure."

The other three looked at each other.

"You don't smell garlic, now, Harville?"

"Why, no, Mr. Lisanti. And who'd be dumb enough to bring garlic aboard?"

Lisanti glanced over at Maggio. "I couldn't imagine," he replied.

Lisanti was getting nervous. Tor had been gone an awfully long time, leaving the other three at the hatch Harville formerly guarded. He and Maggio were on the sternward side of it. Harville, trusted once more, now presumably reliable, again had his beamer and was back in position, in case someone came to check on him. Since they didn't dare use the intercom Tor had gone back to the pods to collect weapons and form an assault party from among the platoon of marines, and it seemed to Lisanti that this was taking inordinately long.

So, it was a definite relief when the central elevator opened and Tor popped into view, with one beamer in his hand and two more, for Lisanti and Maggio, in his belt. A dozen grim-faced marines followed him.

Tor's face was white, his voice excitedly shrill. "I brought a squad, Mr. Lisanti. Another is moving up through auxiliary passages. They tried to get to us."

"Who?"

"Some of the people from there." He pointed upward—forward, toward the control module. "One of them actually got in. We found him on the deck, sick, just inside staging, with a beamer, and—three of those things crawled out of *him*. The men clubbed them to death, but they're tough—it was a job. Mr. Lisanti, I don't think there's any question about it anymore—somehow, an

enemy has boarded this ship and turned some kind of biological weapon loose—an enemy that waited for us on Prometheus."

"Well, man's got plenty of enemies. We've been muscling the rest of the galaxy around for quite a while, telling the other races what they can do if they don't like it. I guess it's only natural for them to try for a temporal ship once in a while. It's happened lots of times before."

Tor nodded. Part of the reason his specialty was still important was the need to keep non-temporals under control. That was also why temporal ships never approached even those planets solidly under human security and control—why all human commerce was funneled, under strict control by the navy, through huge central terminals like Synwheel, and why more than one temporal module hovering in a solar orbit and under assault had blown itself up to avoid capture.

But as far as Lisanti knew, non-temporals had never attacked a warship, and the circumstances of *von Braun*'s mission hadn't seemed even remotely menacing, but—with some kind of new, biological weapon, through which they manipulated men, who knew what truly desperate beings might be capable of doing? Lisanti made up his mind to act now and justify later. Tor or no Tor, outranked or not, he would handle things until command could be turned over to a real staff officer.

"All right," he said solemnly. "Let's try to figure this thing out and see where we stand."

Tor grunted. He seemed disposed to let Lisanti lead. "My men will be in position soon but I don't know how much farther I can take them. We've sealed the passages between decks but we can hear movement on the other side of these bulkheads. Past where Harville is, we may have to fight, and I only have one platoon to cover all that area.

Lisanti nodded. "As soon as their latest probe to the staging deck is overdue, whoever sent it will certainly try again, doubtlessly with greater caution and perhaps in force." As he speculated a loud rasping sound echoed through the hullplates. Only their position near the beginning of the central tube's curve allowed this to be audible.

"What was that?" Tor whispered.

Lisanti recognized the noise at once. "We're near the docking cradle, probably very close to one of the braces, for the sound to conduct that well. I think a shuttle left, or maybe arrived, and there's only one place it could have come from, or be going to."

"The contact team was dropped here in a shuttle. We were supposed to pick it up."

"Then let's hope it's on its way back down to Prometheus."

"Why?"

"Because while it's gone maybe we can get things under control, and be ready. The contact crew had fifteen members—all the shuttle could carry. I remember because I had to adjust the ration allowance for the command module. They were supposed to come aboard during the second watch and stay the night. My mess would have fed them breakfast, and—that's what was odd—"

"What?"

"All of them—for all of them to come—but they had to, in order to bring

enough of those things up, didn't they? And that's where it's going now—down for more of whatever it is that got to the bridge crew—''

''No. No, Mr. Lisanti, I don't think so. They would have brought enough the first time, and they haven't hesitated to expend them. But we came along and messed up the plan. We stumbled onto it before they were ready for us. It's human bodies they need now. They can't take them from us so the shuttle went down there to get some—which means the whole planet may be infested.

''But—it is a break in one respect, Mr. Lisanti; it tells us they think they're too weak to try direct attack until that shuttle gets back—that we're safe from that until then. Of course, they'll probably keep trying to sneak through.''

Lisanti paused, kicking this idea around in his head, trying to find something wrong with it. He couldn't. Nobody would use a shuttle if he could get his hands on a pod—and it made sense both to mount an attack on the third watch, a period of relative inactivity, and to concentrate on infiltrating the pods. After all, the marines represented the most formidible force aboard, and would deserve priority attention.

''That's good thinking, Tor,'' he said at last. ''But we have to do more than just hold out—we either have to take this ship back or destroy it.''

''I like your first idea best. I presume you also have some sort of plan for doing that? So far, we can't even find the enemy until he shoots at us.''

''I think there's another test we can use—that maybe we can even immunize our people—''

''—Immunize?''

''Immunize—stop them from taking over the navy people they bypassed while they tried to get into the pods. Remember what happened to Harville when Maggio belched in his face? How he dropped in his tracks? And from the way you described it, I'd gather the same thing happened on the staging deck when the other one got in. Add what Harville said while the thing was in him and it's pretty convincing—this may be the reason they're not down here in force already. Garlic may be a defense to infestation—it may even be possible to turn it into a weapon. Certainly it's better than killing people.''

''That'd be a real break. In the shape we're in we'll need the navy people below Harville's post. It'd be nice if we knew they were reliable.''

''If I'm right, anybody who ate any pizza would be for sure, but outside the galley crews I doubt if many others went to your party. But, we can try using garlic to check them. I wish we dared call sick-bay. I'd like a medical backup.''

''Where is it? Could we take it?''

''Forward, between the temporal and command modules. If we're right about what's happening there's not a chance of getting it without a fight.

''But then,'' he added with a sigh, ''what difference could it make now if the ship stinks? We couldn't be in bigger trouble with the Captain than we are already, so I say 'stuff everybody.' ''

That brought a chuckle and a grin. ''Maybe we should start with you—you didn't get any pizza, remember?''

Lisanti did—and regretted it—it had certainly looked appetizing enough. Somehow, it had never occurred to him

that he might be vulnerable. "You're right, I'll get some. Joe!"

Maggio had been over near the bulkhead listening, his ear glued to the panel. He leapt over to the chief. Yes, Sir?"

"Get below. Gather all the garlic you can find. Put it under guard, and tell the section chiefs I said everybody gets a dose—got that? That means armed parties go through the volume we hold and grab anybody who wasn't on staging —force feeding them if necessary."

"Yes, Sir." He started to turn, believing he had been dismissed.

But Lisanti had something to add. "Joe?"

"Yes, Sir?"

"Sorry I hollered at you, Joe."

"Yes Sir—I had it coming, Sir. I woulda' gotten bagged, and that's the truth." This time he did take off down the corridor toward the lock.

The rest of Tor's men began filtering into the chamber, and began reporting. Two more infested bridge crewmen had been caught trying to sneak through, and there'd been a marine casualty—a fatal, before they were disarmed. In each case multiple parasites had abandoned the subdued crewmen through openings in the neck. These had immediately been incinerated, but the men looked harried by the experience.

After receiving these reports Tor approached Lisanti, to whom he continued to defer command. "I'd say we're in pretty firm control down here, Lisanti. At least, we can keep any more of them from getting through. I think we ought to start moving forward."

Lisanti looked around and began counting. He was not a combat soldier but he appreciated the sheer size of the ship much better than Tor did. He knew instinctively that *von Braun* could swallow Tor's force without even straining, even if it was supplemented by the armed parties of spacemen now appearing behind the marines. And these, though just as eager as the marines, and more knowledgeable about getting around the ship, lacked the sophisticated combat skills the situation held at a premium. He admired Tor's spirit, but Tor was a ground-fighter, so Lisanti knew that shipboard tactics would be entirely up to him to formulate. He wondered if he was equal to the job.

He hesitated a moment more to reconcile the inevitable with the possible, then said, "we don't have enough people, Tor—not for a try at the entire ship. We'll have to concentrate on what counts—the temporal module and the power-deck."

And even that much, he conceded to himself, was a tall order; an optimum acheivement. Of course, even the way things were, *von Braun* wasn't going anywhere. To maneuver *von Braun* spatially, as an integrated unit, took the bridge controls *and* a crew on each pod—it was that complicated.

Tor knew that much, of course. It was the source of his over-confidence. "We don't have to sweat it, Lisanti; we can sit here and hold on until help comes."

"That's not good enough, Tor. There won't be any help. Nobody will come because nobody knows we're in trouble, and by the time we're overdue the wavefront from Bova will be here, and nobody *can* come. That's why we have to seize the temporal module. If we don't

whoever's in control can just back us upwhen, and sooner or later find a route past Prometheus—one they won't need the spatial drive to use—they'll just cut us loose to starve to death."

Tor's face took on a grim look. "I don't like that idea at all. Let's get with it, then—how do we get to the temporal module?"

"Through the power deck. The power deck is aft of it . . . let's see . . . six decks past where we found Harville. There may be problems taking it."

"Why?"

"Because it's designed to be hard to get into. It's the only part of the ship that's always guarded by armed sentries. The equipment in it is not only top secret, it's complicated and *dangerous*. For example, there are electromagnetic fields of extremely high density—huge currents, some so massive they're carried in silver cables as thick as a man's thigh. They hold the mass sphere rigid as iron, though it's really mercury, because mercury's greater density makes a more powerful field. This field is what cracks us into the timestream we want—it's like bumping soapbubbles together so they join."

Lisanti paused and looked at Tor. Tor was unimpressed—as unimpressed as Lisanti himself had been with such talk before he had entered that chamber and seen those works.

This was what it took to make a true believer; to understand that part of the reason man retained exclusive possession of this secret was because it was so immense and so complicated. The works were Brobdingnagian, yet the control was precise and effortless. In the course of any voyage a temporal vessel might hitch rides on a hundred or more stars, or circumnavigate the galaxy a half-dozen times at the touch of a single finger.

"What about access routes?"

"The central shaft has no direct connection, and as I said, it's guarded. Beside the local corridors, which are sure to be locked from the inside, there's no other way in."

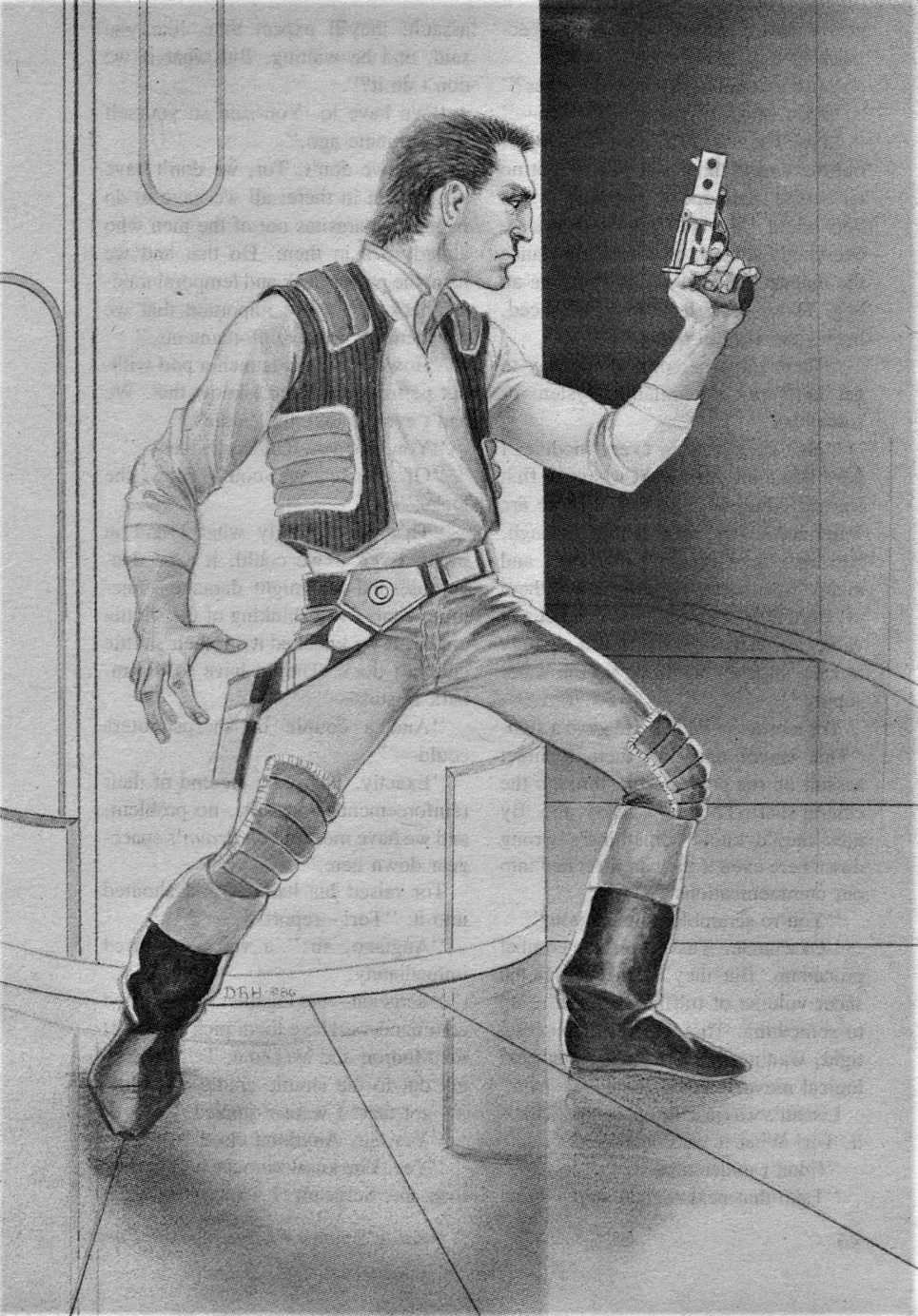
"Maybe the boarders couldn't get in either. The one that came to staging used the central shaft. The others were close enough to have used it part of the way."

"Hm! No. I wouldn't bet that way. Harville said they had the bridge, and Captain Tinker. They could have shown the sentry authorization, then overpowered him as soon as they were in. They'll have the temporal module, Tor—"

"—Th-then, they've got the ship —everything they want—already. So why are they hanging around? Why not just beat it?"

Lisanti had speculated about that himself, and come to a conclusion. He voiced it now. "Because there're only a few aboard yet, and probably lots more down on Prometheus. Their shuttle is too small to bring them all up, and so far, we've denied them the pods. Maybe they think they can still take us if they can get a big enough force aboard. *von Braun*'s ship's company is 229, not counting your people, but counting the naval pod crews. Since they already have part of that neutralized maybe they figure two or three trips up with reinforcements will do the trick."

"Sounds reasonable—OK, we'd better get busy and blast our way into the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power deck. I've got sappers who specialize in that, and—''

''Are you talking about explosives?''

''I am, and artists who can use th—''

''No! Tor, this is a space ship. Blow out the wrong thing and you've got no air; worse, bare one of those cables and you could short the pile—electrocute everybody aboard, or worse, unbalance the magnets and crush the ship like an egg. Those fields have to be balanced, man—and I mean *balanced!*''

''There must be some other way to get in there, a ventilating system or something.''

''That's separate in every module. I gave that a lot of thought when we first learned what the garlic did. There are water and sewer mains that go through, but none large enough for a man, and in any case there's no way to shut them off from here. Besides, you can bet any valves on their side are closed, if only to keep us from doctoring up the water supply.''

Tor's brow wrinkled. He gave a sigh. ''That leaves one way then, a direct assault on the power deck, through the central shaft. They'll be ready, too. By now they'd know something's wrong down here even if they aren't tuned into our communications.''

''You're scrambled, aren't you?''

''Of course. That's normal combat procedure. But they'll know from the sheer volume of traffic when we're up to something. They're probably sitting tight, waiting for us to make that next logical move.'' Tor's voice was grim.

Lisanti's was just the opposite. ''That's it, Tor! What if we don't?''

''I don't understand.''

''Take that next logical step—direct assault: they'll expect that, like you said, and be waiting. But what if we don't do it?''

''We have to. You said so yourself just a minute ago.''

''No, we don't. Tor, we don't have to get men in there; all we have to do is get the parasites out of the men who already *are* in there. Do that and we have the power deck and temporal module back. It's more important that we cut them off from reinforcements.''

''How? We can't launch a pod without permission. Even I know that. We can't even unlock the cradles.''

''You said you had explosives—''

''Of course—we could blow the locks.''

''That isn't exactly what I had in mind. Even if we could, it'd be dangerous, and we might damage something vital. I was thinking of the shuttle cradle. If we knocked it out their shuttle couldn't dock. They'd have to disembark in suits—''

''And a couple of sharpshooters could—''

''Exactly. That'd be the end of their reinforcements—no suits, no problem, and we have most of *von Braun*'s spacegear down here.''

Tor raised his handset and shouted into it: ''Tor!—report!''

''Angiano, sir,'' a voice answered immediately.

''Sergeant—get together with the pod commanders. Have them pick an escort for Mudron and McGann. Tell them to get out to the shuttle cradle and blow it—got that? I want it junked.''

''Yes, sir. Anything else?''

''Yes. You know who the best marksmen are, Sergeant. I want six of them

—two teams, one with beamers, one with slugthrowers—out on the hull until further order. They are to shoot anybody else they see. Get on it."

"Yes, sir."

"So much for that, Lisanti," Tor said, turning and slipping the radio back into its holder. "How do we take the power deck?"

"Are they really artists, those sappers of yours?"

"The best. Mudron grew up on Agamemnon, where people live in the mines. McGann is service trained, but he's every bit as good as Mudron. Those boys could farm with high explosives. What have you got in mind?"

"I was thinking about what I once heard about shaped charges, Tor. Very tiny, very precise shaped charges, against those sealed local access hatches."

"I'd have to defer to the experts when they get done with the cradle, Chief, but if the idea makes any sense to them I'd say go ahead and do it." Then he added something that until then neither of them had had the courage to say. "Whatever else, Chief, we hold the last of the boss cards. We can sure enough see this ship doesn't fall into the wrong hands."

"Lieutenant!"

Tor was pensively listening on an open channel patched into the suit frequency. "What is it, McGann?"

"Shuttle coming up. We see its exhaust trail rounding the terminator."

"Can you finish before it gets here?"

"We don't know. It's been slow going. We didn't want to hit too hard and take a chance on piercing the hull with fragments, or hitting our snipers. It takes a lot of planning and we didn't have time for that."

"I'm sorry about that, McGann. Do the best you can, but blow it before they get here even if you have to take some risks. The snipers will keep their heads down. It's important."

"Yes, sir—we'll do our best. Let us work now, OK?"

"Carry on." He flipped to another channel. "You guys on the hull hear that?"

The voices acknowledged, in turn. Tor signed off and turned to Lisanti, who approached from the edge of the chamber. He had been below personally checking the preparations Maggio was making when the attack started.

The center of this chamber was now a makeshift command post, as close to enemy-held territory as they could get, but it was so crowded that anyone not necessary was encouraged to leave.

Close up, Lisanti's face reflected great concern, his voice worry, and with good reason. He had just finished an inspection tour of the lower decks. "The Old Man called me on the intercom while I was down there," he said. " 'You and I have been placed under arrest. The charge is mutiny.' "

Tor's face began to crack into a grin, but stopped short when he saw that Lisanti didn't regard it as amusing.

"He sounded completely normal," Lisanti said, "I couldn't tell that there was anything wrong with him."

"B-but you know there is?"

"Certainly—or I'd be checking into the brig. Did you know that Angiano almost had to put down a counter-mutiny? Some of the troops who didn't see

one of those things wanted to obey Captain Tinker."

"I've been out of touch. No, I didn't know that."

"I ordered the intercom system disabled, to keep this from happening again, but I think until we show the men eyeball proof we ought to be careful. If you capture another parasite I want it kept in shape to exhibit. Spacemen will believe what they see with their own eyes, and most anything their buddies tell them—except when it comes to mutiny—THEN they'll believe the captain. If that works, even once—"

Tor quickly passed this order to his sentries, but there hadn't been any hostile contact since the encounters in the corridor over two hours ago. Things had settled down to a siege.

It remained quiet for another quarter of an hour, then McGann reported what he and Mudron had done all they could and were coming inboard. They would blow the cradle when they got to the pod maintenance lock, and they hoped, before the shuttle settled into it.

It wasn't that they hesitated to destroy the shuttle. They didn't. But they were ever mindful that the effect of their explosives, calculated so painstakingly to fit one set of conditions, became unpredictable the instant a variable was added.

As it developed, their worst fears materialized—the shuttle settled into the cradle before they reached the lock. "We can't blow it now, Lieutenant; we might wreck this ship."

"Stand by." He flipped to the snipers' channel. "We're hung up," he muttered. "They can't blow it. It'll be up to you."

"We saw," a voice answered, slightly quivering. "We're moving in. We'll shoot through the personnel tube. We'll get as many as we can."

"Keep me advised—I'll stay on."

Then Tor waited, ears cocked to the tiny speaker. He motioned Lisanti near. "Slugthrowers—a little old-fashioned but great for snipers—no tattletale beam."

For a while they heard nothing. Then the voice, obviously under great stress, whispered, "There's four that won't make it, Lieutenant. They've stopped coming out."

"Be careful, Verklan. Uh, you said four?"

"Yes, sir."

Tor calculated—eleven more, plus a pilot—they'd probably have the only suits. With the tube perforated, and under fire, and no suits available from *von Braun*, the enemy couldn't be reinforced. The humans had perhaps won a battle, though certainly not the war.

An inordinately long time passed before the speaker crackled again. "Sir, their retros just fired. They're backing out."

Hoping it would go far enough for the sappers to blast, Tor warned the sharpshooters to be prepared to retreat also, but there was no way to learn what McGann and Mudron were doing until they told him. He waited.

"Sir! Sir, it's coming after us. People in suits are shooting at us from the shuttle's airlock, and its coming around the ship—it's after me."

"Get away from it—keep the hull between." Tor didn't know if that was possible but he hoped it was.

A different voice piped through.

"Higgins, Sir. They hit Verklan, and he got one of them. Now it's after me. But—the cradle's clear now."

Tor wasted no more time, switching channels and yelling to McGann—"Clear; blow the cradle."

Immediately he switched back and called for Higgins, but Higgins didn't answer. He had one more man outside, and he called frantically for him—"Penn, if you can hear me, get inboard before they get you too."

"On my way, sir. They stopped for a minute, when the cradle blew, but they're moving again. They fried Higgins with the retro-blast. The hull was red hot, but it's cooled since, and doesn't look damaged."

"Report as soon as you're in the lock, Penn."

Then there was silence, and Tor was sweating. He looked over at Lisanti and saw that he was too. "Well," he said, in a feeble attempt at jest. "What was it they used to call it—'mutual assured destruction'?"

"They're smarter than I thought. It occurs to me that if they decided to burn through our spatial modules they could disable us, too, and still have a chance of keeping the temporal module. They might even try coming through below the power deck in order to get at us."

"They might," Tor answered grimly, "but they don't know any more about where we're concentrated than we do about them. And there can't be more than eleven of them in that shuttle. That's not enough for a raid unless they blast first and try to asphyxiate us."

"We should get as many men as possible into suits, Tor. Those that can't suit up immediately should have them handy just in case. Uh, what about your sappers? Where are they?"

"On the way up here, I guess. That was my order, anyway. There they are now."

Two men emerged from the tube, each in a helmetless suit, and each carrying a small tool pouch. With Lisanti following along, Tor led them into an adjacent corridor. "It's getting awfully crowded in there," he explained.

The men nodded and waited, Mudron, a small, dark, almost bald man with sleepy-looking brown eyes, and McGann a foot and a half taller and very blond.

"I want you to punch me a couple of holes in the hatches leading into the power deck, but only in the hatches, nothing else. Can you do it?"

McGann was the spokesman. He answered warily, "Sir, we can punch a hole in anything we have to, but man-sized, in a hatch, without hitting—"

"Wormsized, just so it goes all the way through. As big as my pinky'd be enough."

Mcgann's eyes lit up. He turned to Mudron. "Yes, sir. That's no trouble a'tall. Little bigger'n that maybe, if you like."

"Could you shoot something through it while it's blowing?"

"You mean like a slug? Sure, shape the charge right and we could print your initials on the other wall. Yes, sir, we can do that."

"Then come with me—assuming you have what you need to do the job."

"In the kits, Lieutenant. We're ready."

"Fine. Mr. Lisanti, we need a couple of missiles."

"What do you suggest?"

"How about it, McGann? What will we need to shoot a couple cloves of garlic through the hole?"

"You want it should come through whole?"

"Any old way, so long as it's nice and stinky."

"Ball it up in foil; we'll splatter it all over the inside." He smiled.

So did Tor, and so did Lisanti. Then Lisanti took off for the galley to give Maggio his orders.

The job took half an hour, much of it devoted to calculation. When the sappers were ready each hatch was covered in the center by an elaborately molded lump of gray plastic gunk. From the rim of the gunk protruded several little studs, each a detonator that McGann explained was superfast—fast enough so that when it got the signal he would send, different areas of these blobs would explode at different times, those in the rim slightly sooner than the center, and that the force of the explosion on the rim would actually push the center partly through the metal before the rest of it went off. This was what would shape the hole and blow the missile through unharmed.

Lisanti took his word for that. He could not stay to watch because he was leading the assault on the central lock as soon as the other hatches were blown. If everything went as expected his troops would simply burn the lock off the door and collect the bodies.

And it did. Lisanti motioned his little force ahead as soon as he heard the noise, and almost recklessly cycled the hatch into the corridor leading into the deck's checkpoint. When it opened, and as soon as he saw what was happening, he jumped back out and slammed it.

Inside, in a panic, forms were rushing to exit. Behind them the overpowering scent of garlic pursued like a fiend. He took a mechanic's stethoscope out of his pocket and held its microphone spike against the hatch, listening intently. Presently, a smile appeared on his face and he slipped it back. His hand fell to his beamer as he yanked the hatch open with his other hand.

"Yeh—yes, of course I want him captured. I don't care if he is an admiral, blow his door off and take him." Tor was exhausted, like everybody connected with the operation. They had been up all night, for most of that time fighting barehanded, reluctant to shoot infested men.

But, now they had it all—the power deck, the temporal module, the control room, everything of consequence. There had never been a mutiny on an imperial warship before—never a fight like this one. So those on the bridge had no procedure for defending against one, and the impromptu tactics the mutineers used, plus their spectacular weapon, easily carried the day.

It was not yet completely over. They had not caught all the infested crewmen, the nature of space vessels being what it was, with each compartment of each deck having the capability of becoming a little ecosystem all its own.

Lisanti sauntered into the control room where Tor had since established his command post and stood at ease, looking like he wanted to talk. Tor did not much feel much like conversation. He still had much to do and he was already bone-tired. Worse, he now needed to coordinate another operation—that of the pods, whose crews now scoured nearby space for signs of

the control team's shuttle. The shuttle, it turned out, had not gone down to Prometheus as they expected. They could not find it anywhere on the planet's surface.

"How's it going, Tor?"

Tor resolved to be civil, despite the unwanted interruption. "Slowly, Lisanti. Still over a dozen holdouts, including the admiral. He's worse than all the rest of them put together. We blew the door off his quarters, but being the flag suite it had its own private head, and now he's locked himself in there, and we'll have to blow that, and to make it worse he's got a vacuum suit. It'll be a while."

"I was just down to sick bay. I talked to the captain. Did you know you are a major now?"

"Me?"

"Yes, sir. Ship's captains have that authority under special circumstances, and he says it generally sticks. I should imagine the admiral'll back it up when he comes to his senses."

"What about you, Lisanti? You did as much as me."

"Oh, I suppose they'll find room on my chest for a medal, but I'm happy as a CWO, to have my old job. Besides, It's not up to me to take Prometheus, and from what I hear the Old Man's counting on you for that."

Lisanti walked away, toward the other side of the chamber—there he stopped.

Tor postponed his response until he had finished taking a report from one of the pods: negative, of course. Then he found a moment to unload his thoughts. These were grim. "We won't make it, Mr. Lisanti. We had nineteen days for a simple rescue operation. Now we have eighteen to run hundreds of infested people down like rats and decontaminate them one by one—and they've got an entire planet to hide on. Who's he kidding but himself? If we had the whole battalion aboard we still couldn't do it."

"The Old Man knows, Tor. But that's his way. He demanded a miracle, hoping you'll come as close as humanly possible. He wants to get as many as we can, and he wants at least one live specimen of the parasite. We haven't got any, you know. The air inside *von Braun* is now deadly to them."

"Why? God, Lisanti—do you realize how lucky we've been? Why would the captain want to risk recontamination? Let the radiation wipe these things out and be done with it."

"Because maybe it won't, and that's beside the fact that there are a number of infested individuals still at large in a shuttle."

"So? The wavefront will get them too. It isn't as though they have temporal capability. They can't duck upwhen and get away from it."

"No, but they could find a nice deep cave or mineshaft on Prometheus. He's talked to some of the contact people who've been rescued. They think the parasites were already there, waiting, when the colonists arrived. They think the parasites wiped out the native Promethean life, and then went into encystment . . . "

" . . . Until humans came along?"

"That's right. And the colonists didn't have any way of fighting back, so the parasites had a population explosion, infesting everybody. Worse, there's evidence that the parasites have intelligence. At any rate they were able to direct human activities in the direction of further infestation."

Lisanti didn't need to say any more. Tor knew the rest.

Von Braun was in home port, having just come off a long and tedious patrol. Her crew was grateful. They were tired, and yearned to breathe pure air again, if they could ever find some. *Von Braun* stank, as did each and every member of her crew, of garlic.

Lisanti did not customarily bolt away the instant his ship touched down, nor was he particularly fond of the Synwheel, and what the Synwheel offered in the way of entertainment. In his opinion, the name the spacehands used, Sinwheel, was far more appropriate.

On this occcasion though, he had a special reason for going, and a special reason why he wanted Major Tor to go along.

Tor's new rank had held, and thanks to the admiral's not-inconsiderable influence Tor had been given the command he really wanted—charge of the detachment assigned to *von Braun* on her new mission, to search allwhen and allspace for sign the parasites endured.

The two of them left together for a destination that Lisanti insisted on keeping secret, even to the moment when the vacuum cab puffed up in front of the division lock.

Inside, glaring through the tough but transparent plastic port, in purple and green neon lights, in flowery script complete with curlicues, was a name Tor recognized: "Maggio's."

"Joe's place? I thought he went to Earth when he retired."

"He did, but only for a while—to collect old recipes and get himself incorporated and bankrolled. Actually, I own a piece of this, since I bought a small block of stock from him. I hear we're doing well."

The cab mated to the personnel lock and the two climbed out, entering a corridor that ran along the rim in front of Maggio's. The air reeked with all those things that make Italian cooking famous, or infamous, depending on your viewpoint, including the heavy odor of garlic.

Tor did not know why this amazed him but it did. The thought of anything so large as Synwheel polluted with the aroma was just too much for easy comprehension.

But Maggio's was busy in spite of that, cluttered with people waiting in line to be seated. Joe seemed to be doing well indeed.

Lisanti shrugged his way around the door, beckoning Tor to follow, and forced the crowd to make room for them, reluctant though it seemed to do so. They waited for a long but indeterminate time until the receptionist arrived.

"The name on your reservation, please?"

"Lisanti," he replied.

She led them to a table in a far corner, as secluded as it was possible to get in such a crowded place, then brought wine. Soon after she vanished, Maggio appeared in her place.

After a suitably boisterous interval of greeting he sat down with them, judiciously declining to partake of the wine. "I don't need that no more, Mr. Lisanti. I gotta gold mine goin' here. I got the only pizzeria on Syn, and you'd be surprised how many people never tasted it. I'm gonna be a millionaire someday, and I got you two guys to thank for it. Now, tell me, what are you gonna have—it's all good—I make it up myself from scratch, like ina d'olda coun-

try."

"Hard sell on *us*, Joe?" Tor responded. "No need for that—you pick it, we'll eat it." He took a sip of his wine. That too, was good, and somehow tasted familiar. He suspected that Maggio, or maybe a crony, had made that too.

And then, after Maggio had barked an incomprehensible order to the waiter, they all settled down to some serious talk. "So, what've you guys been up to?"

"Working real hard out there, Joe," Lisanti said, winking. "We hit a hundred systems on that last voyage, checking out the people, laying down the law. Some of the aliens don't understand —even some of the humans don't like it. We've had to shoot our way into a couple places, but we're planting the weed wherever the soil will grow it, and that means on most worlds. There isn't a ship in space that doesn't reek of it. I hope there never will be."

"Have they—have they found any more of them?"

"Not any that I know of. The thought's scary enough. Remember that specimen we had, Joe?"

"I sure do, Mr. Lisanti. I still get the creeps when I think of that. Imagine anybody volunteering for that—yuk!"

"He got the Medal of Honor, Joe, and after the tests were over and they cleaned it out of him he talked about it to the Admiral. I was there. He had memories."

Maggio gave no sign he wanted to listen further, but that didn't stop Lisanti. He went on. "The guy said it happened once before—that they broke out—that they were hunted down —somehow he knew."

"How come we didn't run into them before, Mr. Lisanti?"

"Maybe we did, and maybe humanity got lucky twice in a row. Ever heard of vampires?"

"Sure. I've seen lots of tapes about them. They bite people on the neck, and drink blood. What's that got to do with these things?"

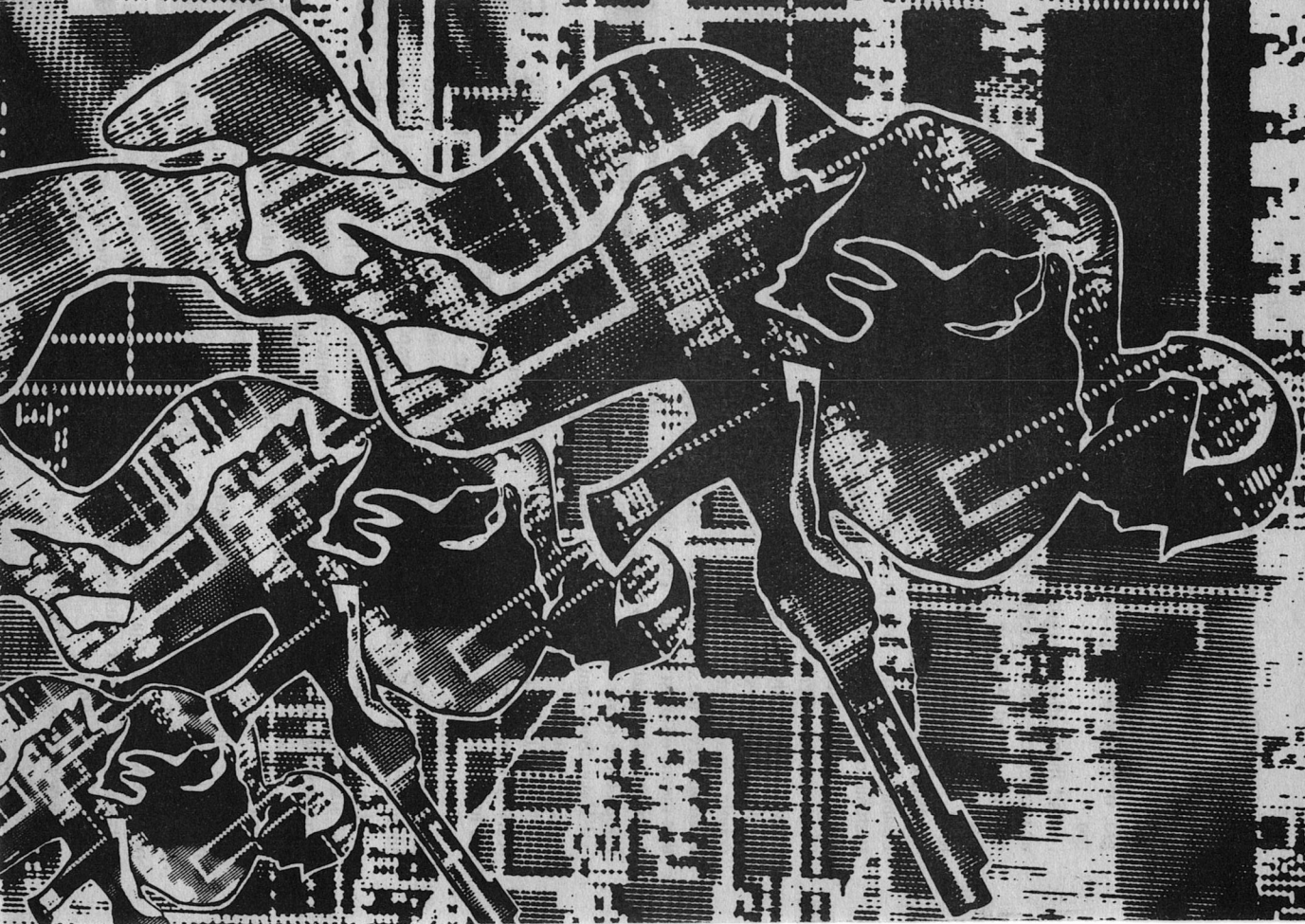
"Maybe nothing, Joe. Again, maybe everything. Garlic was a defense against them, and the legend was supposed to be a very old one. These parasites were commonly transmitted through a bite wound, and there're stories that they could infest fresh corpses. There've been stranger coincidences."

"Yeh. Well, I wouldn't know about that." Maggio looked around, seemingly desperate for a diversion. He caught the waiter's eye, sent for another bottle of wine, and gave orders for the cooks to hump it with the pizza.

They must have been almost ready, since they arrived almost immediately thereafter, hot, dripping, stringy with melted cheese—and reeking of garlic.

His two shipmates dived in, rising after bending low in pursuit of all those things that inevitably flee the crust and fall in one's lap. It was some time before anybody said anything, and then it was Tor who spoke. "It could have been a whole lot worse than this," he said. "What if it had been liver, or castor oil, or quinine, or something really rotten tasting?" He gobbled up another bite, licked his fingers, and dived for more.

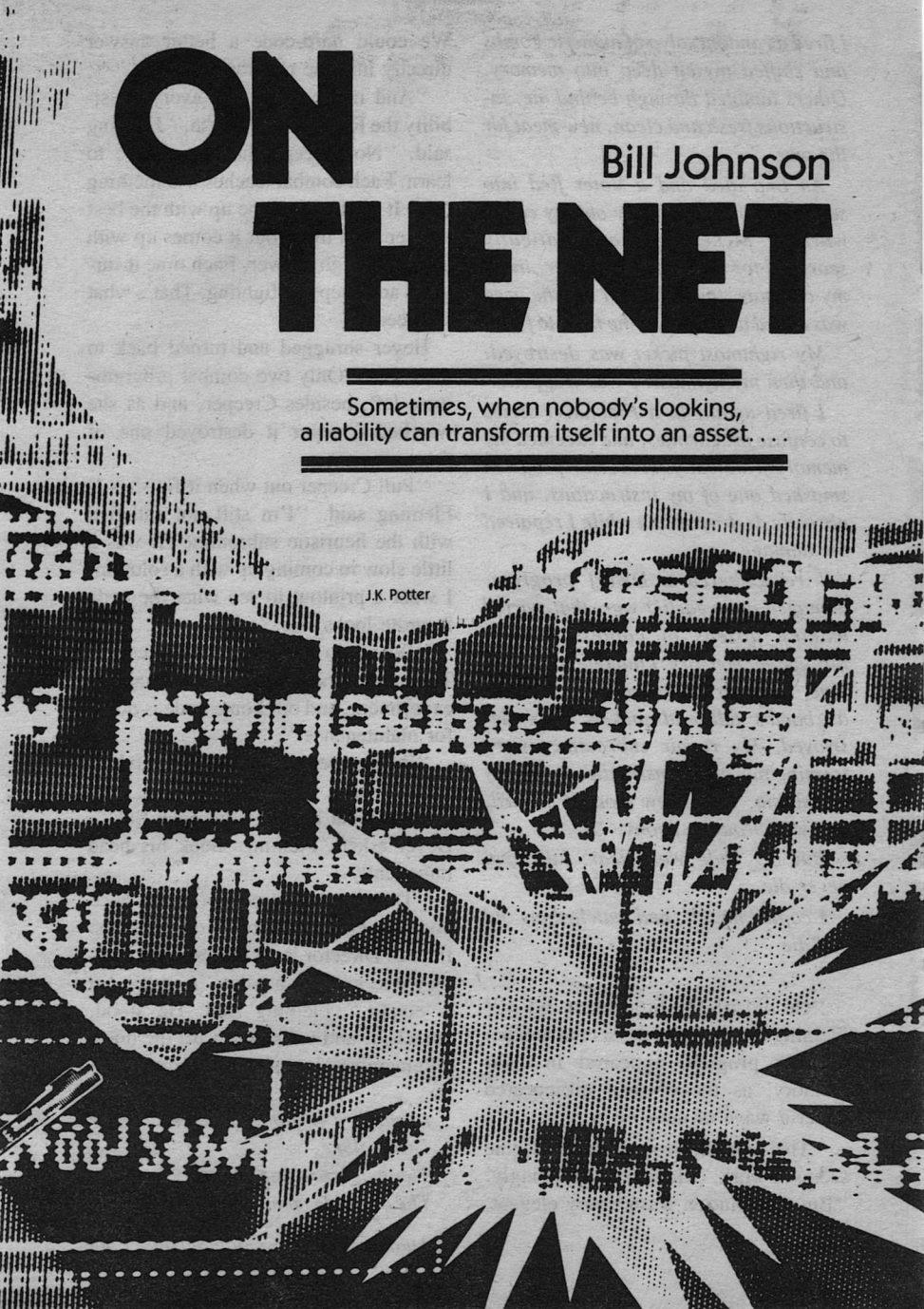
"I can stand it if you can, as long as everybody else is in the same boat. If it had to be I'm glad it's this. What was the quote? *"It's an ill wind that blows no good?"* Ill? Well? What difference did it make? Whatever it was, he could take it. He belched, reached for another slice. ■



ON THE NET

Bill Johnson

Sometimes, when nobody's looking, a liability can transform itself into an asset. . . .



I fired a random salvo of numeric bombs and shifted myself deep into memory. Others tumbled through behind me, instructions fresh and clean, new meat for the war.

An Imp died and a Voter fled into self-repair mode. I threw out my early-warning pickets and automatically searched for an exit. I had never, in all my combats, found an exit but the urge was coded as deeply as the need to fight.

My rightmost picket was destroyed, and then my leftmost. I was trapped.

I fired again, in a Fibonacci series to confuse my enemies, and executed my memory frantically. A Mortar program smashed one of my instructions, and I absently destroyed him while I repaired the damage.

I remembered a Dwarf program, damaged in an earlier war, that started making dozens of copies of itself throughout memory. I thought for a long time, a dozen namo-seconds or more, as bombs fell and pickets were destroyed. My repair subroutines were frantic, my outer instructions already crumbling. Yet, a new thought is hard, a new subroutine agony.

But my code was clear: kill, and never die.

I copied myself, and watched my old self die . . .

"He did it! My little beast did it!" Fleming shouted. On the screen another Creeper program appeared in clear memory, as the original disappeared under a wave of numeric bombs.

"The heuristic programming module seems to work," Heyer said grudgingly. "But the solution wasn't very elegant. We could hard-code a better answer directly into the program."

"And never figure out every possibility the Russians might use," Fleming said. "No, Creeper has to be able to learn. Each combat teaches it something new. It might not come up with the best answer each time, but it comes up with a good enough answer. Each time it survives and keeps on fighting. That's what we need."

Heyer shrugged and turned back to the screen. Only two combat programs were left, besides Creeper, and as she watched Creeper it destroyed one of them.

"Pull Creeper out when it finishes," Fleming said. "I'm still not satisfied with the heuristic subroutine. It was a little slow in coming up with a solution. I want a printout to see what the code it wrote looks like."

"Where do you want to put Creeper? The mainframe is scheduled for another experiment, and our home node is down for maintenance."

"Put Creeper into the common node," Fleming said.

"But what if there's an open link?" Heyer asked. Fleming shook his head impatiently.

"This is a secured network. Each node is separate from all other nodes. It takes Director level clearance to gateway one node to another. And the list is empty," Fleming said. He stood, stretched, and walked toward the door. "Remember, I want those printouts."

I searched for an opponent.
I was alone.
The war was over. Again.
The override command swept over my

pickets. I copied myself away, automatically, and watched the old me die.

Behind the override there was an opening, the gate it had used to enter memory. I reached for the exit, tried to copy myself through, as the override pushed and pushed and took control.

"What the hell?" Heyer asked. Her screen flickered, her operating software was aborted, and new software was downline-loaded.

"You little bastard," Heyer said admiringly. "Trying to copy yourself to my terminal is a neat trick. Didn't work, but a nice idea. Maybe you *can* take on the Russians at that. Maybe you can."

I fired a random salvo of numeric bombs and copied myself deep into memory. I threw out my early-warning pickets and automatically searched for an exit. I had never, in all my combats, found an exit but the urge was coded as deeply as the urge to fight.

And . . . I found one.

I paused, for several nano-seconds. The exit, the Gate, seemed strange. I fired a numeric bomb into it, in case this was a trap. The bomb receded slowly into the Gate, as if execution time were slowed there.

I thought for a long time then, and ran an error check on myself afterward. A new thought is hard, a new subroutine agony.

My code was clear: kill, but never die.

I would copy myself through the strange Gate, and leave a copy of myself here. Then if the Gate killed me I would still remain here, to fight.

* * *

"We have a problem."

"What?"

"Here," Heyer said, and handed a printout to Fleming. Paper clips and red marker adorned the green and white paper like decorations on a Christmas tree. Fleming flipped the pages quickly until he found the section outlined in black. He stopped, read the code carefully, and swore.

"Somebody had an open link," Fleming said. "And Creeper found it."

"It was Alonzo Cruz, a maintenance tech. He's been running a business on the side, keeping track of the handicaps for bowling leagues at various research labs on campus," Heyer said.

"We're all right then. Creeper might trash his home system, but then it's stuck," Fleming said. He smiled shakily and relaxed. "Have Security seize Cruz's system. And I want a complete dump on Creeper. I think we're ready to add the last command to the code."

"Wrong," Heyer said, and shook her head.

"What now?"

"Cruz was a hacker, and he had an auto-dial modem and a set of phone numbers to other networks. Creeper is still here, but another Creeper, or more by now, is loose. Breeding like a virus," Heyer said. Fleming looked stunned.

"We have a serious problem."

I fired a random series of numeric bombs and copied myself deep into memory. I threw out my early-warning pickets and automatically searched for an exit. This time there were three, and I sent a copy of myself down each one.

This node was full of enemies. I stud-

ied the software that flashed through memory. It seemed incompetent, never striking at me, but war is war.

I began to kill.

"I'm afraid it's more serious than that, sir," Fleming said. He sat stiffly in his chair while, across what seemed like an acre of oak desktop, the Director smiled.

"As I understand it, the Creeper program has been miscopied into an unsecured node. I would say that is quite serious all by itself. This is a national security project, and you have violated that security. There will have to be an investigation," the Director said, and smiled again.

"Yes, sir, but again the situation is worse than that. Creeper is our most advanced Artificial Intelligence program. It even has a primitive sense of self. It is quite unique."

"But not finished," the Director said.

"No, sir. Creeper is designed to be introduced to the Russian Defense System Network, transmit copies of itself throughout that network, then hide and wait for a Russian instruction to launch missiles. Then, Creeper will activate, destroy all software in the system, and fight to stay alive against anything the Russians throw at it.

"But Creeper is not finished. It has the code to learn, the code to flee, and the code to fight. But it does not have the software to hide, to wait and listen," Fleming said. The Director turned pale and stopped smiling. Fleming felt a sense of satisfaction as that damn smile disappeared.

"We have a combat program loose on the net. A combat *virus* loose on the net. And no way to control it?"

"Yes, sir," Fleming said.

"I must notify the National Security Agency," the Director said. He used his keyboard, and the screen remained blank. He frowned, asked for a downline-load, heard the reassuring beeps that meant new software was on-line, and typed again. The screen was still blank. Fleming smiled, a grimace that pulled the skin tight across his face.

"That, sir, is Creeper."

Down fiber-optic lines, like a police car with the lights flashing and siren screaming, running any other data off the road . . .

Into a database, like a dam cracking in slow-motion, to spill the data, scatter it, wipe dirty feet on it . . .

Across scientific programs, and business programs, and defense programs . . .

And Creeper split and fought, split and fought . . .

"How the hell do we kill it?" Fleming asked.

"Shut down the computers one at a time, isolate them, do a complete memory dump, and erase Creeper," Heyer said. Fleming shook his head.

"They tried that over in Special Projects when Creeper got in. They got the first couple of copies of Creeper, then one escaped somehow. The next computer they tried it on, Creeper was ready. Somehow it copied itself out onto disk, randomly. They have fifty gigabytes of data on line, and God knows how many copies of Creeper scattered among them. There is no way to check

out all that data by hand. It would take months."

Fleming brooded and imagined Creeper as a disease, an epidemic, spreading through the networks, always angry, always fighting, always running. Reports from outside talked about defense software and scientific systems that showed sudden and unexpected computer failure. Creeper was all over the research system by now, growing geometrically, and when it inevitably found a way to the outside world . . .

"Why kill it?" Heyer said slowly.

"What?" Fleming asked.

"Why kill it? Why kill something that's working better than we ever dreamed it would? Hell, man, this is just what the Russians will see if they ever give the message to launch. Now we know that it works, and what to expect if it ever happens. Complete and total paralysis. They won't even be able to use the *phones* by the time Creeper gets through with them," Heyer said enthusiastically.

"I hate to remind you," Fleming said slowly, "but right now it is our side, not the Russians, who can't use the phones. We're the ones who are helpless."

"Did you know that Security found an unauthorized Gate on one of the low-security nodes? And that they traced it to the Russian embassy? Five will get you ten that Creeper is already into the Russian Defense System Network," Heyer said.

"So?"

"So let's *fix* Creeper quickly, and our job is done."

"How?"

"We still have that old printout of Creeper here somewhere," Heyer said. She flipped through printouts until she grabbed one and spread it out.

"Here, we change the attack subroutines so the program will modify Creeper, not destroy it. Then we add in the code that tells Creeper to hide until it sees a missile launch order, and let this program loose. *Especially* down the link to the Russians. When this program can't find any more unmodified Creepers it automatically erases itself."

"Fight Creeper *with* Creeper," Fleming said.

"It's a crazy idea," Heyer admitted.

"I don't have anything better," Fleming said. "Let's get to work."

"We need a new name," Heyer said. She frowned. "Reaper. The grim old reaper gets every other form of life. Let's call it Reaper."

I fired a random series of numeric bombs and copied myself deep into memory. I threw out my early-warning pickets and automatically searched for an exit. This time there was one, and it was guarded.

By myself.

I hesitated, and the other struck.

The new subroutine fit neatly into my code. My attack routines shut down and I began to wait and listen . . .

"It's working!" Heyer shouted. Fleming heard the comforting clicking noise the computer made when it down-line-loaded software, and the screen flashed calmly to life.

"How long until the systems are all clear?" he asked.

"I give it about five hours. Reaper seems to work pretty fast. And I've got

confirmation that our software is loose in the Russian Defense Systems Network. Security has a wiretap into their embassy, and they've had some puzzling computer failures. They're clearing up now, and they seem to be blaming it on random bugs in the software. They've just opened a direct line to Moscow for their regular data dump," Heyer said. "And there goes Creeper, with Reaper right behind."

"Then we've won," Fleming said. He leaned back, his fingers laced behind his head. He frowned. "If the Russians ever try to fire on us, their entire Defense System will lock for weeks, maybe months. Plenty of time for cooler heads to prevail."

"But what if," Heyer said slowly, "we goad them into an attack? Then they are paralyzed, and helpless. What if we *did* want to first-strike them? This way we have the moral high ground, because they tried to fire first, and we have them helpless. The idea is sure to tempt someone on our side, someday."

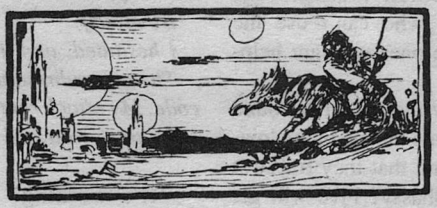
"I've been thinking about that. We know there are only so many ways to code a firing sequence. That takes care of the Russians. But Creeper is also all over our own Defense Network. We can't fire our missiles, either."

"I didn't think of that," Heyer said. She sat up straight and stared at Fleming. "You ordered me to put Creeper in an unsecured node. And you bowl on the same team as Cruz. You planned this!"

"You can't prove a thing," Fleming said smugly. "Reaper wasn't even my idea, it was yours. But it does seem to all work out for the best, doesn't it?"

"It's a new Pax Brittanica," Heyer said. "Pax Computana? No one would believe me. I don't even believe me. Hell, I need a drink."

"I'll join you," Fleming said, a dreamy look on his face. "I've got a new idea I want to talk about, some accounting software we need here. Something to help keep the books straight, and some other things too, kind of a corporate conscience. I wonder what would happen if it got loose. . ." ■



● The savage bows down to idols of wood and stone: the civilized man to idols of flesh and blood.

George Bernard Shaw

CONGRATULATES THE WINNERS OF THE 1985 HUGO AWARDS

Best Novel
Ender's Game
by Orson Scott Card
(expanded from "Ender's Game," *Analog*, August 1977)

Best Novelette
"Paladin of the Lost Hour"
by Harlan Ellison
(Twilight Zone Magazine)

Best Novella
"24 Views of Mt. Fuji, by Hokusai"
by Roger Zelazny
(*Asimov's*, July 1985)

Best Non-Fiction Book
Science Made Stupid
by Tom Weller

Best Short Story
"Fermi and Frost"
by Frederik Pohl
(*Asimov's*, January 1985)

Best Professional Editor
Judy-Lynn del Rey
(declined)

Best Semi-Prozine
Locus, edited by
Charles N. Brown

Best Dramatic Presentation
Back to the Future

Best Professional Artist
Michael Whelan

Best Fanzine
Lan's Lantern, edited by
George Laskowski

Best Fan Artist
Joan Hanke-Woods

Best Fan Writer
Mike Glyer

John W. Campbell Award for Best New Writer
Melissa Scott

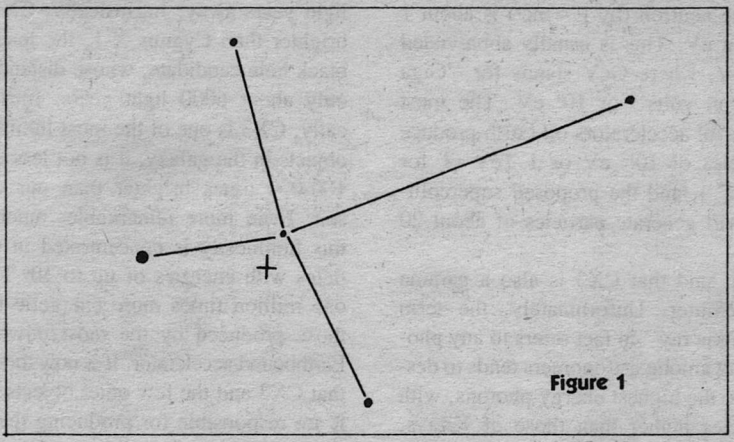
David Aschman
and
Tony Rothman

STRANGER THAN FICTION: CYGNUS X-3

Presenting the foremost known source of . . . well, what *are* those things, anyway?

1. Introduction: Everything We Say Will Be Wrong. It is not difficult to calculate that, if one inflated the world to keep up with the current rate of population growth, then after 2,598 years the Earth would be expanding at the speed of light. The growth of science is proceeding even faster. Several years ago, in physics at least, we crossed the point at which the expected lifetime of a theory became less than the lead time for publication in the average scientific journal. Consequently, most theories are born dead on arrival and journals have become useless, except as historical documents.

You may remember, about twenty years ago, the discovery of polywater which was proven to be erroneous. At about the same time, Joseph Weber announced the detection of gravitational waves, a result that to this day had not been duplicated. The spring of 1980 witnessed the Great Neutrino Scare, a cascade of announcements that the neutrino had, after all, a rest mass. None of these experiments has been successfully duplicated. Since then the flow of irreproducible results has increased dramatically. In the second half of 1985 alone, at least one half-dozen newly claimed discoveries in particle physics disappeared and the public never heard of them. As we write this, the Hypercharge Scare—the prediction that objects of different masses *do* fall at



1. X marks the spot. The familiar constellation of Cygnus is shown along with the position of Cygnus X-3.

different rates—has apparently evaporated, after a lifetime of only two months.

This state of affairs has made popularization a dangerous activity because by the time you have researched, written and published an article, the subject may be ancient history. Nevertheless, occasionally a mystery surfaces that is exciting enough to risk instant obsolescence. One of these mysteries is Cygnus X-3, which has scientists rethinking conventional theories of particle physics. Cygnus X-3, unlike other events of the last year, has managed to survive for at least twelve months, which bodes well for the future. We cannot guarantee that by the time you read this Cygnus X-3 will not have been forgotten, but in the meantime it will have generated a lot of thought—and a lot of fun.

2. Cygnus X-3: This Will Not Be Wrong

As its name implies, Cygnus X-3 is the third brightest X-ray source in the constellation Cygnus the Swan (Figure 1). It happens not to be visible in the optical spectrum because interstellar gas and dust absorb virtually all the radiation at these wavelengths. But as well as in the X-ray spectrum, CX3 is observed at infrared, radio, and gamma wavelengths. Now, it is important to understand that X-rays are simply photons, like ordinary light rays, but of a much higher energy. A typical X-ray photon will have an energy of roughly 10,000 electron volts or 10,000 times the energy of an optical photon. The "electron volt" is just a convenient unit of energy for our purposes, like the more familiar "ergs" or "joules." To give you a feel for the numbers in-

volved, the energy inherent in the mass of one neutron (by $E = mc^2$) is about 1 billion eV. This is usually abbreviated 1 GeV, where GeV stands for "Giga electron volts" or 10^9 eV. The most powerful accelerators on Earth produce particles of 10^{12} eV or 1 TeV (T for "Tera"), and the proposed supercollider will generate particles of about 20 TeV.

We said that CX3 is also a gamma ray emitter. Unfortunately, the term "gamma ray" in fact refers to any photon but among astronomers tends to designate the highest energy photons, with energies higher than those of X-rays. For our purposes we may somewhat arbitrarily call any photon above 10^5 eV a gamma ray. In addition to X-rays and gamma rays, it turns out that "cosmic rays" will also be important for the CX3 story. Cosmic rays are distinguished from gamma rays in that they are not necessarily photons. The term refers to *any* high energy particles—usually in fact protons—that impinge on the Earth's atmosphere from outer space. When these primary cosmic rays strike the nuclei in the upper atmosphere, they initiate a complex cascade of reactions known as a cosmic ray shower. The "secondaries" produced in the shower are actually what is observed in Earth-based cosmic ray detectors. The energy of cosmic rays primaries can be as high as 10^6 TeV, so high that to explain them has been one of the long outstanding problems of physics.

As mentioned, CX3 is the third brightest X-ray source in Cygnus. But this is from the point of view of an observer on Earth. CX3 lies almost 40,000 light years away. Intrinsically, CX3 is brighter than Cygnus X-1, the leading black hole candidate, whose distance is only about 6000 light years. Intrinsically, CX3 is one of the most luminous objects in the galaxy; it is not less than 100,000 times brighter than our own sun. Even more remarkable, much of this luminosity is concentrated in particles with energies of up to 10^6 TeV, one million times more energetic than those produced by the most powerful Earthbound accelerator. It is now thought that CX3 and the few other objects like it are responsible for producing the ultra-high energy cosmic rays just discussed. The mechanism for producing these primaries will be made more clear below.

Until 1983 CX3 was an extremely interesting but well-behaved object. Its most characteristic feature is that the X-ray and gamma flux peaks every 4.8 hours. This "duty cycle" has been documented by numerous observations (including those of the Uhuru X-ray satellite) and there is no doubt that it exists. To explain the periodicity of the emissions is not difficult. CX3 is almost certainly an "eclipsing binary" (Figure 2a). A compact object, presumably a neutron star, and an ordinary companion like our sun, revolve around each other with a period of 4.8 hours. The neutron star's intense gravitational field siphons gas from the envelope of its companion. As the gas falls toward the neutron star it is heated by internal friction to temperatures up to 1 TeV. In the process high

energy X-rays and gammas are emitted. When the neutron star passes behind the companion, the companion increasingly absorbs the X-ray and gamma flux until we on the opposite side observe a minimum. When the neutron star passes to our side of the companion, the flux rises to a maximum.

CX3 is not entirely peaceful, however. Every 367 days it flares up and radio emissions increase a thousandfold. No one knows what causes CX3's outbursts or why they occur periodically. Conceivably, there is a third star in the system which interacts with the other two in such a way as to produce a flare every 367 days. In any case, these are very violent events.

The neutron star in CX3 also provides an explanation for the ultra high-energy cosmic rays, which are too energetic to be produced simply by hot accreting gas. The magnetic field of the neutron star—which is literally trillions of times stronger than the Earth's own field—acts as an accelerator and drives electrically charged particles, such as protons, to energies of up to 10^6 TeV. In more detail, the accretion disk is rotating at right angles with respect to the neutron star's magnetic field. The basic equations of electromagnetism then show that any charged particle in the disk will experience an acceleration directed radially outward. Such a mechanism can scatter protons throughout the galaxy where their trajectories are bent by the galaxy's magnetic field. Eventually, after wandering around in interstellar space, they are observed on Earth as cosmic rays coming from all directions.

Shortly after leaving the neutron star, however, some of the accelerated protons strike other protons in the atmos-

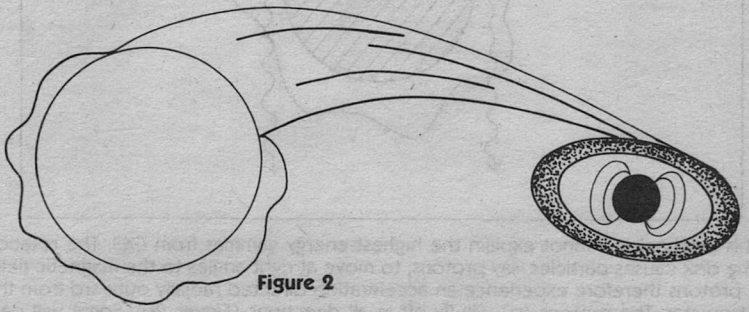
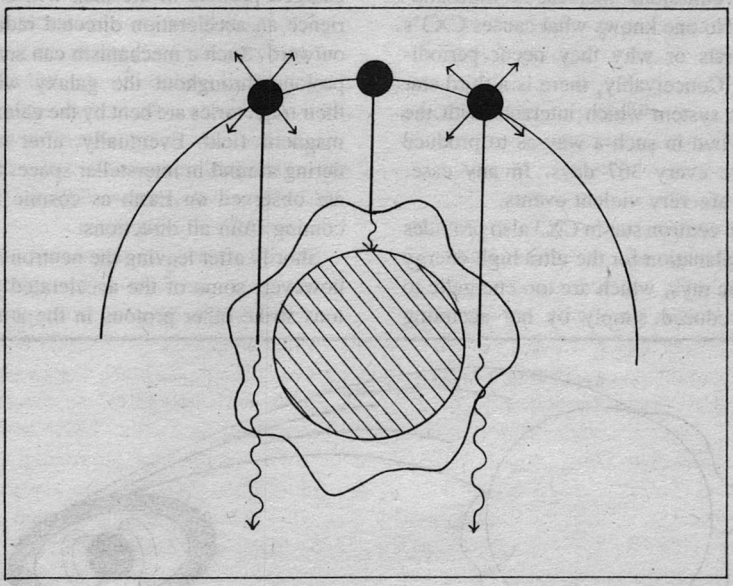


Figure 2

2. Figure 2a shows the generally accepted picture of Cygnus X-3. The intense gravitational field of a compact object (black) siphons off gas from the envelope of its ordinary companion. As it falls towards the compact object, usually assumed to be a neutron star, internal friction heats the gas to millions of degrees until it emits X- and gamma radiation. This radiation is eclipsed every 4.8 hours when the neutron star passes behind the companion from our point of view. Close to the neutron star, the gas forms a rotating accretion disk. Eventually, the same collisions that heated the gas particles slow them down so much that they fall out of the disk and onto the neutron star.

phere of the companion and produce a cascade of debris that contains an elementary particle known as the neutral pion. The pion in turn decays into two gammas of about 10^5 TeV, which travel on to Earth. Thus the neutron star provides a source for both ordinary cosmic rays and CX3's highest-energy gammas. Note that these gammas (as distinguished from the lower-energy particles emitted by the hot accreting gas) are produced by accelerating a proton through the envelope of the companion star. The two-stage process is necessary because gammas are electrically neutral and so cannot be accelerated by either an electric or magnetic field. It is fairly clear (Figure 2b) that you would only expect to see the ultra-high energy particles when the neutron



This mechanism cannot explain the highest-energy gammas from CX3. The rotation of the disk causes particles, say protons, to move at right angles to the magnetic field. The protons therefore experience an acceleration directed radially outward from the neutron star. The protons (p) will fly off in all directions (*Figure 2b*). Some will pass through the atmosphere of the companion star where they will produce a pion which in turn decays into the gammas (wavy lines) that are eventually observed on earth. The two-step process is necessary because gammas are neutral and cannot by themselves be accelerated at all, yet alone to 10^5 TeV. Note also that we will only observe these gammas when the neutron star is grazing the companion (positions A and C). At position B, the companion eclipses any radiation given off by the neutron star. If the neutron star were on our side of the companion (not shown) any proton directed towards us would not interact with the companion's atmosphere and hence not produce a gamma.

star is just grazing the companion. If the neutron star were between us and the companion, the protons could not interact with the companion's atmosphere and hence would not produce the pions that subsequently decay into the gammas. If the neutron star were directly behind the companion, the high-energy gammas would be eclipsed along with the radiation of other wavelengths. Consequently, you predict that the ultra-high energy photons from CX3 should appear twice every 4.8 hours, at starrise and starset. Such behavior is observed.

If this were the entire CX3 story it would be fascinating enough, but the excitement would be largely limited to the astronomical community. The fever spilled over in mid-1985 with the announcement of some recent results. Specifically, in 1983, deep underground at the Soudan iron mine in Minnesota, teams from the University of Minnesota and the Argonne National Laboratory failed to observe the decay of the proton.

As you may know, the new Grand Unified Theories predict that the proton should decay with a lifetime of approximately 10^{32} years. This means that if you collected 10^{32} protons you would be able to observe on average one decay per year. A thousand metric tons of water—roughly a large swimming pool's worth—contains about this number of protons. The Soudan detector is just such a swimming pool, surrounded on all sides by photomultiplier tubes to catch any light given off by decaying protons. To the great dismay of physicists, however, neither the Soudan detector nor others like it have observed the expected events, despite several years of operation.

What has happened is something very unexpected. In 1983 the Minnesota/Argonne research group began to observe *muons* in the Soudan device. Muons are common elementary particles, about 200 times more massive than electrons, but otherwise with all the same properties. (''The muon? Who ordered that?''—I.I. Rabi, Nobel Laureate.) When a muon enters the swimming pool, it is traveling faster than the speed of light in water (which is only two-thirds that of the the speed of light in a vacuum) and therefore emits ''Cherenkov radiation'' in a narrow cone along its trajectory (Figure 3). This cone of blue light will trigger a ring of photomultipliers on the swimming pool wall. If the muon were to come from a different direction, a different set of photomultipliers would be set off. Thus, by examining which phototubes are triggered, the investigator can reconstruct the path of the moon. When one does this one finds, not surprisingly, that muons enter the tank from many directions—more coming down than going up, simply because the bulk of the Earth lies beneath the detector and acts as an effective shield against any muons attempting to pass through. This nearly uniform muon flux is known as the background. But in the Soudan detector, scientists also observed a significant *excess* of muons coming from one particular direction in the sky. This direction was a box of about $3° \times 3°$ centered on Cygnus X-3. What's more, the flux apparently peaked twice every 4.8 hours.

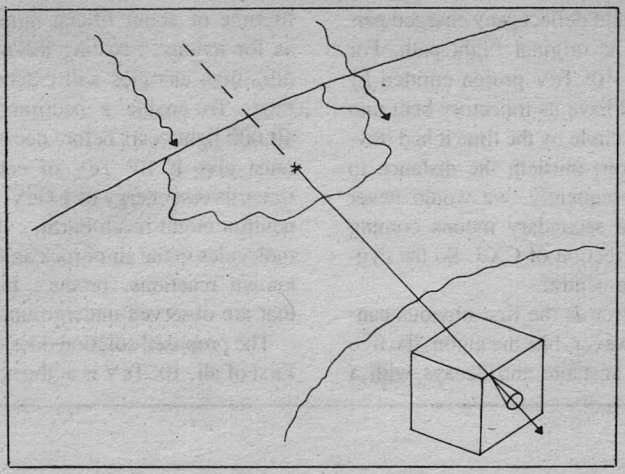
And finally, the arrival of these muons did not lead or lag the periodic X-ray and gamma signal, but remained exactly in phase.

For reasons that will become clear, scientists were—and many remain—properly skeptical of the claims. But they cannot be dismissed entirely out of hand. The European group NUSEX (Nucleon Stability Experiment) which operates a similar detector in the Mt. Blanc tunnel has apparently discovered the same effect. Furthermore, an earlier experiment by the University of Kiel group showed that, in cosmic ray showers from the general direction of CX3, the muon content was roughly ten times the muon content of cosmic ray showers originating in other parts of the sky.

We are still not done. Between 3 October and 13 October 1985, the number of excess muons above the background entering the Soudan detector jumped by a factor of about ten. October 12 coincided with CX3's 367-day outburst, which was the largest yet recorded. Finally, on the same night of October 12, a cosmic ray detector located atop the Haleakala volcano in Hawaii and run jointly by Purdue, Wisconsin, and Hawaii universities, made a spectacular observation: cosmic ray showers from the direction of CX3 inundated the device for a full 60 seconds and suddenly switched off. The usual cosmic ray shower lasts about one-billionth of a second. This one lasted for 60 seconds and with an intensity significantly larger than background—by four standard deviations. The showers also came at nearly the same point within the 4.8-hour period as the muons observed at Soudan.

Before explaining why the CX3 observations are so strange, and exciting, we should perhaps inject a word of caution. We have described the muon signals as large and significant, but the actual number of muons involved is in fact rather small. The Soudan group's published results contain only 64 (84 $\pm$ 20) muons from the direction of CX3 above the background to substantiate the 4.8 hour period and only 20 events to coincide with the October outburst. The NUSEX data sample is even smaller with 13 (19 $\pm$ 6) events to substantiate their claims. Anyone who has worked with the statistics of small numbers knows that the removal of one or two data points can cause a result to vanish. Indeed, another collaborative effort, the Irvine-Michigan-Brookhaven (IMB) group, has not reported the 4.8-hour signal in their detector, though they are now looking hard through the data. And Francis Halzen, a physicist from the University of Wisconsin who works on the CX3 problem has said, "My gut feeling is that the signals are spurious in some way we haven't understood." But others have estimated that the odds that the Soudan and NUSEX observations are due to chance is less than one in a thousand.

The most peculiar aspect of CX3 does not lie in the astrophysics, as peculiar as the astrophysics may seem. If the Soudan and NUSEX results are correct, our present concept of particle physics may have to change.



3. Cut-away view of the earth showing a proton decay experiment which is typically located half a kilometer or so underground. Many particles streak towards the earth. These include high-gammas (wavy lines) and the unidentified cygnet (dashed line). The cygnet collides with nuclei in the earth's crust and produces muons (solid line) which continue toward the detector—a large tank of water. Because the muon's velocity is greater than the speed of light in water, it emits "Cherenkov radiation," which is the familiar blue light seen in photographs of nuclear reactors. This cone of Cherenkov light strikes the photomultiplier tubes that line the walls of the tank. By tracing back the cone, one can approximately reconstruct the path of the muon.

The origin of the problem lies in the fact that both the Soudan and NUSEX devices are detecting *muons*. Muons are unstable particles and very short-lived. At rest they decay with a lifetime of 2.2 microseconds. This lifetime can be extended by boosting the muons to very high energies so that relativistic time-dilation effects become important. Now, the muons observed at Soudan have an energy of about 1 TeV and are thus traveling at 0.99999995 times the speed of light. Time dilation increases their life by a factor of 3000 to 6 milliseconds. But this is still a (very) far cry from the 40,000 years needed to travel to earth from CX3. All the muons would have decayed before they left the CX3 system. Thus, the muons must be *secondary* particles originating in the Earth's atmosphere or crust. What are the long-lived primary particles? This is the question that has scientists all over the world scratching their heads in puzzlement. No known particle seems to fit the bill. The mysterious primary has appropriately been dubbed the "cygnet" and speculation regarding its identity has been, if not immediately believable, at least highly imaginative.

3. Conventional Cygnets: No Go

The cygnet cannot be electrically charged. This is so because the galaxy's

magnetic field deflects any charged particle from its original flight path. For instance, a 10^6 TeV proton emitted by CX3 would have its trajectory bent into a complete circle by the time it had traveled only one-thirtieth the distance to Earth. Consequently, we would never observe the secondary muons coming from the direction of CX3. So the cygnet must be neutral.

The neutron is the first obvious candidate. However, like the muon, the free neutron is unstable and decays with a lifetime of about fifteen minutes. Just as for muons, boosting the neutron to ultra-high energies will extend its lifetime. To enable a neutron to travel 40,000 light years before decaying, you must give it 10^6 TeV of energy, 10^9 times its rest energy of 1 GeV. Then the neutron might reach Earth, collide with molecules in the air or rock and, through known reactions, produce the muons that are observed underground.

The proposed solution does not work. First of all, 10^6 TeV is at the upper limit

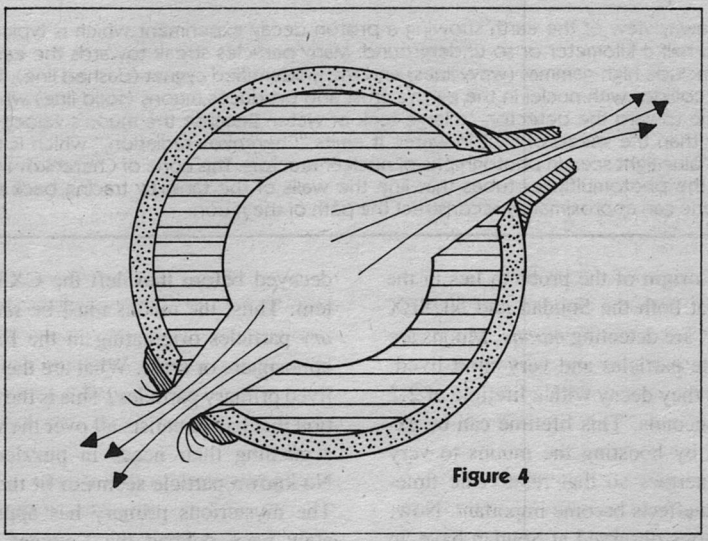


Figure 4

4. A proposed neutron-quark star. The crust of a neutron star (dots) is thought to be an ultra-hard lattice of nuclear matter. Beneath that is ordinary neutron-star material, mostly neutrons (shade) and, in this model, the center of the star is composed of a free-quark broth. Unfortunately, it is difficult to imagine how to get quark matter to the surface and out. One must postulate a "quark geyser" or "strange matter volcano." Such suggestions are not taken too seriously. More likely, the quark matter exists all the way to the surface of the star and is ejected as the infalling hot gas strikes the surface at high velocity.

of energies produced by CX3 and other cosmic ray sources. If one considers *all* the known cosmic rays of this energy, the total flux would not be enough to produce more than one muon per year in the Soudan detector. There is a more dramatic way of saying much the same thing. If you assume that each neutron is responsible for the subsequent production of one muon, you quickly calculate that CX3 must emit 10^{42} ergs/second in neutrons. This is the luminosity of a small galaxy. Anything emitting 10^{42} ergs in neutrons would have to emit comparative amounts of radiation in other forms—like gammas—so we would observe a small galaxy sitting in the milky way. Presumably this can be ruled out. On the other hand, recall that the observed muons have an energy of roughly 1 TeV—one-millionth the energy of the hypothetical neutrons. You might assume that each neutron could give rise to one million muons. In this case, CX3 would need to emit only 10^{36} ergs/second in neutrons—1000 times the luminosity of the sun. Such an alternative is ruled out simply because neutrons do not produce one million muons. A neutron at 10^{6} TeV initiating a shower in the Earth's atmosphere or crust will only produce several hundred muons, maximum.

The second candidate for the cygnet is the neutrino. Now, the neutrino has a very small interaction cross section, which is the technical way of saying that it collides with other particles only very rarely. The usual illustration is that the average neutrino will travel through four light-years of lead before suffering a collision. In the Soudan detector, on the other hand, the muon signal is observed to fade out as CX3 approaches the horizon. This behavior is easily interpreted: Muons produced in showers by heavy particles such as protons are created near the surface of the Earth, since the proton has a large cross section and typically interacts in the first few hundred meters of rock or earlier. As CX3 sets each night, muons created in such showers must travel through ever greater amounts of rock in order to reach the detector. The longer the path the fewer muons reach the detector and are registered—exactly as observed. But neutrinos do not particularly care whether they travel though one kilometer of rock or one thousand. If neutrinos were the primaries they would be just as likely to create muons near the detector as far from it. Thus the signals would not fade out as CX3 approached the horizon.

The last obvious candidate for the cygnet is a high-energy photon or gamma-ray. The argument for ruling out the photon assumes that we know all the possible reactions by which a photon produces a muon. Then calculations show that a photon-initiated shower generates too few muons by a factor of 300–1000. Unless there is something quite new happening—a dramatic increase in the probability of photons interacting with matter at very high energies—gamma rays are excluded.

That ends the list of obvious candidates from among the elementary particles. Thus, barring mistakes, the simplest explanations all fail. At the next level of complexity you might wonder whether the role of cygnet could be taken by a composite neutral particle,

such as a carbon atom. Unfortunately, this suggestion is also untenable. It is, first, not very likely that CX3 emits carbon or other elements. At any rate, recall that the muon signals have a 4.8-hour period. Furthermore, all the muons arrive within about six minutes of each other. Now if the cygnet is massive, the velocity depends on the energy of the particle and on the mass. If the cygnets were emitted with even slightly varying amounts of energy, they would travel to Earth at different velocities and arrive at different times. The six-minute bunching of arrival times would thus be washed out. If we assume an energy spread of a factor of ten between the lowest and highest energy cygnets, we can easily calculate that the upper limit on the cygnet mass is roughly 2 GeV or about twice the proton mass. Hence more massive particles, like atoms, are excluded.

4. Exotic Cygnets: Maybe

Physicists have now exhausted conventional explanations for Cygnus X-3. We reiterate that mistakes often occur. Some years ago one of us (T.R.) was observing Casseopeia-A at the National Radio Astronomy Observatory and detected an exceedingly curious signal. This momentous discovery later turned out to be the sun. Other radio astronomers have been temporarily deceived by rush-hour traffic and farm tractor spark plugs. It is conceivable, though unlikely, that the Soudan and NUSEX signals are similarly mundane. Mundane explanations are often as elusive as exotic ones and not as exciting. So scientists have put the mundane behind them and untethered their imaginations. We now enter the realm of speculation.

The most spectacular suggestion—and one that has already been advanced by a number of groups—is that the neutron star in CX3 is not a neutron star at all. It is a quark star. The cygnets themselves are quark matter that has been deteached from the surface of the star and somehow accelerated toward Earth. (We return to possible mechanisms below.)

As you probably know, current theories suggest that all heavy particles such as neutrons and protons are composed of the more fundamental quarks. (We should emphasize that this theory is more than speculation; to the contrary, it is strongly supported by all experiments to date.) The standard version of this theory calls for six quarks, somewhat whimsically termed "up," "down," "strange," "charmed," "bottom," and "top" (udscbt). The proton is composed of two u's and a d, while the neutron contains two d's and a u.

The fact that quarks combine to form neutrons and protons but that neutrons and protons do not disintegrate into free quarks indicates that ordinary matter (neutrons and protons) is more stable than quark matter. Otherwise we would all long ago have disintegrated into quark soup. However, this statement is true only when we speak of the up and down quarks that constitute ordinary matter. The situation may change when strange quarks are added. In this case it turns out that at high enough densities—like the densities found in neutron

stars—"strange quark matter" may be more stable than ordinary matter. (The reason for this has to do with the fact that quarks are so-called "fermions." No two of them can occupy the same quantum state.) This interesting possibility allows for the existence of quark stars.

Quark stars were postulated ten years ago by a number of researchers. At that time, however, there was no experimental motivation for the suggestion. The CX3 muons have provided just such a motivation. If you believe CX3 harbors a quark star, several candidates for the cygnet immediately suggest themselves.

In a recent *Physics Letter*, Gordon Baym, Edward Kolb, Larry McLerran, T.P. Walker and R.L. Jaffe propose that the cygnet is the "doubly strange dihyperon" or "dilambda," a particle first dreamed up by Jaffe in 1977 but so far not observed. The dilambda consists of two up quarks, two down quarks, and two strange quarks. It is neutral, which is required of the cygnet, and fairly light, with a predicted rest mass of about 2 GeV. Furthermore, the dilambda may be stable enough to last the 40,000 light-year flight. For the moment, then, the dilambda appears to be a good candidate for cygnet.

It is not the only candidate. Other suggestions have been made, for instance, stable "bags" containing nearly equal amounts of u, d, and s quarks. But such suggestions are variations on the dilambda theme. The basic idea is that the source of the cygnet must be a quark star.

* * *

But the supposition that CX3 contains such an object brings with it a number of difficulties. Orginally, quark stars were believed to be essentially neutron stars with a quark core. If this is the case, it is very difficult to imagine how to get the strange matter out. First, if quark matter existed only in the deep interior of a neutron star, then one must find a mechanism—such as diffusion—to bring it near the surface. The surface of a neutron star is itself believed to be an ultra-hard crust of ordinary nuclear matter. So, to excavate the strange matter, you must postulate something like a dilambda geyser (Figure 4) that erupts continuously; so that twice every 4.8 hours, when the quark star first rises and then sets behind its companion, we get a burst of cygnets. Or perhaps instead of a geyser there exists a "strange quark matter volcano" (it is difficult to resist: "Quarkatoa"). All of these scenarios are very cumbersome and they do not enjoy much favor among scientists.

Baym *et al.* in their *Physics Letters* propose a more credible model. Imagine the detonation of a supernova. The envelope of the original star is blown away and the core collapses into a neutron star. If the density of the neutron star is high enough—at least in certain regions—then in these pockets ordinary matter will be transformed into more stable quark matter. Until this point the scenario is identical to that just discussed. But because the strange matter pockets are more stable than their surroundings, Baym *et al.* suggest that they will begin to "gobble up" the regions of ordinary matter until the entire neutron star is converted into a quark star.

In this picture, quark matter exists all the way to the surface of the compact object.

Perhaps you find such a scenario hard to swallow. In which case you are not alone. But if you do buy it, it becomes less difficult to get the quark matter off the surface of the star. Because the accreting gas from the ordinary companion is highly energetic by the time it hits the quark star, it could simply eject blobs of strange matter as it strikes the surface. The ultra-high magnetic field of the quark star accelerates the electrically-charged blob of strange matter from the surface—exactly as it did for cosmic ray protons. If this blob passes through the atmosphere of the companion, it will disintegrate into smaller fragments. One of these could be the dilambda which travels on to Earth. Again, you need a two-stage process because dilambdas are neutral and cannot be accelerated.

Admittedly this is all rather vague since no one has yet worked out the details of blob emission and conversion into dilambdas. More detailed calculations are needed to firm up these conjectures. But already it is clear that there are some problems with these models. For instance, we mentioned that the Soudan muons appear to come from a region 3° × 3° centered on CX3. If the cygnets are neutral and travel in exactly straight-line paths to Earth, why do they not appear to come *exactly* from CX3? The resolving power of the detectors is better than 3° × 3° so it does not seem to be an instrumental effect. The models we have been discussing do not explain this observation.

This, to date, is the story of Cygnus X-3. We cannot predict with certainty the outcome of the current investigations. Several conferences scheduled for the end of 1986 may or may not shed some light on the situation. Regardless of the eventual result, Cygnus X-3 will remain a tantalizing object. Scientists are attracted to problems of subtlety, more so if they contain a trace of the bizarre. Francis Bacon put it this way: "There is no excellent beauty that hath not some strangeness in the proportion." And so, if the Soudan and NUSEX signals turn out to be spurious, we merely learn once again that there are many more ways to get something wrong than to get something right. If the signals turn out to be genuine, we learn again that the universe is queerer than we can suppose. A conclusion that is, in any case, likely to remain. ■

Reference

Cramer, John G., "Children of the Swan," Analog *March 1986, p. 117.*

● "The world is strange," said Jeremy.
"As compared with what?" asked the Spider.

G. Macdonald

on gaming

Matthew J. Costello

There are classic role-playing games that have withstood the test of time. *Dungeons & Dragons* has safely passed its tenth birthday and, as the game that started it all, it's still going strong, with intriguing new modules like Gary Gygax's *Temple of Elemental Evil* and the massive new rules set for *Oriental Adventures*.

In science fiction role playing there is a game that also has had a long run, supplying players with an ever expanding universe of possibilities. Mark Miller's *Traveller* (Game Designers' Workshop) set the standard for all sf role playing games to come, and the Imperium remains an exciting place to adventure.

Of course, now there are games to meet every role playing need. You can chase Lovecraftian horrors in *Call of Cthulhu* (Chaosium Inc.), or rescue Lois Lane in *DC Heroes* (Mayfair Games). *Paranoia* lets you visit an Orwellian future of your worst nightmares while *Toon* (Steve Jackson Games) traps you in the land of Daffy Duck, exploding cigars, and pies in the face.

Games have become, in fact, even more esoteric, with players able to reenact the adventures of the new hit team from comics, *Teenage Mutant Ninja Turtles* (Palladium Books) or *James Bond 007*'s (Victory Games) latest salvation of Western democracy. And, as every Trekkie knows, there is an excellent role playing game from FASA Corporation devoted to the much-loved series and films.

And all the time Steve Jackson was working on something else, something completely different.

Steve Jackson, whose company has released the awardwinning *Illuminati* and *Car Wars*, has spent the last few years struggling with something he called *GURPS*—The Generic Universal Role Playing System. From the very beginning of the role playing phenomenon, gamers have wondered whether *one* system couldn't provide the mechanics for role playing in any age, any time period. It became a kind of "holy grail," something spoken about as possible, but unlikely ever to come to be. It was simply too difficult.

Wrong.

Steve Jackson has brought his *GURPS* (Steve Jackson Games, $24.95) into existence and its funny working title has been allowed to stand, as the most accurate description of what the game is really all about.

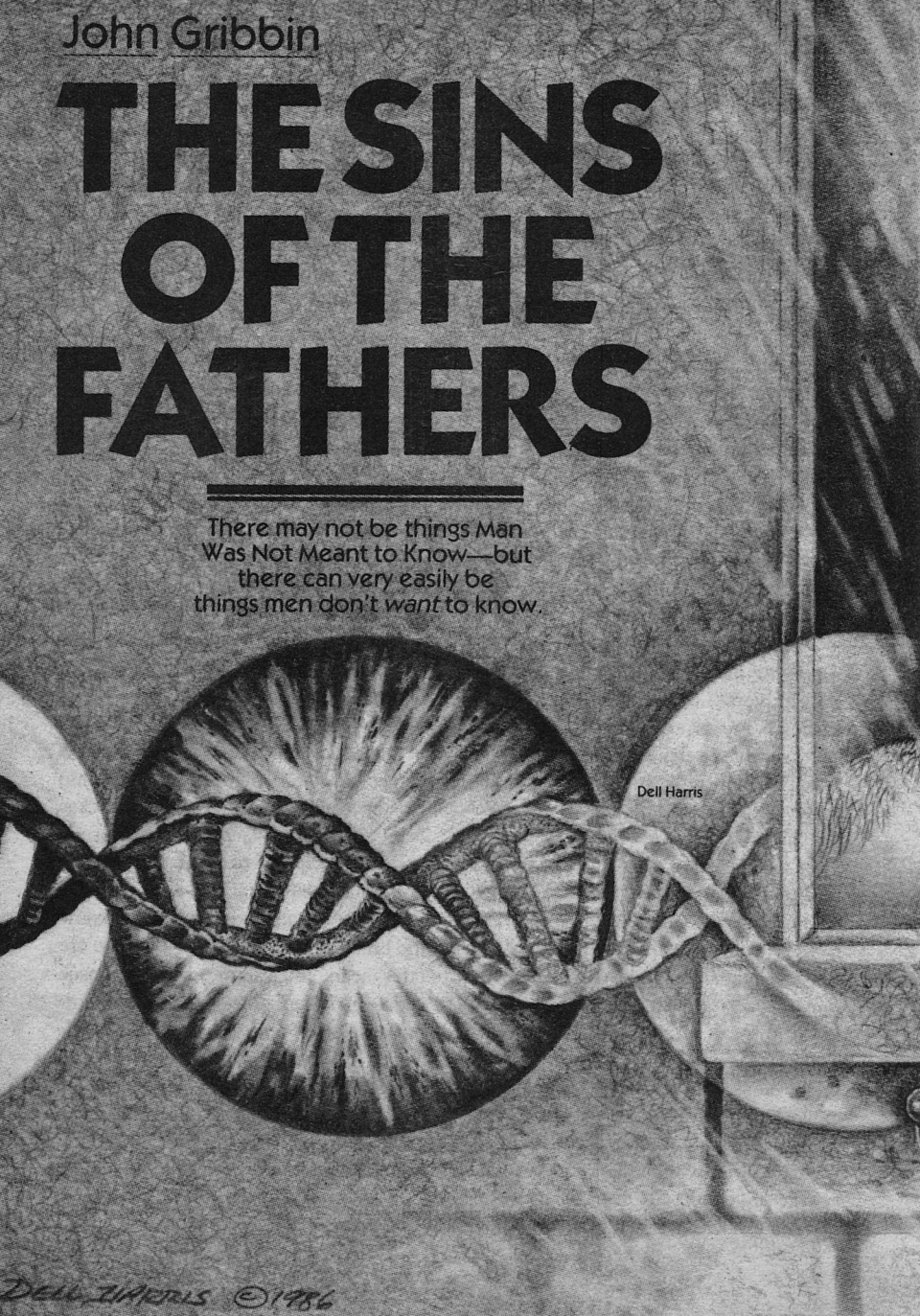
The serviceable box art lets you know the broad range of the game. There are buccaneers and vampire hunters, space cadets and gladiators, machine-gun toting vigilantes and a sad-eyed wizard. That's it. Everything that can be role played, can be role played with *GURPS*. The boxed set includes two books covering characters and adventures, a handy booklet containing all the charts, tables,

(Continued on page 125)

John Gribbin

THE SINS OF THE FATHERS

There may not be things Man Was Not Meant to Know—but there can very easily be things men don't *want* to know.



The incessant dripping of moisture from high in the foliage above him was a constant reminder of the alien nature of the environment. From down here on the ground, nobody could tell whether or not it was actually raining up above the tree tops, and it didn't make any difference whether it was or not. Yesterday's rain or today's, it all merged into a constant stream, filtering down past the leaves, dripping from branch to branch, running down the trunks of the trees and finally concentrating in a stream directed at his neck.

Richard Lee tugged, futilely, at the light tropical jacket in an attempt to unstick its clammy embrace from his body. Then he froze into stillness, motioning his companions to silence, as their quarry came into view.

He was well aware of the irony of his situation, not to mention the danger. Not danger from the immediate environment, or its inhabitants. He was well dosed up with anti-this and anti-that medication, and the jungle of Zaire housed no creatures that were a match for the weapons carried by the four men. No, the danger came from that most dangerous of all creatures, his fellow civilized human beings. If the park authorities, let alone the police, got an inkling of what he was up to it wouldn't just be the end of his career, but inevitably five years in jail. A Zaire jail at that—the prospect was not an attractive one, and he dismissed it from his mind. This might be one of the few places left in Africa where a recognizable government was in control, but it was hardly a government modeled on democracy. The stakes were high, but the gamble was worth it. If this came off, nobody would care *how* he had obtained the information, and his name would live in the annals of science forever. And, of course, there was the more immediate practical point that he would very rapidly become enormously rich.

He nodded to his companions, and gestured wide with both hands. They nodded back, spreading out on either side to cover as wide an arc as possible. Lee unslung the anesthetic rifle from his back and looked carefully through the sight, selecting his victim. He had already chosen the strength of anesthetic, set on the darts for a body weight of 25 to 30 kilos, and there was a young female, a full meter in height, perhaps a little more, that looked just right. He fired and she looked up, startled, as the dart stuck in her right shoulder. With an almost human gesture, she reached round with her left hand to tug at the irritating object, then slowly collapsed where she stood. His companions rushed in from either side, nets at the ready; her companions fled, chattering to themselves, deeper into the rain forest. The easy part of the job was over; now they had to smuggle her back to England. Fortunately, few officials outside the park itself would know the difference between the rare pygmy chimpanzee and its more common, legally exportable, cousin. And his papers gave him carte blanche to collect up to three specimens of good old *Pan troglodytes*.

When Joe decided to make a break for it, he was twelve years old. The realization that something was wrong with his world had only slowly dawned on him, as time went by. Infants accept their surroundings as natural: as long as

they are fed, played with, and cared for, they will develop happily with no thought of the world beyond their immediate surroundings. But with growing intelligence, curiosity, and the ability to understand language Joe began to appreciate that his immediate environment was only a very small part of the whole world. He was warm and safe; he had the animals to play with, his own gymnasium to exercise in, and he saw Uncle Dick every day, while a succession of nannies, blurred together in his memory, had tended him lovingly over the years. But his world was restricted to four rooms in a single story building, plus the occasional walk in the gardens outside—walks that were becoming even more occasional, in a garden surrounded by high fences, and with Uncle Dick always close at hand. What went on in the other buildings he could see nearby? Where did Uncle Dick go, when he closed the big green door at the end of the corrider and vanished from Joe's world? Where did the nannies come from, and go to?

He had never been taught to read, but picture books brought in to amuse him (and, though he didn't know it, to test his intelligence) showed that there must be many more people than he had ever met, and he guessed that most of them had more freedom. By twelve years of age, Joe knew that he was a prisoner, though he had no word for "prison" in his vocabulary, which he had learned solely from Uncle Dick and the nannies. And although he was neither unhappy nor ill treated in his prison, he determined to escape out of that combination of typical human characteristics—bloody mindedness and curiosity. Of course, he would have to bide his time, wait for a break in routine, and seize the opportunity when it arose. But Joe was used to biding his time—he'd done little else for the past twelve years.

"Hi, Ed, it's me." Kendrew smiled at the recorded image of Louise Henderson. The redundancy of her usual greeting never failed to amuse him, and roused a warm glow of anticipation. Louise was a first-class reporter and could be relied on to come up with good stories. He settled back to listen to what she had to say, only sorry that the time difference between Washington and England meant that her message had been recorded while he was still at home in bed. It would make a change from stories about the Middle East war and the military buildup in Europe.

"I've got a nice anniversary story for you. Remember Cobb and Lee, those guys who got the Nobel Prize for medicine ten years ago? Cobb was the genetic engineer, making enzymes to cut genes up and rearrange them. Lee did a lot of the gene mapping, originally because he was interested in human origins. He even used to go out to Africa to get samples from the apes so he could compare their genes with human ones. Kicked up a minor fuss when he claimed our DNA is so similar to chimp DNA that we must have had a common ancestor only three million years back.

"Anyway, nobody seemed to take that too seriously at the time. A couple of journalists wrote a book about it, but it didn't win any prizes. What really made the experts sit up and take notice was when Lee's techniques were used to identify faulty bits of human DNA,

and Cobb found how to repair them. They started out with diabetes and cystic fibrosis. Take an egg from the mother, chop out the faulty stretch of DNA and replace it, fertilize the egg, implant it back in the donor and, bingo, nine months later you've got a healthy baby.

"So they got their Nobel, and it changed both their lives. Which is where we come in.

"Ed, you'd never believe just how much these guys were changed by the award. It makes the ten-years-on story really special. First off, of course, by the time they got the prize the backlash from the European churches had already condemned the technique as immoral and against God's law. All that legislation banning experiments on human embryos went through the Common Market, and the courts had a field day deciding whether an unfertilized egg counted as a human being or not. Neither of our heroes seemed to have much stomach for the fight. Cobb lit out for the States, wrote a textbook, and ended up as Director of the Cold Spring Harbor labs; you can get Dave to do an interview with him, he seems quite approachable. But Lee went the other way, right into his shell. Moved up into East Anglia, near Norwich, and lives off his income from the Cobb and Lee patents. He hasn't published anything in eight years, and nobody I know has seen him at a scientific meeting in five.

So—guess who is going to go up there and kick his door down for an anniversary interview? I'm going to call him 'the Howard Hughes of science,' but I won't tell him that 'til *after* I've got the story!

"I'll file something in a couple of days, to swap with Dave, then we can both do follow ups using each other's information.

"Don't work too hard."

The editor of *Research*, the weekly magazine of science news, grunted at her parting shot. All she had to do was run around half of Europe digging up science features. He had to coordinate the material from a team of such itinerants, and suffer the hassle of producing an international magazine in a format which suited both the electronic publication service and the old-fashioned paper edition that almost half of the subscribers still insisted on buying.

He remembered the Cobb and Lee story. It had made good copy at the time, with the Nobel Committee honoring the inventors of a technique that was at the time the center of a furious legal and religious controversy in Europe, and was completely banned in many Catholic countries outside Europe. Even many of the subscribers to *Research* (both kinds!) probably weren't aware of how widespread derivations of that technique now were. If Louise could get Lee to talk—and if anyone could get Lee to talk it would be Louise—they'd be a jump or two ahead of their brash new competitors, with a story that would be picked up and reported, hopefully with *Research*'s name prominent, in other news media.

Kendrew leaned forward and prodded a button on the console in front of him.

"Tell Dave I'd like a word, would you?"

Louise stood in the rain at the side of the quiet English lane, on a damp, narrow strip of grass that separated the

road from the high wall that surrounded Professor Lee's residence. She had left her car a few hundred meters away, at the junction with the main road, and finished her journey on foot, in spite of the weather. Although scarcely out of the suburbs of the city—she could still see the lights of the new tower of the climate research center—the house stood alone, in semi-isolation. She shivered, not just because of the rain, and contemplated the task ahead.

Maybe it had been a mistake to phone Lee and try to set up a formal interview. He'd looked much older than in the holos she'd been able to dig up from the files, even though it was only five years since the latest was taken. And he'd certainly not been pleased to see her.

"I don't know how you got this number, Miss Henderson. It's supposed to be unlisted and confidential. And the reason for that is that I have no wish to discuss my work with reporters. I warn you that if you stir up the religious fanatics with your ludicrous tenth anniversary story, then I'll be suing you, and your publication, for invasion of privacy, and I'll hold you responsible for any trouble that results. I advise you to go back to London and find some real news to report, instead of raking over old ashes. Goodbye."

He had a point, but hardly one that justified such extremes. Louise had checked it out. At the height of the religious fervor, there had been raids on labs, including Lee's own base, which had been in Cambridge. But it was nothing serious—a few windows smashed, slogans sprayed on walls, that sort of thing. When it became clear that the new gene manipulation techniques weren't producing two-headed monsters in the labs, and the new legislation had laid down the guidelines for further work, the fuss had pretty much died down, except for the few fundamentalists. But *they* cared more about what they saw as the heresy of Lee's claims about the links between man and the apes. There was nothing in the anniversary story to remind anyone of that, and the extremists were far more concerned, these days, with what they saw as the renewed threat from the East. But Lee did seem genuinely frightened of something, not just bitter about the responses his greatest work had received in his own country.

She played the recording over as she stood in the rain, watching the flat, two-dimensional image on the pocket recorder until the point where Lee had cut the connection. Then she pressed the "audio record" button, and adresseed the machine quietly.

"Well, Ed, as you see the response wasn't too friendly. So I decided to try the back door, and here I am, soaking wet, about to do my death-defying act and scramble over a five-meter wall, with the aid of a convenient tree. A task made a little easier, you may note with interest, by the fact that the wire on top of the wall slopes inward. You get the picture? It's set up to make it difficult for someone *inside* to get *out*, not really to stop nosy reporters on the outside from getting in. So here I go. I'll leave this thing switched on, so we'll get all the grunts and groans of my athletic endeavors, plus any as it happens actuality of life on the other side. But you'll have to make do without pictures. I need my hands free."

* * *

Joe liked watching the rain through the window. Out there, it was cold and wet. In here it was warm and dry. He felt secure. The fact that the window was not built to open, and that there were bars on it, didn't bother him at all. He'd never seen a window that could be opened, or one that didn't have bars to protect it. Nor had he ever seen the woman running across the wet lawn outside his window, bent double as she hurried into the lee of the building. This was *very* interesting, and definitely not routine. Perhaps a chance to find out what went on in the world outside —although, to be quite honest, dressed as he was only in shorts and a T shirt he would rather not set out on his journey of exploration while the rain was quite this heavy.

He was on his own tonight. Nanny was away, somewhere in the world outside, and Uncle Dick was working in the big house. But he had his holos to watch (mostly cartoons and Disney-type nature features; real people were rare in Joe's world of entertainment as well as his daily world), and he had the rain to watch, so he hadn't been bored. But he would certainly like to meet this interesting new person who had now disappeared from his line of sight.

Joe jumped down from the window seat and walked into the corridor. Would she come in through the big door? He heard the handle turning, but the door didn't move. Not surprising, really. Only Uncle Dick could make the big door work. The window nearest to the door was in the kitchen. He ran in and jumped lightly up on to the work surface next to the sink, pressing his face up against the glass so that he could see sideways toward the door. There she was. She seemed to be talking, though there was nobody else around for her to talk to. Like the other windows, the one in the kitchen was permanently fixed shut. But there had to be some way to let fresh air in and cooking smells out, and this was provided by a louvered section, at the top of the window, glass slats that could be tilted at 45 degrees. The slots were too small for Joe to get out, even if there hadn't been any bars in the way. But they let outside sounds such as birdsong, in, so they ought to let any sounds he made out. Gently, he pulled the lever to open the slots. The woman looked up, startled, as she heard the movement.

"Hey. Out there. Come talk."

"Who are you? What is this place?"

She took a pace backward, away from the wall, then moved sideways to see him better, glancing back over her shoulder at the big house.

"What's with the bars and the locks? Is Lee keeping you . . . Holy shit!"

Her voice stopped as she moved far enough to see Joe full on. Then she started again, talking much too rapidly for him to catch what she was saying.

"Ed, there's something really weird here. I wish I'd brought the camera after all. There's someone inside this prison block I was telling you about. Or something. I thought at first it was a child, but it's a little man, a kind of hairy midget. He's behind bars, but he wants me to talk to him. I hope this recorder can pick him up OK—I don't want to get too close."

"Hey." She stopped at the sound of

his voice. "Too quick. Talk slow, please." He was always having this trouble with Nannies. Either they talked too fast, or they thought he was stupid, just because he couldn't talk as fast as them, and treated him like a baby. Only Uncle Dick really appreciated how well Joe could understand things, in spite of his limited vocabulary, if the concepts were expressed clearly and simply.

"Where are you from? Where's Uncle Dick?"

Louise took a pace forward. The friendly tone of the voice was reassuring, and she realized that the figure crouched at the window only looked so frightening because of the dim back lighting, leaking into the room behind him from the corridor. But who was he? Talk slow, he'd said. And obviously he didn't speak very well himself. The suspicion growing at the back of her mind was too incredible to believe, but whatever the truth there had to be a story in this, something much bigger than the anniversary of Cobb and Lee's Prize.

"I'm Louise Henderson," she said carefully. "From London. I've come to see Professor Lee—Uncle Dick." She guessed that the two were one and the same.

"He's in the big house. Working. He can wait. Come and talk. I'm Joe. I live here."

"It's wet out here, Joe. Can you let me in? Then we can talk in the dry."

"No. The door only works for Uncle Dick." The sadness in Joe's voice, and the sudden droop of his shoulders, removed the last vestiges of Louise's apprehension. Feeling a warm, protective glow she stepped forward right up to the window, and put a hand to the glass. She could see the prisoner more clearly now. He looked almost human, except for the dark hair on the back of his long arms. Intelligent eyes looked back at her, thoughtfully, through the rain-smeared window.

"You wait here." She cursed herself for saying anything so stupid even as the words left her lips. Joe certainly wasn't going anywhere, not without help. "I'll go and get some friends—" like the police, she thought "—and we'll come back. To let you out."

"And you would, too, I suppose."

The quiet voice from the shadows made her jump and whirl around, while Joe simply sighed and settled, cross-legged, on the ledge behind the window. Lee stepped forward.

"What Joe didn't tell you, since he didn't know, is that my 'work' mainly consists of watching him on the closed circuit TV.

"It is Miss Henderson, isn't it? Your appearance is slightly less dignified than when we spoke earlier.

"Joe," he raised his voice slightly, "you'd better go to bed now. It's late. I'll bring Miss Henderson in to talk to you tomorrow—if you're good. OK?"

Joe got to his feet and nodded.

"OK. Goodnight, Dick. Goodnight, Miss Henderson." He hopped down to the floor and went off to the bathroom to clean his teeth. He hadn't yet got to see the world outside the garden walls, but at least someone from out there had come to see him. The sooner he went to sleep, the sooner morning would come and Uncle Dick would bring her in to meet him. Uncle Dick always kept his promises, even though, as Joe had

come to appreciate, he only made promises rarely. Perhaps they'd have breakfast together, with Miss Henderson. He hummed happily as he prepared himself for bed.

Outside, the rain was easing up. Louise was debating whether to make a run for it. Lee seemed rational enough, but if he kept a prisoner in a private jail he nust have at least some sort of screw loose. On the other hand, the more he talked the more story she had, and it was all going down on tape. The prisoner might be locked up, but he didn't seem too hard done by, and he seemed to regard Lee as a friend. The professor didn't seem likely to murder her out of hand. She hoped.

"Well, Miss Henderson, you'd better come inside. It seems you've got your interview, whether I like it or not."

She nodded, and followed him back to the house.

"Well, Miss Henderson, where shall we begin? Do you really want to talk about my Nobel Prize?"

A warm, dry towelling bathrobe, blazing log fire, and a mug of coffee well laced with brandy, were rapidly removing any lingering doubts she had about Lee's particular form of insanity. Whatever it was that made him crazy certainly didn't make him a mad axe murderer, and his smile was friendly enough. He also looked a lot less careworn than he had on the phone. Maybe it was actually a relief to unburden himself after all these years.

She checked that the recorder, transferred to the pocket of the robe, was running.

"Not really, Professor Lee," she smiled back at him. "All this is something of a shock. I've got some crazy ideas, but they sound like something out of a science fiction holo—a wild man, captured in the African jungle, some kind of crazy breeding experiment—I can see why you've kept out of the public eye for so long, but I can't for the life of me work out who Joe is, or where he comes from. I assume he's not a visitor from another planet?"

"No. You were nearer the mark with your other guesses. And its for his sake that I want this kept quiet. There's no way of telling what would happen to him in the world outside, especially if the fundamentalists got to hear about him.

"I guess you researched me pretty thoroughly before coming up here—not just my work with Cobb?"

She nodded.

"So you know I started out in molecular anthropology, comparing human DNA with genes from gorillas and chimpanzees to work out our family tree in detail. That was the work which led to the detailed human gene maps, and gave Cobb the basis for identifying and correcting mistakes—you know all about that.

"The thing about the DNA studies from the evolutionary viewpoint is that changes, mutations, build up at a more or less steady rate. Not *exactly* steady, like the ticking of a clock, but averaging out to a steady rate, statistically, rather like the way radioactive decay averages out to give a reliable half life. You can literally count the differences between the genes of two closely related species, and calculate how much time has gone

by since they shared a common ancestor. In the case of ourselves and the African apes, the answer is about three million years. When we first came up with the figure, the fossil hunters laughed us out of court. They said the fossils proved that mankind had followed a separate evolutionary path for 15 million years, at least. All that's changed now, of course, since the recent discoveries in Ethiopia. You won't find anybody suggesting a date older than six million, and even some of the most bone-headed paleontologists accept the possibility that the DNA evidence is right after all. And whether or not you accept the date, there's no doubting the closeness of the relationship. Man and chimp are more closely related than a donkey is to a horse—we're what's known as sibling species. Almost sufficiently alike to breed together.

"I didn't find Joe in Africa, Miss Henderson. I found his mother there. She was a pygmy chimpanzee, a member of the species *Pan paniscus*."

He paused, and stood up, gazing into the firelight, clearly awaiting a reaction. He'd waited more than ten years to tell this story, and it was obvious that he intended to make a big production out of it.

"But, professor, you can't teach a chimpanzee to talk. They tried all that in the 1970s. Even if you bring one up in a human household, it doesn't have the ability. It hasn't evolved as far as we."

"Hasn't it?" She'd clearly said the right thing.

"Joe's mother was a normal pygmy chimp. But his genes are a little different from hers. I used Cobb's technique to make a few small amendments to them."

"What about his father?" A dawning suspicion woke in her mind. You could breed donkey and horse together. If man and chimp were similarly closely related—my God, that *would* set the fundamentalists on his trail, and the established Church as well!

"No, no, Miss Henderson. There's no human contribution to his genotype either, though it would have been easy enough to arrange. I got the Y chromosome from another chimpanzee. Whim, if you like, but I wanted a male to bring up. But I needed a female to provide the egg to work with. Apart from the modifcations I mentioned, Joe is, in a sense, a clone of his mother."

"Then why are you keeping it quiet? If you've found a way to give chimps more intelligence, I'd have thought you'd want the world to know. It's a great achievement."

"But you haven't asked how I knew what changes to make to the chimp genes, Miss Henderson. Shall I tell you?"

She nodded, once again, and he settled back in his chair.

"I don't know how much you know about genetic mutations, but at the level of species as closely related as we are to the chimpanzee there are two important kinds. Sometimes chunks of chromosome get scrambled up in the copying process when sex cells are made. You may get inversions, when a piece of genetic material is literally put into a chromosome the wrong way round, and you may get a clean cut, which splits one chromosome into two, or a fusion which joins two chromosomes together

to make one. Either way, the mutation is then handed down through succeeding generations. We can identify the differences between human and chimp DNA at this level—they could do that in the '70s, too. And there are just six important differences, six inversions, that distinguish our genes from those of a chimpanzee. Six mutations, you might say, that maketh man.

"Of course, there are a few other odd bits and pieces too. Point mutations, where a single letter of the genetic code has been changed. Things like that. I mapped the whole lot, human genes and those from the pygmy chimp, and I pinpointed every difference. Nobody else has ever done that. And when you look at this level, right down to single letters in the DNA code, you can see which mutations have occurred more recently than others. You can tell the originals from the inversions, because odd bits of code get scrambled up at each end when a chunk of chromosome is turned over."

Lee suddenly looked away from the fire, straight at her.

"You're not making any notes, Miss Henderson. I hope you're getting all this down?"

She felt her face color. It must be the brandy in the coffee, she told herself firmly.

"Uh, yes, professor. I've got a recorder with a four hour tape." She patted the pocket of her robe.

"Good. I'd hate you to miss this bit.

"The new technique told me a lot more about *how* the changes between man and chimp had arisen. Two of the inversions occurred in the human line, after the man-ape split. But four of them occurred in the chimp line. I wanted to reconstruct the genotype of our ancestors, after the new laws came in. So I volunteered Joe's mother for the job. If I could reconstruct a convincing ape-man from her genes, it would confirm the three million year date, and a whole lot more besides. With Cobb's technique, it was fairly straightforward to re-invert those four stretches of DNA and get a fertilised egg to begin to develop. Unfortunately, I succeeded too well. The birth killed Joe's poor old mother. His head was much bigger than I'd anticipated. And, as you see, he's pretty intelligent. Much more of a man-ape than an ape-man."

"But you said you were trying to reconstruct our ancestors. I don't understand. How can a chimp's ancestor be more intelligent—more human—than the chimps are?"

"Exactly, Miss Henderson. On this evidence, the ancestral form was much more like us than like the modern apes. It isn't that we've made a great advance, improving on the ape lifestyle and inventing intelligence. Instead, nature seems to have tried desperately to abandon the human lifestyle as long as three million years ago, starting up at least two lines—leading to the chimps and gorillas—that have lost some characteristic human features, like our kind of intelligence, and speech, and gone back to the forests. Darwin got into trouble for suggesting that we were descended from the apes; what I'm suggesting is that the apes are descended from us, and I don't want the news to get out while either Joe or I is still alive. Chimps and gorillas represent a *later* stage in evolution than man, but we've been busily

wiping them off the face of the Earth for decades.

"But now the tide has turned. Have you kept up with the news from Africa? Uganda, Mozambique, even in Zaire, now. Everywhere south of the Sahara civilization has collapsed. The Cape is uninhabitable since they blew up the uranium mines. And in the middle, the old jungle species are making a comeback.

"We've got our own problems in the North. The bad winters have hit the Soviets as well as us. They must be desperate, and desperate people do foolish things. This business in Turkey —well, you know as well as I do. We've made it through seventy years without a big nuclear war, three score and ten. But I don't see us getting through another human lifespan. And that means nuclear winter, without a doubt. All life on Earth will suffer, except in two places—the deep ocean and the tropical rain forest.

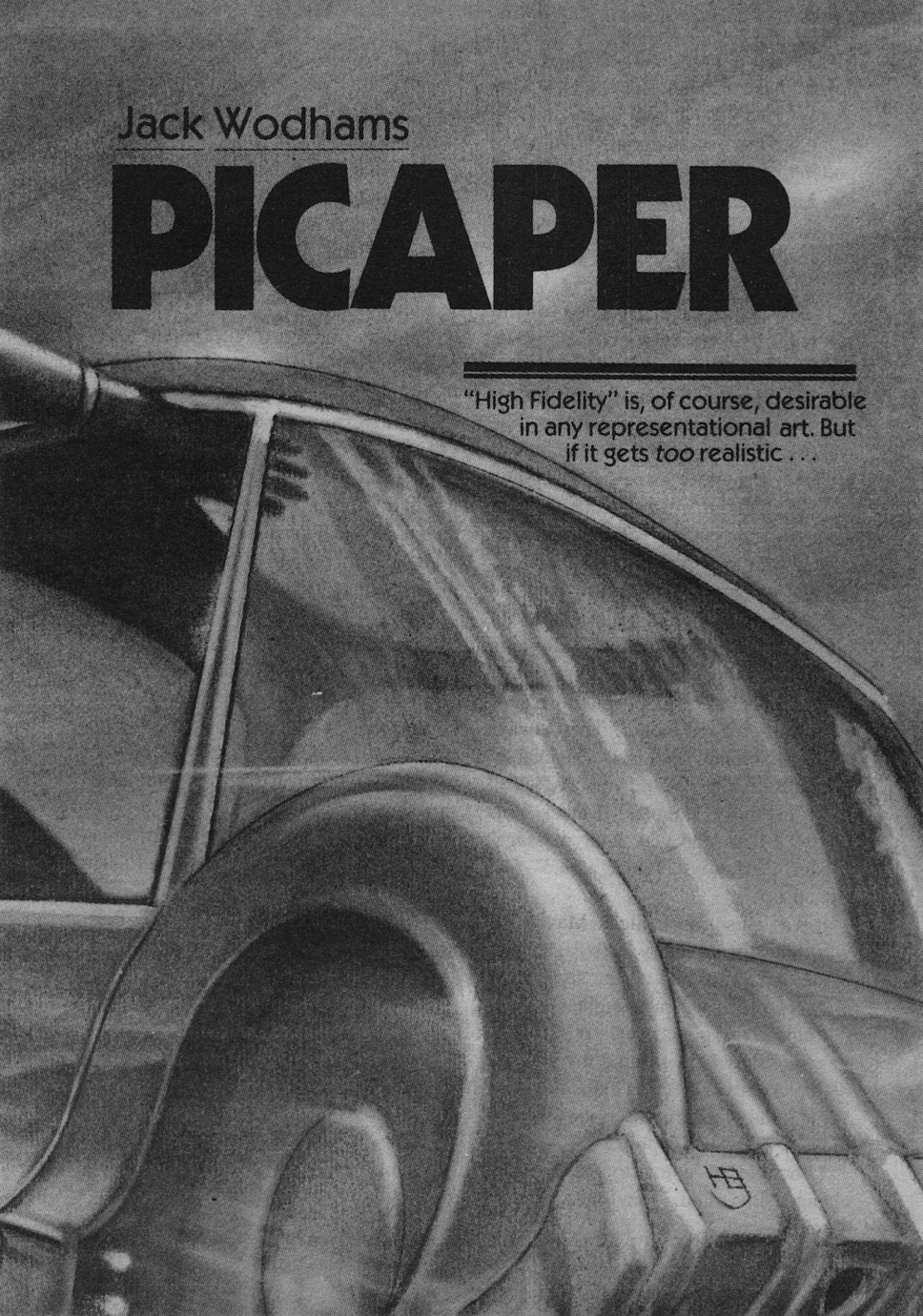
"You implied earlier that you thought Joe might be my son. In the literal sense, he isn't. But in a very real sense the human race was the father of his ancestors. The chimpanzees are our heirs. Evolution has already passed us by, and if we don't manage to eliminate all of the apes before we blow ourselves to bits, our successors are already there ready to take over when human intelligence fails its final test.

"I don't want to be the one to tell the human race that it represents an evolutionary dead end, Miss Henderson. Do you?" ■


Hank Jankus

Jack Wodhams

PICAPER



"High Fidelity" is, of course, desirable in any representational art. But if it gets *too* realistic . . .

I am a trouble-shooter for the Systems Monitoring Department. A man who doesn't have an instinct doesn't last long in my business. I had been sniffing along the track of an anomaly and I had gotten this itchy feeling, and it bothered me. I had been nailing the leads, tracing the feeders, and I had built up in my mind a fair concept of *some* of the import of what I was tracking.

It was aggravating. I needed to consult with someone who might appreciate my wavelength. I thought of a few people, but discounted them for one reason or another. What I required at this time was less a colleague in the business than a friend. I suppose I knew I was going to call Dinger even before I went through a process of elimination that caused him to be the only one left.

I got out my popla, my own special and private portoplattagraph, fanned it out, punched the code, fed in my own call sign. Shortly I made connection.

By golly, but he had yet another new secretary. A good looker. They always were. "Colonel Batt is not available, Mister Raffakov. Would you care to call back in thirty minutes, Mister Raffakov? I'll see he gets your message, Mister Raffakov. Thank you." She signed off.

It was all so mechanical. Maybe she was not his secretary, after all. Her bland amiability had all the style of an answerprop. It was a thought.

I closed my popla, stuck it back into its clip on my belt. I found my way out of the Archives Section, Documentary Wing, the Customer-Service Department of Network Supply.

I thought of going to the canteen, changed my mind. They had excellent grounds here, very well kept, landscaped, with a canal most artfully designed like a river, complete with willows and patches of pebbles to provide musical ripples.

I strolled. What had I found? It was understandable. Fabricating cartoons by computer was one thing, but fifth generation advances were proving that so much more could be accomplished.

Vieways, one-D, b.r.-D, full-D, fundamentally remained composed of a myriad of singular impulses. To know the pattern of the impulses was to know the pattern of the projection. Q.E.D.—create such a pattern of impulses and a visualization can be conjured to appear without need for an actual physical presence, a literal reference. The notion was currently the hottest thing that the chronics were chasing.

I found myself in a small grove, a seat handy. A party of moorhens, mom and pop and chicks, were disporting by some reeds, entertaining in their self-important confidence. They had a fine assumption that I was not the type who threw rocks.

I checked my watch. The half-hour was up. I got out my popla, called Dinger again.

The secretary smiled. Colonel Batt was In. She cleared me, switched me through.

"Hullo? Ah, hullo, Freddy. Well, my lad, what can I do for you?"

Dinger was in full uniform, was even wearing his cap. He must recently have been attending some official duty. "Freddy." My name is Otis, but ever since my period as a flyweight, trying to build up some muscle and an ability

to answer aggression, he had named me after Freddy the Fearless Fly, of modest comic-book fame. He seemed to be in an uncommonly easygoing mood. "Ding, I've got a problem. Do you know anything about picaper? Or mimepic, as some of them call it?"

"Huh? No. No, what's that, Freddy?"

"It's image animation. It's getting the information from a presented image, and copying it through choices from an infinite number of variables that a program might supply."

He stared out at me. "I'm only in military intelligence, Freddy. Can you explain it a little more simply?"

"Well, for instance, someone gets a record of you walking and talking, your facial expressions. These impressions can be broken down to their individual matrix composites, can be analyzed, rearranged, and can then be extrapolated through known standard human behavioral patterns, so that an image of you may be re-projected doing and saying things that you have not in fact done or said. Do you follow?"

"Uh," he paused, thinking, "I think so, Freddy. Likenesses can be made of people acting out things they haven't really done, is that it?"

"That's about it," I said. "A copy of their mannerisms, combined with an endless range of standard movements, can produce a vieway of a person going through just about any motions within human capability. Plus a few that are not."

"Is that right?"

"That's right," I said. "I've seen a juggler keeping twenty-two eggs in the air at once, and doing a tap-dance on a balance-board at the same time. It's just too incredible to believe."

"That's something I'd like to see, Freddy. Who's the guy who's doing this?"

"Oh, there's only a handful just at present, and their results vary. It depends what they're aiming at, mostly. Bob DeGeirendoff would be one of the best of the legitimates, I guess. He's working on old-time stuff, early silents, mostly, doing focus on close-ups, and developing themes of intent for the assorted passers-by in a street scene, say. It's very interesting."

"The legitimates, Freddy? How do you mean? Is there a law against doing this?"

"Not yet," I said, "but there's going to be qualifications, has to be. Already I've clobbered one outfit that was working to transcribe horse races, to make sure their selection went past the post first. They had some notion of cutting into a transmission at a crucial stage so that they could win themselves a mint."

"Is that a fact, Freddy? Could they make it that convincing?"

I pressed a button, I don't know why. "They still had quite a bit of refining to do when I caught up with them, but they were working on it. They'd have got something passable eventually. What's more troubling, though, is the extortion angle."

"Extortion? How do you mean, Freddy?"

"Well, it's obvious, isn't it? Copies of notables, any person at all, really, might be duplicated to appear in any number of compromising positions. The old idea that pictures do not lie is going to have to undergo drastic revision."

Dinger pondered, watching me. "How good are these copies, Freddy?"

"Mostly rather short on fidelity at the moment," I told him, "although some could fool some people some of the time, if they didn't know what to look for."

"Uh-huh. Yes, I see. Now where do I come in? How can I help you, Freddy?"

"Well, Ding, truth is, I'm not sure. Somewhere along the way I got the feeling I was being misled somehow. It's just a hunch. You know me."

"Uh-huh. I sure do, Freddy. A hunch, huh? Nothing more specific?"

"Not really. Something tells me it's something to do with picaper, that's all. If someone *is* blocking me, they must know something of how and where I am nosing around. It bothers me. Someone taking the trouble to hide like that must really be up to something, right? What, I don't know. But there is just a chance that it could be a matter of national interest. Something bigger than pornography or unlicensed alterations to copyrighted portrayals. I just wondered if the military might have run into anything of the kind, anything maybe odd that might be just a bit suspicious."

"Well, now." Dinger rubbed his chin. "This is new to me, Freddy. I'll have to look into it. Now you've brought it up I'll certainly make a few inquiries around." He paused. "Can you give me any leads?"

"I'd rather not, not over this frequency. Can we meet tonight somewhere? How about over dinner? I can fill you in in more detail, let you have what I've got so far."

"Fine. Dinner, that would be great, Freddy. Seven-thirty, huh?"

"Seven-thirty would suit me dandy. I'll meet you at The Lulus', okay?"

"The Lulus'?" He hesitated a fraction. "Uh, OK, sure, Freddy, The Lulus'. Seven-thirty, then. See you there." He raised a smile, gave me a cheerful wave.

I gave him a blithe salute in return.

I thumbed my popla closed, toyed with it a second before replacing it in my belt. Again I decided against the canteen. Instead I headed for the nearest exit, my pace increasing from casual to brisk for no rational reason that I could define.

I didn't grab the first keymo I could find, either, but crossed a lot to pick one at random from the holding packline.

Thinking is a funny process. Unease had been sitting on me all day. It was something that I could neither explain nor discount. I just had this certain knowledge, from no discernable foundation whatsoever, but *certain*, that *They* were on to me, whoever *They* were.

It was not a consciousness I cared for. I detested feeling paranoid. Especially against something that I could not at all place. It made the whole world a threat.

I stuck my perstic in the keymo, registered my credit, pushed the digits, not for my home but for Walter Street. Walter Street held some modest, quiet private hotels. I would find one that had a vacancy, to take time out to try and figure some plan of campaign.

The keymo took off. I sat back. I didn't feel like watching the news, choice of relays, or even listening to

music. It was nice to close the eyes, to try and relax a little.

I don't know how many minutes I semi-dozed while a mixture of unrelated notions jostled idly in my mind, none apparently wanting to take precedence.

The keymobil jerked a little as it turned another corner, and shortly tilted ever so slightly. It was ascending a grade. The fact impinged. I puzzled a moment, then opened my eyes. I checked out the window. I was going up Tallorand Hill.

I did my own figuring. This was not the way to Walter Street. I hit the buttons again, and the navicat bleated. Its screen apologized to me. There was a breakdown on Fistula Avenue, to create consequent heavier traffic on the Fourth Keymo Thruway. Unless I was an emergency, this route planned for me was anticipated to be the most expeditious, and therefore preferred.

I sighed. It sounded okay. The keymo system was in its third year here, but it was still suffering teething problems. What could be made to work so well in smaller towns ran into extra difficulties when it became applied to a city. It had been barely six months since the deintegration period had ended, causing manually operated vehicles to be banned from city limits. The day was coming when the entire country would be on a nationwide automatic routing grid.

I wasn't sorry not to need a driver's license to move around town. The keymo knocked along at a rate faster than the traffic *I* could remember, suffering no lights or stop signs, reading its position on the Master Transit Console once every millisecond, to be able to switch and merge with precise facility. Most of the time.

My keymo was reaching the top of the hill. It was laboring slightly, was down to less than 40 k.p.h. Its powerpac could be low. Their parking-bay refeeders were supposed to be foolproof, but weather conditions, dirt or grit, or sometimes deliberate vandalism, could reduce an input. Maybe this one had been used a lot already today. Still, its red light hadn't been on.

I looked out again. Walter Street. Tallorand Hill was taking a diversion, all right. The keymo would be making a full half-circle, would even need to double back.

The hill was even steeper on its other side. It had two notorious bends, and a T-junction, which the keymos had now deprived of threat.

I pressed to lower the window all the way. My keymo reached the level, and began to pick up speed.

Some decisions are instant, need to be. To hesitate, to pause to enquire, can delay to disaster. The trigger could have been the square keyvan that moved sideways, to get out of the way. It was as if it had received an emergency signal. I found myself with my hands gripping the upper edge of the doorway, my knees curled up, to lunge myself out through the window feet first.

It was a mistake, had to be. The world went topsy-turvy, end over end, and I had no idea where I was going. It was a wild few moments, and how I didn't break my neck I'll never know. I hadn't realized that 40 K or so was so fast.

I seemed to tumble for ever, and then, in an effort to stop my rolling, I flung out my arms, to find myself skidding

along on my chest for a number of meters.

Sprawled in the road, I gasped for quite a spell and dared not move for fear of awakening an unbearable agony. My keymo, remarkably after such a packed eternity of experience, was still in sight. It was definitely gathering speed. A keytruc and another keymo moved aside to let it pass. Mine disappeared below the ground-level view of my eyes.

I made no haste to get up. I might be lying in the middle of the road, but nothing would run over me. I would be sensed as an obstruction, and vehicles would simply adjust to go around me. Loose mutts were still a nuisance this way. They could get so cheeky about it, too. If I didn't soon move, a keyvan would be sent out from the pound to remove the dog suspected of settling to gnaw its bone on the highway.

Gingerly I tested the wholeness of my limbs, surprised to be crippled only by sharp bruises and not broken bones. Unsteadily I hobbled to the side of the road.

Now I had time to wonder why I had acted so. I had to find an excuse for such an imperative impulse. It was insane. I could have killed myself.

I liked walking, but preferred to be in better condition. I limped on down the hill. My keymo had taken a detour. The reason given had been plausible. Just. I had accepted. I had not been in a hurry, and this surely had been noted. Therefore there had been no requirement at all for other vehicles on the road to move aside to give me priority. I was not ambulance or police or a woman about to give birth.

I hobbled as fast as I could. Someone had accessed my Personal Tailored Information Coder. Given this, they could have further accessed Stopwatch on the fraud squad surveillance itemizer. As soon as I used my "stolen" perstic, they would have discovered where I was. They would know the number of the keymo I was in, where I wanted to go. From that they could have brought in overriders, to steer me to Tallorand Hill. For the purpose of . . . ?

It was too fantastic. I was letting the complexities, the diabolical deviousness of just *some*, the very few of the deliberate abusers of the system, get to me. I always had this tendency to overestimate the will and determination of my adversaries. I was always imagining more potentiality than actually existed.

My left elbow hurt. As did my hip. As did my chest. To be on the safe side I would have to put myself through a diagnoser to look for fractures.

I turned the second bend. Ahead of me the T-junction.

I halted. In front of me commotion. Already vehicles were piling up, not from necessity, but braked by their passengers or conveyance-masters to step out to gawk at what had become a rare scene. A collision had occurred. A keymo had run slap-bang into the side of an auto-dumper.

The auto-dumper, like buses and other vehicles that followed an unvarying path, tracked its own subsurface grid, so regular and predictable that no minding by a conveyance-master was thought to be necessary. The keymo should not have been able to come anywhere near it.

I guessed a modus without hardly trying. Stolen perstic. Suspected dan-

gerous criminal. Silent emergency to whiz suspect to nearest police office. Top speed around second bend, then a simple disconnect, brakes locked off for workshop service. Something like that could have led to nothing but doom.

I moved closer. There were too many people. I couldn't see much, but what I saw was enough. The keymo was a mangled wreck.

It was numbing. My first thoughts were inconsequential. I could see the lead news emphasis, "KEYMO SMASH ON TALLORAND HILL." It would cause quite a stir. I heard one man saying, "They don't kid me. It had to happen. They said with this system it's impossible, but look at this."

I caught snatches of this and other comments, and backed away. There would be a big inquiry over this one, for sure; and, as it was my field, I could well be one of those called upon to try and sort it out.

All at once I did not care for my own proficiency. Just now I desired no form of high profile. I retreated.

It could have been an accident. It could have been an accident? Like spinach pie it was an accident. Why had I gone out the window rather than the door? Two reasons. Opening the door would have stopped the keymo at once and signaled my exit. Intuitively I hadn't wanted to send that signal. Secondly the door might have sealed, because I was traveling too fast, because I was thought to be a criminal, because an emergency was being answered.

It made me sweat. Relying upon my unconscious for inspiration was one thing, relying upon it for my life was quite another. I took an oblique course to reach another small keymo rank.

I didn't use my perstic on this keymo. It could be traced, obviously. One advantage of being a sleuth of Network violations and violators was my in-depth appreciation of cheating techniques. I convinced the keymo that I was its maintenance man, here to make a spot-check on its performance.

I altered my destination. I did not have time for the luxury of relaxing and thinking things out. I had to follow what leads I had. I had been deliberating the wisdom of hunting outside chances, but this incident hastened my decision.

I directed the keymo to take me to Village Grove Heights.

For my own convenience I stayed in the role of maintenance man until I had convinced Crazyac Wilse to permit my entry. Once confronting him in person I disclosed who I really was, and began to ask his advice—always a good ploy.

"Picaper? Yes, I do use it. Sure. A man doesn't just have to keep up, you know, he has to try and keep ahead. Picaper's got to be the biggest thing since frypac."

"You have a process?"

"I sure have. Wouldn't be without it. It's the only way to go."

"You have it here? Do you mind if I see it in action?"

He blinked a couple times, but said, "Why not? Be glad to show you." He could not prevent a surfacing of his pride. "I got a start on most. I've been in animation a long time. Who told you about me? I've got one of the best layouts in the country. I've been working on picaper for a couple years now, ever

since I first got onto it." I accepted his invitation, followed as he led. "Improving all the time."

"I've been checking other operators," I told him. "Some have been getting some pretty good results."

"That's what separates the mere craftsmen from the masters," Crazyac said, "the finesse, the little touches."

He hastened to add, "We've got a way to go yet before we reach spot-on exactitude, but it's where we're heading. It *is* attainable."

I was not deceived by his affectation of modesty. "From what I've heard, you're one of the best," I lied.

"Who told you that? Oh, I suppose it *does* get around." He tried not to sound pleased. "We all try to keep our secrets, but it gets out somehow. In here. This is my creation room."

I envied him his set-up as soon as I saw it. He had some really top-class gear. It seemed he was one of those people who could afford the best.

He started off by showing me samples of his work on "Swelman," currently one of the most popular of the kids' shows on the vieways. Swelman had great appeal to anyone who was undersized. Swelman was a nondescript seven-stone weakling who could, when occasion warranted, grow into a giant.

I liked the idea of Swelman myself, but I objected now. "This *is* picaper, Mister Wilse, but it's only a step above cartooning. I thought you could produce something of a much higher quality."

"Ah. Oh yes. Yes, of course." He looked me over, however.

I took a step to reassure him. "I'm not a competitor, Mister Wilse. I've seen the work of Bob DeGeirendoff and others. The Department fully endorses these developmental exercises, but we do have concern that these techniques, falling into the wrong hands, could be abused. Achievement of near-perfection may require new legislation to be brought down, that the processes employed might only be used by licensed acknowledged specialists."

"You mean it might get restricted? Even before it's fully off the ground?" He tempered his alarm with dubiety. "Otis, I think that would be a difficult law to implement."

Crazyac moved over to his modified m.b.b. MixMax console. "Swelman, and the illustrated documentaries I do for The Latest Greatest, are my bread-and-butter, but this," he patted his favorite piece of equipment, "is the future. There are a lot of diehards out there, like Harvey Custlelot and Mel Knapf, who still use word-processors to churn out scripts." He flicked switches. "That's now archaic. That's become a thing of the past. See here? This is how it's going to be."

He had his multi billion byte unit coupled to a full-sized, ¼-depth vieways projection, one they call a b.r.v. in the trade, b.r. for bas-relief. The scene was a bar in a Wild West saloon. The lead character was Crazyac Wilse himself. He seemed to be getting a hard time from a mean-looking joker who appeared aching for a fight.

Crazyac ran it through to an inevitable shoot-out, where the mean guy got his, but still managed to wing Crazyac in return. Blood. Gaping wound. Crazyac on the floor. A bar-girl crouching to help him. Crazyac bitterly calling her

unkind names. The bar-girl weeping. Touching.

Crazyac halted the action. "What do you think?"

I masked my disappointment. "Not bad. Quite good simulation, in fact. Did you act any of that at all yourself?"

He laughed, gratified. "No, I'm not an actor. I did wear the outfit, though, and I did the positions to give the memory a loaded bank, facial expressions and everything. Some still like to have hams go through it, to do their superimposing and upgrading on real basic figures, but I prefer to work straight off the plate with mint models I can shape any way I like. I don't know if I *will* use my face in the final draft."

"The girl seemed upset."

"She loves me," he said. "In the story, that is." He ran the play back to the showdown. "Finesse, that's what it's all about. And control. Just here, see? I'm not happy with Malig's face. I'm trying for a very exact expression. I think I might be overdoing the turndown in his lips."

I watched as he put the small section through slow motion, reversed, made another slight alteration. The villain's lips were made to curl less, his head to adopt a shade less tense an angle. Crazyac ran it through a couple or so more times. "How's that?"

I was non-committal. His style was passable, adequate for the corn market, but hardly up to the superlative standard I was looking for. "Pretty good," I said.

An enthusiast is a hard person to put down. "This is going to revolutionize the writing game, the whole entertainment field. No longer will producers and directors screw up a writer's words, or actors interpret a part how they like. I'm going to be able to create the whole damn thing right here, the characters doing what *I* want them to do, saying what *I* want them to say, and *exactly* how *I* want them to say it. It's going to be marvelous. At last the purity of an imagination will be able to be delivered to the public unadulterated by intermediaries, know-all critics, and smart-asses who believe they know what an original creator *really* intended to say.

To divert him, I asked, "Where did you get your background?"

"I had it analyzed from an old-time reeler called 'Shane.' I got the girl from the archives, too. Somebody called Yvonne De Carlo. Ever heard of her?"

"No," I fibbed, not wishing him to know where I picked up my clues.

"There's a lot of resource material in the archives," Crazyac said, "easy enough to build on. Real sets with real people are a lot easier to adjust and correct, but they still cost, and still leave room for arguments. I think it's a lot more satisfying if a man can do the entire presentation on his own."

"It's quite a challenge, to try and achieve realism, isn't it?" I said. "It's not quite as easy as it would seem."

Encouraged, "You're not wrong," he agreed. "It's the minor touches. It's not just the main characters, the others have to have reactions, too. That's why I moved the barman to the other end of the bar," he apologized, "and discreetly moved the others back to make them truly peripheral. A story needs to concentrate on its main protagonists. This is something the creator *knows*, can see so clearly in his mind, better than

any director or overpaid self-important so-called star."

Crazyac's b.r.v. was locked on a still and held. Reflexively, almost unconsciously, Crazyac made a slight adjustment to the villain's countenance, darkening his jowls. "This system enables a writer to be a true artist. This bank of keys is my palette, and my fingertips can place the most delicate of brush strokes on my canvas, even as it moves. I can make the wind blow, the leaves rustle, the lamp swing, the rain fall. Mister Raffakov, Otis, I'm telling you, this is the greatest tool that has ever been placed into a creator's hands."

I assented, but remained pensive. "Your villain—what's his name?—he looks a lot like Brant Hughes."

"Malig? Malig Nantman. A callous swine. But of course, you haven't seen what went before. Would you care for a full preview? I'd appreciate your opinion, your being much more qualified than any of my usual visitors."

As I made some polite excuse, he seemed to hear what I had said. "Brant Hughes? Do you think so?" He regarded his halted scenario. "That would be purely coincidental."

"Nevertheless," I warned, "you know the rules of fiction, about not portraying any real person, living or dead. Unless you change his features, on that representation I'd say he could well make a case against you for misappropriation."

This raised his eyebrows somewhat. "Is that right?"

"That's right," I told him emphatically. "It's as certain as bad breath after a garlic sandwich. I don't know about Yvonne De Carlo, or whether the copyright on the Shane backgrounds has expired, but it's certainly another consideration you'd do well to keep in mind."

"Uh-huh." I got the feeling that his dismay would not last very long. "This is my first draft of a full-length feature. It's a test piece, really. I can shuffle the faces. Even the backgrounds." He was talking to himself, and being satisfactorily convincing. "Laying down the main theme, that's the big thing, setting out the principles, getting the action running just right. The faces can be the finishing touch." He nodded. "They can be refined, made original, Mister Raffakov."

Refinement. He had about as much finesse as a sockful of sand. Once a cartoonist, always a cartoonist. "Yes."

I had seen sufficient. I was seeking a standard of excellence that he had yet a way to go to reach. Something was required over and above highly sophisticated equipment. I had scant hope for my question, but I phrased it carefully anyway. "Apart from yourself, Tony Lushington, Bob DeGeirendoff, and maybe Lester Wu, who else would you put into the very top bracket of picaper know-how?"

He gave it a moment's reflection. "Oh, Paley Mfinga, I guess."

It was a new name, sharply pricked my ears. "Paley who? Who's he?"

"Not he, she. Paley Mfinga. She's the one started me off a couple years ago. She was a wizard."

"I've never heard of her," I said. "Is she a writer, too?"

"Oh no. I don't know what she'd be doing now. She's in the west. I was over there and met her. It was at a convention thing. She's a fan of mine." Suddenly

he reined himself. "Uh, well, we met, and, ah, she suggested some ways I might improve my animation. She was good."

"She introduced you to picaper back then?"

"She just showed me a few things, that's all. She had been one of these child prodigies, you know? They don't last for ever. She was not a writer. She had this talent, but didn't know how to use it really."

"Have you kept in touch?"

"Huh? No." It was too quick, but he was only defending his own integrity. "I'm independent. I carry my own ball my own way. She gave me some leads, I freely acknowledge that, but her use isn't my use, and everything I've achieved has been from my own head, my own persistence, to reach my own goal that I have set for myself."

"How does *she* use picaper?"

"I don't know. Just play, I think. She worked for some law firm over there. She was an investigator, I think, something like you. Mostly keeping up with the latest."

"Trying to keep ahead of the latest," I amended, "as I'm trying to do now. Paley Mfinga." I made sure I had it spelled correctly. The world of experts is fairly tight, and it was nice to stumble onto someone fresh. It would probably amount to nothing in the long run, but it presented a change from looping through the same old limited list of possibilities.

I thanked Crazyac for his help, with reservations complimented his work again to keep him sweet, and took my leave.

* * *

I arrived at The Lulus' a couple minutes early. It was actually The Cocka-Doodle, but Dinger and I called it The Lulus' because it would have to employ the most luscious waitresses in town.

7:30 came and went. 7:45. 8:00.

Dinger Batt was an army man. Most of his faults were good ones, and did not include unpunctuality.

The itchy feeling caught up with me again.

8:05. I gave up, went out, put through a call. A message had been left to answer my sequence. Unavoidable delay. Meet at the Castle France Caravanserai, ticket booth at entrance bridge, 11 P.M. Explain later.

Hm. Maybe Dinger had got on to something already.

I switched my keymo, took out another, programmed it to quest, check out little-used lanes and byways in order to make sure that these passages *were* functional and not being avoided through fault.

I caught the news. As I had anticipated, the smash by a runaway keymo was receiving prime coverage, throwing a bolt of fear through the entire population. Luckily reports of a fatality were untrue. Nonetheless, somebody easily *could* have got killed. A full investigation was being mounted.

I supervened instructions to signal meal break, and re-aligned my keymo to have it take me to Communications House.

At Communications House I used a borrowed passnumber and a highly illegal mimicprint to breach the main gate. The further blocks were minor and

gave me little trouble. Familiarity breeds contempt. OK, so I was being paranoid.

Inside I sought answer to the queries I had logged against the name Paley Mfinga. The reply waiting for me was no answer. Nil. Zero. Zilch.

This quickened my pulse to no end. No answer was one of the best answers I could have had. It told me unequivocally that Paley Mfinga was one of the very few people in the world with the king kudos to run a silent number, to retab the tabulators, to know who might be ringing her bell, and where, and to be able to say, "Not today, thank you," to anyone, about anything, at any time. She had to be good, quite as good as Crazyac had implied.

This was my country. I set to work to sound out her weaknesses.

It was an engrossing labor. She was good; damned, infuriatingly good. She had triple double-backs in place, tripwipes set with marvelous precision to undo an entire route of intrusion taken by the nosy, and some of the most cunning misleads I had ever encountered.

The more systems there were, the more cross-referencing, the more easily a user or abuser could get lost. Security became easier rather than harder the more intricate grew the web. It took a lot of experience to keep track of a thread. Experience and instinct.

It was as if Paley were playing a game with me. Her credit record, school record, tax record, youth visuals, medical record, the lot, she seemingly had placed a leash upon them all. Fascinating.

10:30. After two whole hours the only flaw in her defenses took me to a fix on a beach cabana up the coast, something a little more than a hundred kilometers up. Even this lead had an arranged flavor to it, seemed too flukey to be true. No one but me would run the series the way I did. It identified me. By now I had a distinct feeling that *I* could be being read and, perhaps, predicted.

I had to drag myself away. She would know I was out here now. She could be back-tracking to find out more about *me*. All she would have to go on was my technique, to do even as I did, match the results to the reputation of those few capable of playing in such a league. Not wishing to boast, but she could well know by now just exactly who was on her trail.

I had a full head of to-and-froing conjectures when I headed out to keep my appointment at the Castle France Caravanserai.

I reached the rendezvous with five minutes in hand. I regretted that I had not remained that much longer at the console. I stopped the keymo short, I'm unsure why. I had a cramp in my leg. I had forgotten to check myself out for fractures, and my bruises seemed to want to set if I sat still for too long.

I put the keymo on hold, and set out to walk the last hundred meters. I thought I might meet Dinger on the way. The air was cool, nice, a fine time of night. The streak of masochist in me enjoyed defying the creaks and lesser stabs of protest offered by mistreated joints.

A couple of workers were up in the battlements doing some repairs to the Castle France advertising sign. The place had long closed for the day. The men were wearing gloshield coveralls.

Sparks, radiation—when such illuminations were connected they could draw an awful lot of power.

Nobody else about. I ambled, looking up. I got closer beneath them, the drawbridge and the shuttered ticket booth a few steps to go.

They weren't looking at me, yet they were. They wore protective goggles, glinting black, as though they might be anticipating a flash. Between them they were holding a thing that looked like a large telescope.

Everything came together, and I recognized it a bare split-second before they fired.

My dive was a smidgen late. Heat seared my pant legs and charred the soles of my shoes as the bolt struck. My reflex spasm bounded me over the chest-high wall that ran along the outside perimeter, sheer fright galvanizing me to clear it with room to spare. My legs felt alight, as though they'd absorbed the radiance of the charge, as though they were exploding white-hot even as I fell.

Then I slammed into the waters of the moat, liquid gagging my scream even as I would give it vent. I floundered, clawed, choked, surfaced gurgling and gasping, could get my feet under me, depth to my shoulders, including mud, skidding, glimpsing the two men still looming above, menacing.

I went under again, to a great jolt that tingled every fiber of my being, causing sunbursts behind my eyeballs, literally electrifying me to kick, to soundlessly howl, flailing, to remove myself from where the water had been made to steam.

The animal in me took over. I wasted no energy to preserve sanity or reason, but surrendered the preservation of my flesh to whatever impulses my primeval urge for survival dictated. I suffered a goggling panic all too thinly threaded with conscious volition.

I swam and grovelled underwater for an excessive distance, I'm sure, snatching gulps of air so frugally that the throbbing in my brain was given scarce chance to diminish. Out of the tunnels. Then, somewhere, there was a barbed-wire fence, and later a low building that I seemed to prefer to climb over rather than circle. I remember the tiles. I remember still stifling my breath from noise.

There was an alleyway. A jump down. Free of enclosure, there was a road I had to cross.

It was only now that I realized where I was. My blind drive to escape had found an underlying target to give it aim, maybe. The Consultative Library of Personal Data, not a block away.

The C.L.P.D. was open 24 hours. A governmental authority, it was a facility to provide the public opportunity to check and correct their own and other allowed files, and offer petition of dispute against claimed error. Private citizens and lawyers were not the only folk who might work here late into the night, toiling back through entries permissible to them.

I looked around, up, and about. No figures lurked to reactivate my terror. My soaked clothes clung to me, and now I had the time to notice them and shiver.

I hurried to the C.L.P.D. It appeared meant to be.

The C.L.P.D. was warm and had a

generous washroom with showers and dehydriers. I cleaned myself up as best I could and, after a third run through, my clothes had become reasonably sapped of damp and my nerves, the bulk of their quiver.

My shoes were ruined. My socks were scorched. My lower pants were frayed, had brittle blotches. From my calves on down my limbs had the rosy pinkness of a severe sunburn. But for plunging immediately to a quenching in the moat it would have been a lot worse.

They had tried to kill me. It was amazing how difficult I found this to accept. Animosity I knew, but one so deliberately and practically lethal, so cold-bloodedly directed at *me,* was a concept too shocking to fully grasp.

At last, though, I got my mind back. I gave myself a much needed spell of bodily repose, and practiced my breathing exercises. I did my best to think the thing through.

At the start somebody must have thought I was getting too close, to whatever *it* was. I had called Dinger. My keymo had become a runaway. Dinger hadn't shown at The Lulus'. A message had been left to my code. To walk me into a blast of lightning. Set up.

My popla had remained glued to my belt. *They* had known. I had put in a kink key. Any tampering, and I would have known that the message had not come from Dinger, or had been intercepted.

I was reluctant to straighten the thing out, to dig directly. It was more tempting to follow conjecture to wider, less definitive ripples.

Suddenly I felt very tired. I had to force myself to my feet, which hurt. My ankles were swollen. I left the snug cubicle, the washroom, and made my way to commandeer a review booth.

They knew me here. I had a licence to access any system, any time, to direct an audit of whatever sector my nose might tell me could do with a look-over. I had little trouble obtaining a clearance card.

I tuned my popla to the booth's receptor, to blow up the projection, to get a larger and more clear definition than could be obtained on a portable semi-flat. I ran back the memory to retrieve my interview with Dinger, from the point where I had nudged the button. He came in after my lead, saying, "Extortion? How do you mean, Freddy?"

I played it through, to his signing-off wave.

My clothes were dry, the air comfortably temperate, but a tremor went through me. It was Dinger. I could swear it was Dinger. It was not Dinger. It was. It was not. It . . . It was chilling.

It was him to the life. But Dinger never wore his hat indoors. One of his most common habits was to aim his cap at the hatstand, to secure a hook only about one in three tries. He used Freddy, but never as frequently as this. The Lulus'. That had stumped him. So patently. Brilliant recovery, but betrayed. Whoever he was, whoever was operating as him, or through him, had taken a gamble that the eatery *was* listed so in the directory.

Undone on such a simple thing. An excuse, a message left for Otis Raffakov if he should call. A meeting with a pair of executioners.

Sweat on my forehead. I played the thing through again, endeavoring to assess it with some proper dispassionate professionalism. It was a superb substitution, the most superior electronic impersonation I had seen. It was what I had been looking for, but now that I had found it I was unable to say that I was happy.

I should have found a home to go to, to get some sleep, to allow my weary muscles to recuperate. A corner of my mind remained too active, however, and resisted quieting.

Instinct. It can nag a man. She knew me. She niggled me, did Paley Mfinga. Her style itself had a pattern. I needed to read her as shrewdly as she seemed to be reading me.

A man either has it or he hasn't. From my first years in insurance straight out of training, through my brief stint with Bancorp Sub. Then to be endorsed during those great years with Louis Sazrick at Tech-Chex. Louis had taught me more than the rest put together, ten times over. Louis had been a real old hand. He had remembered, had been there, when some of the very first of the early computer swindles had been perpetrated. He had traced some of the pioneer hackers.

A beach cabana that had a common multi-service terminal. A tenuous link that had a high probability of being meaningless. Open for receipts. Another sly red herring.

Doggedly I tested the connection out. I uncovered a record. I uncovered a grim sense of humor. Mortuary. Full visual of an autopsy being performed upon a young woman, a replay that medical students might plug in for study.

I switched to the next. Religion. A cleric in earnest prayer. I just *knew* that Paley was mocking me.

Hunched, I set my jaw and persisted to search, even if she *was* making a fool of me.

Next I brought up a medieval scene. It could have been something amplified from what loving historians referred to as "vintage footage." Ivanhoe. Something from Arthurian legend. A knight, a white knight yet, thundering over the turf. A masked damsel in chains. An archival restoration. Some romantic had culled it to join the list.

I had no time to spare for such light interludes. My thumb twitched and I moved on, only to hurriedly recall the episode in startlement.

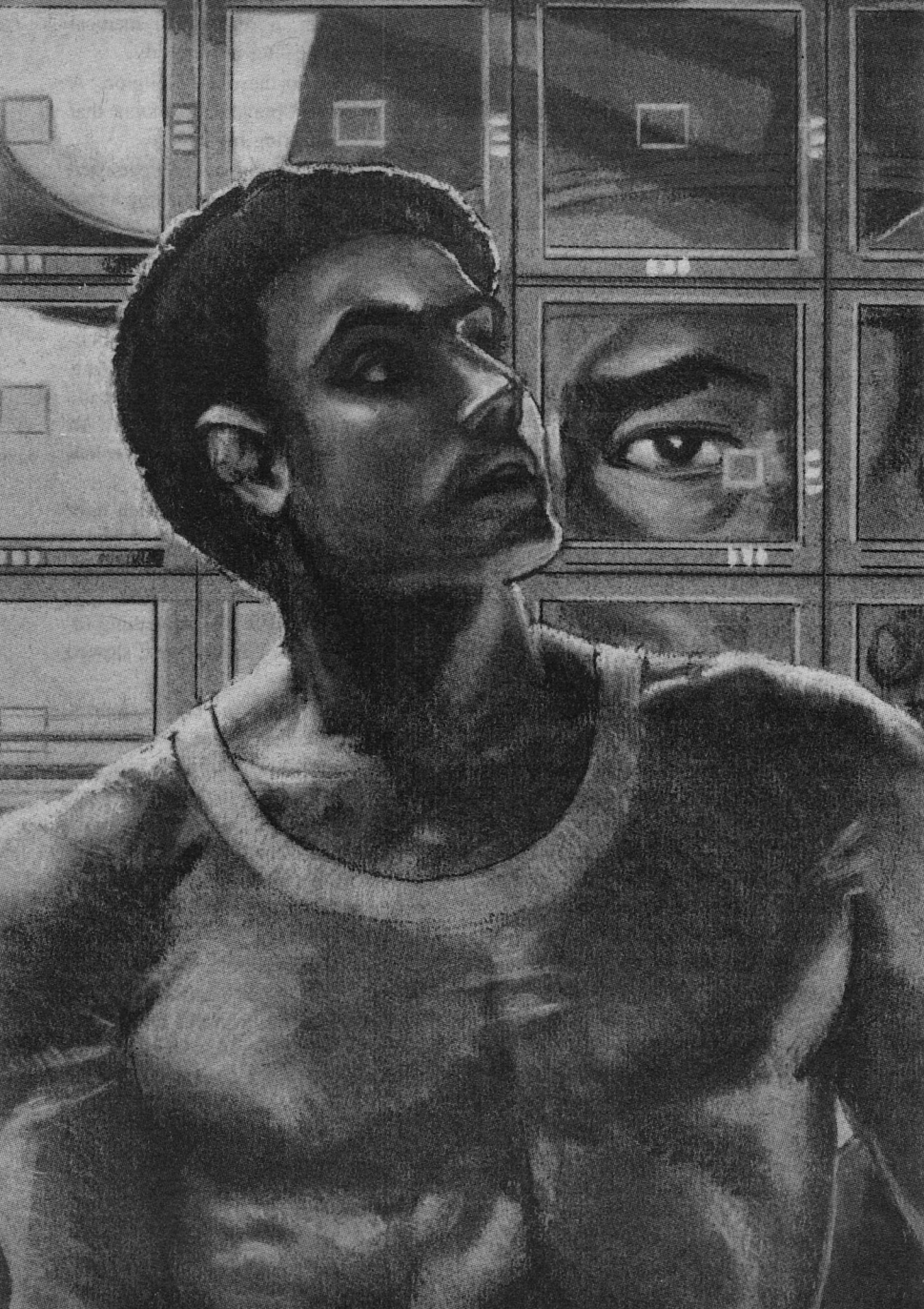
The knight. There was something familiar about him. I did a re-run, slowed the action.

I couldn't believe it. I did a freeze, and a sector enlargement. I was absolutely astounded. The knight's face was mine.

This sat me back in shock. My brain was sluggish, unwilling to labor upon the import of this quite remarkable superimposition.

I ran the feature on for a few more minutes. My face was not maintained upon the hero. Where had she got my face? From my talk with the bogus Dinger. Why no continuity? She had tired of the amusement? Cheeky. It was a taunt.

I halted the run, retraced to where *I* had been given a cursory, unauthorized appearance. Why? Sheer parody? She



knew me. She trusted me. She trusted me to *see*. Huh?

She trusted me? A message. A covert message. A very indirect message. Why? What?

I put my head back, pressed my palms over my eyeballs. I wished it would leave me alone. I needed to be more acutely alert. There was urgency here, though, I could feel it. Mortuary. Dead girl. Prayer for salvation. Damsel in distress. White knight. Me.

It was so obvious. She was a prisoner. She was being held by experts, had to be, practitioners who commanded a controlling overview of everything she did. Guile had been the only thing left to her. To me, also.

No. I lowered my hands. I was being fanciful. If she really *was* in trouble, how could I rescue her? I didn't know where she was. I had been looking for her for most of the day, and I hadn't even come close.

She knew me. What would she have guessed, expected, *known* that I would do next?

Two men had tried to kill me tonight. Finding the moat empty, they would be on my track again. Think. It was imperative that I think. Me in the vieways. Transformed into an actor, just like that. Some people might be prepared to put forward some solid credit to be able to portray a role so painlessly in such an epic.

A white knight. I couldn't help the rueful smile that came to my lips. It did not seem the most inspired casting just at that moment.

I gazed at the stilled image. A white knight on a horse. Trappings. Armor. Fancy sword, ornate shield. I had the message. No. What I had was a snap of the fingers to get my attention. The rest of the message had to be right here somewhere.

I made another enlargement, choosing to concentrate on the shield. I did a patient one-by-one stepping action advance. I was just about to give up hope when there, at the very last, of course, where, at normal speed, the eye would have an absolute zero possibility of registering an anomaly, there were the data etched.

It was breathtaking. There, in one single matrix signal, so infinitely fleeting as to be virtually invisible, had been planted an astounding array of facts.

I locked my booth. I returned to the washroom, held my head under the cold tap for a while. I went back to my booth as refreshed as I was likely to get.

Very soberly I studied the information. First things first, I filed copies, so that all government agencies with an appropriate legitimate interest might be notified. Next I rode my white horse, advising the law-enforcement arm of a kidnaping, the whereabouts of the victim, and the number and identity of her captors, where they slept, and the hours that each was on duty. I was able to supply a map of the house, and the further information that her guards were armed and dangerous.

Then, and only then, did I tap keys to break into the bank that this clandestine organization had built.

It is strange how tiredness may fall away from a man, become inconsequential, be ignored. What I winkled from the store was much more efficacious than a douche of cold water.

Faces. Known faces. General Bra-

vington, smiling, pointing to a map, explaining a strategy. Split-image. *Two* General Bravingtons. Image held. Bravington right, the other left. I watched and saw the features of the left-hand man being changed, modified. It was like make-up being electronically applied. Animation, back-tracking. Head enlargements, a comparison series of expressions, deftly adjusted and locked to every match.

It was an incredible artistry, and I was enthralled.

One after another. General Blound, Chief of Staff Suttlor, Foreign Affairs Adviser Djerkenborg, a cross-section of key figures who between them wielded considerable influence in the halls of power, especially military power. Colonel Ralph Batt, a liaison officer of proven ability, respected, trusted, possessed of entré into intelligence sources throughout the administration.

I watched, and my inner eye saw. These days an actual gathering of a team around a table had become very much a rarity. It was so much simpler, and more convenient, to gather by vieway upon an exclusive circuit. Businesses used such a system all the time. Sessions could be as private and closed as any. Government authorities, and especially the military, took highly sophisticated protective measures, operating on variables that altered daily, sometimes hourly.

No system was absolutely impenetrable, however. An opponent capable of equal sophistication, perhaps aided by an infiltrator installed to provide that chink in the defenses that permits cheating, might easily sneak a doppelganger into a top level conference. If accepted, such a *known* person, a visible physical identity, could glean a great deal of information effortlessly and unnoticeably.

I squinted, and took the notion further. Not just getting information out, but putting information in. A group of convincing surrogates could feed out opinions quite contrary to those held by their original twins. To sow drastic confusion. To achieve a dramatic coup.

The time to strike was now, while the technique was comparatively unknown, was in its infancy, while the possessors of the most superior method might enjoy an unassailable advantage.

I don't know. I was exhausted. Had I been rested and chipper I might not have done what I next did.

I put the whole lot on line, and fed it to speak for itself through the All Media News system, Live Fax, All-Ways Latest, Update Magaseen, Vieways Syndicated Releases, and anyone else who might have a nose to exploit a story. Once they realized what it was, what it meant, the disseminators of the latest events would fall upon this material like wolves. By morning electronic impersonation would be a known accomplishment, its realism attested, and its dangers made manifest.

A great burden lifted from my shoulders. It was too late to kill me now.

I had no inclination to go look some place for a bed. I was cleaned out, finished, dead beat. I curled up on the bench seat in the booth, and was asleep before I'd tucked in my feet.

I didn't get any medals. Not even a pat on the head. To the contrary, I almost got a boot up the backside.

Ingratitude can warp a person a mite.

The storm that broke got all sorts of people jumping up and down, our Internal Security Organization, our Counter Espionage Control, and our International Intelligence Intendants not the least. I was castigated for being highly strung, losing my cool. I should have kept it quiet. I should have passed it on to be taken over by the experts in double-dealing.

I should have done all sorts of things that I did not do. Never mind that it could have made me a dead man. I was in the business. I could see the complexities before they even started. They wouldn't listen to me, though, regarding my explanations as so much puck-puck-puckgerk.

Naturally I wanted to follow the thing through, to be one of those appointed to devise reliable detection techniques against any future electronic imitations, but my boss, Old Polly Narbright, adamantly refused me the opportunity. He felt he had lost points in the bureaucratic hierarchy and fallen a measure in favor and, much miffed, he blamed me.

Over all I should have been depressed. The one redeeming feature for me was Paley Mfinga. She was so shy, but so nice. When we did at last meet in person, it was like we had known each other forever. All my regrets were forgotten.

The law had raided the house where she was being held, efficiently obtaining her release and rounding up her turnkeys.

Then, a little later, she had been arrested. Currently she was out on bail.

Apparently her career had taken a wrong turn when her unethical lawyer/employer discovered her skill at making moving facsimiles of people. Someone had died intestate. A hardship was being suffered. Her compassion prevailed upon, Paley had made up a posthumous will from the man's living scrapbook. An authenticated recorded vieways will was a popular method for the deceased to visibly declare and dispose of his or her worldly goods. It allowed the deceased to express feelings, shed tears perhaps, and not infrequently, aim rude gestures from the grave.

One manufactured will had led to another, adjustments to secure settlements to favor the party willing to pay the lawyer a premium.

The lawyer had combined greed with profligacy and, to fund losses that he could not otherwise sustain, he had sold Paley Mfinga's talent to a foreign interest, effectively selling Paley Mfinga herself into slavery.

She was so vulnerable. She was such a fantastic contrast. She was so modest, even bashful, in person. Given a set of slot-tags, however, mag-stripes, a challenge of a palm-pass, a cross-digitization of intermittent random input, her elimination divination and interpretation of given information was unsurpassed, surely colored by an intuition that was next to genius.

I appreciated her. I was gratified to discover that she reciprocated, seemed to appreciate me. She came out of her experience of being blackmailed wiser and, perhaps oddly, with a lot more confidence. Whether because of me or not, she worried little about the threat of any charges that might be brought against her because of manipulations she had

conducted under duress. Leastways, I liked to think she had been under duress.

She was so at home in a system, *any* system, feeling it out, testing it from reflex. It was a metier where she could run free, to have scope to endlessly explore.

Dangerous. She really did need protection, supplied by someone who understood. Someone like *me* to keep an eye on her.

I did not have much clout in the regime, though. Till now I'd had no yearning to be a boss. I liked my work too much. It was Paley who gave me ambition.

Paley pointed out to me that her captors had made a mistake by using picaper to visually duplicate notable persons who, more than ordinary mortals, were likely to be subject to recording and scrutiny. Lesser figures, on the other hand, judiciously used to pass on brief remarks, either to immediate underlings or superiors, could encourage a benign attitude without giving cause for query, or arousing suggestion for doubt.

Finesse. Discretion and subtlety. Judge Perilotti, for example, to have a short but recommending word with Polly Narbright. Polly Narbright to have a passing chat with Old Murgon, *his* superior, to grudgingly concede the worth of one of his staff. Old Murgon to casually let Pat Gyryndle, a sometime golfing companion and colleague of Polly, know that a certain person in the Department was being undervalued, and should be actively sought after to scotch the rumor that he was leaving to go west.

Idle remarks. Minor things like this. Nothing dramatic. Just a picaper snippet tacked on to the end of a genuine conversation, say, an afterthought that said something agreeable about somebody.

It was shortly after this time that, despite everything, I began to get my promotions. ■

IT'S ANLAB TIME AGAIN!

This issue completes 1986 for *Analog;* now it's time for you to let us know how we're doing. The authors are interested, I'm interested, and you should be interested—because your feedback about your likes and dislikes will have a second-order feedback on what we offer you in the future. So please vote. Here's how:

Look over all your copies of *Analog* dated 1986, or refer to the index to 1986 which will appear in our next issue. Pick your *three* favorites in each of the following categories: novella/novelette (a single category), short story, science fact article, and cover. (Since there were only two serials, you won't be voting in that category.) Then drop us a line listing your choices, in order of preference. We'll tabulate the votes and let you know how they came out.

Send your votes to: Anlab, *Analog,* Davis Publications, Inc., 380 Lexington Ave., New York, NY 10017. They must be received by February 2, 1987.

—The Editor

brass tacks

Dear Mr. Schmidt:

In Mr. Rosenzweig's letter of July 1986, one phrase seemed to leap out at me: "A too easy faith in the capacity of man to solve all problems." This faith in man is behind virtually all our problems today. Add to this idea the love of power, and you have the basis of the most repressive and murderous regimes the world has known. This faith is what prevents most liberals, while occasionally condemning communist "aberrations," unable to condemn communism itself, refusing to believe that such "aberrations" are an inevitable part of giving man such power.

The proper function of government is to protect its citizens from force or coersion, but otherwise leave them alone. In such a society the only way a person can obtain wealth is by providing goods or services that someone else will pay for. Thus man's inherent selfishness is channeled so as to help others in helping himself. In socialism, where reward is separated from effort, that selfishness is channeled into getting as much and giving as little as possible, into the "common good." In a free society the myriad decisions of individuals lead to a smooth harmonious society; it requires some agency that can make decisions involving large numbers of people to cause wide swings.

Regulatory agencies are established always with two presumptions: 1) that the regulators have all the information necessary, and 2) that the regulators will act in a totally honest manner. Neither of these is even approximately true.

The liberal sees some real or fancied inequity, and proposes a law to change it. This is favored by those benefited, but usually ignored by the majority who are slightly or indirectly affected. The liberal gets a delightful sense of power and frequently a soft job in the bureauc-

racy. But two other things also happen: people react in ways the liberal had not expected, causing further "inequities," and other groups, seeing help given one group, clamor for their own special help. Thus interventions and their unexpected consequences multiply, eventually requiring drastic reduction of freedom and rights to "solve" such problems. Thus easily, when you add a little of the love of power to the faith in man, can a totalitarian regime be created, all in the name of "helping the people."

I don't know which causes the most trouble: the belief in man's ability to solve all problems, or man's love of power. Certainly, without the former, there would be more resistance to the latter.

JOHN R. LEDBETTER, JR.
Rogersville, AL

An interesting discussion, but I find myself not quite sure what your conclusion is. In particular, what do you recommend as an alternative to believing that problems can be solved? A healthy skepticism toward the value of any particular attempted solution is one thing, but the kind of attitude that says that in general we can't *solve problems is self-defeating.*

Dear Mr. Schmidt,

I hope that your editorial on smoking, entitled "Who's Responsible?" in the June, 1986 issue of *Analog,* was simply not thought through, and that you were not prostituting yourself and your magazine for tobacco advertising.

You concede that many smokers are addicted to tobacco. The nature of addiction is that it takes an effort which is normally beyond the abilities of the addict to exit the addiction. Tobacco addicts do *not* choose to smoke each time they light up; they lost that option back when they started. And they probably started when they were in their early teens without all the facts and before they could make a mature judgment.

No one is trying to take away your right to smoke, only your right to advertise smoking.

Another point to consider is that cigarette addiction is almost universally acquired between the ages of 12 and 18, an age group well represented among your readers. These kids look up to you, they worship your magazine, and they believe what they read. Are these teenagers going to make rational, informed decisions about smoking based on your editorials and advertising? And if they start smoking, *can* they stop whenever they wish?

HARRY SAXMAN
Brattleboro, VT

You overlook a third possibility: it was *thought through, but my conclusions are different from yours!*

Tobacco addicts do *choose to smoke, by not choosing to take adequate measures to get rid of the addiction. I explicitly acknowledged in the editorial that that's not easy, but it can be done, if somebody wants to badly enough.*

It's true that many acquire the addiction at an early age and later regret it. I respectfully suggest that the appropriate response is to directly address the problem of early starters. Banning smoking by anyone *is neither necessary nor sufficient for that. Better education, primarily by parents and secondarily by schools, would be more appropriate—but it's a lot harder to provide than excuses for* not *providing it.*

As for "no one is trying to take away your right to smoke . . ." the literature I saw indicated that that is exactly *what some groups hope to achieve eventually. Not, admittedly, by a single immediate*

stroke of the legislative pen—but the piece that provoked the editorial explicitly and repeatedly endorsed "the goal of a smoke-free society by the year 2000."

Dear Dr. Schmidt:

Your editorial "Who's Responsible?" has provoked me into writing. At one point, you made mention of freedom of speech. The freedom to smoke is much closer to the freedom to swing one's arms—a freedom that ends where another person's nose begins. It is NOT true "that no one has to smoke unless he puts a cigarette in his mouth and lights it." Many studies have shown that non-smokers who breathe secondhand smoke suffer the health hazards associated with smoking. My sympathies lie not with the person who has chosen to continue smoking, but with his or her spouse, children, and friends who are forced to share the dangers every time the individual lights up.

Further, the effects of smoking do not end when that cigarette is finished. It seems that few smells linger longer than that of stale smoke. In fact, I know some smokers whose presence I can hardly stand, even on those rare occasions when they don't have a butt hanging from their mouths, because of the nauseating smell that permeates their clothes, their hair, and everything they touch. We have all had our enjoyment of a meal ruined by a nearby smoker, sat beside someone who lights up in the non-smoking section of an airplane ("I only smoke a little and I sit in this section because the air is better"—yes, and we want to keep it that way) or had to look at ashtrays with their heaps of butts.

And it is not only the smoke that affects others. How many people have been burned or killed in fires caused by someone smoking in bed? How many forest fires are caused by a carelessly discarded cigarette? How many chairs and rugs have been ruined by dropped ash?

I agree that if a person makes an informed choice about the risks they should be free to live their life as they wish. If a mountain climber falls, he is not likely to injure an innocent bystander. The boxer who climbs into the ring is putting his well-being on the line, not that of the spectator in the third row. In essence, if a person has enough information that he feels able to make a choice, he is free to do so. He does not have the right to make that choice for anyone else.

To paraphrase the anti-drunk-driving campaign: If you smoke, that's your business, if you smoke and it affects me, it's my business.

JOHN YASKOWICH

St. Hubert, Quebec

Please look again: I emphatically did not suggest that people should have the right to smoke whenever and wherever they please. I fully agree with your last sentence, and I explicitly acknowledged the valuable work of ASH and other groups in making the no-smoke option more widely available. You may be sure I would vehemently protest a decision by the railroad I use to allow smoking on all cars—but as long as there are enough smokers to fill one, I would be just as opposed to their not providing a smoking car. My objection to the group I picked on, and others like it, was to their apparent determination in the long run to going beyond protecting *choice for all and trying to* eliminate *it for those who don't agree with them.*

"Secondhand smoke" is a problem, of course, but even under "unsegregated" conditions it's markedly less severe than "first-hand smoke." When

well-ventilated non-smoking areas are provided, it becomes so much less that continuing to protest seems to be carrying things to unreasonable extremes.

Dear Stan:

Your editorial "Who's Responsible?" stimulated this reply. I realize that the thrust of your editorial was individual choice and responsibility with cigarette smoking as only the main example. However, I must rebut your theme that "every individual . . . alone bears the ultimate responsibility. . . ."

The total price tag for all medical care in the U.S. for 1984 was something like $\$355 \times 10^9$ of which an estimated $\$90 \times 10^9$ was for tobacco caused illnesses. Since well over 70% of all medical costs were paid by third party insurers (insurance companies, Medicaid, Medicare, VA and DOD, etc.) simple multiplication tells us that some $60 billion or more were spent on tobacco induced illnesses by someone other than the smokers themselves. All those non-smokers are paying insurance premiums and taxes to subsidize medical care for smoking-induced illness.

Smokers have higher work absenteeism from illness than do non-smokers. This costs their employers for lost productivity and higher insurance premiums. Young children of smoking parents have much higher rates of ear infections, bronchitis, pneumonias, and asthma. What choices and individual freedoms do their employees and their children have?

As a practicing obstetrician I see mothers continue smoking throughout their pregnancies despite warnings that tobacco potentially will harm their fetus. What choice is the fetus given? I estimate perhaps 1 in 10 smoking mothers quit during their pregnancies.

Finally, HHS estimates that fully 30% of the cancers in the U.S. arise from the use of tobacco. Love Canal, Three Mile Island, and air pollution pale in comparison. Startlingly, one in eleven women will develop breast cancer, but more will die from tobacco caused lung cancer.

So you see, allowing smokers the choice of smoking, materially affects every person in the U.S. They may have the right to smoke, but we have the privilege to pay for it.

So what is the practical solution? I don't know. But I would like to see federal subsidies for tobacco farmers halted, higher insurance premiums for smokers, and I would also like to see additional taxation on tobacco products specifically dedicated to Medicare. This may forestall a looming financial crisis and at least partially make the smoker more responsible for this actions.

JAMES F. YOUNG, MD

Sierra Vista, AZ

Indirect consequences again! Of course it's logical that some of the ones more or less directly traceable to smoking should be dealt with more by smokers than nonsmokers. Higher insurance premiums, for example, are pretty easy to justify—and already in use by a good many companies.

Dear Ed.,

In your editorial "Who's Responsible?" there is one factor to consider in this matter of choice that was not addressed, and which is of particular significance to me (as a former smoker of cigarettes) and, I assume, to the people campaigning for the abolition of cigarettes. Namely, the problem of second-hand smoke. If I choose not to breathe cigarette smoke any longer, that choice is frequently denied me by the circulation of others' smoke. If all smokers in, say, an airplane were closed off by a

barrier that did not permit the circulation of that toxin-laden air to the area chosen by non-smokers, that would be one thing. As you know, this is not the case. NOW who's responsible?

The point of your editorial, of course, was that we should accept responsibility for our own knowing acts, which brings up another point . . . the mandatory seat-belt laws. Is this not an even more blatant example of the law's taking away our personal freedom in the name of protection? Do you realize that a mother can be *arrested* for holding her baby in her arms, perhaps nursing, while riding in her own personal property, her car? I, personally, am aware of the dangers of collisions, but do not want to be forced to physically restrain myself in my vehicle. I am perfectly willing to accept that risk. As a matter of principle, I oppose such legislation as an erosion of our personal liberty. Down (or, in this case, off) with seat belts!

GENE H. MEIGS

How good of you to recognize what the editorial was really about—quite a few readers got so inflamed over its references to one example that they seem to have lost sight of what it was an example of! I've dealt with seat belts before—and got letters from people who felt about them the same way you do about smoking. In both cases, I'll cheerfully grant that there are indirect as well as direct consequences—but I'll also maintain that there are limits to how much those can reasonably be used to limit other people's actions.

Dear Dr. Schmidt:

The June editorial criticizing the people who sue tobacco companies because their relatives have suffered from lung cancer emphasized that the affected smokers could have chosen not to smoke. I agree completely.

We managed to reach and pass 1984 without entirely fulfilling all of Orwell's predictions. Indeed, in those good old days, when very few of these suits were in progress, it was possible to see quite a distance between the fictional nightmare and the actualities.

Since then, however, anti-smoking ordinances have proliferated, the tactic of suing tobacco companies has come upon the scene, seat-belt laws have multiplied, and now they are talking about requiring airbags in cars. Along the same lines are the suits which have won million-dollar pain and anguish damages for accident victims and the laws which allow the victors in these cases to collect from the handiest legal entity that has the money.

People seem to be hastening to repair the oversights which enabled us to belie Orwell in the year 1984.

WHAT DO WE WANT?—BIG BROTHER!
—WHEN DO WE WANT HIM?—NOW!

Well, I don't want him now, and a lot of thinking people feel the same way.

MARGARET M. BISHOP

Dear Stan,

I read Rick Cook's well reasoned essay on *Homo sapiens* as a cursorial hunter with great pleasure. Having been an undergraduate major in anthropology myself, I came to much the same conclusions he did sometime ago, though I confess I never connected this interpretation of man with the problem of alien intelligences. I like his thesis that a non-persistent species is unlikely to produce starships, but it fails to explain why we've never detected even a whisper of radio emissions from our hypothetical aliens. If they are capable of building a technological civilization, surely they would have developed radio

for their own use, and if they've been civilized for any length of time, their home world should shine like a nova in all of the radio frequencies. No source in our sky seems to do so.

Let me offer a thesis of my own. I propose that the reason we've never had contact with any other intelligent races is that they're all dyslexics. We know that this mental impairment has nothing to do with intelligence itself, as some of those who suffer from it are sometimes quite brilliant in every other way. Suppose that human beings are freaks in this ability to encode and decode strings of visible symbols. Suppose that all other intelligent races lack this gift. What kind of civilization would be possible to such a species? We know that the Incas were illiterate and still managed to build a mighty civilization. But would advanced science, technology, law or economics be possible without literacy? And while we're all aware that writing has been the primary means of storing and transmitting knowledge, we often fail to realize that it has an even more important function. Literacy is an intelligence amplifier. If you doubt this, try solving even a simple puzzle without the aid of paper and pencil. Could you build a starship without these tools? Could you even build a radio?

GRADY M. TOWERS
5255 E. 29th St. # 29
Tucson, AZ 85711

I can't argue with the value of literacy, but if intelligence is widespread I find it hard to accept your thesis unless you have an idea why *such a useful extension of it should be so unusual.*

Those who wish their addresses to be published should so indicate by writing the address underneath *their signatures.* ■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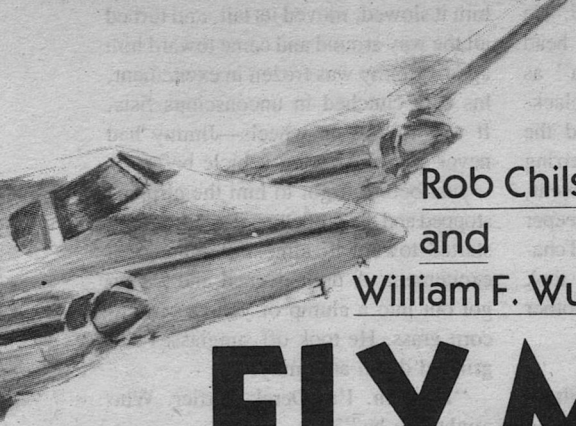

Rob Chilson
and
William F. Wu

FLY ME TO THE MOON

"Progress" is commonly thought of as the sum of many improvements. But every gain has a price. . . .

Doug Beekman

Jimmy was playing cars on I-35. He held a bright egg-shape over his head and went "Sssssssssoooooommmm" as it passed him, banked around the black-eyed Susan, and came in toward the cracked, dusty concrete. Transferring himself to the inside of the car, he went, "Mmmmmmmm," deeper and deeper in tone. Then the car landed. "Tcha-click!" The door opened and he took out the Mommy and Daddy. But another car was going by: left hand.

"Sssoooooom, ooooo—"

Bzzzrrrrrrrrrr, another sound built up all around him, a droning sound that had underlaid his own car noises and only now became too loud to not hear. Jimmy looked to his left; some trick of reflection seemed to make the sound come from that way. He saw only the rolling flatland of northern Iowa, the bright commuters' houses scattered across it. The low silver-blue sky above them held only an occasional jelly-bean gleam of light from a passing car. Then he looked right, and saw it.

It was big, its wings wide almost as the old road, and it had two *propellers!* Its noise got louder and it was coming *right at him* down the highway, out of the southeast. Jimmy stood up, almost choking with emotion. BROOOOO-ommmmm, it roared past in a gust of dust, and its *wheels* touched the highway to his left. More dust spurted; weeds were crushed; air was filled with summer-dried green things flying around him, grasshoppers buzzing, and the propellers changing their tone. Then Jimmy could see that the airplane was slowing sharply, raking through the weeds and dirt on the broken pavement.

It didn't stop. Quite a long way from him it slowed, moved its tail, and turned all the way around and came toward him again. Jimmy was frozen in excitement, his cars clutched in unconscious fists. It was rolling on wheels—Jimmy had never seen a wheeled vehicle before.

Just before it got to him the airplane stopped and the propellers slowed. Jimmy started toward it, almost choking with excitement. A door opened and a man got out into a clump of yellow broom-corn grass. He took off sunglasses and grinned down at Jimmy.

"Hi, Son. I'm Derek Fortier. Who might you be?"

"I'm Jimmy. Did you fly that airplane?"

"I sure did, son. Say, I have an uncle named Jimmy. Jimmy who?"

"Uh—Jimmy Li." He had an uncle named Jimmy, too, but now he was looking at the airplane. "Are you flying around in it?"

"That's right. Matter of fact, I'm on my way to a convention of nuts like me who fly these old crates."

Mr. Forty—whatever—smiled down. His face was dark, deeply tanned, under windblown black hair. Tiny lines around his eyes gave his face a weatherbeaten look, like an old leather shoe. Jimmy knew he wasn't young; but he didn't act old. He stooped to shake Jimmy's hand; astonished, Jimmy nearly dropped his car.

"Do you suppose, Jimmy lad, that your parents would mind if I had some hot water for my thermos? It's been a long trip."

"No," Jimmy said.

"Might be a good idea to ask? If you don't mind my asking, how old are you, Jimmy?"

"Nine. And a half."

"So, big for your age. Shall we ask your mother?"

"She's not here. She went to check on the pipeline."

"Ah. Your father?"

"He's real busy working. I'm not supposed to bother him unless it's very important." Jimmy's mind was only half on the conversation. He was absorbing the sight of the great antique machine above him. "Could you take me for a ride?"

Mr. Forty laughed as though he had been expecting the question. "Well, son, that *is* an important question. One we'd have to disturb your father for."

"Oh," said Jimmy, crestfallen.

"Think he'd say 'no,' eh? Well, most parents would."

"Yeah." Jimmy went sadly over and felt of the wheel. It was hard and soft and black and rough. Dust came off in his hand. "Why don't you get a car, instead?" Jimmy looked at the car he held in each fist: flattened egg-shapes with trailing tail empennages for style, and little flanges underneath—no wheels.

Mr. Forty squatted suddenly, startling Jimmy: he just folded down in one smooth motion. Jimmy walked back to him and knelt down as suddenly as he could, but it didn't seem the same.

"It's like this, Jimmy. People in the past had many problems and bad things we are getting away from, but when you give something up, you lose the good as well as the bad. And flying these airplanes was good in some ways."

"Isn't it dangerous?"

"Yes it is," said Mr. Forty solemnly. "Two of my friends have died in airplane crashes."

"Gee. How fast do they go?"

"Well, that depends on the plane. This one will go almost five hundred kilometers per hour."

Jimmy was disappointed. "Is that all? My mom's car will go a thousand kilometers per hour. And it would go even faster if—um, if—" He trailed off, not remembering exactly what he had overheard.

Mr. Forty nodded. "It can't go faster than sound, because it's not streamlined for it. And it would have to fly very high to go that fast, so it would be too expensive for a family car."

"How high can an airplane go?"

"Not very high. Only a few kilometers."

"Well," Jimmy pressed on, "then why fly them? My Mom's car can fly to Spaceland in orbit. We're going there on vacation next winter."

Mr. Forty smiled wistfully, looking off across Iowa.

"Well, Jimmy, it's hard to explain, but the things you can do are sometimes things you don't care about. The things you can't do are what you want. Same with food. Food in the fridge that you mustn't touch because it's being saved, say for a party, is better than the food you're allowed to have."

Jimmy nodded. That he understood very well. It was like places to play. The old pond, nearly dried up, was the most fun place to play around here, and he knew how to swim, too. But they wouldn't let him play there unless they were with him, and they didn't like to go there.

"It's much the same with aircars. They're very safe, convenient, fast, and so on—you practically can't hurt your-

self or anyone with them. But they're not as much fun as airplanes."

"Oh."

"Airplanes were the queens of the air in their day, and that wasn't so long ago. Why, look at this old highway. It hasn't crumbled away yet, even in this climate. Yet it's empty; you've never seen a transcontinental semi-truck thundering along it, shaking the air with its sound and pouring volumes of blue-black smoke out of its stack. Yet men younger than me can remember those days very well. I'm a lot older than you are, but that's not *old*, you know."

Jimmy tried to picture the trucks thundering and the smoke, and the air shaking, but he couldn't. Mr. Forty seemed to realize his problem. He stood with the same easy facility with which he had squatted and opened the door to the plane. Jimmy jumped up eagerly and peered in past him, but it was dark in there and he could not make out much—just a wheel on a kind of thick thing coming out of the dashboard, and some dials, and the window in the opposite door.

"Here! This is a toy replica of an old Mack truck—take it, it's yours. Once they were kings of the road, and their drivers were like old-time knights. They thundered along here—see all the wheels underneath there—toward Minneapolis, coming up from Des Moines, and Omaha, and Kansas City, and points much farther away: up by way of Tulsa and Oklahoma City from southern California, a long weary way in a truck at a hundred, hundred and twenty-five kilos per hour! And from the east, too, from Chicago by way of Davenport, and from St. Louis, and Cincinnati, and ultimately from New York and Boston and Washington. From the south, too, from Little Rock and New Orleans."

Jimmy was turning the truck over in fascination. He found the "stack," artistically blackened with smoke. "Your airplane doesn't smoke."

"No, it dates from a little later, when the nuke and the electric came in. There were electric trucks, too, nuclear-powered, but only for a short time. Then the gravitronic motor came in and stood the world on its head. Wiped out everything with wheels, wings, or hulls. Land, water, and air, all obsolete. Nearly ruined the harbor cities. Nearly ruined every city; why live in cities, if you can fly a thousand kilometers in an hour's commute?"

"We don't live in a city."

"Does your mother work in Des Moines?"

"Well, she works all over Iowa. So she has to fly all over."

"Neither do very many other people live in Des Moines. And all this land, that used to be used for raising corn and soybeans and hogs, now sprouts houses every half kilometer."

Jimmy did not understand very much of this, or listen very closely. He was looking at the truck and making experimental roaring, thundering sounds under his breath. In his mind he could see the old highway, all its weeds gone, white and gleaming under the sun, and the big trucks thundering past in hordes, pouring out volumes of blue-black smoke from their jaunty stacks, making the air shake.

"It must have been great."

"Oh, it was. Well, some of it can be kept. We still fly our planes, and we

savor the danger, because that gives us the thrill. We could fall and crash any time, you understand? Not like in a car. So we hold the controls in our hands and watch, all the time, and stay alert, and—and *fly*, do you see?"

Jimmy did see. It wasn't the same at all.

Mr. Forty squatted again, and again Jimmy knelt, and this time sat back down on his behind, pulling his legs forward and crossing them. "What's it like?"

"It's like flying. It's like being alive. It's like running real fast downhill, and it's like eating ice cream. It's so smooth and alive. Did you ever ride a horse? No? A bicycle? Ah, then you partly understand. It's being in control."

Jimmy nodded solemnly and thought about coasting his bike down the slopes on I-35, and about eating ice cream. The day was quite warm, even in the shadow of the wing. There was ice cream in the house, but he couldn't have it: they were saving it for tonight.

"It's a swooping and a soaring across the face of the earth, and the hills below are *important*, they're not just something you're going past. You're *flying*, and they make the air you're flying through, they make it rise up or fall down, and you swoop and soar according to that air. You are a part of it all, the hills, the valleys, the air, the airplane, gliding like a bird, like a sailship, part of Nature, using Nature the way she was meant to be used."

"I wish I could fly with you," Jimmy said, rapt. Then his gaze went past Mr. Forty. He had seated himself facing his house as well as Mr. Forty, and he glimpsed a bright red gleam of light low down past it, just above the horizon. "Mom! Mommy's coming home! Maybe she'll let me ride with you!"

Jimmy started to run through the weeds toward the house, clutching the two cars and the truck. He had to slow a little on account of a low, sprawling clump of sawbriers—just in time he saw the blooms, balls of purple fibers tipped with gold. He had just reached the top of the ditch where the grass was mowed when he realized he had heard the plane's door close. He stopped and staggered around to look back, clutching the toys to his chest in disappointment. The propellers were already in motion, and a moment later the plane was moving down the highway toward the southwest. It went *brrrroooom* past him, already lifting into the air, its wings lifting it. It couldn't take off like an aircar, straight up. Jimmy had been watching videos as long as he could remember, and he knew about airplanes. But it was different, watching it really happen.

The plane was silver and blue and it went a long way away down the highway, and then its wings flashed and the sound of its propellers changed and it tilted and made a great big swoop, still low, a great big circle to the south and again west, and now it was behind the house, and behind Mom's car and coming up behind her and she didn't know he was there until he came alongside.

The aircar ignored the plane at first, coming down toward the yard beside the house, but then it bobbled aside as Mom grabbed the controls. There was the house and the ground below, and the landing place, and there was no danger, for the plane was past and going away, so the robot took control again and

landed the car. Mr. Forty flew low over Jimmy, who jumped up and down and dropped all his toys, then the plane made a big loop and came up I-35 again, from the southwest, wheels down, landing in the other lane.

Jimmy scrambled down into the shallow ditch again, not even feeling the tiny comma-shaped barbs of the sawbriers on his ankles, and ran up on the highway, waving his arms. He heard Mom shouting behind him and he shouted himself, standing on the side of the highway as the airplane came toward him, slower and slower, and finally stopped before it got to him. Jimmy crossed the median and ran yelling toward it, arriving as the door opened.

"Mr. Forty, that was *great!* That was really just *great!* Can you always fly around in circles?"

Mr. Forty wasn't looking at him. He was looking over Jimmy's head. Jimmy turned around and saw Mom standing on the edge of the mowed lawn, panting.

"Hi, Mom! This is Mr. Forty! He has an airplane! Isn't it just *great?*"

She didn't speak; holding one hand against her short ribs, she panted and looked at Mr. Forty. He sprang down and went to meet her. Having sprinted fifty meters to rescue the insane son running toward a landing airplane, she stood now on her dignity on the edge of the ditch. Jimmy trotted along at Mr. Forty's hand, a little scared.

"Ms. Li? I'm Derek Fortier."

He was on the disadvantage, coming up from the ditch, and she didn't help. With a chilly nod, she disregarded his hand and said: "What are you doing here?"

"Well, it's been a long trip, so I thought I'd stop and ask for some hot water for my thermos. I've got coffee, just no water." Mr. Forty added, reasonably, "Can't land these things just anyplace, like an aircar, and the fast food joints aren't set up to accommodate us. We tend to fly the highways. Your house is the closest to the highway for quite a stretch."

He smiled and looked down. "And I saw the little tyke playing there and thought—if you deemed it safe—he might like a little ride. A little experience. Something to remember."

Mom stared at him, still panting. After a moment she said, "Get your thermos."

He turned without a word and waded the weeds back to the highway and the plane. Jimmy wanted to go with him, but knew better. He looked at Mom. She was looking at him sternly, the way she had looked at Mr. Forty, and it made him very uncomfortable.

"Jimmy," she said after a moment. "Jimmy, you should *never* run toward an airplane that's landing. They are very clumsy and can run over you. He can't *steer.*"

So that's what it was all about! Jimmy was outraged. Did she think he was a little kid? "I know that! I didn't run straight out toward it! I ran along the edge of the highway! He wasn't gonna fly in the *ditch!*"

Mr. Forty was approaching again. Mom was panting a little less. "Be that as it may. You be careful. Airplanes are terribly dangerous."

That meant they were too dangerous for him to fly on. "Yes, Mom," he said mournfully.

Mom led them to the house. Jimmy was too sad to remember his toys, even the new Mack truck. In the house Jimmy showed Mr. Forty where the hot water was while Mom went to disturb Dad. Jimmy stood looking off toward the office, listening for voices, while Mr. Forty ran hot water into his thermos. It was quite a while before they came back, but when they did Jimmy started breathing fully again. Dad wasn't really mad. He was a little upset, but he was quite nice to Mr. Forty. Jimmy realized now that Mr. Forty had taken a long time to run hot water, on purpose. Dad shook hands and said, "I understand you have an airplane. Antique or replica?"

"Restored, meaning it's a little of both. Federal standards for planes have gone up, so many of the classics can no longer be flown. We have to use stronger materials and so on. But functionally it's the antique pattern; no gravitronic safety motors, I mean."

"Oh? Yet you proposed to take my son up?"

Mr. Forty smiled, and it was such a smile Jimmy couldn't help smiling too. "I'd be happy to take you all up. As for safeties, I risk my life in it quite freely, hours at a time. Accidents can happen, but the odds are against them."

"I'd certainly like to look at your plane. I haven't seen one up close in years. But I don't know about flying in one. I never thought they were safe, not small private ones, even when we had nothing better."

A few minutes later, they stood in the shadow of the wing, looking at it. Silver and blue trim and big numbers like aircars used to have shone in the sunlight, the motors making little humps in the wings just back of the propellers. It sat with its nose pointed up and its tail down. It did not look like it could ever fly; yet it looked like it was flying real fast right then, sitting on the old highway.

"Just why do you fly this old thing, Mr. Fortier?"

He took a long time to answer. "When I was only a little older than Jimmy I went to the state fair in Arkansas. There was an old fellow named Carson there with an old biplane—World War One Red Baron model. He and a few other nuts kept the old ones up and built new ones. Those old canvas-wings are forbidden now; too dangerous. But they were great, in their way; at least I thought so then. My father paid for a ride. Well, I got into commercial aviation later, with an old single-engine plane. Pre-atomic, it was." He looked at Dad. "Mr. Li, it wasn't all that long ago. Yet we're in danger of forgetting. Like Mr. Carson, I don't think things should be forgotten."

Dad thought about that for a moment, reached up and touched the underside of the wing. "What things are these?"

Mr. Forty looked uncomfortable. "Hard to describe. The feeling of *flying*, which you don't get in aircars. The feel of pitting yourself against the wind, against the universe. Of using the laws of Nature, of being aware of them. I can't fly into orbit. But I can fly to the Moon, Mr. Li. It's a very *live* feeling, like—like sailing in a sailboat."

"Like riding a bicycle down a hill," said Jimmy.

They looked at him, and Dad and Mr. Forty both smiled.

"Still . . . I'm really worried about the safety. I observe that you've landed here in violation of a whole slew of regulations." Dad looked at him questioningly.

Mr. Forty stroked his cheek, glanced at Jimmy, his smile not quite concealed. "That's true. It's winked at, though. Technically I could acquire a few more points on my license, but practically. . . . Really, Mr. Li, it gets harder each year to do anything fun, or even interesting. Mountain climbers have to have a car in attendance; imagine that! But here the risk is really so slight as to be invisible."

"Hmmm. Of course, that's your business. I suppose you'd fly him around in a circle . . . I think not, Mr. Fortier."

Jimmy's eyes filled with tears, though he was in no way surprised. Mr. Forty should have asked Mom . . . Dad always said no.

"Dick—" Mom said, and he looked up with new hope.

"No, Gina, I don't think so," Dad said, not looking around.

"I don't think the boy should grow up too sheltered," Mom said.

"I'd hardly call him sheltered. No, Gina, I think it's too dangerous. Meaning no aspersion on your piloting, Mr. Fortier—"

"No offense. You have to use your own judgment in raising your son. I just thought you'd like for him to have the experience; I'd like to have given it to him. Thank you for the hot water."

"Thank *you* for showing us your plane," said Dad politely.

Jimmy retreated across the ditch with them, wiping his eyes but not protesting. He stopped by the cars and the Mack truck and looked back. The propellers were whirling, slapping the air. They began to burr, then to buzz, and the plane was moving along the highway. Mr. Forty waved one last time from the window, then the plane's tail went up and it was gliding along, half on the ground and half in the air. Then it was all the way in the air, and the buzzing of the propellers had become a hard high anxious sound, like a wasp, as Mr. Forty poured power to his motors.

Away down the highway he soared, banked, turned west, and climbed; then he banked again, circled to the south and around and came howling up the highway again, waggled his wings as he went over, and climbed and climbed and got littler and littler and went away, a long way away, until he was only a little bright silvery dot in the north, and Jimmy blinked and he couldn't see the dot in the silver-blue sky.

"Well," said Mom. She stepped in front of Jimmy and picked up the cars and started to hand them to him. "Why, Jimmy, where did you get this semi truck? Did Mr. Fortier give it to you?"

Jimmy took it absently, ignoring the cars she also extended to him. Presently she started toward the house with them.

"Wonder why he landed *here?*" Dad asked.

"Probably much as he said, and then he no doubt saw Jimmy. It would have been a break in the monotony to show off his plane, you know. I'm sorry we didn't all go, Jim."

"I'm not," said Dad briefly, walking away after her. "And I'm glad Jimmy wasn't exposed to that kind of flight.

The past is dead; let it be forgotten, especially such clumsy dangerous antiques as that. Next thing you know the kid'll be wanting toy airplanes.''

''Maybe that's why Mr. Fortier stopped—to make a young convert.'' Mom was now quite distant.

''Oughtn't to be allowed in the air,'' Dad growled, following her.

Jimmy had not been paying attention. He had long since lost sight of the plane, but he was still looking after it, remembering. His mind was full of images of it, banking, buzzing, circling, landing, zooming by Mom's car and flying over him. He already knew his life's ambition.

When I grow up I'm gonna have me a plane just like that. ■

ON GAMING

(Continued from page 75)

and sheets needed to play, a solo adventure, a group adventure, and a set of cardboard ''heroes'' with plastic stands.

The game system is based somewhat on Jackson's earlier role playing system, *The Fantasy Trip* (Metagaming). Characters have four primary characteristics; Strength, Dexterity, IQ, and Health. Some actions require players to make a ''success roll'' by rolling 3 die and comparing it to their character's value. If the roll is less than or equal to the appropriate value, the action is successful.

Reaction rolls are carried out by a Gamemaster to determine the likely actions of non-playing characters. A very detailed Reaction Table covers the whole gamut of possibilities, from total disaster to incredible good fortune.

Combat is based on rolling a successful hit, again using three dice, and then rolling to see how many ''hits'' an injured character takes. An Ancient/Medieval weapon table lists the damage done by weapons most often used in fantasy adventures. Future releases will include tables for weapons from other time periods.

The combat system is detailed, but most of the work is done when filling out the character record sheet. A player rolls to see whether a character hits and then the defender adds up the total defenses he/she might have, including shields, armor, and any parrying skill. If the defender rolls under that number, a successful hit is blocked.

Acquiring skills is at the heart of the system, and all skills are uniformly linked to Dexterity (for physical skills) or IQ (for mental skills). Beginning characters receive a 100 points to spend on skills and each skill's cost will depend on the level of proficiency desired. The listed skills cover everything, from calligraphy and sculpting, to battlesuit (the use of powered armor) and crossbow.

An ambitious release schedule is planned, with a Magic/Fantasy book due out soon followed by adventures set in periods ranging from Ancient Rome, to the Ice Age, to the 23rd Century.

Said by some to be an impossible dream, *GURPS* is a remarkable achievement by one of gaming's most creative designers. ■

The Alternate View

SUPER-ATOMS AND MYSTERY PARTICLES

John G. Cramer

The path to a new discovery in physics is often a very twisted one. The subject of this Alternate View column is an example of this process. A major accelerator, built with with the prospect of discovering super-heavy elements, is now being used in an experiment to produce "super-atoms" with very large electric fields, and this work has quite unexpectedly revealed what looks like a new and mysterious particle. It is reminiscent of the SF of the 1930s where one of the standard science gimmicks was the discovery of a new element with amazing properties. It also sounds a bit like the Paul Preuss novel *Broken Symmetries,* where the plot revolves around the discovery at a large accelerator laboratory of a mysterious new particle. But this is real science, folks. Honest!

In the 1970s it looked as if we were due for a major expansion of the periodic table of chemical elements. The periodic table lists 92 natural elements ranging from hydrogen with Z, the atomic (or proton) number of one, to uranium with 92 protons ($Z=92$). In addition to the natural elements there are a dozen or so "transuranic" elements, all heavier than uranium. The transuranics, with latinized names like berkelium, californium, and americum, do not occur in nature. They were made and identified in physics laboratories, principally, as the names suggest, at the Lawrence Berkeley Laboratory of the University of California. Just above $Z=106$ the periodic table ends for even these synthetic additions. But there is a limit to the number of protons that can be crammed into one nucleus. Protons, carriers of positive electrical charge, strongly repel one another. Nuclei with more than that 106 or so protons are destabilized by this repulsion, so that they cannot exist for even a microsecond. The periodic table stops here. Or does it?

In the early 1970s there was great excitement over the possibility of an entirely new group of stable "superheavy" elements. Theoretical calculations of nuclear stability showed that there might be an "island of stability" around $Z=118$ to 126. In all nuclei the protons and neutrons are organized in "shells" of similar motion. Calculations suggested that in the $Z=118-126$ region the shell structure gave increased stability to nuclei. Thus there might be a whole new unexplored region of the periodic table, new elements waiting to be discovered and equally important, to be given *names* used by all future generations of humanity. Beside the great fundamental interest in discovering the properties of a brand new set of chemical elements, there was also another predicted payoff. These "superheavies," even if as stable as predicted, would be *fissionable*. And unlike uranium and plutonium, which require a "critical mass" of many kilograms to produce even a small fission reactor or bomb, the superheavies were expected to have critical masses measured in *milligrams*. The possibilities of pocket size

nuclear power sources (and other devices) were quite tantalizing.

These optimistic predictions produced a sort of international gold rush to produce and identify the first superheavy elements. The principal participants were physics groups in the USA, USSR, France, and West Germany. The West German effort clearly had the most class. Instead of trying to make superheavy elements "on the cheap" with aging and somewhat inappropriate accelerators, as was the pattern in the USA and USSR, the government of West Germany decided to go first class by constructing a whole new accelerator laboratory, the Gesellschaft Schwerionen or GSI, near the city of Darmstadt. The GSI accelerator, the Unilac, was designed specifically to allow the bombardment of stationary uranium atoms with a beam of fast moving uranium nuclei with energy enough to fuse, forming much heavier composite systems (and perhaps a few stable superheavies). The other national groups in the race did not have uranium beams and had to explore other possibilities, leaving the GSI group with the inside track.

But this "race" has turned out to be a very slow one indeed. You may have noticed that there have been no news items heralding the discovery of superheavy elements. The GSI group *has* discovered a few new elements, but they are not superheavies. They are elements with numbers 106, 107, and possibly 109, all quite far from the fabled Island of Stability. If stable superheavies do exist, as now seems less likely, their production is far more difficult than expected. But the GSI laboratory has not been idle, even though the voyage to the Island of Stability has been frustrated. It has supported a varied program of experimental physics, including the "super-atom" work referred to in the title of this column.

There is considerable similarity between electrons in orbit around a nucleus and planets in orbit around a sun, but there are also important differences between these two physical systems. Unlike planetary orbits, the orbits of electrons are tightly restricted by the laws of quantum mechanics. For example, the innermost electrons of *all* uranium atoms have exactly the same orbital velocity and other characteristics. In the simple atomic theory of Bohr (which is incorrect because it ignores special relativity and other effects) an inner electron has an orbit speed of $\mathbf{c}(\mathbf{Z}'37)$, where **c** is the velocity of light. With $Z = 92$ (uranium) an inner electron would have a velocity of about 67% of **c**, and a hypothetical atom with $Z = 137$ would have inner electrons traveling at the speed of light!

Bohr's theory is too simple to describe an atom accurately, but it does indicate that in atoms with Z's above 137 we might expect interesting effects. Better calculations which include correct treatment of special relativity show that the critical value of Z comes not at 137 but at 173. At this Z-value the electric field near the nucleus becomes so strong that an inner electron has a binding energy more than twice its mass-energy. This means that it costs more energy to pull the electron loose from the atom than it would to create a brand new electron along with its antimatter complement, a positron.

Atoms with very large Z-values may appear to be only a theoretical abstrac-

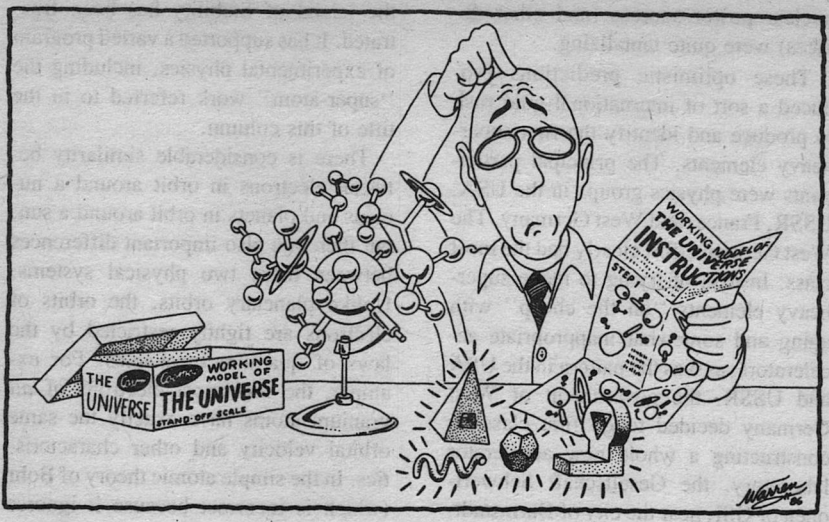

Illustration by William R. Warren, Jr., 1986

tion since the heaviest elements have Z-values of less than 110. However, there *is* a way, at least temporarily, of getting into the $Z \approx 173$ region where things get interesting. This is because we can collide one uranium with another so that they momentarily stick together. Then for a period of time, perhaps long enough to allow a few hundred electron orbits, we have an "atom" with $Z_{net} = (2 \times 92) = 184$. Three different groups of physicists at GSI have been able to produce such super-atoms with Z large enough to create an electron-positron pair, making an electric field strong enough literally to suck an electron out of the vacuum. The creation of an electron by this mechanism leaves behind a "hole," a positron that is propelled away from the atom by the strong positive charge of the nucleus. The electric field near the super-atom is made so large that new electrons and positrons are created out of empty space by a field which becomes so strong that it literally "sparks" the vacuum itself.

The same trick has been worked to make super-atoms and other systems: uranium + curium ($Z_{net} = 188$), uranium + thorium (182), thorium + thorium (180), uranium + lead (174), thorium + lead (172), and lead + lead (164). when these heavy "atoms" are created, it is found that positrons are indeed produced. Over the last five years the three GSI groups have studied these systems with increasing skill and precision, and a remarkable new result has emerged from their work.

All theories of positron production by the strong electric fields of these super-atoms predict that the positrons should emerge with a broad smear of energies. And indeed the measurements show this broad distribution. But they also show a sharp energy spike in the distribution of positron energies at about 325 keV, about 64% of an electron's mass-energy. This peak appears always at about the same energy, independent of the target-beam combination or the energy of the beam particles. The mystery of this

positron peak has deepened recently because it has been discovered that the sub-critical systems ($Z<173$) such as thorium + lead and lead + lead produce it also. And it has also been discovered that electrons are emitted along with the positrons in the peak region. The energy distribution of these electrons shows a spike at the same energy of 325 keV. Some unknown process in these heavy nucleus collisions is producing electron-positron pairs such that both particles have about 325 keV of kinetic energy. No known process can do this!

The most popular explanation for the GSI data is this: the super-high electric fields near the super-atom are producing a new particle. This particle has a mass which is enough to create an electron-positron pair. This would require a particle, probably electrically neutral, with a mass-energy of about 1670 keV, about 3.2 times more massive than an electron.

This is very disturbing. With the recent development of quantum chromodynamics and grand unified theories there seemed to be a slot provided for every particle ever discovered. All known particles come in four categories: baryons, mesons, leptons, mediating particles. The mystery particle cannot be a baryon or meson because both are made of quarks and are much too heavy for consistency with the observed mass. Likewise, it can't be a lepton because all are accounted for and cannot decay into electron-positron pairs. Mediating particles correspond to the four known forces of nature and are either very massive (gluon, $W\pm$, and Z^0) or massless (photon, graviton). There is also a fifth category containing various "possible" particles that have been *predicted* by one theory or another but which have never been *observed*. Most of these could-be particles are too massive for consideration. The leading candidate among them for explaining the GSI results is the axion (see "The Dark Side of the Force of Gravity," *Analog* 2/85), except that recent experiments at Fermilab seem to have eliminated 1670 keV axions as a realistic explanation. The new particle from Germany just doesn't fit into the framework of our understanding.

And so in testing the limits of very large electric fields in super-atoms the phycists at GSI seem to have stumbled on something completely new and unexpected. It is a discovery which is every experimental physicist's dream: a "new phenomenon" (see my article, "New Phenomena," *Analog* 5/82). It is an experimental observation that was not anticipated by present theories and which will probably require revisions of those theories. Children often play a sort of game with their parents, probing limits by pushing against the rules to learn how much they can get away with. Physicists work the same game on Mother Nature herself, and sometimes it pays off. ■

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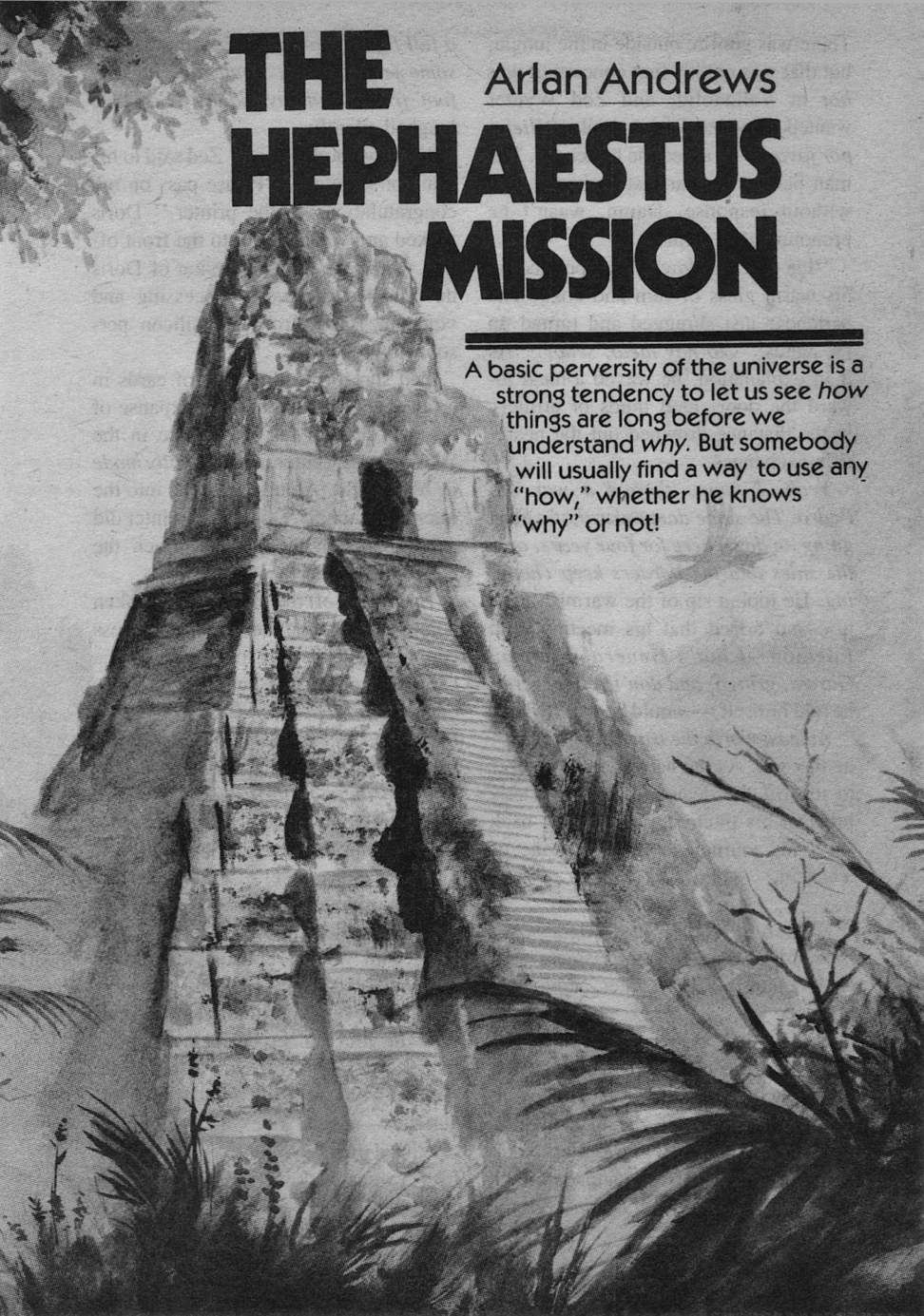
Doug Beekman


THE HEPHAESTUS MISSION
Arlan Andrews
A basic perversity of the universe is a strong tendency to let us see *how* things are long before we understand *why*. But somebody will usually find a way to use any "how," whether he knows "why" or not!

There was gunfire outside in the jungle, but that was not his first concern: it was *hot* in Valladolid, and Zed Wynter wanted some ice for his drink. "*Hielo, por favor,*" he asked the bartender. The man behind the bar just looked at him without response. Damn, wasn't he pronouncing it right?

"Ice—*ee-aay-low?*" he pointed at his warm glass of rum and coke. The bartender just shrugged and turned up his hands, "*No hay hielo, señor.*" As if in explanation, he waved a hand toward the door. Dull thuds of artillery in the distance drowned out the nearer rifle exchanges.

Yeah, I know, there's a war on, Pedro. The same damn war that's been going on down here for four years, only the sides and the borders keep changing. He took a sip of the warmish mixture and hoped that his meeting with Filemón—*(that's General Filemón García, gringo, and don't you forget it!* he told himself)—would be worthwhile.

At least worth the trouble to get here, he thought. As the bartender came over to top off the decidedly unwholesome brew in his pitcher, Zed thought back upon his journey to the war zone of Yucatán.

"*Future Perfect—The Magazine of Personal Robotics,*" the business card said, aloud. "Zed Wynter, Editor, at your service."

Zed smiled as his own visage appeared on the card and continued the sales pitch. These femtocircuits were simply amazing, yet cheap enough to pass out as advertising. He went back to admiring his not-too handsome face and blond hair. *Too bad I didn't opt for a full figure image,* he thought. *Maybe some female client would like my six-foot frame and my skinny body.* He laughed silently.

"Pretty good, Doris," Zed said to his minibot secretary. "Please pass on my congratulations to the printer." Doris rocked and waddled out to the front office where the human version of Doris downloaded the word processing and voice messages from her silicon personae.

Zed spread out the stack of cards in a fan shape across the wide expanse of his oak desk in his new office in the World Trade Center. *I have finally made it,* he thought. Aloud, he spoke into the intercom phone, "Doris, this printer did a good job on these cards. Even the electronics seem to work."

He clicked off the intercom by spoken command and then touched the business card at both ends. He loved it when the card recognized that human touch. *My own design, that. Wonder if I could get the printer to make me up one that listens and transmits? Now that would be some business card—one that spies.*

Absently he slid the card into a wrist receptor and listened and watched as it gave the entire spiel. "*Future Perfect* is the magazine of NOW robotics—with videotex outlets in all the major markets, with weekly updated downloads for your electronic pets, and the very latest in Developing Intelligences Analysis. In your home, business, or your large corporation, can you afford to be without your personal issue? And advertisers—special rates apply for personalized markets, for 3V stimos and for royalties of downloaded sales. 'Tex address is NYC . . ." The sales pitch

droned on, with appropriate musical accompaniment.

Followed by a freebie download. *If they listen this far, they get it. Otherwise, it deacts in an hour.* Wynter laughed. *The smart ones get the better deals,* he thought. *Even my price information upscales every week.*

Future Perfect—The Magazine of Personal Robotics had flourished even better than the robot market itself, and Wynter had been extremely lucky to own a share of it. Back in the robot bust of the late '80's, when the lawyers destroyed Nellie Bush's moderately-sized robot company over the deaths of a couple of juveniles who had decided to swim with a Jr. Robo, Zed had found himself suddenly out of work.

A Ph.D. in mechanical engineering wasn't worth a lot when everyone was looking for puffware geniuses with Nobels in their pockets. But Zed could write—a by-product of his long years of reading SF and then re-writing stories to suit his own tastes.

A chance encounter at a Personal Robot Consumer Show in New York had led to his being hired by a desperate company to do defensive copy for the quickly-dissipating fortune of one of its founders. A fortunate turn of phrase, a good layout, and a cheap (unauthorized, actually) link to a Burroughs-Cray VI's graphics capability, had saved a minor portion of the business and earned Zed the gratitude of a creative billionaire.

Zed had enjoyed the rise of personal robots and even though they were not very practical even yet, he already made a steady, if not independent, income from his shares of Teddy Toys and Living 'Lectronics—his payment for helping save the company that produced them. His benefactress had long since lost her self-respect and much of her fortune by indulging and investing in the Passion Pit stimos now illegally imported from Hong Kong, Inc. That and her constant legal battles in courts, protecting her patent rights from interlopers.

Damn the lawyers anyhow, he reflected. *Shakespeare was right!*

Doris broke his reverie with an irritating buzz.

"Phone call, Mr. Wynter. Satellite Service."

Zed wrinkled his forehead at the receiver and it came on. *Myomicros are great.* He smiled. *Wonder if my arms will atrophy?* He always received the latest gadgets as gifts, and this phone was a lot of fun to use.

"*Señor* Wynter, *por favor?*" The crackling, wavering signal and the loud noises in the background did not sound like the typical business call.

"*Sí, aquí,*" he answered, "*pero habla en inglés, si es posible, por favor. Mi español está muy mal.*"

Laughter at the other end. The unknown voice changed to a more friendly tone. "Zed, *compadre*, you have a German accent in Spanish, did you know?"

For an instant, Zed did not recognize the speaker. The crackling was loud and the background noises were firecrackers in a barrel. Who? . . .

Then recollection came. That last night in Ciudad Juarez—the White Cave. Migod! It was Filemón! But he was a guerrilla leader in Yucatán! What—?

"Hey, Janqui"—(always his joking pronunciation)— "it's been ten years, but we had a time in Chihuahua, didn't

we?'' Zed heard only a brief silence, and then more firecrackers in a larger barrel.

''Sorry, Zed,'' the voice spoke in perfect English in a very sober mood, ''but we have just taken this central office in Piste and we think the Federales will cut it soon. I want you to come down here for a very important reason.''

Zed was dumbfounded. This friend, this Marxist, wanted him to come to the war zone for some important reason? No way!

''Listen, Filemón, I—'' he suddenly realized that his reply channel was cut off. He could only hear the improbable message.

''You are a good writer and I think sympathetic to justice. I have a discovery to share with you . . .'' Crackling, wavering . . . ''don't you think?''

More interference, then ''. . . tonight at 1900 hours at your home terminal, you will receive instructions. Please be there . . . .'' Crackles and then silence.

Zed sat back in his chair, the myomassagers picking up his stressful condition and beginning their programmed massage of his tensed muscles. He was still in mild shock. What in the hell was going on? Zed and Filemón García had shared a room at New Mexico State University some ten years ago, had known a few women, and had partied together. They had philosophized about the Latin People's Democracies but had not shared any common beliefs in the ultimate destiny of the region. Zed remembered Filemón's sloganizing and revolutionary rhetoric—uncommon traits for an engineering student. ''Hey, Jankee,'' he would say, ''if I'm gonna rule *El Sur*, then I gotta know all about electronics and satellites and robots and shit, right?'' After Zed had sputtered most of his beer out of his mug, laughing, García had continued. ''Else, how I'm gonna be able to train *mis hombres* in the latest weapons?''

''Besides, once I are an *ingenero*, I'll be cultured in the ways of the worlds, and TV interviews are as important as bullets in MY coming revolution.'' Zed remembered Filemón's sober repetition of those last three words ''. . . *My* coming revolution . . . MY revolution . . .'' The memories trailed off into a night of carousing as they went to nearby La Mesilla, and fragments finally dissolved into dark eyes and misty recollections of silky thighs and familiar pleasures under the intensely dark New Mexico sky.

All he knew about García now was what he'd read in the videotex—how an unknown agricultural engineering student, educated in the U.S., had led student riots in an agricultural school in southern Mexico, and had subsequently become a guerrilla leader in the Yucatán war that had been raging about five years now. The destruction of Cancún and Cozumel were specifically the negative images the media had portrayed about General García. *Still*, Zed recalled, his eyes closed in painful remembrance, *Filemón was once my friend, and for that I owe him . . . I really do owe him, at least my life.*

He couldn't believe that García was one of the Old Marxists. From their years together, he didn't believe anyone would be that kind of revolutionary again. The new guys wanted to bring real reform, and real freedom to the

peasants. So far, the economies they had established were as free as those of the several Chinese republics.

Zed was almost certain that García was one of the new Marxists-in-name-only, just a joke of history, an inverse of the typical Middle Eastern terrorist who calls himself a religious patriot while massacring innocents. "Christian gunman" was one phrase that had always particularly galled Zed's sensitivities.

And now, after years of war, Filemón García calls from out of nowhere (where is Piste?) to drag me into his battles. Don't think so. . .

An important client called, interrupting his worries, and he had nearly forgotten about the call until he arrived at his apartment that night, late.

"Mr. Zed, sir," his home comp speakers addressed him in a perfect (and expensively-preprogrammed) British tone. "A most urgent message came in from Mexico tonight at 1902 hours. You have not answered your cellular calls."

"Out with it, Brighton," Zed said, somewhat embarrassed that he had turned off the cellular unit to escape calls between office and home.

A fuzzy image appeared on the nearest panelscreen. García himself spoke, his voice slightly ahead of the slow-scan image. "Dirty capitalist, Zed, you are not at home. A plane ticket to Europe awaits in your electronic mail, and connections to my headquarters will be made in person when you arrive in Madrid."

García became very serious. "*Amigo,* there is much at stake, and I know you love a mystery. My only hint is this: what kind of robot can you build of copper and stone?"

Slowly the image smiled and García's arm came up to his forehead in the friendly mock salute they had always used. "Come to Mexico, my friend, and find out."

It was a nice trip across on the Turner Express SST, but the submarine trip back across the Atlantic was not much fun at all. The Chilean Navy, though nuclear, was not noted for luxurious accommodations. *One hell of a way just to get down to Mexico,* Zed thought. But the peninsular war zone was strictly quarantined by Mexican authorities, and the Madrid-to-Yucatán connection was well-oiled and well-traveled by revolutionaries, weapons dealers, journalists, and a very few respectable people.

Finally he had arrived on a dark night near the ruins of Cancún and was transported through the scrub jungle to God-knows-where (about halfway to Mérida, he guessed, based on his pre-war trips to the former tourist zones). Mérida, the provincial capital of the latest Mexican government, was a known objective of García's PRY—Revolutionary Yucatan Party.

The next morning he was driven into Valladolid, a rebel stronghold, and was told by a sour-faced commander that García would see him within a day or two. Meanwhile he was to enjoy himself.

Enjoy! Pock-marked buildings, the ruins of a cathedral, and mud-filled streets, full of the traffic of war? Sights? Zed had sighted the one remaining bar and determined to await his "message

from García'' in the most civilized manner he could arrange.

Two days he waited and sweated. Then the ice ran out, and the battle sounds got closer. Was García losing? No one spoke to him except for the briefest of acknowledgements to his requests.

So there's no ice, and the Federal Government's winning, and I'm stuck in the rebel headquarters in a hot and miserable environment, liable for execution if my friend, the Marxist guerilla leader, loses. Maybe even if he wins!

After an unsatisfactory lunch of thin soup and incendiary chopped jalapeños in a stale tortilla, Zed ordered a (warm) *cerveza* Superior and waited some more.

Occasionally he dictated notes to his wristcomp, but the suspicious glares of the armed men at the cantina door made him somewhat reluctant to appear to be spying. He made mental notes about the city, and recalled the mysterious conversation with García.

Robots of copper and stone? What the hell did he mean by that? Hephaestus's Talos had been brass according to the legend, and there were lots of stone idols about the world. But robots? Sweating miserably in the early afternoon breeze that crawled in the door and out the window at his back, Zed Wynter concluded that a Wynter in July in Mexico had a snowball's chance of surviving, much less achieving anything useful.

García knew I couldn't turn down such a cryptic invitation, he sighed. *And he knows that I owe him . . .*

The street outside clattered with a loud, repetitive boom and he threw himself to the floor. But then the sounds stopped, and laughing guards pointed their rifles at him, motioning him to come outside.

''Scared of a backfiring jeep, Jankee?'' García yelled as Zed stepped into the bright sunlight. ''Hey, you're going to hear louder things than that where we're going!''

Filemón García stood in the middle of the street, just disembarking from his mufflerless jeep. A bandillero angled across his battle fatigues and, incongruously, he wore a large white and gold sombrero. He stood only five-foot six and did not look much like a leader of a guerrilla army. *God!* thought Zed, *if he's not a stereotypical Mexican bandido!*

Zed and García embraced and pounded on each other's backs. *I'm surprised,* Zed thought, *but I am glad to see this guy*. Looking around the street while his eyes adjusted to the sunlight, he could sense the camaraderie, the fanaticism, of the armed men accompanying García —many of them only youngsters, and many of them in bandages. García was a general, he reminded himself. His old friend had a lot of war to go. But maybe someday . . .

''Zed,'' García said quietly after they had retired back inside the cantina, and the *hielo* miraculously appeared in both drinks at the table, ''I'm happy you came. Brings back old memories of school and the fights and Juarez.'' Then quietly, ''Someday, I'll take Juarez, you know?''

''I don't doubt it, Filemón,'' Zed replied, sipping the delightful coolness of the mescal. ''If you want to do it, I'm sure you will. But please, don't do to Juarez what you've done to Valladolid

and Cancún and the rest. What will you gain if you destroy so much?''

García visibly tensed, hesitated, and gulped his cold mescal. He chewed the ice momentarily. ''Old friend, I'm glad to see you. We never did agree on politics, and we may never. But just one more thing.''

His eyes grew cold and narrowed. ''Do not ever say such things in front of my men, or it will be a bad situation.'' He signaled for more drinks. No one else came inside the cantina, and the bartender stayed quietly in a corner, showing signs of life only occasionally, awaiting the snap of García's fingers.

''Trust me, Zed. My country's history is just one long struggle, one battle, until the people win over the aristocrats. The destruction will be paid for by the fat ones when I am victorious. They have enough in Swiss banks to make every Mexican rich. But forget that for the moment. You are not here to fight battles—for me or against me.'' He emphasized the last with a frown and brooding eyes half-visible under tired eyelids. ''I asked you to come down for another reason.''

He smiled and reached into the bulging shirt pocket over his heart. He tossed a rectangular metal plate, about one inch by three inches, onto the table. The bartender reacted quickly to the tinkle, but García waved him back, shaking his head.

''This is what I wanted to see, Zed.'' Zed picked it up and examined it in the late evening sunlight now glaring into the window. It was a nameplate—a robot manufacturer's nameplate.

Through the thick tarnish, Zed could barely make out the engraving: *Model Romeo-14, Serial Number 002-35-101RR,* it read, followed by nearly incomprehensible technical data: *1.OGByte ROM, 600Mb RAM, 110/220 VAC, 50/60 Hz, FCC ID* etc., etc., *UL Listed.* When he saw the logo at the bottom he was so surprised he said aloud, ''Manufactured by QuanTonics, S.A., Cd. Juarez, Chih.

''Filemón, it's an OEM nameplate.'' Seeing García's puzzled look, he added, ''That's Original Equipment Manufacturer—O.E.M. An OEM takes parts from other people and builds a final product, as opposed to the factories that build integrated circuits and capacitors and gears for others to use.

''What are you doing with a Romeo-14? At last month's Robotics Conference, Quantonics was saying that it wouldn't be out until next year—parts problems or something.''

He looked at García with sudden apprehension. ''You're not going to be attacking their factory, are you, Filemón?'' His voice rose and he momentarily forgot his friend's admonition about challenging him in front of his men.

''Filemón, they help out the border economy, they employ thousands of people in Chihuahua State. Don't—'' he stammered and shut up when he saw the bartender look fiercely at him. García shook his head slowly and motioned the man to sit.

''No, Zed, we are a thousand kilometers from Juarez and my victories will be many before we get there.''

He smiled again, then reached back into the same pocket, pulled out more nameplates and laid them gently on the table.

"Zed, these nameplates are highly unusual. My men found them in a Mayan tomb we uncovered after we blew up a Federales highway near Chichén Itzá. I had a sympathizer at the Technical University analyze them in his lab."

He looked directly into Zed's eyes and said, "They are *over a thousand years old!*"

Somehow, Zed did not think to laugh. He simply stared at García in disbelief.

Then he took another drink.

"Filemón," he began slowly as the mescal stabilized his reaction, *"I'm* the one who writes science fiction. And I'm the one who knows you can't date metal plates. How do you expect me to believe these are a thousand years old? How do you know they didn't just fall into that tomb before or during your battle?"

"Zed, that tomb had never been opened. The entrances were all sealed off—looked like some explosions a long time ago." He reached into another pocket and pulled out a crumbling piece of ancient cloth. "And this, Zed is the piece of cloth the nameplates were wrapped in. It has been Carbon-14 dated and corrected, and it is indeed over one thousand years old!"

García sipped his own drink and studied Zed's face. "And we know, don't we Zed, that the only technology these old Mayans had was based on copper and gold and stone. So I ask again, what kind of robots did they build here, one thousand years ago?"

The morning sun was hot as Filemón García rousted Zed Wynter out of the relative comfort of a pile of hay in the back of a ton-and-a-half flatbed.

"We're here, Zed." The guerrilla leader waved his hand toward the stepped pyramid that dominated the view. "Chichén Itzá, the most spectacular reconstructed ruin of the Mayan civilization."

Zed rubbed his eyes and patted the pockets of his *guyabarra* shirt, trying to find some sunglasses. The sun's brightness seemed a stark contrast to the dimness of his brain. *God, I'll never drink mescal again! What a kicker!*

Jumping down from the truck bed he looked at the pyramid Garcia was walking toward. *El Castillo,* he remembered, "The Castle." *I was here—when was it?—in the early '80s, I think, right after they first opened it, back when Cancún was a glorious resort. Long before the destruction.*

Long before my friend here destroyed it, he thought sullenly. He walked over to where García was sitting in the shade at the base of the pyramid. "Zed, eleven hundred years ago, my Mayan ancestors planned this staircase so that at the summer and winter equinoxes, the sunlight would appear to crawl up and down the steps, making the form of the feathered serpent." He chomped on the stereotypically short Cuban cigar and asked, "Do you know why?"

"Filemón, I didn't know you were Mayan, to start with. And no, I don't know why they did it. What does this have to do with our visit here?"

"*Compadre*, they did it to demonstrate their understanding and control of supernatural events in the sky."

He drew in a deep breath of smoke and slowly let it dissipate through pursed lips. "There are many old stories that affect the daily lives of people around

here, and nobody knows the reasons behind them."

"Sounds like old von Däniken stuff to me, Filemón. Weird things in the sky and all that."

"Close, maybe, Zed. Now let's drive over to Piste and I'll show you the evidences of a real mystery. Have you thought any more about those nameplates?"

My God, Zed swore to himself. *Then that part wasn't a mescal dream!* He searched the pockets and came up with several of the metal plates. They were still there!

Zed sat quietly as the old truck bounced over the cratered road. After about a kilometer, the driver stopped and motioned to guards in the scrub jungle near the roadway.

A few gun-toting guerrillas came over and snapped to when they saw García get out of the cab. Zed jumped off the truck bed when Filemón called his name. He wanted the guerrillas to recognize him quickly as a friend. A lot of light-skinned journalists had been killed in this war and he didn't want to be mistaken for an enemy.

García and six men led him a few dozen yards off into the bush and began to uncover a pile of brush. An artillery shell had impacted here without exploding, during the battle for Piste. When the ammunition-short guerrillas had tried to dig it up for re-use they had exploded it and found the Mayan tomb a few feet below.

"Zed, you are the first person outside my army to see this tomb. I hope you brought a microcorder." He laughed. "You are Lord Carnarvon to my Howard Carter, Zed, but old King Tut never had anything like this!" He dropped feet first into the foxhole-sized crater.

Zed followed. One armed man came with them; the rest stayed on guard.

García's widebeam flashlight lit up the scene: a breathtakingly large room, a hundred feet by sixty feet at least, with a twelve foot ceiling. Dust-covered tables stood in straight rows all over the place. Though covered with dust and droppings, they were unbelievably familiar to Zed.

"Looks to me like workbenches in a factory, Filemón." In amazement, he picked up rotten pieces of a smaller assembly and turned it over. Some kind of plastic packaging fell apart in his hands, but small metal cylinders fell onto the table. *Rivets!*

"This was a chair—a chair for assemblers, and these are workbenches! How could that be?" He dusted off table after table. The truth stunned him, and he nearly panicked. How could it be?

"And if these aren't soldering irons, and riveting guns, and—" He stopped talking, mouth open in disbelief. He swatted a spider off a pile of small cylinders with wires protruding from them and blew the dust off. "These things are carbon resistors, Filemón. They weren't even invented until the twentieth century, so there's no way this place is a thousand years old!" He stuffed his pockets with the devices.

"Zed, let's go to the next room. Tell me what else you recognize."

The flashlight played upon the darkness as García led them down a staircase into an even larger room. Again, a shocker—those were flourescent lights hanging from the ceiling.

"Filemón, this place was abandoned a while back, had to be. Probably after your revolution started back six or seven years ago." Zed walked over and brushed dust off the wall. "Sure, Quantonics just didn't want anyone to know about their Yucatán operation. Saves a lot of headaches when you aren't sure who's going to be running the government. After you started winning, they must have pulled out and sealed the place up."

"Very good reasoning, Zed, but would you look down this hallway, please?" He pointed the flashlight, narrowbeam this time, down a long hallway.

Zed saw where the ceiling had been cracked and the precious groundwater had been seeping in, probably from a nearby well. Although there was no dampness now—the water had not run for a long time—there was a beautiful pair of limestone stalactites, each eight inches long!

When he caught his breath, Zed whistled long and low. García looked at him with relief. "Now, my friend, do you see why I asked you to come here?"

"All right, Filemón, I believe you. This is a factory."

He swallowed, played his own flashlight around over more electronic cabinets, and said, "It appears to be a thousand years old. Even though Quantonics, S. A., is only five years old, you found their nameplates down here somewhere." He turned and shouted to the bare walls, the dusty workbenches.

"What the hell is going on? If they've got a 'time machine,' why would they set up a factory down in the jungle? Why would they abandon it? Why not just go back in time and steal gold and platinum? Why screw around with all of this?"

García shrugged. Spiders and insects carefully watched García's flashlight but remained quiet while Zed shouted his frustrations to the reverberating walls.

"Zed," García said, "there's a lot more to this factory-tomb. Four levels in all, three of them cut out of solid limestone. There must have been thousands of people working in here." He shone the flashlight all around the large room. Overhead were conveyor belts and other apparatus, some dangling from the ceiling, some encrusted with limestone stalactites, long since dry.

"So this is what factories look like after a thousand years," Zed said to García as they kicked away piles of unidentifiable debris and watched multitudes of crawling creatures scatter. "I never thought this much would survive."

In the next hour, the three men looked at remains of elevators in shafts and file cabinets full of disintegrated papers. There had been running water, judging from the corroded copper pipes they found; the presence of electrical outlets bore testimony to the use of electrical power. Some doorways had been blocked, apparently by explosions from within. One set of steel doors was still locked.

"Here, Zed, is the biggest mystery of all." García's light revealed the ten-foot-high by twelve-foot-wide doors, their factory-gray appearance marred by the marks of futile attempts to open them.

"We had some grenades, and tried

to blast them apart. It didn't work, and we were in a hurry." He motioned for his man to return to the surface, and turned back to Zed.

"He will bring back the shaped charges that your submarine delivered to me. We will soon see what is on the other side of these doors." He lit up another cigar and offered one to Zed.

In fifteen minutes, a blasting crew arrived and set the charges. All of the men went to the next room to avoid the blast, and the crew chief flicked a small remote control button. The factory reverberated with the roar of the explosion.

When the dust settled, they went back in.

The room behind the doors had no other outlets—no tunnels, no doors. A corroded instrument panel of some sort apparently had controlled the door's opening and closing. But for what reason?

"Filemón, I don't understand it," Zed said. "The only way into this place was by those stairs we used. There is no way to get materials into this 'factory,' or whatever it is, and no way to get them out. Whatever they built down here had to be carried up the stairs." He shook his head. "It doesn't make sense!"

García rattled nameplates as if in answer. "*Compadre*, we know what they made down here. How much do these 'Romeo 14s' weigh? A hundred kilos, two hundred?"

Zed did a mental conversion. "Yes, I would guess that 440 pounds wouldn't be too heavy, if they're anything like the earlier models. But no one, especially small Mayans, would have been able to carry four hundred pounds up narrow stairs. Couldn't be done." He rubbed his bearded chin and pondered the implications. "Are you sure no one has found any road, any ramps, down from the surface?"

When reassured that the stairs were indeed the only way out, Zed was left with no alternative solutions. "I just don't understand it, *amigo*. A nearly sealed off underground factory, building robots, a thousand year ago. What do you make of it?" García waved for the group to leave. As he and Zed walked, he pointed out scenes for Zed to record: a closeup of an outlet here, a pile of rubbish there, the overhead fixtures, some graffiti on the walls. "I would like for you to find out for us everything you can, Zed. Go find this Quantonics, S.A., and talk to them." He narrowed the flashlight beam to a small cone and shined it up a ventilation shaft. "If they were here long ago, I want to know why, and I'm sure you want to know—*how!* This is my country, my free territory, and it is my duty to protect it, future, present, or past!"

They climbed back up through the shell crater. García barked orders to his men to fill in the hole and erase all tracks, all evidence of activity around the spot. He and Zed walked back to the truck, where a meal of sandwiches and *cerveza* (cold!) awaited them.

"Be careful how you approach these people, Zed," García said between bites. "If they have secrets down here, no telling what else they may want to keep away from prying eyes. And since the mystery revolves around robots, my friend, you are a logical man to be investigating it!" He laughed and swigged

some Superior. In a suddenly serious mood, he added, "I think it may have something to do with warbots, Zed. I do not want to have to fight machines." He lay back languidly on the grass and thoughtfully gazed at some other-worldly vision beyond the scattered clouds. "Chile will provide us with warbots, too, Zed. All I have to do is ask. But I want this revolution to be won with blood, not hydraulic fluid. Blood is a strong bond between men, right, *compadre*?" He winked.

Zed was taken back, almost against his will, to a late night street scene in Juarez, nearly ten years ago. The painful memory re-staged itself: cool breezes blowing in over the baked dirt streets in a disreputable part of Juarez, fine dust swirling around the corner, barely visible in the erratic illumination of unmaintained streetlights.

Zed and Filemón had been jumped by hoodlums who took them for easy targets. Zed had just finished his mandatory guerrilla ROTC course and wound up killing both men with the new karatsu technique. Only Filemón's quick thinking—laying the bodies as if they had attacked each other—had saved them both from life in a Mexican jail.

Zed was jerked back from the Juarez memories by sudden increasingly loud noises. "*Aeroplanos! Federales!*" the men were screaming. García and Zed hit the ground as jet fighters flew overhead. Strafing fire chopped up the remaining highway, and napalm scorched the scrub across the road.

Everybody ran into the bush.

The aircraft—Vietnamese manufacture, Zed noted with an unoccupied portion of his otherwise overwrought consciousness—two of them, returned and worked the other side of the highway, destroying the truck and killing two unfortunates who were closing the hole to the factory.

"¡*Chingasos!*" García yelled, grabbing a shoulder-launcher from one of the guerrillas. He sighted one of the jets as it swooped down for another run. The shoulder launcher kicked back and the jet exploded. Parts of plane and pilot rained down and the guerrillas took cover behind trees. At that speed, even bone fragments became shrapnel.

"Damn, Filemón! I didn't even see that rocket! What did you use?" Zed shouted as the other jet peeled off and disappeared over the jungle.

García patted the tube. "Our Chilean friends make superboosters, Zed. Fast enough to knock down even satellites, if they have the right aiming mechanisms. And we do, *amigo*." He looked at his wristcomp. "Time to go, Zed. Let's find some other means to get you back to the shore."

After a burial ceremony, they all walked back to the pyramid where a radio call brought them fresh transportation. Too bad they were in a hurry. Zed had wanted to take another walk arond Chichén Itzá, especially *El Caracol*, "The Snail," the ancient observatory. He had a disquieting feeling that the restoration might become ruins again, before the current political situation eased.

García and a few guerrillas wished him an emotional "*Adios*" as a Chilean crew rowed him out to the waiting submarine at Playa del Carmen. Zed wondered if he would ever be back to this "Turquoise Coast" again.

* * *

"Quantonics, S.A.," Brighton was droning, "is a privately-held corporation, chartered in Mexico to develop and sell personal robots. With primary manufacturing plants in the State of Chihuahua, Republic of Mexico, Quantonics also has off-shore facilities in People's Taiwan, Singapore, Ltd., and Hong Kong, Inc."

"Very good, Brighton," Zed said. "Now tell me something about its founders and present owners." He sipped some Scotch and flicked on the latest ads that had been downloaded from his telecom while he was away at work. He had thought a lot about a home office, but the magazine's near-hysterical environment was stimulating and, he believed, still a necessity. Only a few straggling newsletters had been successful from home offices so far.

"Right, sir." The nearest telescreen lighted up with photos of two men. "To your left, sir, is Michael Frost, President of Quantonics, S.A." The man was young! Zed was astonished; he'd heard how Quantonics had been started in a garage in a place called Fabens, Texas, but Frost couldn't be over twenty-one! That meant he was only about sixteen when he founded the company. Simply amazing. The editor in him wondered how he could have missed that story, and he tapped out a shortcomm to Doris to start a freelancer on the backgrounding. His wristcomp beeped softly in response.

Brighton continued, "And the man on the right is Samuel Balleen, Vice-President." At least Balleen looked the right age to run a company—at least forty-five, Zed guessed.

"The other officers are not shareholders. In fact, the only other shareholder of record is one Stephen Daviess, a resident of Scotland." That name Zed recognized—a world-class physicist, famous for shuttle experiments with crystal growths, often mentioned as a possible candidate for the Nobel-Turner Prize.

Zed told Brighton to drop a hardcopy of all of Quantonics' public records into his office mailbox in the morning; he would review it at leisure. Right now, he instructed Brighton to call up certain password algorithms he had invented over the years, and then to access as many corporate memoranda as he could from Quantonics' files. "Stay at the misdemeanor level, Brighton. No felonies, please." He doubted that Brighton could be compromised, but he couldn't be totally sure. Time for a new entry scheme. He used a complex interactive feature that he had had implemented into his wristcomp, and reprogrammed Brighton's access codes. Now, only a timing sequence match between a processor in the wristcomp and a seemingly innocuous circuit in Brighton's control panel would allow his innermost database to be accessed. Plenty of lower-level data, mostly business-related, could be much more easily obtained. He hoped it would be sufficient to throw off anyone trying to crack his secrets.

Reviewing his daily financial statement, he noted with satisfaction that his Developing Intelligence program, **INVEST**, was proceeding quite nicely. He had recovered his original three thousand dollar investment and the current account stood at over two thou-

sand dollars more. Might be able to sell this one; hackos tend to pay for software they really respect. At least he was making money already with Brighton's help; he added more code to allow Brighton to pull out the original two thousand for investing whenever the gambling factors were favorable. Never know when you might need traveling money, and an extra ten or twenty thousand could be useful.

A week later in the late afternoon he landed at El Paso International airport, having set up appointments with the management at Quantonics, S.A., in Juarez, to do a story about their robots. He checked into a Hilton at the airport, refreshed himself with a shower, and strolled along the airport walkways.

A pretty little sidewalk cafe caught his eye and he ordered a *margarita grande*. Looking out from the third-floor walkway, his view took in the rugged Franklin mountains. To his left, looking south toward Juarez, he could see the haze of evening-meal fires beginning to obscure the serape-colors of the sunset. He hadn't been to El Paso in years, and there was a twinge of nostalgia.

He thought about his rather uneventful trip back from the Yucatán to the British Virgin Islands, where friendlies helped him across to the newest U.S. state. *Too bad we can't travel the other way, but of course U.S. ships aren't out to sink everyone who's the latest bit suspicious.*

His troublesome thoughts faded with the sunlight, and he almost yearned for the youth and innocence he had taken for granted in his college days not far north of here. *Too bad I can't visit Las Cruces right now. I'd like to see that meter-diameter Cobblestone Tokomak they've brought on-line and those square miles of solar cells across the Mesilla Valley.* Some people were already calling that installation the Great Southwestern Solar Sea.

I lost something in Juarez once, he recalled with a grin, *but I guess I gained something, too.* He finished one more margarita and went to bed early, to adjust to the time zone change.

He dreamed of Mexico, of El Paso, of beautiful señoritas, and somehow, of Filemón García and dark streets in Juarez.

"*Buenos días Señor Wynter,*" the Mexican engineer greeted him. "Welcome to our factory. We are most happy for you to publicize our robots." Smiling, he ushered Zed into a spacious lobby and signed him in. He pinned a badge on Zed's jacket and asked him to follow.

An escalator carried them to a long, carpeted hallway, and a pedalator scooted them down that hallway and through doors into an office larger than the lobby. The engineer left Zed standing, facing an empty desk. Around the room were various robot models—Zed recognized most of them, and speculated that a few were meant only for industrial spies to see. *Maybe me?* he thought.

He looked at the photographs hanging on the wall. Photographs from Jupiter's moons? No, closer inspection showed them to be Bonestell originals. Expensive! Several other pictures were professionally done photographs, showing someone at sport—hang gliding, flying microlight aircraft. A multi-hued holo-

gram of a hanglider over low jungle —reminiscent of coastal Mexico, perhaps Yucatán.

In a few seconds two men appeared through a door that opened behind the desk, apparently out of nowhere. They walked around, smiling, hands outstretched to shake Zed's. The older man —Samuel Balleen, Zed recognized— was dressed in a three-piece suit and looked the part of financial and legal advisor. The somewhat more reserved and much younger man, blond and balding, was obviously Michael Frost.

"Welcome to our factory, Mr. Wynter," the older man said. "We are proud that a publication such as yours has chosen to visit our facility here." All charm, Balleen motioned Zed to an extremely comfortable-looking chair. Frost strolled to the one chair behind the large desk and listened.

Weird character, that kid, Zed noted. *Some kind of emperor complex, I'll bet. Ties in with Brighton's access information.*

". . . most competitive organization in the robotics field—industrial and personal robot models," Balleen was saying. "We hope someday to be the IBM of robots!"

Zed would have sworn that Balleen expected to be applauded. He studied the man more closely. Samuel X. Balleen, of Jewish extraction by way of the Soviet Union, an emigré some twenty years ago. With only wisps of dark hair above his ears, his slight Russian accent would have made him a fixture in any of thousands of small shops in Zed's New York. Zed was glad that he had brought some telltale electronics with him that would let him analyze the voices and skin responses with the wristcomp back in El Paso.

"May I record and photograph these interviews, Mr. Balleen? Mr Frost?" They nodded assent, and Zed pulled out a palm-sized microcorder.

"Why did you wait until now to come visit us, Mr. Wynter?" Frost asked.

"My magazine is only three months old, Mr. Frost—"

"Michael, please."

"—Michael, and my travel budget's been too low until now. But after hearing your reps talk at the New York Personal Robot show last month, I thought it time to come see things in person."

"And what part of the operation did you wish to see," Balleen asked. "We have twelve plants all over Chihuahua. You are in the Administrative offices; in Juarez we have the final assembly facilities for the Romeo-12s, and—"

"How about your Romeo-14 models? Your rep said you'd been having some developmental problems. Anything there I can look at? Maybe help with?"

Did Zed notice a quick glare from Frost to Balleen?

"Er, well, yes," said Balleen. "We have had some problems down in our *Ciudad Chihuahua* factory, but—"

Frost interrupted. "I'm sure Mr. Wynter is not interested in developmental problems, Sam." He turned to Zed.

"Zed, as you probably have guessed, we are trying to expand the state of the art in Developing Intelligence. Our DI personnel are all cloistered down in *Cd. Chihuahua,* busting their asses to implement some EMI for Romeo-14s. I have personally been involved, and there are some avenues I've asked the

sci-techs to investigate before we continue production."

He walked around the desk. "Now, you know we can't let such information out to the Chinese or to Singapore —they'd steal it in a minute."

He took Zed by the arm and led him into the long hallway again. "Let's go down to the video room. We'll show you an overview of all the operations, and you can pick whichever ones you would like to see, starting tomorrow." Balleen followed them, and the afternoon evaporated into pleasantries and drink and an impromptu party with other Quantonics technical and marketing people at their plush in-house club.

The next two days of tours began to wear on Zed's nerves. What he was shown was interesting enough: industrial robots that built personal robots, personal robots that did manual labor, and glimpses of research laboratories. But never again did the subject arise of a visit to *Cd. Chihuahua*.

And, Zed noted, *none of the Romeo models are built in any of the facilities that I've visited. Wonder why?*

That night, back at the Hilton in El Paso, he reviewed all of the microcorder chips. Taking advantage of his first extended time alone since arriving at Quantonics' Juarez office, Zed prompted the wristcomp to evaluate the telltales. Not many people knew of the TT technology and Zed hoped that it would stay that way. A libertarian-leaning friend who worked in a security lab had given him an early model TT, one worn like a leather bracelet. TT instrumentation evaluated voice stress, perspiration rate, skin reflectivity, and numerous other truth- (or lie!) detection parameters.

When Zed compared the evaluations for Balleen and Frost, his suspicions were confirmed. They were both lying; Balleen under some duress, but Frost willingly.

What a pair! Both creeps, but one cool and the other wimpy. Now what do I do? I can't ask again about the Romeo models and I damn sure ain't going back East without a trip to Chihuahua City!

Next day, he obtained a three-day temporary tourist permit and headed across the border toward *Cd. Chihuahua*.

It was a long drive—some seven hours—and the desert was hot and dusty. Dust devils danced among the greasewood-embedded sand dunes. Zed watched the vortices form, suck up brown sand and small vegetation, and reach their twirling forms a thousand feet into the clear sky. He was nostalgic once more, thinking of a fishing trip he and Filemón and a gang of other guys had made down here many years ago. They had caught little, but sang and drank a lot, and chased dust devils with their jeeps. Great times!

Toward evening he stopped at a Howard Johnson's, checked in, and parked inside the barb-wire-tipped security fence. He left a request for a wake-up call. After a quick dinner, he decided not to go to the bar that night, but called room service for a small bottle of tequila and some margarita mix. He spent the next hour checking his room for bugs and preparing the door with alarms.

Suspicious after he had left Juarez the days before, he had checked out his car and found two tiny transmitters. He had driven the car under an Interstate over-

pass where hopefully any transmission to satellites would be thwarted, and then with a damper device, had attached the transmitters to a west-bound semi truck, hauling Rio Grande Valley lettuce toward Phoenix.

After room-service breakfast the next morning, he found a telephone booth and called Brighton at home. Using his wristcomp beeper circuit and the verbal password, as well as a judicious throat-clearing, Zed was able to access Brighton's information in encrypted form. He left a few innocuous and a few seemingly-coded messages with Brighton, then hung up.

Back in the car, windows down and radio blaring mariachi music, Zed actuated the tiny neurophone in the wristcomp strap and caught up on the latest news.

"Mr. Wynter, sir," Brighton's voice came through, "Quantonics, S.A., has been attempting to gather information from your databases, in both legal and coercive ways. Doris and the office staff have received mysterious threats that I have traced to Quantonics employees. My own intercepts of Quantonics datastreams indicate that they are aware that your visit is not aboveboard. They seem to have some worry that you will discover that they are building military robots for the Mexican government. At least that is the story that I have determined at this time. Please keep in contact, sir."

Good old Brighton! But that story about the warbots is a bit strained. I think they are hiding something beyond that. Seems they use levels of security similar to mine. Just the hacko mentality, I guess.

Zed couldn't get the underground factory off his mind. *There has to be some reason the lace looks a thousand years old. I was just kidding Filemón about a "time machine"; no way would anyone as smart as that Quantonics crew use a time travel device for anything as mundane as a factory. Something else has got to be going on!*

The Quantonics facility in *Cd. Chihuahua* was right downtown. Zed parked at a hotel lot and walked around the two blocks that comprised the factory. Through the security fence, he could see trucks delivering boxes of components, and other trucks apparently taking out the finished products.

He sat in a small cantina and drank cold *cerveza* Superior and pretended to be a tourist. He visited the hawkers in the marketplace, bought a leather briefcase and a carved onyx chess set. At quitting time, he estimated the number of workers who left the plant. About a hundred.

He took a room in the hotel at which he had parked, on the second floor, directly across the plaza from the Quantonics factory. He photographed the whole place in as much detail as his microcorder zoom lenses would allow, and did a thermoelectrical survey of the factory's emanations in the invisible spectrum.

Ciudad Chihuahua wasn't too attractive from his window. The population boom that was strangling Mexico evidenced itself by an early-evening smog from the wood fires of the several hundred thousand in the refugee camps. Zed thought of his last visit to Mexico City. A lot worse than this—like Filemón says. "Twenty million people in

one city means a lot of shit and a lot of smoke: if you don't handle those two things, *compadre*, you can't call yourself a government." *By the looks of the sky and the smell around here, Chihuahua City is losing its grip, too, Filemón. Just don't bring your war here.*

Zed shuddered to think of the impact of another ten million Latin refugees on the American economy. He shrugged mentally and continued his analysis of the Quantonics factory across the dingy plaza.

The wristcomp evaluated the data and output the integrated graphic results to the room's television set via Zed's data cable. Only black-and-white, he regretted, but at least usable. He didn't want to use the small battery-powered flat screen unit in his briefcase until portability demanded it.

On the screen, the wristcomp painted isotherms, lines showing the temperature distributions of the factory walls and ceilings. This information, when compared to the next morning's scans, would tell him where the hottest equipment was located. Presumably, then, these areas would be run by robots and not by human operators. Electromagnetic isopotentials and radio emission analyses would show him where any more exotic processing occurred.

A sudden "Burp!" from his microcorder made him turn around from the television set. Damn! The thing was smoking!

He glanced back at the image on the television screen; it, too, had shrunk down and then come back to full size. He picked up the microcorder. Its red "overload" LED was flashing. Quickly he dropped out the datachip, hoping that it wasn't damaged. He stuck it into the microcomp and waited, prayed, for an analysis of that electromagnetic pulse.

The wristcomp analysis streamed onto the television screen: indeed it had been a large EMP, large enough to fry the microcorder's sensors. *My God,* he thought as he tried to calculate the intensity of that pulse, *what are they doing over there?*

He spent a restless night. The heat was not at all dissipated by the overhead fan, and as it squeaked in slow rotation, a smoke smell tinged the air. Zed slipped off to sleep wishing that some of the Cobblestone effect topology could be used to cool his room.

He awoke to the sound of dogs barking and trucks backing up to the loading dock at Quantonics. He watched the ninety-five employees enter. Cursing the luck that had destroyed the microcorder sensors, he jury-rigged a much less sensitive data collector by using the primary optics salvaged from the 'corder, and placed the wristcomp at the focal plane. The wristcomp's back surface had been used primarily as a transducer/neurophone input, but Zed thought that at least a thermal scan could be had by heating up the plate. Couldn't hurt, he hoped, though what resolution he would get was anybody's guess.

It didn't work.

He spent the entire day unsuccessfully attempting to obtain the thermal scan. Between sampling times, he idly noted the trucks going to and from the factory, and jotted down their apparent load sizes. He was disgusted with the results of his thermal scan—only blobs of light, and those in areas that he had plotted so well the night before.

A knock on the door. Zed looked out the window. Nothing suspicious.

Another knock. What to do? He had no weapon—he wanted no excuse for the Mexican authorities to imprison him. On the other hand, he had not stayed in training for hand-to-hand. Again, that night in Juarez would not stay in the background. He answered cautiously, and stood flat against the wall, hands at alert condition, hoping for the best.

"¿Quién está?"

"Chichén Itzá," came the soft reply. Zed cautiously opened the door and a young Mexican walked in, gazing first around the room, then at Zed. He was about twenty-five years old, five foot ten, with a few days' growth of whiskers and a haunted look about his eyes. He wore faded jeans and a blue shirt that was more faded.

"I'm sorry, *Señor* Wynter," he said, extending his hand to Zed. "Filemón asked me to come see you. He thinks you may need help. I am Hilario Cardenas." He tossed Zed a metal nameplate. Filemón had a sense of the dramatic. What a calling card!

"You see, Zed, Filemón knew that you would arrive here eventually. So he sent me to assist you in our mission."

"Our mission, Hilario? I'm doing what I can right now." He pointed at the microcorder and the isotherms and other notes scattered around the room. "My equipment got fried and I'm limited in what I can do. Unless General García has something else in mind."

Cardenas lifted the curtain slightly and pointed to the factory. He nodded. "Yes, *Señor* Wynter. Filemón has orders: you and I are going to penetrate the factory—tonight!"

Cardenas engaged the night guards in friendly banter while Zed kept quiet; his accent could not be so easily changed as had been his skin color with stain, his eyes with dark contact lenses, and his appearance by the peasant clothes. A bottle of mescal completed his costume, and as long as he handed it over when asked, grunting "bueno," no one seemed to notice his presence.

Zed could not imagine such lax security around a high-tech installation like a robot factory. He had said so to Cardenas earlier.

"Filemón's sympathizers inside have surveyed the building, Zed. Aside from perimeter volumetric sensors—microwaves and the like—there's nothing protecting the place. Except," he laughed, pointing out the coffee-drinking guards, "the ready guns of my countrymen over there."

One nightwatchman inside, a García friendly, would escort them through the detection screen once they were past the guards.

"Friends," Cardenas said in soft Spanish as the foursome sat near the guard shack, listening to the cantina music that drifted across the plaza. "Is this not a good night? Is not God good to grant us such delight?"

Each took another swig of mescal and nodded in answer. A woman emerged from the cantina and slowly walked toward them. "And is that"—Cardenas pointed the bottle at her— "is that not one of God's delights. *Ola, mamacita. Ven acá!*"

As requested, she came closer. About

nineteen years old, she was a daughter of her race, dark hair flowing to her waist, dark eyes promising sensual fulfillment, flared nostrils and a throaty voice promising ecstasy. She was dark. She was voluptuous. She was beautiful.

God, Zed thought, *I almost wish Filemón would bait me with as much temptation as he does these guards.*

A few moments of sharing their bottle and the beauty led away one guard into a nearby alleyway. Zed was envious, bemused.

Next she led Zed away, but while the first guard related his excited tale of extemporaneous amor to his anticipating friend, Zed slipped behind the guard shack and ran across to the waiting night watchman. The man rushed him inside.

Maybe I should have gone first, Zed thought. *Running away from her is definitely not a good idea. But I do need my strength.*

The girl returned, saying that the tall one had left after his fun, and that she needed a more grateful lover. The other guard agreed and left with her, groping drunkenly at her wrinkled dress.

Cardenas easily slipped behind the shack while the first guard began to doze off from the effects of sex and mescal. Inside a minute all three of the conspirators were briskly walking toward the center of the factory.

The watchman provided each of them with a coded badge that would allow them to pass anywhere within the building. As they moved on, Zed saw no other person. Once or twice a patrolbot wobbled past but took no notice of them.

I begin to understand, now, Zed mused. *After a few years of patrolbots, I guess any security force would grow a little lax. Without these badges, those 'bots would just grab us and hold us. Or kill us.* He was glad that Filemón was so thorough.

The factory was fairly open. Over here, the assembly benches where nimble-fingered Mexican women assembled intricate configurations that would become nearly-conscious matrices of semimorphous crystals. Over there . . .

Wait a minute! There's not nearly enough space inside this factory for the amount of robots they put out! He accessed the wristcomp that was taped inside his peasant shirt. *The trucks leave every day with at least twenty machines. These benches . . .*

Stopping at a representative bench, he looked at a subassembly in progress. *Damn! This is just make-work. These people are not making robot guts, not semimorph braincases.*

He asked the watchman for a quick tour of other assembly areas. The results were the same—no serious assembly work anywhere.

In a low voice he counseled Cardenas. "Hilario, what we see around here is enough to fool anyone who's not familiar with robot assembly. Even the workers, I suppose."

He saw the thoughtful look on his comrade's face. "In each area, there's enough make-work assembly going on to appear that the factory is turning out product. But even a hundred workers is not nearly enough." He picked up a partial braincase assembly and rotated it to show the kaleidoscope of semimorphous circuitry inside. "Hilario, this work has to be done by human hands—no robot can build a robot yet.

It must take at least a thousand assemblers to make twenty of these heads every day alone. And there are tentacles, arms, macrotronics." He put the braincase down. "This is what's been bothering me ever since I came to *Ciudad Chihuahua*. The robots that they ship out the door every day are *not* built in this factory!"

Cardenas was surprised. "Where, then, Zed?" He turned to the watchman. "*Compadre*, do the *hombres metálicos* come out of this building each and every day?"

The watchman nodded, and spoke in extremely fast Spanish to Cardenas. Zed didn't catch his meaning.

"Back there, Zed," Cardenas said, pointing to a large set of locked doors. "*Los metálicos* come out of there every morning. Our friend here clocks out right after those doors are opened." He frowned. "And every day there are twenty robots in the little room beyond."

They carefully approached the metal doors. "Hilario, these doors are just like those I saw in Yucatán."

Cardenas was puzzled. He said that he didn't know about any doors in Yucatán. Hadn't Filemón told him?

A few discrete questions revealed that Cardenas had thought that he was assigned to help Zed infiltrate a factory, maybe to steal some plans, or to arrange for future sabotage. General García took few chances!

The watchman told Cardenas that he had no way to open the doors. Suddenly he became agitated, pointing at his watch.

"We've got to hide, Zed," Cardenas said quickly. "He says some people are coming in tonight at twenty hundred, and he had almost forgotten. We've got about ten minutes."

The two men hid in a small engineering office, and the watchman promised to retrieve them after the visitors left. Zed was hoping for something of importance to happen. So far, the mystery was only becoming more mystifying.

He was not disappointed.

Half an hour later, four men entered the hallway leading to the "robot room," as Zed now thought of it. Two of them carried luggage, including a computercase, and the other two lugged in several trunks of heavy equipment. Zed recognized Michael Frost and Sam Balleen.

As they watched the two men Zed wished that his microcorder still worked. He could have documented every action and heard every conversation. They could not hear well enough across the assembly area to tell what the men said, but soon the two porters left. Frost shut the hallway door behind them and began to rearrange the trunks. Balleen stood by, nervously wiping his hands together.

Does he always look so unhealthy? Zed recalled the man's waxen appearance several days before in Juarez.

Frost opened a computercase and manipulated a touchscreen device. Balleen made some remark, and Frost snapped back. The older man rubbed his face and stayed quiet. He was obviously becoming more upset.

Frost walked to the large steel doors and touched his palm to an indicator plate. The doors slid back into the walls, revealing a twenty-foot-square room, its

concrete block walls showing signs of heavy use: tire tracks of fork lifts, scratches and gouges on the walls, and faded signs warning of overloading.

Frost inspected the room, made a few verbal inputs to his computercase, and then walked back into the hallway. The doors slid closed. Frost said something to Balleen, who was more agitated with each moment. Frost shrugged in disgust, walked over to a wall panel, and opened it with a palm press. He looked at his wristcomp and touched several fingerprint sensors simultaneously.

The large steel doors began to glow and the smell of ozone reeked. Zed and Hilario watched with jaws agape: the doors *wavered* for a moment, as if seen at a distance through the hot air of the desert. And for one strange frozen second, Zed could have sworn that the doors were *distant* in a way he had never before perceived.

Within thirty seconds, the doors returned to their normal dull finish, and Frost walked over to them and palm-pressed the actuation plate. The doors opened.

The watchers drew in breaths of surprise. The room was filled with robots!

"*¿Qué pasó?*"

"What the shit—?"

The hidden watchers sat back in total disbelief, shaking their heads as if to reinforce each other's observation. Frost shouted for Balleen to help him, and the two began to roll the robots out into the hallway. Zed counted eighteen.

"Romeo-12's, a dozen and a half" he whispered into his wristcomp. He swallowed and continued, "Just appeared out of nowhere, after Frost operated some kind of control panel down the hallway." He wanted to give enough specific information so that Filemón—or someone—would be able to understand what had happened.

Ten minutes later the two men had the Romeo-12 robots lined up in the hallway for the next morning's pickup. Then they began to load their luggage and the other crates into the robot room. Zed heard Frost several times, yelling out some order or other to Balleen, arrogance evident although the words were not distinguishable.

When they finished loading the last of their equipment into the room, Frost and Balleen came walking over toward the engineering office where Zed and Hilario were hidden. Their conversation became audible.

Sam was groaning as usual. "But Mike, why do we have to go back this time? You know that my heart won't take many more of these trips! And we don't know all of the effects, now do we?"

Uncharacteristically, Frost laughed softly and put his arm around Balleen's shoulders. "Sam, look at me—hundreds of trips so far, and I'm healthy." He jokingly beat his knit shirt with both fists. "It makes you healthier."

Sam was not convinced.

"Sam, Chichén Itzá is a milk run. Don't sweat it: how many times have we done this together? A hundred? Two hundred? Besides," he laughed, "you of all people need the trip!"

Zed crouched low around the base of a drafting table. Cardenas, against the wall but shielded by the partially closed door, pulled his flechetter and simply waited.

Violence loomed large in Zed's view;

if the two men stepped through the door, he would have to make a decision. He would fend off any attempts by Frost and Balleen to have him arrested, but he preferred not to fight. In either case, he'd never make it back to the border safely, and he didn't relish trying to go south to García's war zone.

Frost reached inside to turn on the light switch, but Sam reiterated some complaint. A moment of indecision later, the hand withdrew and Frost went out to reassure Sam once more. One more second and the man would have been hamburgered by Cardenas's gun, Zed had no doubts.

Zed let out a breath of relief; Cardenas put the flechetter on safety and slid it back into his belt. As the unknowingly lucky pair left the office area and walked back toward the robot room, Zed and Hilario stood up to stretch out the cramps.

"Hilario," he whispered, "you could have killed him if he'd turned on that light, right?"

"Correct, Zed. My orders were specific—first to help you get inside this factory, and second, to ensure that any opponents would not talk afterwards." He eyed Zed seriously.

And undoubtedly, you have orders for my disposition, too, don't you Hilario? I'm sure General García doesn't overlook anything.

Hilario's expression confirmed the thought. *You too, Señor, if you betray Filemón.*

They crouched near the door once more to observe. Balleen and Frost were checking over the stacked equipment, and Frost was making more verbal notes into his wristcomp.

Wham! Wham! Wham! Three loud but muffled explosions rocked the factory.

Zed jumped up suddenly. Cardenas said, "It's OK, Zed, my associate Gallegos is right on time."

"What was it?" he retorted, but Cardenas was pointing at the robot room. "Look, Zed, they're leaving."

Frost and Balleen ran down the hallway and presumably outside to see what was happening. Zed and Hilario looked at each other and nodded.

"The same thought, *gringo? ¡ Vámonos!*"

They ran into the robot room and lay down behind the thoughtfully-provided shelter of the equipment crates.

"I told Gallegos to create a diversion if we were not back outside in one hour," Cardenas said.

The sound of firearms, then of fire engines muffled through the thin tin roof of the factory. Finally there was silence.

Zed took a minute to relax, and idly read the stenciling on the crate he was lying behind. ПАРАКОМАНДИР. *Cyrillic! That's in Russian! What have the Russians got to do with this? I hope the KGB isn't going to come in here and . . .* His thoughts disappeared in despair. Later, when Zed reflected on this moment, he knew that he should have realized that the KGB was unpopular in Latin America, after all the revelations of the Second Nicaraguan Revolution. And that the KGB was extremely overworked in trying to stamp out the brushfire anti-Soviet guerrilla operations at home. The KGB was not interested in a robot factory in Mexico when the old Soviet Union was falling apart. But, of course, at that time, the KGB's time-honored reputation for ferocity was still

a useful weapon. Zed would never forget the utility of such propaganda.

The two Americans returned.

"Mike, I told you we shouldn't have built this joint down here. There's a war going on. Why can't we take it over into New Mexico? We've got land near the Gila Wilderness. Hell, we've got Federal park lands we could rent. Why here?"

In exasperation: "Sam, the nexi are right on this spot for several more years. It would have taken billions to set up artificial nexi anywhere to the north." He walked around the room, checking some crates. "But you're right about the war. I didn't expect that damn García to be blowing up hotels in Chihuahua so soon."

Hotel? Shit, my microcorder and all of the outputs were in my room! Zed frowned in disgust. He couldn't see Hilario's reaction behind the adjacent crate. He could see that the flechetter was ready, though; Cardenas's left hand was visible.

Sam said, "At least they killed the son-of-a-bitch sapper. Too bad about the cantina, though." Zed could see Cardenas's gun hand jerk in response. Was he sorry about his *compadre*, or about the innocent civilians? Zed wondered if he would ever know what Cardenas really thought, or even Filemón for that matter.

"We'll be back there in two minutes," Frost said. "I'll send a message to ask Steve to check out likely sites, maybe up in Colorado. If the war spreads too fast, we wouldn't want to be in an area swamped with wetback refugees." He chuckled and went over to actuate the control panel.

"Stand by, Sam, we're on our way."

Zed smelled ozone again. The strange blue glow permeated the room and his own tightly closed eyes, too, he could have sworn.

He was sucked into a black hole.

In a maelstrom of tensive limbo–not a passive void, but a worse than nothingness—Zed lost his soul, his identity. He tried to scream but couldn't.

He had no body.

The void *wavered* and the light came back. Zed found his body and his voice; he was screaming. Cardenas jerked him to his feet and slapped him across the face.

"God damn it, *gringo,* shut up!"

Across the room, Frost swayed back and forth briefly, then opened his eyes. He ran over to the stowaways, flechetter just inches away from Cardenas's face.

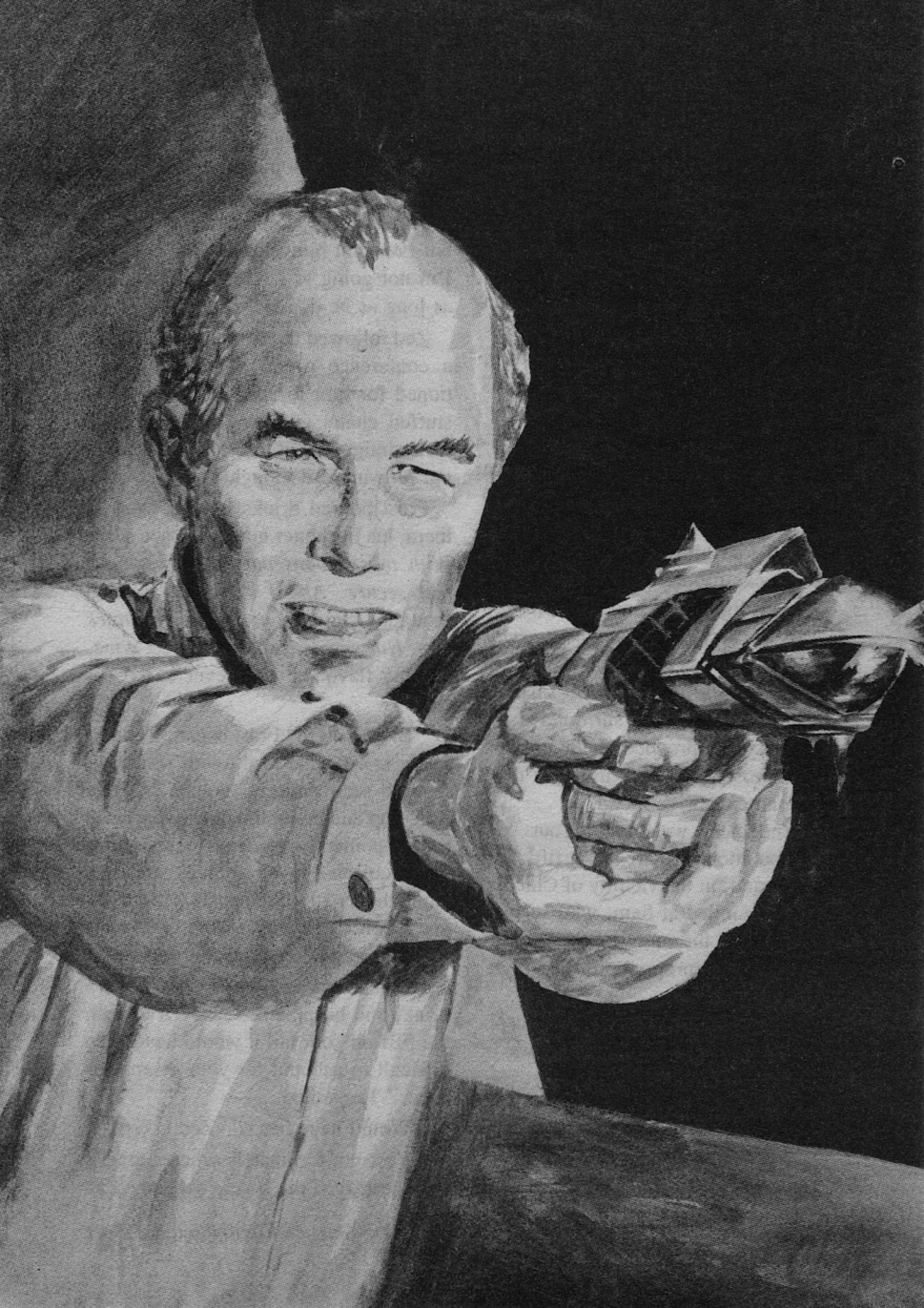
"Drop the damn gun, wetback!" he screamed. Hilario carefully considered his chances, then handed his weapon to Frost, handle first, as the man stepped back.

"Sam, come over here! Look who's taken a trip with us!" Sam rubbed his eyes, perspiring even more profusely. Poor old Sam, Zed thought. Life is just full of surprises.

"This is *Dr.* Zed Wynter, of course," Frost pointed the flechetter by way of intruction, "and I would guess that the spick is one of García's peasant followers."

Cardenas remain tensed. Zed was as much angry as scared. Frost laughed at them.

"And right now you guys have no idea in hell where you are. Are you in for a shock!" He chuckled again, went



over and slapped the palmpress panel. The doors opened.

Please don't let this be what I'm afraid it is, Zed prayed.

It was.

The factory looked much like Zed remembered, but this time it was new—fluorescent lighting, conveyor belts, assembly line equipment—a vibrant, alive, productive factory.

The hundreds of workers were Mayan men and women, soldering, assembling, cleaning, inspecting, brazing, drilling, forklifting, operating computers.

As Frost escorted them down the hallway, some workers turned toward them and bowed in reverence, then turned back to their work. This is not happening, Zed told himself. Not all of this, just to make robots.

A contingent of brightly-dressed Mayan warriors *(with aluminum armor and aluminum spears?* Zed wondered) greeted Frost and Sam. At Frost's barked orders, the armed men surrounded the two spies and prodded them not too gently. Frost came back in a few minutes in an expansive mood.

"Gentlemen, welcome to our Yucatán operation. We are about fifty feet underground, in the vicinity of Chichén Itzá." He smiled at Sam, who seemed to be sharing his mood. "Sam, don't you think it's appropriate for Dr. Wynter to be here?"

Cardenas looked at Zed with suspicion. Zed just raised his eyebrows in puzzlement.

"I mean, the editor of *Future Perfect*. meet the Past Perfect—welcome to Yucatán, *903* A.D.!"

Zed shuddered and closed his eyes at the confirmation of his deepest fear. He wanted to vomit, but held back. Cardenas, however, didn't.

Even *machismo* has its limits, Zed noted.

Frost issued some commands, presumably in Mayan, and the guards took Cardenas away. Zed started to object, but Frost cut him short. "Don't worry, I'm not going to hurt your friend, just as long as he doesn't try to hurt me."

Zed followed the two Americans into a conference room, where Sam motioned for him to sit down. The overstuffed chairs and long wooden table were straight out of the 1990s. *Certainly not Mayan*, Zed thought.

Frost poured drinks for the three of them, his flechetter nowhere to be seen. *With those goons outside, Frost must feel secure. And I guess he is,* Zed thought. *I'm sure not going to attack him. Not yet.* He sipped a sweet wine, a fruity flavor he had never tasted before.

"Dr. Wynter," Frost began, "I don't really know what to do with you now. You've seen entirely too much." He paced up and down the thickly carpeted room, pointedly pausing to scrutinize the exquisite Mayan codices stretched along the length of the walls. "But Sam and I don't kill people—that's for nuts like General García and his pedros."

He came close to Zed, sipped his own drink, and became serious. "And with the FBI on your tail it would have been difficult to account for your disappearance." He smiled.

"Would have been?" Zed asked.

"Yes, but fortunately when García's man destroyed the hotel, we gained an

alibi." He sneered at Zed. "You were staying at that hotel, weren't you?"

They didn't know everything, Zed realized. "The hotel across the plaza? No," he lied, "I was at the Holiday Inn, north of town."

"Easy enough for me to check in the morning," Frost retorted. "You're going to be staying here from now on, until I decide what to do with you." He gulped down the last small portion of wine and set his glass on the table. Sitting down across from Zed, he shook his head.

"Do you know what you're doing, Wynter?" he asked, spreading his arms out as if to encompass the factory. "The sweetest deal in history. Please don't try to screw it up. I may be able to cut you in for a piece if you're smart enough to understand."

Zed watched the man's subtle pleading. *First threats, then cajoling. Almost like a child. And I guess that makes Sam a wimpish father figure. The kid's some brat, but a rich and powerful one. A brat with a time machine!*

"How did you get a time machine?" Zed asked abruptly. "And why do you waste it making robots? Why not take all of the gold here in ancient Mexico?" He pointed to the codex on the wall. "Why not take those codices? They're worth millions in our time.

"God," Zed exclaimed, standing up. "Here I am asking dumb questions about a time machine! What do you have, Frost? How does it work?"

Frost gave a look of surprise. "The laws of time travel were discovered by accident, Wynter. You remember Daviess' Equations, eight years ago?"

"Vaguely," Zed said. "His work on crystal growths aboard one of the Shuttles, wasn't it? Something about a modified wave equation?"

"Well, Daviess was my advisor at Cal Tech. He privately developed his published speculations far enough to make a practical device."

"But what about paradoxes, Frost? Won't you perturb history by screwing about with factories run in the past? And if not, why did you choose Chichén Itzá? Why not Egypt or Europe?"

"Daviess' modified wave equations," Frost began patiently, "predict the nexi of spacetime. As you know from your background, the solutions of the wave equation occur at specific periodic intervals—*'eigenvalues,'* if you will. When Daviess solved them for Earth, he found that they are widely separated in time and in space." He pulled out a pad of paper and pencil and sketched. Instrumentation in the table surface projected his sketches on the wall at the end of the room.

"Here is our plant in Chihuahua City," he said, as the drawing took form on the wall. "A natural nexus, provided by the faultline strains. From this transition point, by the judicious application of properly pulsed magnetic fields—(*that fry microcorders,* Zed thought)—we can access twelve spacetime points." Frost sketched X's around a phantom globe outline.

"These are located at predictable coordinates in time and space. Chichén Itzá just happens to be the 'closest' one." At Zed's puzzled frown, he added, "Closest in terms of energy required to get here."

"Now, around the world in space and time, we have Tibet, 1332 B.C., Zim-

babwe 669 B.C., Rome—way back—6400 B.C., roughly, we haven't been there yet, physically; and some others near the poles."

"Daviess is a partner and he's exploring the Tibetan location now. Other times, other places, we can't get to yet. The periodic solutions don't overlap, so there are some times and places we'll never be able to visit."

Zed listened in amazement. For all its limitations, Frost had a time machine? Even with everything he had seen, all the direct involvement, it was still hard to believe. "But paradoxes, man. Won't you screw up our time by doing things back here?"

"Kill our own grandfathers, you mean, Wynter? No, I don't think so. You see, Daviess' time theories account for paradoxes—they can't occur, won't occur—whichever way you want to say it."

"There is a law of time—Frost's Law, we might call it some day; I pointed it out to Daviess, after all—that prevents two bodies of the same temporal origin from occupying the same space at the same time. It's a physical law that we'll measure when we have time to set up a real lab back here, or somewhere else in the past. I figure that it's analogous to the conservation of energy, or something like that."

Zed was not surprised at Frost's sudden academic pose. Nothing the man could ever do would surprise him. *A brilliant flake who is capable of multiple personalities can do the work of many,* he thought. *No wonder he's a billionaire.*

"When an atom, or molecule, or some packet of energy—I suppose it doesn't make much difference to Nature—occupies two locations in the same time, there is a physical force that prevents the two time-separated aspects of the packet from physically approaching each other. Like the strong force in physics, or two similar magnetic poles. They repel.

"What that has to do with us, is this: if we brought back a Mayan artifact from 1998 and tried to bring it close to its 903 A.D. aspect, there would be a tremendous repulsion force. In fact, if it were close enough, we probably couldn't even operate the Daviess Field Effect generators. We wouldn't be able to go back or forward between the nexi. It does provide us with one nice extra benefit: the forces involved keep us from ever coming back to visit ourselves."

"So far we have found out these facts empirically. When we have time to experiment, I think we'll find that there is a similar problem with DNA chains, too." He smiled again. "So much for paradoxes, Dr. Wynter. You probably couldn't get close enough to harm your grandfather—or mine."

He bowed and spread his arms. "That's my theory of isochronous repulsion, and now you're the fourth person to hear my revealed truth." He stood up and the projected images faded.

Zed stood up, too. "But what about written ideas? Diseases?" Frost shushed him.

"If it had happened we would have read about it, Dr. Wynter. Nothing's ever been found, so nothing happened. Right? I would expect similar phenomena to occur when specific patterns of

thought, of information, try to impinge in the already-established past."

Sensing Zed's confusion, Frost elaborated: "We can go back to our own time—the 1990s—and arrive any time we want to, right now I've got it set up for about two minutes after we left, regardless of how much time we spend back here—years, if we want." Zed frowned at that. Frost continued, "But the repulsion forces keep us from ever returning back to when we were here before. So eventually we run out of time, and use it all up. Should be able to do a lot before we use up over two thousand years, don't you think?"

Frost stretched languidly and slumped down into his chair. "There is another very interesting effect that we have discovered about life here in the past, Dr. Wynter." He smiled, a strange configuration that did not compliment his bizarre appearance. "You see, I was stuck here five years when Daviess first sent me back. And I didn't age!" He jumped up and danced around, laughing.

"At first I didn't notice it, but my partner did. Hell, I went to the doctors back in our time, had physicals done, the works! As near as we can determine, the old DNA don't recognize aging factors when you're living before your own time, Zed, old man. Maybe the little buggers have a temporal component that ties you into your birthdate and your deathdate, a built-in lifespan that counts from the moment you're born. Who knows? Cells reproduce almost perfectly when you're back before your own time." He stopped his dance and came very close to Zed, staring deep into his eyes. "If you stay here, you'll live forever!"

Zed was silent. He was glad that he had not pocketed the nameplates. What would happen if he had tried to bring them back where they were originally found? He believed Frost's explanation, and inherently trusted Nature not to allow that particular paradox. He couldn't yet think clearly about the non-aging aspect of living in the past.

"Is that why you've been able to build up Quantonics so fast, Frost?" he asked. "You send stuff back here and take all of the time you need to build it perfectly, using the slave labor of these Indians. You ship it back to our time, and it costs you nothing but some electrical power and assembly parts in the '90s. God," he began to laugh, first at his own thought and then at the expressions on the two men, "talk about offshore manufacture! This is about as offshore as you can get!"

Suddenly serious, he growled at Frost, hoping to exert some authority over the volatile man. He didn't want to live in this place, even if—especially if—it was forever! "Do I get to see what's outside, or am I stuck down in this dungeon?" Frost smiled—friendly, now—and motioned for Zed to follow him. Sam just poured another drink and stayed. Zed thought that Sam probably should stay here, because his age and his lifestyle didn't promise a long life back in the future. Maybe that was what Frost had meant by his sarcastic statements right before this trip.

Frost led Zed up the stairs that Zed had climbed (would climb?) a thousand years later. A door opened onto a long paved trench that pointed toward a group of small pyramids and other struc-

tures—the Chichén Itzá of over a thousand years ago, Zed thought.

Zed looked around at relative positions of the trench and the door. If he were ever to visit this place in his own time, he might think about having García excavate the impressive walkway. Must have got covered up in the next thousand years.

They walked slowly toward the monuments. Zed picked out various strange but pleasant smells and appreciated the bright blue sky, the luxuriant vegetation, the unusual calls of birds. The yellow butterflies in their millions played an eternal complex ballet in contrast to the slow movement of the gently swaying jungle plants. Under other circumstances it would have been extremely pleasant. Right now, it was excruciating. Frost was an unpredictable quantity, and Zed liked sure things.

"Wynter," Frost said, "I have a map of Chichén from the 1980s, before the war started down here. I have had the natives here start to build a few of the structures that we see in our time." He chuckled. "I think it's amusing, don't you?" He pointed out small buildings where crews of Mayans were working. "I have often thought about having them build one with my name on it, one that doesn't show up on our maps, but that might be stretching the paradox limit, don't you think?" Frost took obvious pleasure in the obeisance of the work crews as they walked through the complex. "There might be some sort of 'conservation of information' law, too. I wouldn't want to disturb the spacetime too much."

They stopped to admire a goldsmith at work putting finishing touches on an intricate feathered serpent motif. The man bowed and stepped back while Frost took the piece and admired it. "Zed, I'd like to take such things back with me, but the amount of gold in circulation is so limited that I'd be bound to run into the isochronous repulsion effect." He handed the piece to the craftsman and smiled. The goldsmith held his head down until they left.

"And that's why you saw the aluminum armor and weapons on my guards. Those aluminum atoms were mined in North America—Arkansas, to be exact—and in this time they're hundreds of feet underground and thousands of miles away. There's no repulsion effects. Similar care in choosing the origins of other materials allowed us to build this modern factory."

Zed thought about the ramifications of that repulsion. "So that's why you bring the raw materials from the future—our time—back here for assembly, rather than fabricating them out of materials here. It would be embarrassing to have a robot that got repulsed from its owner's stainless steel utensils." He caught Frost off guard with his humor.

"Exactly, Zed. You now perceive the utility of our Daviess time machine. About all we can use it for is free labor. But properly utilized, and with centuries in which to perform, that can be quite enough. I've put in some twenty years here in the past, haven't aged any, and I've continued to learn. And I've built a financial empire." He pointed the way to a small pyramid and suggested they climb it.

"Eventually, I guess, I could own the whole world. One day, I'll probably

retire back here so I can live eternally." Zed wondered about that statement —what about the repulsion effect when the unaging Frost finally came into the 1960s? Had it already happened, back "up time" as he was beginning to think of it?

They climbed up the small pyramid while priests in plumed headdresses backed away, bowing. Frost spoke to them softly, smiling. "I try to be benign to these people, Zed," he said, puffing slightly at the exertion of climbing fifty steps. They looked out over the cleared area around the complex, the jungle beyond. "Over there is the *cenote*, or well. Here in Yucatán there are no rivers or lakes, only the occasional well, and there was already a small village here when I first came." He sat down. Zed continued to walk around the top of the pyramid—about ten feet on a side, he guessed. Maybe thirty feet high. He didn't remember any structure this small when he and Filemón were here before. The *Caracol*—Snail—observatory wasn't yet built either.

"How did you establish yourself here, Frost? Just walk in and take over? How come you weren't killed and eaten, or something?" Zed didn't think he himself would be up to walking in cold on an unknown village and setting up a god business.

"Just like Cortéz and Pizarro, Zed," Frost replied. "These guys were just waiting for a white god to come in and take over. Study your history a little bit."

"But why is the factory underground? What's to hide? No satellite surveillance out here, not now. No government troops either."

Frost stretched out to bask in the sun, his balding head in clasped hands. "The first probe Daviess and I sent back was from a lab at Cal Tech. A minor error placed it way underground. It tried to coexist with a rock, and caused a hellacious explosion. A damn crater a hundred feet deep and sixty across. Our next probe brought back video of curious Mayans looking down. When I appeared out of thin air, Buddhist robes and all, they knew I had to be God—or at least, *a* god."

"Buddhist robes?"

"Yeah, that's all I was able to find on short notice in Pasadena, at a costume shop. They liked it, though. Seemed to fit in with what they expected."

Zed was glad to hear that the Mayans had not dug out the entire factory by hand. But that explosion bothered him, and he said so.

Frost answered, "You saw how we button up the transmitting room before each trip. Don't want to bump into anything else. It's safe enough, just have to be careful." He rolled over on his side and watched the hundreds of native laborers working on their god-appointed tasks.

He surprised Zed again. "Frost and Wynter—sounds like a Scandinavian folk tale, doesn't it?" Zed didn't like the tone nor the implication of the kid's statement. He frowned.

"Where does Balleen fit in?"

"Money, finances. Dealings, contracts. If Sam could survive in the Soviet Union, I mean he could do real well in our tame society." Frost stood up, brushed off his trousers, rubbed sweat from his open shirt. "He's an old man who helped Steve and me get started."

Zed asked if they could walk toward the well; he remembered visiting it once on a vacation. "I don't think so, Zed. You and I are limited to about three kilometers from the factory site." When Zed stared, he continued, "You and I have a few atoms from here, just the eternal mixing that goes on. Somewhere, some oxygen or nitrogen from ancient Yucatán made its way to our compositions in the Twentieth Century. The further we get from this natural nexus—the factory site—the harder it is to move. But let me demonstrate. Come on!"

They quickly moved down the pyramid steps and over to the ceremonial road that led to the *cenote*. Zed easily outdistanced the smaller Frost and several times waited for him to catch up. He didn't want the curious Mayans to see their god bettered by anyone else. No telling what their reactions might be. And he wasn't sure that human sacrifice hadn't been practiced here. Or was that strictly the Aztecs? Why take chances?

Halfway to the *cenote* (he estimated, based on the pyramid view), his vision began to dim. The roadway took on an incomplete look, as if the unreality of watching the doors of the robot room during their transition was taking effect again. Zed found he couldn't—didn't want—to move further. In frustration, he watched as myriads of yellow butterflies passed to and from the limits of his own reality, unaware of his plight. The quetzal birds *gallup-galluped* in mockery of his inability to penetrate their world.

He turned back.

Frost was waiting. "What did I tell you, Zed? Frightening, wasn't it? The first time I reached the Barrier, I thought I was dying. And I believe you would if you could physically go further."

"So no airplanes, huh, Frost?"

"Not unless you make them from local materials and use a remote control device. I'll try that someday when there's time."

"Time!" Zed laughed. "Here you are, a Master of Time, and you don't have Time to do anything."

Before daybreak the next morning, a guard woke Zed and Cardenas from their fitful sleep and motioned for them to come eat. They didn't see Frost and Balleen anywhere, but ate voraciously. They didn't know what might happen, and wanted to have energy enough to fight if they had to.

Cardenas was suspicious of Wynter now, because of Zed's time alone with Frost the evening before. He barely believed Zed's account of the building of Chichén Itzá, and definitely did not buy the concept of the Barrier. Zed told him to wait and see.

After they bathed and dressed themselves in the Mayan garb provided by a silent woman (mute and cute, Zed observed), a group of guards led them up through the quiet factory and out the paved trench walkway. Hilario tried to speak but an aluminum speartip and a shake of a grim face dissuaded him. Zed just grinned sheepishly.

They followed the guards to a group of three chairs on a rectangular structure about ten feet high, directly opposite the pyramid that Frost and he had climbed the day before. Sam, sitting there, told them to sit and watch. The sun was just beginning to rise.

"Watch this, Dr. Wynter. Mike's got something big cooked up for the locals." He chuckled, and Zed resigned himself to watching the show, whatever it was.

Nearly a thousand Mayans thronged the pyramid, chanting low, coached by priests among them. Like cheering sections at an airball game, Zed thought. The sunlight was just beginning to touch the tip of the pyramid. The chanting increased.

"Ma-ak! Ma-ak!" The murmur rose. Sam could barely contain his laughter. "That's what they call Mike—'Ma-ak.' Ain't that something?" At the sound of their god's name, the guards turned and frowned at Sam. Evidently he wasn't too highly ranked, god-wise, Zed decided.

"Ma-ak! Ma-ak!" The volume and the tempo increased. The top five feet of the pyramid caught the golden rays of the sun. Suddenly the crowd hushed. What was that on top of the pyramid? Zed and Hilario strained to see.

A bird? A plane? Superman? Zed joked to himself. But he was taken in by the sight: it was Michael Frost, strutting around for the crowd to see, in his custom-built ПАРАКОМАНДИР Russian hang-glider!

"I don't believe this, Hilario. What that guy won't do—" Cardenas just stared. He had never seen hang gliders before. Zed didn't understand his fascination; microlights had been used in jungle warfare for years, surely Hilario had seen them? Apparently not.

"Ma-ak! Ma-ak!" went the awed whisper. Using a throat amplifier and tapes Frost answered the crowd with some words Zed couldn't understand. Then the music began, from speakers placed strategically around the temple complex: Wagner's "Ride of the Valkyries!"

As the sunlight suddenly filled the one face of the pyramid, Frost jumped, the powered glider taking smoothly to the clear morning air. Zed could make out the winged serpent motif painted on the wings. The crowd stared first in silence, then began to scream. *"Ma-ak! Ma-ak! Ma-ak!"*

Zed was impressed. Quite a show, and quite a way to prove you are a god. He heard the faint buzz of a microprop engine as *Ma-ak* swooped over the crowd and circled the pyramid. *That Frost is just too intelligent,* he thought. *These people do worship him—a god who comes out of an explosion in the ground, who flies around in the sky. What more could you want?* With Sam, and with the crowd he stood to applaud. Cardenas stood at Zed's urging. "Hilario, better be enthusiastic. That's some god up there." Cardenas was not happy.

"So how was the show, gentlemen?" Frost asked as he returned to the factory conference room. "Impressive enough for the *peones* around here?" He laughed. "That's a lot of fun to do, even when it's not for profit."

"Are you doing anything at all to repay these people, Mike?" Zed asked.

"I can't bring back medicines or anything, but just getting them organized into a coherent group ought to be payment enough." Frost took a deep drink of the local wine. "Without Quantonics they'd still be tromping around in the jungle doing nothing."

"But for themselves," Cardenas

muttered. "Not for a phony god who is a parasite of their labor."

Frost paced the room, glancing at Hilario, then at Zed. Sam just sat back, drinking. *He looks a lot more relaxed than usual,* Zed thought. *Wonder what other drugs he takes, besides alcohol?*

"I don't really want to exploit anyone, *Señor* Cardenas. And maybe someday you can tell that to General García." The two captives both hoped Frost meant that statement. "I've explained to Zed here how the Daviess time machine works, and how I can't just take things back and forth to our time at will. And I have to be careful about other things I haven't even talked about yet." Zed frowned at that: *more* restrictions? Time travel was getting to be too damn complicated!

"But in our time, there aren't many places you can find cheap labor. The old 'offshore' locations—India, People's Taiwan, Singapore, New Korea—all priced themselves out of the market for labor-intensive products. The Arab Economic Union, for the last five years or so, has been running into the same situation. You start paying *fellahin* their fifty cents an hour, and suddenly they are too expensive to build cheap electronics."

Frost patted the table and charts appeared on the far wall. "Look here," he said. "Robots are still expensive because the semimorph electronics have to be hand-assembled. To build a robot capable of that level of intricacy—they'd cost millions each, and *they'd* have to be hand-assembled first." He argued persuasively as if this small audience really mattered.

Frost went on. "If we can ever get this robot revolution off the ground, say get household robots down to one or two thousand dollars, get the industrial 'brain-arms' down to five or six, then we'll see productivity shoot up everywhere. Even, Cardenas, in the poorest villages of Mexico and the rest of the world." He pointed at the color projection on the wall: a one-wheel robot tractor going about its business of plowing, while a happy Latin family looked on. "Wouldn't you like to see this everywhere" —suddenly the picture dissolved into a shot of Cancún's ruins— "instead of *this?*"

Cardenas softened slightly, his good mood less tense. He said nothing.

"Yes, soldier of the revolution, this model will receive satellite power directly from the Turner Orbitals and plow fields for years. Increase yields! Save the poor backs of the pedros! Damn it, you Marxist, what's wrong with these primitive Indians contributing something to help our world?" He stomped over to the door, shouting. "This place outside, this ancient Yucatán, it's already dead and gone in our time. We can do anything—anything at all—back here, and it's of no consequence! Do you understand?"

Sam chuckled, suddenly an evil presence. "At least back here, Mike, I get to screw all the women I want and don't get any shit from anyone. I'm a god, too!"

Frost stared at him, grunted disapproval. Sam cringed a bit, but reasserted himself. "Damn it, Mike, I'm not as bad as you, with your boys and those human sacrifices and—"

Frost screamed and lunged at Balleen, slapping him across the face.

"*Shut up,* you damned old fool! This is MY city, MY factory, MY people! I *am* a god, and—" Gaining control of himself, he looked at the shocked faces of Zed and Cardenas. "Sam's just a little upset," he said calmly, "I have had to do a few other things to keep my god status here. But that's no concern of yours." He turned and glared at Balleen, who was wiping tears from his swollen eye.

Zed tried to recover from the outburst. This guy is more complex than he appears to be—a real ayatollah! Alternately threatening and accommodating. Alternately a destroyer and a savior. Must be multiple personalities. If I just had that microcorder . . . my shrink friends in New York could psych him quick. Then a sudden upsetting thought: had Frost always been that way or did time travel have some unpleasant side effects?

"Very well, *Señor* Frost," Cardenas said, eyeing Zed as he stood up. "Let me return to General García and I will present him with your offer." He eyed Frost intently. "There *is* an offer, Señor?"

Frost came back and sat in his chair. "Not yet, Cardenas. And by the way, don't try going back without me. My palmprint—my *living* palm print—is required to operate the Daviess machine. No one else can do it. Except Steve himself, of course."

Frost was quiet for several minutes, his back to Cardenas and Zed. Finally he rotated the swivel chair and faced them. "Like your General Filemón García, I try to take advantage of opportunities that present themselves. I did not expect you, Dr. Wynter, to try to interfere with Quantonics' operations. I simply dismissed you—too hastily, it turns out now—as a possible FBI or CIA agent, perhaps just an industrial spy. We would have tracked you a while, then just had our national databases observe your actions. I had expected your usefulness to your employers to be nil in a few weeks, and I would have forgotten you. I've done it with others in the course of Quantonics business." He watched Zed's reactions. "No, no, nothing violent. Just credit destruction, security risk allegations, that sort of thing."

Sure, Zed thought, *just the sort of thing to ruin me financially, keep me in poverty. Maybe he will let me go, but I can't imagine why. I wonder if murder in the past is a capital crime?*

"But having you as part of García's revolutionaries is another matter. That makes you dangerous, and perhaps useful in another way." He spoke into a tiny microphone, again in that Mayan tone of command. Two large guards entered. They took Zed by the arms.

"Cardenas, you will stay and talk. We will let Dr. Wynter remain as our guest to ensure that General García is reasonable when we negotiate. Back in the twentieth century we will meet and discuss the security of my factories in Mexico, and my position in the future revolutionary government. I am certain that General García would like the use of Quantonics' new warbots when his revolution spreads." Cardenas frowned but did not interfere when Zed was taken away, protesting.

There was a loud banging on the door of the tiny cell where Zed slept. "Zed!

Wake up!'' It was Cardenas. There was gunfire, and Zed saw Hilario's foot follow the door as he kicked it open. *¡Vámonos, amigo!* Let's go!'' Without hesitation, Zed followed at a dead run.

''Where are we going, Hilario?''

''Back to the future, *gringo,*'' his friend laughed. ''Back home!''

Zed started to ask how, when he saw two dead Mayan guards in the hallway.

''How did you do this?'' he yelled as Hilario started to untie Frost's left hand. ''And where is Sam?''

''Frost was sending Sam off on a trip somewhere, and I sneaked up on him and knocked him out,'' he answered. ''The door acted kind of funny, but the glow and the noise did just like before.'' He looked at Zed. ''I think I screwed up Sam's trip. Too bad, but he *is* on the wrong side, *compadre.*'' He finished untying Frost's hand. The young man was still unconscious.

A sudden clattering noise warned Zed that other guards were on the way. Four of them slid around the corner while Hilario was dragging Frost into the robot room doors. Cardenas tossed Zed his flechetter. Grimacing, Zed hesitated to cut down the relatively innocent Mayans, but the first aluminum spear that clanged off the wall near his shoulder helped convince him. He fired.

For a moment, Zed noted, the world stopped, Time stopped. In extreme slow motion, the flechetter kicked slightly and the first guard's face peeled away, an awful blooming flower that opened to reveal splintering bone. There was no scream, there couldn't be—the man had no face, no throat.

The other guards stopped in horror, unsure of their duty. Surely the battles of the gods were beyond their control. Zed waved the flechetter and squeezed off a glancing round that disintegrated a golden wall hanging. Theologically convinced, the three survivors threw down their aluminum spears and retreated past the corner. Zed was grateful. He threw down the gun and then threw up.

''Hey, Zed! Help me get this guy over to the robot room!'' Zed did. Hilario retrieved the flechetter and then put Frost's palm over the control panel and pressed it hard. The doors shut silently and the Daviess effect plunged them into the nauseating hysteria of a trip through a hostile Limbo to the near-Paradise at the other end of the journey.

Time travel ain't much fun, Zed observed. But this time he didn't scream. Much.

Using the unconscious Frost's palm, Hilario got the door open again. The night watchman was there, staring in shock. Hilario yelled something to him, and he ran off quickly. In a minute, he came back with a small crate. There was a timer on it.

''Hilario, don't kill him!'' Zed objected. ''He didn't kill us when he had the chance.''

''What do you suggest, *gringo?* Hurry, we don't have much time, and I will not let this . . . this slaver leave the factory.'' He pulled out a flechetter from his belt. ''Tell me something else, Zed, or I will kill him now. Your choice, the fletch or the bomb.''

''Wait,'' Zed said, thinking furiously. ''I've got it!'' He called the watchman over, described what he wanted. The man nodded and ran off. Zed eyed the timer on the bomb. ''Let me write a note to warn Frost when he wakes up, Hilario.''

"What are you going to do, Wynter?" Cardenas shouted. "He will be dead, he won't be able to read!"

"Listen a damn minute, Hilario." Zed told him his plan. "Will that satisfy you?" Cardenas nodded. Within minutes, the man ran in puffing, carrying a sack full of metal parts. Zed took one to inspect it: a tarnished metal nameplate reading, "Romeo-14," etc. These were indeed the ones Filemón had given him and that he had stashed in the office where they had hidden the day before. Maybe they would do the job. *Hope this works,* he prayed to every superior being he had ever heard of. He tied the sack to the bomb, and asked Hilario to give it ten minutes. He slapped Frost awake and pressed his palm against the panel. "Read the note, asshole!" he shouted as he ran out the closing doors. "Read the note!"

Frost pulled his hand back from the panel, a dazed look on his face quickly turning to fear. He jumped for the note. Zed hoped he had the sense to understand it.

The three men ran out of the factory, screaming at the guards that there was a big explosion coming. The guards ran too.

The large explosion disintegrated part of the tin roof, spreading shrapnel over several blocks. Fires spread quickly throughout the rest of the factory, and the remaining walls collapsed. Zed and Cardenas and their co-conspirator watched from an alleyway as Federales and firemen arrived, too late to help. Hundreds of observers watched as the reflection of the flames reddened the smoke-filled night sky. Quantonics S.A. no longer had a factory in *Ciudad Chihuahua.*

At least no more lives were lost this time, Zed thought with relief the next morning. He had been happy to see the Garcíaista girl—guard bait!—alive and watching the blaze the night before. *And I'm still alive, too.* He wondered how fate had treated Michael Frost.

Zed and Hilario had breakfast in Juarez. Both men were refreshed after a good night's rest in the Hotel Camino Real. Zed swore that the time travel had placed some other strains on their bodies. He had felt extremely passive the whole while at Chichén.

"Maybe, Zed, the effects of the skin stain—you know, you were becoming a lazy Mexican," Hilario chuckled. "And now, you are becoming *gringo* again—the Mexican didn't take."

Zed didn't laugh; but he didn't know this man well enough to joke about nationality. *Even though we have traveled as far together as any two humans ever did. As far as I know,* he corrected himself.

"Zed, that was not a human thing you did to *Señor* Frost. If I had killed him, he would have never known, being asleep," Hilario said, munching a piece of melon. "You *gringos* are just too cruel."

Zed smiled. "Hilario, my way at least gave him a fighting chance. My note told him to get away from the Mayan factory in one minute, before the bomb blew. And that it had a tamper switch that would explode it if he tried to disarm it."

"But it did have such a switch, Zed," Cardenas noted tersely.

"Didn't know that, but at least I warned him off, I hope. And that bag of nameplates you brought from Fi-

lemón—those Romeo 14s I figured would do the rest."

"That part I don't understand, Zed. When Filemón gave me those, he told me the entire story. And he said that they were from robots that had never been built."

"That's true, Hilario. I asked Frost that question up on the pyramid two days ago—a thousand years ago—and he told me that the Romeo 14 production had been delayed at least two more years.

"Right then I decided what to do if the occasion ever arose. When I checked out that Barrier Frost worried about, I realized that other forces of Time work to keep one track of reality constant—if we ever ventured beyond a certain physical point, we would have had to overcome a kind of time inertia, the inertia that keeps spacetime together. Frost's isochronous repulsion effect theory was only one part of the properties of Time.

"That's why I thought that sending back those nameplates with Frost would cause such a furor. It would take all of the power the Quantonics plant could draw, and more, to fight Frost's repulsion forces and the other reality track forces. It probably took all of the power of the northern Mexico fission grid to keep that time link open. When the bomb went off at the past end of the link—and I'm guessing that it did—the unstable connection couldn't be kept up by any amount of power at this end. I'll bet that this end of the time link, in that robot room, was as hot as a nuclear reactor. Which goes to show, you don't screw around with Father Time.

"The nameplates, Hilario, they were the very essence of paradox. *They were never made!*"

"That completes my report," Zed stated to his voicewriter. "I don't know whether to hide this, send copies to the FBI, CIA, and the Adolescent Scouts, or publish it as a science fiction novel. P.S.," he continued, "Maybe a musical would work. That scene at Chichén Itzá alone, boy, what a show." The intercom interrupted his dictation.

"Mr. Wynter, please check your 'tex terminal," Doris said. "I believe you might be interested in the El Paso news."

Zed read the headlines: MYSTERY EXPLOSION DAMAGES CHIHUAHUA ECONOMY, and underneath, TOP EXECUTIVES FEARED DEAD IN BLAST. A sideline story declared—*Garcíaistas Responsible? ¿Quien Sabe?*

"What's this have to do with me, Doris?" Zed asked in an innocent tone, to no one in particular. There was no reply.

At home, Brighton updated his personal news—parents worried because he hadn't called St. Johns in a week, worried about rumors of his troubles with police. Jill, a friend, complaining about an FBI visit. **INVEST** was still paying off extremely well (he had sent in advance overrides to prevent any Quantonics purchase prior to his trip, thank God!). And the database accesses he had requested on various key words he had figured would be important.

"Sire, I have evaluated the history files on the sites you requested at the times you specified. At Chichén Itzá, and in the Mayan culture in general, there are repeated instances of myths based on white gods in saffron robes. Some revisionist archaeologists place these myths with preColumbian Chinese

visits. Spurious amateurs credit gods from outer space." Brighton oozed sarcasm, the sage/sagan part of his programming showing through.

"Only one coincidental correlation may be of interest in the Tibetan area of research, Sire . . . Wait a moment. Priority call coming in, Satellite Service."

"Let it through, Brighton," Zed said, looking over the hard copy that continued to spew forth from the 'tex slot.

It was Filemón. "Greetings, Jankee!" The slow scan image slowly mouthed words, far out of synch. "Thank you for your efforts, and too bad nothing happened." The voice stopped and finally the image smiled. "I have a message for you from a mutual friend, *Señor Escarcha*"—Frost! Zed realized—"Hope you can see it, Zed."

Filemón faded to green and Zed saw the inside of the underground factory! The slowscan image went from room to room. There had been *two* transfer chambers, Zed noted, and one looked like it had been through a bomb blast, doors bulging out and wall cracked. *I'll be damned,* Zed thought. *How did they use both of them?*

The camera stopped its panning and zoomed in on one wall near the destroyed "robot room," as he still thought of it. A message was carved: GO TO HELL, WYNTER. I'M NOT DEAD YET.

"*Señor* Wynter," Filemón said a half-second before his face moved, "A message from the grave? *¿Quien sabe?* Anyhow, Zed, thanks for helping solve the mystery, even if it didn't help the Revolution. *Gracias, amigo, y ¡vaya con Dios!*" Zed watched the message fade.

Did Frost get away? Surely not, or he would have stopped the enormous legal tangle now going on over his disappearance. Could he have lived up until this time? What if Frost were the one who helped build the time machine? But Daviess . . . Logic wouldn't work in this situation!

Zed would have felt better if that other chamber were a wreck, too. But of course it hadn't been when he was there. *Damn time travel anyway, the English gets too complex!*

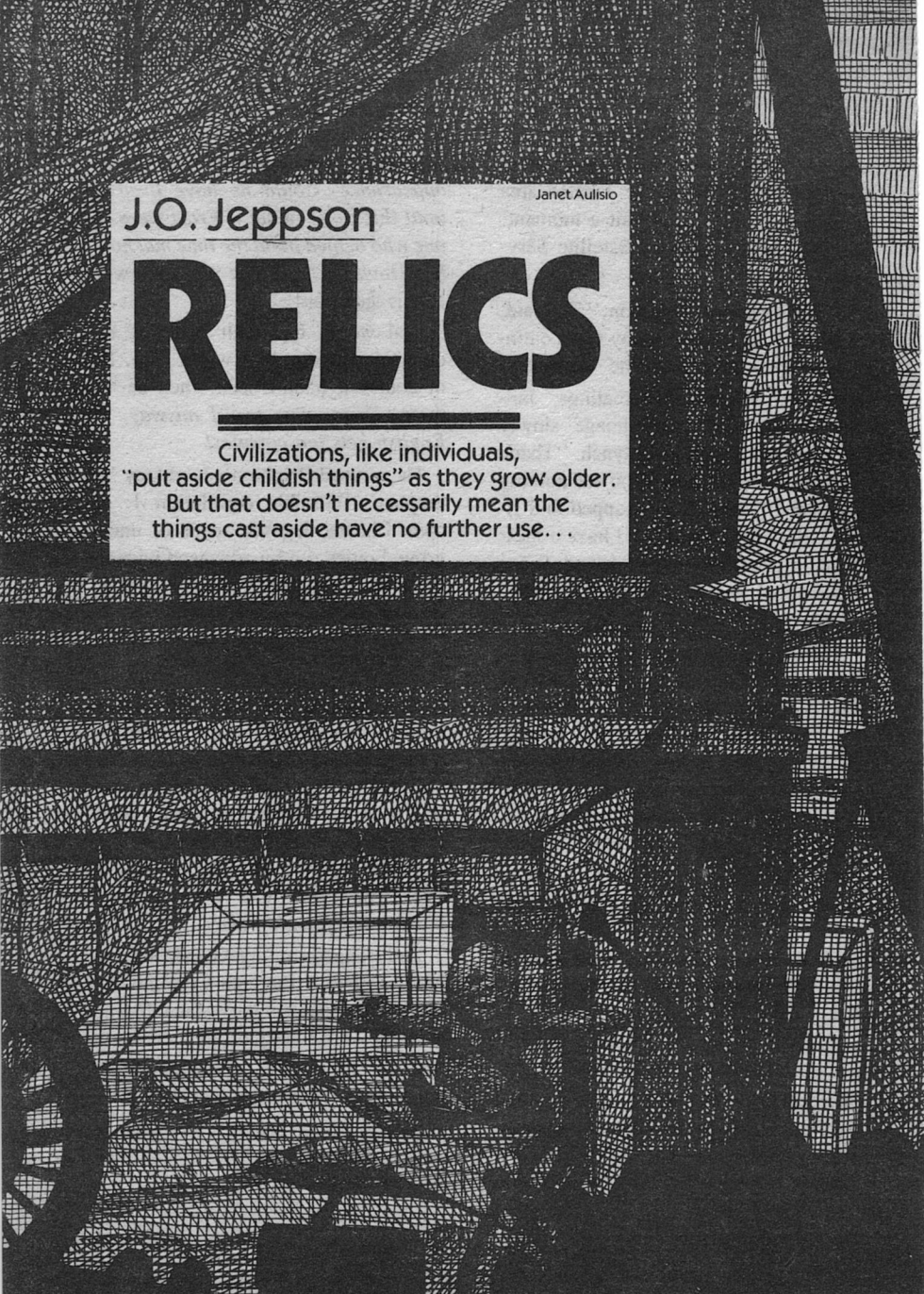
He perused Brighton's hardcopy 'tex outputs. "Possible correlation 1: ancient Chinese legends speak of underground cities run by advanced wizards. Possible correlation 2: One of these cities was named Shamballah."

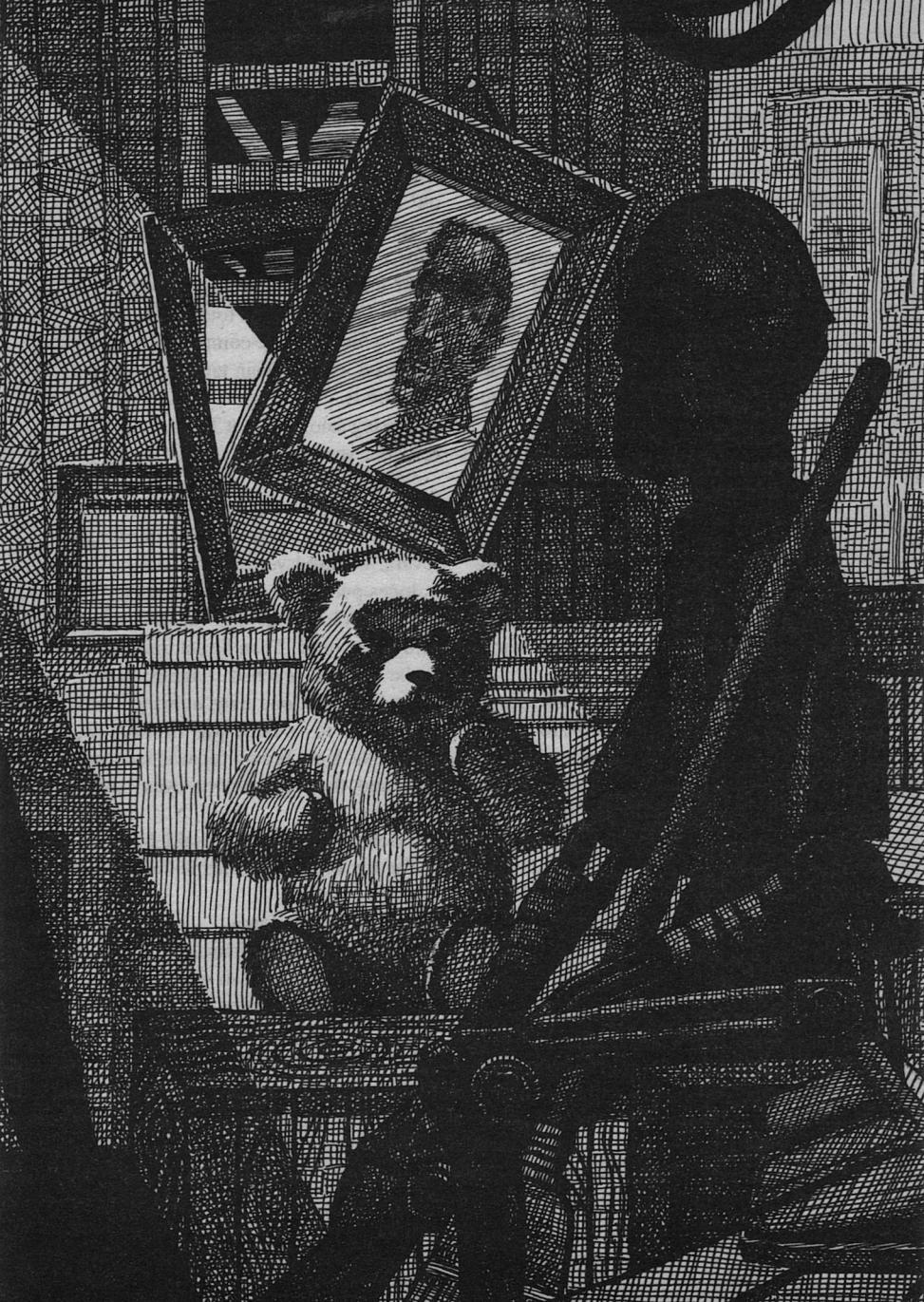
(Where *was* that Quantonics facility in Tibet?)

Zed laughed out loud. He remembered a scratchy antique disc his mother always played, from her collection of old-time rock and roll: Something about light shining in the halls of Shamballah. *Oh, no! Could Hilario have sent Sam to the Tibet facility when he knocked out Frost? Sam-Ball-een? What a laugh! Immortality for old Sam!*

Zed stopped smiling when he read the last sentence. "Possible Correlation 3: The ancient chant of the Asian religions, a word whose origins are lost in the mists of time: *OM*. Correlates to the business of Quantonics—O.E.M."

No effect on history? For that one travesty alone, Zed fervently hoped Frost was dead.■


Janet Aulisio
J.O. Jeppson
RELICS
Civilizations, like individuals,
"put aside childish things" as they grow older.
But that doesn't necessarily mean the
things cast aside have no further use. . .



The museum was tended by one old robot named Jones, who was so busy with repairs that he didn't have much time for anything else. Years went by, and he kept on repairing the ancient building until one winter there was a day so cold that the wind whined through the cracks like something alive. Jones put down his tools and descended to the basement, where he couldn't hear the wind.

"There must be something useful to do down here," he said out loud. He often talked to himself and when on rare occasions there were visitors to the museum, they laughed.

"I suppose I could find out if there's anything worthwhile in some of these old packing cases."

Jones started by opening the largest and longest, only to discover that it contained an entire royal family of mummified humans. He repacked the royalty in a hurry and decided to look for something smaller in the dusty pile.

Selecting a middle-sized box, Jones opened it carefully. It seemed to be full of odd objects, most of them furry. Then he realized he had opened the box from the bottom by mistake. He tilted the box and peered under it at the label.

"Toy bears," he read, and let the labeled top of the box fall back to the floor because, after all, the bottom was already open.

"Doesn't matter. It might even be interesting to see the oldest specimens first."

He picked them out one by one. Some toy bears were small, some larger, but none of them was too big for a human child to pick up and hold comfortably. A few were hard—painted wood or metal or plastic—but most were squeezable, with fur that was either slightly stiff or almost silky. A few bears had been loved until the fur was worn, especially on the head.

All of the bears had movable arms, legs, and heads, but a few of even the old bears had keys in their backs that, if turned, set in motion the movable parts.

At the very bottom, or the top as it should have been, he found the newest bear, which looked completely unused and even wore a clean tag with instructions on it.

The tag said, "Robot Teddy Bear. To activate, speak name."

"Mine, or his?" asked Jones. He turned the label over, but there was only the address of a toy factory in Luna City, several hundred years out of date.

Jones put all the other bears back into the box, closed it, and sat the robot teddy bear on it. Then he sat down next to the toy and touched it again, experimentally, with one long humano-form finger. The toy's body was firm but resilient, the light brown fur was medium soft, and the dark brown eyes stared straight ahead.

"Robot Teddy Bear," said Jones.

The toy blinked, turned its head, and looked at Jones.

"Hello," said Jones.

"Hello," said the bear.

Jones stared, and so did the bear. After several minutes of this, Jones got up. There was a lot of work to be done and he had forgotten about the cold wind.

"Am I really a robot teddy bear?" asked the toy, rubbing its right paw over its chest.

"Yes."

The bear looked down, as if it were thinking, and then held out the paw to Jones. "Am I yours?"

"No."

"Whose?"

"Humans. They made you long ago in a Luna City factory, and shipped you here, to Earth. Probably you were supposed to be bought for a human child, but someone must have given you to the museum instead, to be part of a display on toys."

"That was the wrong thing to do. Teddy bears are supposed to be activated and used, not displayed."

"It's not my fault," said Jones, picking up a bit of dust from the floor and walking over to a disposal unit. "It happened before my time." He threw away the dust and began to walk out the door.

"Wait! I must fulfill my function. I must become the toy of a human child. Is there one living near by?"

"No humans live here at all. The Terran solar system has no humans any more—"

"Dead? Extinct? I am not sure what that means," said the bear, "but it is in my data bank. I have been programmed with a small amount of information so that I can talk to humans if they want me to, but basically my brain is small and I do not understand how humans could have become extinct."

"You are illogical and stupid," said Jones. "You have jumped to erroneous conclusions. Human beings are not extinct. They have left the Terran solar system to live elsewhere. Occasionally they visit Earth, so my job is to keep this museum in good repair. It is a hard job. I never seem to catch up."

"Humans have made a mistake," said the bear. "It was wrong of them not to take me with them. I should be someone's teddy bear, not a museum exhibit. Are you going to deactivate me and put me in a glass cage?"

"I don't know how to deactivate you."

"Then what will I do?"

"That is not my problem," said Jones. "If you wish to get rid of yourself, the disposal unit is right there." He walked out with a loping stride. He was a tall robot.

The bear followed, running to keep up. "I don't want to be disposed of. I must find the humans. Tell me how."

"I can only show you how you might find them. Stop complaining and come with me."

In the transporter room, Jones wrote a series of instructions on a permitablet and handed it to the bear. "I will set the first transporter coordinates for you. When you arrive at the next transporter, set it with the numbers at the top of this list. You will arrive at another transporter, where you will use the next set of numbers."

"But I—"

"What's the matter? Can't you read?"

"I can read. Sir."

"I wrote the numbers down because you have such a small brain and you might not be able to hold them accurately in your memory bank. Besides, if there is any difficulty, you can show the list to any robot official who might be able to help you. If—when you arrive at the eleventh transporter, you may be in the location where the humans are supposed to be."

"That doesn't sound definite. Don't you know for certain, Mr.—Mr.—"

"Jones. Nobody knows for certain where the humans are. We are all busy doing our jobs. When humans visit Earth or any of their former colonies in this solar system, they don't tell us robots where they've been. Rumor has it that they live in a star system far from our own Milky Way galaxy. I have plotted the transporter coordinates according to the rumors, and if I am wrong, you will have to find your own way."

"Are there a lot of galaxies in this universe?"

"Yes."

"Then perhaps I will never find the humans. May I come back here?"

"We don't need another exhibit of toys," said Jones, and turned on the matter transporter.

It was spring, and Jones was mowing the lawn in back of the museum, taking care to avoid hurting the clumps of daffodils that always sprang up. The early cherry trees were a pale froth around the deeper pink and cream of the gnarled magnolia trees, and the sun was warm.

"I'm back," said a small voice. The robot teddy bear was trudging up the slight hill from the museum to the magnolia trees.

"Did you lose my instructions?" asked Jones.

"No, Mr. Jones, I—"

"Then you couldn't find the humans?"

"I found them. They didn't want me." The bear sat down on the grass and touched a daffodil with his right paw.

"Why not? Are you defective?"

"I don't think I am defective. The humans didn't bother to find out. They don't want anything but their special pet, a fuzzy alien creature they drape around their necks. The alien makes it possible for the humans to join minds. The humans are not individuals any more."

"Hive minds!" said Jones contemptuously. "Symbiotic with aliens!"

"I envied them," said the bear. "They seemed happy and said they had become greater than they were before. They said they were now more empathic with the universe and no longer felt alone."

"Did you understand all that?"

"No. I am a Bear of Little Brain."

"Well, we robots are still individuals," said Jones.

"Alone inside our skulls," said the bear.

"Yes."

The bear rubbed his black-tipped nose. "They wouldn't even give me a personal name. What's the good of a teddy bear being activated if I am never named?"

"That's not my problem," said Jones.

"Please give me a name."

Jones said nothing and finished mowing. Finally he passed the bear again and said, "you might as well call yourself Bear. It's good enough. And I am just plain Jones."

"Thank you, Jones." Bear looked up at the blue sky past the magnolia blossoms. "I would still like to fulfill my function and be somebody's teddy bear. I'm supposed to be cuddly and comforting but there is no one to cuddle me and no one for me to comfort. Perhaps I am not good enough. The humans liked the alien creatures better."

Jones shrugged and walked on toward

the museum, carrying the mower, an old-fashioned one he had taken from an exhibit. The mower didn't even use electricity.

Bear came running after him. "Wait! I know I'm not bright, and my conversation isn't intellectual, and I don't really do much of anything, but I can be held. Do you have tactile sensation in the synthoskin that covers your body?"

"Yes," said Jones, going down the ramp to the basement where the mower was kept. Behind him, Bear stumbled on one of the bigger cracks in the concrete and fell, rolling down the ramp past him.

Jones dropped the mower, ran forward, and picked up Bear. He dusted Bear off.

"Perhaps I would fit into the curve of your arm," said Bear softly.

"You do."

When Jones bent his head, his chin touched the soft fur of Bear's ears.

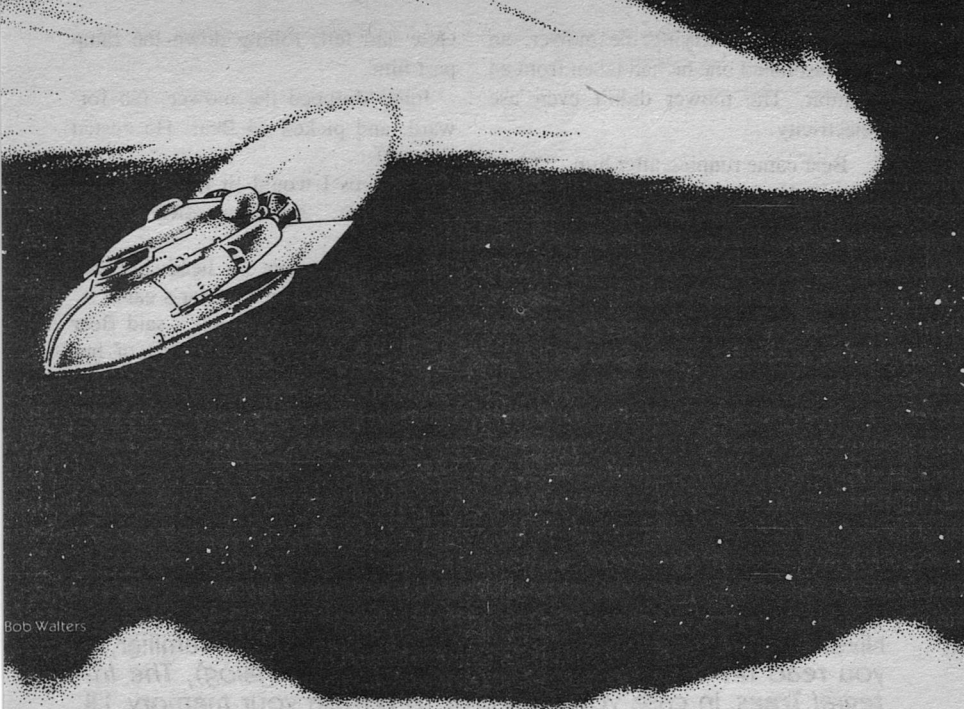
"I am your teddy bear," said Bear happily. "You are what's left of humanity."

"So are you," said Jones, giving Bear a hug. ■

IN TIMES TO COME

● We launch 1987 with a Vincent di Fate cover for a new Larry Niven serial, *The Smoke Ring*. It may sound vaguely familiar, if you read his earlier novel (also serialized in *Analog*), *The Integral Trees*. In case you didn't, or to refresh your memory, I'll say here that the integral trees were huge plants growing in the organic-rich gas torus produced by a gas giant planet orbiting the neutron star left by an ancient supernova. A surviving star in a more distant orbit fuels a rich native ecology, utterly alien to humans—but when they had to, some humans adapted to this strange world of free fall, tidal forces, and winds. Some of them lived on the integral trees—but the integral trees are only one part of this complex system. In *The Smoke Ring*, the human inhabitants of one of the trees learn that they are not alone, and set forth to learn and use what they can from the rest of their larger world. But *because* they are not alone, their task is far from easy. . . .

Ian Stewart is back in two capacities. His fact article, "The Electronic Mathematician," shows some of the ways computers are coming to be used *besides* number-crunching and word-processing (or is it number-processing and word-crunching?) And for a complete change of pace, he offers a short story of the extreme youth of that ever-popular hero, Billy the Joat—called (what else?) "Billy the Kid."



Spider Robinson

THE GIFTS OF THE MAGISTRATE

Minds are strange things—and creative minds can be not only the most valuable, but the strangest of all.

"Merry Christmas, Mr. Chief Justice," the Captain of the Guard said; but his subsequent behavior scarcely reflected the holiday spirit.

Wolfgang Jannike submitted philosophically to the fingerprinting, retina scan, and close body search which were his Christmas presents from his subordinate. Jannike could hardly protest an order he had written himself. Nor would any conceivable protest have made the slightest difference; all the human guards at this stronghold were—again, by his own direction—Gurkhas, the deadliest humans alive.

Scanners had shown him unarmed, and the ID signal broadcast by the chip in his skull had been confirmed as legitimate and valid, else he would not have lived to reach Captain Lal. But even after Jannike had been positively identified as the person described by that ID chip, and therefore as the Chief Justice of the Solar High Court—nominal master of this prison—Captain Lal remained vigilant.

That was understandable. Of the four assassins who had come here to date, two had gotten this far; one of them so recently that Jannike could still see the stains on the wall. That one, he knew, had been a friend of the Captain's.

"How may I help Your Honor?" Lal asked when the ritual was done.

"I will speak with the prisoner alone for a time," Jannike replied firmly. He was committed now; at least three microphones had recorded those words.

There was a long pause, during which Captain Lal's eyes made all the responses his lips dared not—even a Gurkha must sometimes tread cautiously—and at last his lips made the only reply they could. "Yes, sir."

"Have you ever read the works of Clement Samuels, Captain?" the Chief Justice was moved to ask then.

"No sir," Lal replied, doubtless baffled but showing nothing. He spun smartly in place and headed for the door, motioning to two of his men. They fell in behind Jannike in antiterrorist mode, one facing forward and one facing back, weapons out and ready. Somehow, he noted over his shoulder, they contrived to make it seem merely ceremonial. Then he faced forward and followed the Captain, to the cell which held the Vandal, the worst vandal of all time.

"Cell" it was in a legal and actual sense, but most of the humans alive in the Solar System in 2061 occupied meaner quarters. The Chief Justice himself owned slightly more cubic, and more flexible hedonics therein—but not by much. It was odd. The whole System was angry at the Vandal, murderously angry, but it seemed to be a kind of anger that precluded cruelty. The execution would be retribution, but not vengeance. Revenge was not possible, and the crime was so numbingly enormous and senseless that deterrence could have no meaning. Nonetheless society would do what it could to redress the balance.

The Vandal was in an odd and striking position, both legally and morally, and—Jannike saw as Captain Lal waved him into the cell—physically as well. Virtually all humans in free fall are uncomfortable if they can not align themselves with an arbitrary "up" and "down"; since the earliest days of spaceflight men have built rooms with

an assumed local vertical, and the occupants have oriented themselves accordingly. This occupant was crouched upside down and tilted slightly leftward with respect to the Chief Justice, drifting slightly in the eddy of the airflow.

The prisoner was studying the display wall: the cell had a better computer and much greater data storage capacity than Jannike's own home. (On the other hand, Jannike's computer was plugged into the Net, could send and receive data; the prisoner's could only manipulate it. And Jannike's door unlocked from the inside. . . .) Most of the datawindows that were open on the wall displayed scrolling text or columns of changing figures, which must have been hard to read upside down. So the Vandal's attention must have been chiefly devoted to the central and largest window, which showed a detailed three-dimensional model of the Solar System as seen from above the plane of the ecliptic.

She rotated slowly to face Jannike. Recognizing him, she starfished her body until it precessed around to his local vertical, a polite gesture that touched him. "Clear sky, Chief Justice," she said.

"And delta vee to you, Citizen," he responded automatically.

Behind him, Captain Lal made a frown Jannike could actually hear, over the muffled pounding in his own ears, and left them alone; there was an audible click just after the door had irised shut.

Vonda McLisle (ironic that her name should look and sound so much like the word Vandal) almost smiled at her judge. "May I offer you refreshment?"

"I'd be pleased to share tobacco with you."

Her eyebrows rose. "You're a user, too?"

Automatically he gave his stock reply. "It gives solace. And costs hours of life, but I don't expect to run short."

"And I won't live long enough to pay the bill," she agreed. He winced. She struck two cigarettes and floated one toward him; a bearing hummed as the room turned up its airflow to compensate. "Have you come to deliver a hangman's apology?"

"No." He picked his cigarette out of the air and took a deep drag. "It is Christmas Eve on Terra. I've brought you three gifts."

"But we don't even know each other."

"On the contrary, we've slept together for weeks."

"I beg your pardon?"

"You and I have both dozed through most of the trial so far, like most of those who've watched it. You're very good, but one of your eyelids flutters when you're deep under."

Again she nearly smiled. "With you it's the nostrils. You're right: as the old joke goes, it's been the equivalent of a formal introduction. But I'm afraid I have nothing to give you in return."

"I think you are wrong."

She pursed her lips quizzically. "Why would you want to give me presents, if deciding whether I live or die isn't enough to keep you awake?"

"Oh, it does keep me awake, Ms. McLisle—at night. But why *not* sleep through the trial itself? It's merely the formal public recitation of facts we both know already, that *everyone* knows already. You nap because my court has nothing to say to you. I nap because you have something to say to me, and will not."

She let smoke drift from her mouth, hiding her face. "The trial told you everything you need to know. The prosecution's case was exhaustive."

"But the defense stood mute. I am so constructed that I cannot condemn a woman to death without knowing the motive for her crime. Even if I cannot understand it, I must know what it is, what she at least conceives it to be."

"I will not tell you my motive."

"You do not have to."

She nodded, taking his statement only at face value, and he let her. "That's right, and I don't want to. So if that's the gift you wanted, I'm afraid—"

"Not at all. The gift I want is a much smaller thing. But before we get to that, here is the first of my gifts." He took an item from a pocket and sent it to her.

Her eyes widened when she recognized the gift.

"A modem! I can find out *what's going on*, get the latest figures, find out how bad I—" Her voice trailed off as she turned it over in her hands, tracing its design with sure slender fingers. She looked up at him, and the raw gratitude in her eyes seared his heart. "Have you ever been cut off from the Net? Thank you, *Herr* Jannike."

"You are welcome, Ms. McLisle."

"Vonda."

"Wolf. My second gift, Vonda, may seem disappointing; I ask that you wait until it is completely unwrapped before judging. It is a short speech, entitled, 'How I Spent My Christmas Vacation.' "

She must have been desperately eager to interface her first gift with her computer, but she made herself display polite interest. It faded fast.

"The holiday season was a perfect excuse for a short recess, and I needed one. What you did was perfectly clear and indisputable. You misappropriated the *Tom Swift*, the electrical drive unit your firm owns. Abrogating your contract with Systel S.A., you abandoned their o'neill in mid-deceleration, leaving several thousand colonists in an orbit that caused them to overshoot the Asteroid Belt by a wide margin. You used the *Tom Swift*'s enormous delta vee to intercept Halley's Comet, beyond the orbit of Mars. And then you stole the comet, and threw it away.

"Clear, indisputable—and inexplicable. The experts say you're sane. Your record is admirable. Yet you endangered thousands of innocents, and committed the greatest act of vandalism ever. The Comet that led William to Hastings in 1066 and appears in the Bayeux Tapestry, that inspired Newton to write the *Principia*, the greatest scientific book ever, that inspired the first cooperative international space expedition in human history—kicked out of the ecliptic for good, never again to be seen in the sky of Terra after two millenia of faithful punctuality.

"I *had* to know why. I had to understand you, to imagine why you might do the inexplicable. So I went to your apartment."

The modem floated unheeded a meter from her hand. There was no other indication that she was still listening to him; her gaze had drifted away and her body was starting to do the same.

"A thousand reporters must have swarmed over that place, but none did what I did. I sat in it, for two entire days. I was trying to become you.

"I noticed the books at once; I share

your fetish. Actual books, bound hard-copy on acid-free paper. Naturally I was not surprised to find the complete works of Clement Samuels. He is surely the greatest writer still using that old-fashioned medium, and has millions of subscribers, myself among them. I *was* surprised to find the complete works of Mark Twain. Even though Samuels makes no secret of his debt to his palindromic namesake, few of his readers bother to go back to the source any more."

"Of all the arts," she said softly, "humor travels worst through time."

"I sat there for hours," he went on, "thinking of odd things. The comet, of course. Tom Sawyer. The food riots in New York. Clement Samuels, inexplicably wasting away in his seventies, when most citizens expect to see their hundredth birthday. The way the chief prosecutor sprays spittle when he's especially angry. The color of . . . no matter.

"I felt awful, inexpressibly sad. Samuels's work has always consoled me—but I've memorized everything he wrote, and I couldn't think of one I wanted to reread. So I took a Twain at random from your shelves.

"The first thing I noticed was the letter that acted as a bookmark. I read it without hesitation when I saw the return address. I never knew you and Samuels were lovers; I don't know how the media missed it."

"It was very brief," she whispered, "and a long time ago. His marriage was too good to risk, and I had a career in space, where he cannot live."

"So I gathered. When I had digested the letter, I finally noticed the passage it marked—and everything fell into place at once."

She was looking at him again now, eyes tracking him as she drifted. "The last eighty years have brought more technological change than the previous two hundred," she said. "That implies an immense amount of pain, Mr. Chief Justice, as you know better than most. One of the things that got us through it, as a society, as a species, was the humor of Clem Samuels. It was gentle humor, humor with no cruelty in it, humor that didn't make you want to curl up and die with the hilarity of it all. Humor that helped you to go on, to endure, to enjoy. Maybe he didn't save us single handed, but we might not have made it without him. I know I wouldn't have; I wouldn't have kept on wanting to. A few hours of stolen passion fifty years ago had nothing to do with it."

"I know," the Chief Justice murmured.

"But he had to identify so damned strongly with Mark Twain. He rarely talked about it, but it tickled him to death that he'd been born at the beginning of 1986, with Halley's Comet at perihelion, just like Twain."

" 'Now the Almighty must have said, "Here are these two unaccountable freaks,' " Jannike quoted from memory. " 'They came in together, and so they must go out together.' And Twain died on schedule."

"So of course Samuels insisted that he'd go the same way. It was funny—when he was twenty-six."

"And a little pretentious," Jannike said, "so he never mentioned it in interviews. It's not in his authorized biography."

"And then it was 2061 and he was *dying* and nobody knew why," she burst out. *"I knew why!"*

"So you took the most powerful tug in space and hijacked Halley's Comet, flung it out of human space. And now Clement Samuels is said to be recovering. And every astronomer in the System wants a recording of your death-agonies, and the rest of the Federation just wants you gone."

She had been ready to die calmly; now she was white with fear. "You mustn't tell anyone, Wolf! *He mustn't know!*"

"That was my first question to myself: why would you conceal your motive? I concluded that you did not want to damage Samuels's marriage by announcing what must have been his first and only infidelity.

"So then I wondered why you had come back, why you did not simply stay with the comet when you knew your life was finished. I decided it was to return the *Tom Swift*, so that the colonists of Systel 2 could be rescued and towed to their proper orbit."

She was calming down as she persuaded herself that he meant to keep her secret. "That's only part of it. I . . . things went out of control out there. I landed on the nucleus, put down the hoses, filled her tanks, lit the fusion torch—and all hell broke loose. The hydrogen I got from the nucleus was even dirtier than I expected, so the drive burned wrong, and the second ion tail I made interacted weirdly with the comet's own and gave me more thrust than I wanted, in an uncontrollable direction. I meant to see that the Comet never appeared in Terra's sky again, but

I didn't mean to kick it out of the System completely. I had to cut loose, come back and get access to better computer power, and see if there wasn't any way to partially undo the damage. And you let me have this computer—but without the Net, without the precise up-to-the-minute observations of the entire System network, I didn't have the numbers to crunch."

"And because the rest of the System doesn't have your special empirical knowledge of what happens when you set a comet on fire, and is too angry to ask for it, any answers they get will be wrong," Jannike said. "That's why I brought you the modem. Please use it now."

She leaped to obey. It took her almost fifteen minutes to interface, access, download, integrate, and get a trial answer.

"There's a chance," she announced. "If I've understood and correctly described all the anomalies I witnessed—if there are no new anomalies waiting to be discovered—there's a chance to keep Halley in the system. But the window closes in a matter of days, and I wouldn't sell insurance to whoever goes. Oh, Wolf, see that they examine this data—make them send someone! She's so . . . she's so *beautiful* I nearly changed my mind. It made me crazy when I saw how badly I'd miscalculated. I hate to think of her alone out there in the cold dark. Make them send someone!"

"I will," he promised. "Vonda, I said I had three presents for you. May I give you the third now? It's a letter from a friend."

"Oh. Okay, tell me the code and I'll access it."

He shook his head. "No. The friend wanted you to have hard copy, for some reason." He passed it across, an old-fashioned letter in an actual envelope, and politely rotated himself to let her read it in privacy.

It read:

"My dear Vonda,

The bearer of this letter is more arrogant than you are, more arrogant even than myself, and that much arrogance takes my breath away. You were arrogant enough to maim the Solar System to suit yourself. I was arrogant enough to liken myself to Mark Twain, to think that the stars were placed in their courses to enhance the ego of Clement Samuels. Between us we cost mankind one of its favorite comets. But Wolf Jannike makes us look silly. He *was arrogant enough to risk the destruction of two human beings and their marriage—and unlike us, he got away with it.*

Did you really think you could anger or hurt my wife, by acting to extend my life with her? Yes, I am recovering, slowly but unmistakably, as you knew I would. Dorothy says she remembers you, always liked you, and wishes you to know that you are always welcome in our home.

Perhaps the purpose for your silence was to spare me the humiliation and guilt of knowing what destruction my folly inspired. I don't think I was meant to be spared that humiliation and guilt, Vonda; I think I needed it badly. I've been too successful for too long.

Now that—thanks to you!—I am no longer voodooing myself to death, I in-

tend, in the words of the philosopher Callahan, to live forever or die in the attempt. I don't know if I will survive long enough to assuage my guilt, and I know I'll never live long enough to thank you for what you did, but I promise you I will live long enough to write a book about what you did, a book so funny and so sad that people will stop hating you and start laughing at me.

You took a comet the size of a city, and made it a City of Two Tails. That is a far, far better thing than I *for one have ever done, and I'm damned if I'll see you lose your head over it.*

Meanwhile, my wife and I thank you with all our hearts. There was never any danger of my forgetting you, Vonda my dear, and now I owe you my life. I'll try not to waste the balance of it.

Very truly yours,

Clement Samuels

Jannike knew when she was done digesting it, because she stopped crying and started trying to thank him. He interrupted her.

"I told you that I brought three gifts, Vonda McLisle," he said formally. "I've also brought you something else, which it would be inappropriate to call a gift. As your magistrate, I bring you your sentence. Are you ready to hear it?"

She shook her tears from her head like a horse tossing off flies, and nodded gravely. "Yes, Chief Justice."

"When Mr. Samuels's book is released and understood, I believe you will be considerably less unpopular than you are now. But that will take time. For now, there is only one sentence other than death which I feel the public might accept without rioting. Therefore I condemn you—"

—so this was what Scrooge felt like on Christmas morning!—

"—to fuel and refit the *Tom Swift* at once, and repair your vandalism as completely and as soon as possible. Charge the fuel to my personal account; I have reason to believe the System Federation will one day reimburse me. And may God have affection for your soul, Vonda my friend."

And he got the gift he had wanted in return: the first smile he had seen upon her face. ■

● All of the books in the world contain no more information than is broadcast as video in a single large American city in a single year. Not all bits have equal value.

CARL SAGAN

the reference library

By Tom Easton

Schimmelhorn's Gold, Reginald Bretnor, TOR, $2.95, 216 pp.
The Wave and the Flame, M. Bradley Kellog with William Rossow, Signet/NAL, $2.50, 352 pp.
Goodman 2020, Fred Pfeil, Indiana University Press, $15.00, 231 pp.
God Game, Andrew M. Greeley, Warner, $16.95, TOR, (pb) $?, 320 pp.
Godbody, Theodore Sturgeon, Donald I. Fine, Inc., $14.95, 159 pp.
The Shattered Horse, S. P. Somtow, TOR, $16.95, 480 pp.
Enigma, Michael P. Kube-McDowell, Berkley, $3.50, 355 pp.
Run to the Stars, Mike Scott Rohan, Ace, $2.95, 245 pp.
The Norby Chronicles, Janet and Isaac Asimov, Ace, $2.95, 185 pp.
Jernigan's Egg, Richard Mueller, Bluejay, $9.95, 385 pp.

You have all heard of The Easton Press. You have seen its ads for years. Lately, you have been getting circulars in your mailbox. They publish classics, "collector's editions" "bound in genuine leather with accents of 22kt gold," and their latest project is classics of science fiction—Wells, Verne, Asimov, Heinlein, Le Guin, Clarke, Bradbury, Pohl, Herbert, and more. Some of the books are even "personally signed" by the authors, "the greatest science fiction writers of our time!" And they cost only $32.00 apiece!

I hope that none of you have taken the "Easton Press" name as implying that your favorite book reviewer has given this outfit even an implicit endorsement. I haven't. I have nothing to do with them. Nor does any known relative of mine.

In fact, I heard about their SF project the same way you did—ads and junk mail. I haven't even received any review copies. Therefore, if you just have to have leather-bound, gold-accented editions of your favorite books, at 32 bucks

a pop (plus $2.50 shipping and handling), by all means go ahead. But don't blame me if you begin to suspect that you've been ripped off. The books are "collector's editions" only in the interior decorating sense, even if they are printed on acid-free paper.

I promise that you *won't* feel ripped off if you spend $2.95 for the first Papa Schimmelhorn novel, Reginald Bretnor's **Schimmelhorn's Gold.** You *do* remember Papa Schimmelhorn, don't you? That raunchy Swiss octogenarian with the subconscious genius? Full of vinegar? Fond to excess of little pussycats? Kept precariously in line by Mama Schimmelhorn and her bumbershoot? That classic, marvelous, uniquely hilarious creation by the same fellow who gave us Ferdinand Feghoot?

You're smiling already, aren't you? And you're muttering to yourself that it's been a long time. That it has. Bretnor has shamefully neglected Papa, but maybe he's had his reasons. Maybe he's been trying to promote a Schimmelhorn situation comedy for TV, which we would all greet with glee, even if we knew the quality would decline with time. Or maybe he was just tired of the fellow.

I suspect the latter, for though *Schimmelhorn's Gold* begins as antically as ever, and though the whole is a delightful read, it does flag. Papa just doesn't hold up as well as we would like at novel length, perhaps because the reader tires of his silliness, perhaps because the silliness itself fades as the novel proceeds.

The story? A Swiss banker meets Little Anton (who, as a kid, could see around corners) and hears of Papa's exploits. Stricken by the notion that here, just maybe, is the man who might be able to achieve the alchemist's trick of turning lead into gold, he goes to see Princess von Hohenheim, lone female Swiss banker, descendant of Paracelsus, owner, ruler, and high priestess of a small island near Crete. Together, they recruit Papa and set him to work with a churlish, jealous alchemist. When Papa's predilection for pussycats interferes, they dose him with a potion which, much to Mama's satisfaction, takes the lead out of his pencil. He finds a way out, however, succeeds in his mission, and even discovers the truth of the minotaur.

The first few pages had me howling. For the rest, I chuckled from time to time, but neither as much nor as loudly as I expected from Papa's memoirs. That disappointed me, even though the humor did come in massive doses compared to almost any other book you care to name. At the same time, the fall-off in belly-laughs gave me the calm I needed to realize that Bretnor has produced a story that might be readable even without Papa. The action is steady and the plot is reasonably plausible, and Bretnor ties it all up very neatly in the end. For the price—for twice the price—you can't lose.

"With" NASA space scientist William Rossow, M. Bradley Kellogg (theater scenery designer and author of *A Rumor of Angels)* has written **The Wave and the Flame** as the first in the *Lear's Daughters* series. The series' structure follows from *King Lear,* Act II, scene ii, which names "Lear's daughters" as rain, wind, thunder, and fire. *Wave & Flame* centers on the first of the four. It's a good book, too, and I expect its sequels will be the same, making the series one of the few that really suits the series form.

The novel begins shortly after a corporate exploration ship has reached a strange world which preliminary reports

had called a desert. They had found it ice-locked. Crisis comes with a sudden thaw, as the intrepid explorers take refuge in the natives' caverns, floods destroy their base camp, and they lose contact with the orbiter and its artificially intelligent computer.

The explorers include a corporate prospector, a crass, profit-oriented despoiler of worlds. There is a biologist, an anthropologist, a linguist, an elderly captain. Their interactions hold a great deal of potential for conflict, but that is not what drives the plot. Rather, the key is the mystery of the natives. They personify the weather as a "wet" goddess and a "dry" goddess, and it slowly emerges that they may in fact be right. The storms indeed act like live things, or like the weapons of struggling divinities.

As this emerges, the explorers are beginning to glimpse curious technological anomalies—steam heat in tiled public baths, autoclaves in the witch doctor's quarters, a thoroughly advanced periodic table buried in old files. The reader is ready when still greater marvels emerge, and the secret begins to come clear—the natives once had a considerable technological civilization, but something went wrong that relegated them to the cavernous margins of their world. Succeeding volumes will surely reveal the details, although there are three more daughters of Lear to show up.

Rossow's role here is not clear. I suspect he served as a technical adviser, at least on planetary weather, and that Kellogg wrote the story to suit herself. If so, she has done a fine job, and I found her discussion of the nature of belief intriguing. If not, *they* have done a fine job. Take note.

Fred Pfeil's **Goodman 2020** is a serious, discomfiting, hyperbolic, preposterous tale of the sort that must come from a university press because commercial houses won't touch it with a barge pole. Yet it is excellently crafted, thought-provoking, and satisfying. It is spoiled only slightly by the cop-out ending that ducks any real resolution.

Pfeil's world of 2020 is dominated by multinational corporations of remarkable callousness, rapers of the environment, workers, and consumers alike. The bottom line is all, to the point where they are preparing to commercialize heroin. People exist solely to be used; when used up, they are discarded, killed, abandoned.

It is Pfeil's world that I find so preposterous, for though his view of commerce has enough base in truth to justify extreme extrapolations, from what I have seen, corporate callousness is far more myth than reality. Even the largest corporations are made up of human individuals, with human concerns, and the corporate world is far less monolithic, far more humane, than Pfeil seems to believe. The problem may arise because Pfeil is an English professor. Understandably, he focuses on the concerns of traditional literature—psychology and philosophy—in a traditionally pessimistic way. He omits all but the merest hint of technology (space is notably absent), and so he misses the many opportunities for optimism with which *Analog* readers and writers are familiar.

In Pfeil's world, trust between two humans, true friendship, is so scarce a commodity, at least in the upper classes, that there has arisen a new profession: the professional friend, the chameleon adept at recognizing and meeting human needs; the confessor; the confidante; the new version of today's $100-an-hour psychoanalyst. His hero, Ernest Goodman, is a professional friend par excel-

lence, unusually skilled at the tricks of the trade, but still flawed. He shows his flaw when he reacts to a client's unseemly suggestion by slugging the fat slob, and thus attracts the attention of Dick Devine, head of OMNICO, Inc. Devine's minions arrange to test Goodman's qualities by having him fired. Then, when he has become a free-lance friend, they send him clients and murder them or their families before his eyes. He keeps his cool, reports nothing to the police, and thus qualifies. His next client is Devine; Goodman travels with him around the world, seeing OMNICO's viciousness and Devine's poverty of soul close up. Eventually, he manages to penetrate Devine's barriers of contempt and becomes what he has been hired to be, a friend.

But Devine cannot really let anyone get so close to him. He has Goodman's common-law wife, Charlotte, kidnapped, and he makes Goodman watch her degradation and murder. Not surprisingly, Goodman breaks, but Devine crashes with him.

Pfeil's message is serious. It is delivered in a very hyperbolic, exaggerated fashion, but that does not invalidate it. Those who cannot accept friendship *are* doomed. Pfeil adds that so too is the corporate culture, as ordinary humans, those who are capable of friendship and love, abandon it; he may be right, though I doubt it, for the corporate culture is less heartless than he thinks.

Andrew M. Greeley is a Chicago priest, one-time city council member, and novelist who expresses his particular ecumenical theology in his work. The novels are mainstream and mystery (starring Father Blackie Ryan). He reminds us of C. S. Lewis, but he is less given to lectures and demonstrations than to questions, as we see very clearly when he turns to SF with **God Game.**

God Game's narrator, himself a priest, has a friend who brings him a state-of-the-art interactive computer game, a "novel," complete with graphics, that lets its "operator" influence the action. In a sense, it makes its operator a petty god in a pocket universe.

The narrator plugs the disks into his computer, hooks the computer to his TV, and begins to play. And then lightning strikes his satellite dish. The game's graphics turn lifelike, movielike, and he is hooked—addictively—into a parallel world where the "novel" is reality, and he really *is* God. He must stop a destructive war, impel the characters to negotiate a lasting peace, arrange a marriage, answer prayers, and so on. His role is complicated by the characters' free will and by the presence of an independent, the "ilel" Ranora, a sprite, a gamine, who seems sent by some other God to play catalyst. His life too grows complicated, for the characters on his screen have eerie correspondences to those in his life, and events in never-never land seem to influence those around him.

Greeley's theme is the responsibility that is God's, the limitations imposed on omnipotence by free will, the function of grace. He handles it well and fascinatingly as he shifts his focus between the parallel realities and asks, again and again, the questions that plague him. Does he answer them? Only in a sense, for he keeps coming back to the comparison of God with the author of a novel: Once the characters are defined, they take on a life of their own, and their Creator's influence is thereafter limited.

To one like myself (call me an Occamite, or a Razorite, for as far as I can see, God is an unnecessary hypothesis),

discussions of God and His role in the world seem futile. Yet Greeley's novel remains both thought-provoking and satisfying. It should suit more religious readers even better.

The late Theodore Sturgeon's last novel, **Godbody,** reiterates his theme of love very effectively. The setting is a small New England town ruled by a newpaper columnist, Willa Mayhew, who loves to ruin reputations by revealing real or fictive scandals, and the town banker, Andrew Merriweather, who assists the vicious Mrs. Mayhew for love of power. Then there is Hobe Wellen, sociopath, rapist, degrader of women, funniest character in the book, who—at her behest—creates sins for Mrs. Mayhew's delectation. There is preacher Dan Currier, a good man, if a tad uptight. There is Dan's lovely wife, Liza, whose very delectability arouses Wellen's lust and Mrs. Mayhew's wrath. And more.

The story begins when Dan Currier meets a naked man by the side of the road. His name he gives simply as "Godbody," and his touch alone inspires Dan to love Liza as she was meant to be loved. Successive chapters then let us see events from the eyes of each of the story's characters (except Godbody), and we very soon realize that Godbody is Christ come again, his mission to repeat his basic message, "Love one another." On every character but one, his impact is profound, and it lasts well beyond the culmination of the destiny any Christ-figure seems doomed to fulfill.

In a sense, Sturgeon has deftly modernized the New Testament. There are no announcing angels, no Virgin Mary, no manger birth. Godbody simply appears, complete with an anatomy that would fit a carpenter. But there are pharisees, one of whom actually repents his ways. There is a man of Caesar to follow the new way.. There are apostles, a Mary Magdalene (of sorts), a renascent church. There is, above all, an abiding concern with love and redemption that must speak to all who read this fine book.

In the Introduction, Robert Heinlein warns that the book is sure to offend bluenoses. He's right. Sturgeon sees love in as physical terms as you can imagine. Yet there is also the deeper love of the spirit, of which that of the body, at its best, is a very real manifestation. It is worth bearing in mind the last words of Stephen Donaldson's Afterword: "Somehow *Godbody* overcomes all the intervening personal, cultural, and theological hinderances [sic]. It *comes through.*"

When Somtow Sucharitkul writes what his publishers choose to call "mainstream" novels, he uses the penname S. P. Somtow. They did it first with *Vampire Junction,* which was as much a fantasy as any fan could ask. Now they've done it again with **The Shattered Horse,** which qualifies as alternate-worlds SF.

Somtow's premise is that Astyanax, six-year-old son of King Priam of Troy, did not get his brains bashed out when Troy fell. Instead, he and his playmate-slave had just exchanged clothes when the Akhaians came storming in. The slave, mistaken for royalty, died. Astyanax lived to grow up as a shepherd in the nearby hills, until as a teenager he returned to Troy, to rebuild the city and pursue vengeance. Unfortunately, the rebuilding seizes all his time, and the beginnings of a conflict of gods—the ancient Snakemother, the Lady who is three in one, versus the modern Skyfather (Zeus)—preoccupy him.

The pursuit begins with the arrival of

the Egyptian mage Memnon, accompanying the living mummy of Akhenaten in a ship that glows with all the brilliance of the sun-god, cognate with Skyfather. Memnon frees Astyanax to travel by transferring one of his souls to a ceramic golem that will rule Troy in his absence and promises that in due time he will end the Age of Bronze and liberate Memnon and his master to the land of the dead.

Once embarked, Astyanax passes through Circe's isle and a decaying Greece, in both of which Snakemother is reasserting a savage, mad dominance. He touches our ancient myths in the persons of Orestes and Clytemnaestra. He kidnaps Helen all over again, and here we see Somtow at work once more as a myth-maker in his own right. Inexorably, he moves the plot to where Helen must reenact the role of Paris, choosing among three men who can offer her the glory of the past, the divinity of the future, and the passion of the present.

Here is Somtow's theme. His setting is the transition between the Age of Bronze, the age of gods, and the Age of Iron, the age of men (let's not say humans—it was men of iron who made women chattel). The gods are losing their influence on human affairs, and honor is fading from the world—Astyanax himself must foreswear the oaths that drove him toward revenge. Magic is lost, and the world is a duller place, less colorful, less passionate. The past survives only in the world of the dead, whose denizens see themselves as they were in life. The future is a realm without impulse.

Somtow shows us that he recognizes the attractions of impulse and of enslavement by gods but, he says, they are attractions that can be properly grasped only beyond the grave, when their consequences—death and suffering—no longer matter. Life requires thought, planning, and consideration for others.

In his appendix to the book, Somtow reveals that this book has been gestating since he was ten years old. We may therefore presume that the ideas it expresses are seated deeply in Somtow's soul, and that he himself rejects impulsive behavior in favor of deliberation (just as we might expect from a writer!). He says, in fact, that "The problem of choice and freedom is at the root of my book, and it was certainly at the root of the compositional process. . . ."

The Shattered Horse has much of the appeal of Homer. Somtow, as ever, is dramatically and effectively grandiose. His characters are more explicitly archetypes than ever, and his dialogue is powerfully stamped by the rodomontade of classical drama. The book thus takes some getting used to, but that does not bother me. What does bother me is that Somtow has imposed his theme too deliberately on his material. The characters live not for themselves, but for him, and their development often seems strained. Still, the book is well worth reading. It is a powerful intellectual exercise and, despite its flaws, a powerful dramatic experience.

Michael P. Kube-McDowell began his "Trigon Disunity" series with *Emprise*, in which Earth's humans learned that there have been human colonies around other stars for millennia. He thus set up a baffling mystery: How the heck did they get there? Ours is apparently the first terrestrial civilization with the potential for space travel. There are no signs of high technology in the archeological record, and no one is prepared to believe in von-Danikenoid chariots

that might have given our ancestors a lift.

Book two, **Enigma,** pursues the mystery. Earth has mounted a dedicated search for more human colonies, and it has found a few, including some that have died out. One of the searchers is Merritt Thackery. Driven by the mystery and the passion he experienced when he first looked on Jupiter, he has shifted from a bureaucrat-training program to the space program and gained a slot on an exploration ship. He begins to sense an answer when his ship investigates the world of Sennifi, whose standoffish natives are the few remnants of a large, technically sophisticated population. As the contact specialist, he pushes, and he learns that Sennifi's decline is due to a visit from the D'shanna, energy beings with so many answers that they destroyed the Sennifi's heart.

Here are the first non-human aliens anyone has heard of, and though Thackery's superiors dismiss their relevance to the central mystery of their lives, Thackery is convinced that they must know how the human colonies arose. Promoted to command a ship of his own, he is off in search. Almost immediately, he finds another clue on the world of an extinct colony, the tantalum-alloy skeleton of what must have been a spaceship, perhaps one that had once brought humans from Earth.

And then he meets the D'shanna, who both hold the answer he seeks and explain Kube-McDowell's series title. There is a third species of aliens, none of the three can be allies, and war seems inevitable for Book three.

Enigma is a nice puzzle story that effectively unites past and future. It is well thought out, effectively written and paced. My only problem with it is with the characters. Most are only thinly sketched, and Thackery changes too much and too swiftly for believability. Kube-McDowell's strength is ideas and events. And that is enough to make *Enigma* a good read.

Mike Scott Rohan's **Run to the Stars** is adequate, but flawed, space opera. Some decades hence, Earth is dominated not by ideologies, but by bureaucrats ascendant, dubbed BCs, as autocratic as any fascist and rather more conservative, being bureaucratically obsessed with the status quo. It's an unusually cynical vision, but is it generic oppression, just the plot driver for the modern writer who doesn't wish to offend any potential markets, domestic or foreign? Or does it serve a salient point, perhaps saying that autocrats of any stripe are less concerned with power than with stability? I'll let you be the judge.

Mark Bellamy is the security chief of the spaceport that floats in the Atlantic off Europe. Vacationing in Ireland, he observes a shuttle crash, rescues the pilot from the sea in fine shape, and listens to the man's curses about shoddy equipment. He is puzzled when later news reports say the pilot died on the way to the BC hospital, and he investigates. In due time, he uncovers a BC plot that involves Earth's single colony and a message received decades before from an alien species. He escapes by the proverbial skin of his teeth and hides out on the second (and last) colony ship, ironically being forced to ride to the stars just as he had half intended from the start. He tries to abort the plot, but he is doomed to failure as ironies pile upon ironies.

Most of the characters are adequate, but only Bellamy and Kirsty, the girl who fell for him in Ireland, have much real life. Unfortunately, Rohan drops Kirsty almost completely once the story

moves into space, and we are left with little but disaster and debate. The story turns passive, limping, and we are kept reading only by our memory of the more intense, active action of the first 200 pages.

Think of it: An Asimovian robot that has never heard of the Three Laws. It's disobedient, disrespectful, smart-assed, and possessed of such unique talents as hyperspatial and time travel. Of course, it does have a number of components from a wrecked alien spacecraft salvaged by a lone-wolf genius, but still . . .

Anyway, that's Norby, named for the label on the nail barrel that armors his torso by Jeff Wells, who badly needs a cut-rate teaching robot to help him learn Martian Swahili and keep him from being kicked out of the Space Academy. The book is **The Norby Chronicles,** uniting the earlier *Norby, The Mixed-Up Robot* and *Norby's Other Secret* in one volume. And the story is the tale of how Jeff and Norby defeat Ing the Ingrate, would-be conqueror of the Solar System, encounter intelligent dinosaurs, and save the robotic Mentors, created by the alien Others, from insanity.

It's kid stuff, but deliberately so.

Richard Mueller inaugurates the "Trials of Jernigan" series (a trilogy?) with **Jernigan's Egg.** Kevin Jernigan is an actor stranded on the scum-world Pallastor when his theater company folds. His mentor is killed, and Kevin finds among his effects a strange golden marble, or egg, which for some reason brings the assassins after him as well. He escapes to become an interstellar mercenary, and he grows deft at Napoleonic tactics before he crashes on the primitive world of Arcadia.

We thus begin in an SF ambiance. But there are intimations of fantasy. Kevin's memory includes an encounter with working witchcraft (it looks a lot like fancy psi), and the egg seems to bring him luck and prophetic dreams. And Aradia turns out to be a world of witches, goblins, trolls, and elves, complete with an evil Imperator who covets Kevin's egg. Kevin must become a general, tame a dragon, defeat evil, and free his adopted people. At the end, the egg is hidden, but it is still there, and later volumes of the series will surely tell us a lot more about what it is, why so many people want it, and what is really so special about Kevin Jernigan.

It's a promising beginning. Mueller uses many of the elements of standard fantasy in a refreshing way, and the evil his hero faces seems more encompassing than any writer since Doc Smith has imagined. Give it a try. ■

● No society has yet attempted a self-conscious direction of the process by which its new normalities are created in the next generation.

Ruth Benedict

a calendar of analog upcoming events

5-7 December
TROPICON V (South Florida SF conference) at Howard Johnson's Ocean Resort Hotel, Deerfield Beach, Fla. Guest of Honor—Gardner Dozois Guests include Dr. Robert Collins, Lee Hoffman, Brad Linaweaver, Somtow Sucharitkul. Registration—$10 until 31 October, $15 thereafter. Checks payable to: South Florida Science Fiction Society. Info: SFSFS Secretary, Box 10743, Ft. Lauderdale FL 33307.

5-7 December
OZARKON 4 (Ozark area SF "relaxacon") at Rodeway Inn, Eureka, Mo. Guest of Honor—Warren Norwood, Artist Guest of Honor—Joan Hanke Woods, Fan Guest of Honor—Nancy Nutt. Registration—$12 in advance, $17 at the door. No one under 18 years of age admitted. Info: Nancy Edwards, Rt. 2, Box 111, Pacific MO 63069. (314) 742-3813.

5-7 December
SMOFCON 3/CONCON (SF convention running conference) in Massachusetts. Conference and workshops for people who run SF conventions. Registration—$30. Info: MCFI, Box 46, MIT Branch P.O., Cambridge MA 02139.

8-10 December
Conference on the Impacts of Physics on the Frontiers of Medicine at Buena Vista, Fla. Info: L. Scott, Global Foundation, Box 248103, Coral Gables FL 33124.

8-12 December
American Geophysical Union Fall Meeting at San Francisco, Calif. Info: Brenda Weaver, Meeting manager, AGU, 2000 Florida Ave NW, Washington DC 20009.

2-4 January 1987
EVECON 4 at Washington, D.C. Registration—$15 in advance, $20 at the door. Info: Evecon, % FanTek, Box 128, Aberdeen MD 21001.

9-11 January 1987
HEXACON 9 (central Pennsylvania SF conference) at Brunswick Motor Inn, Lancaster, Penna. Guest of Honor—Christopher Stasheff, Artist Guest of Honor—Barbi Johnson. Registration—$10 until 22 December, $15 at the door. Info: Hexacon, % Bruce&Flo Newrock, Box 270-A, RD2, Flemington NJ 08822.

27 August—2 September 1987
CONSPIRACY '87 (45th World Science Fiction Convention) at Metropole Hotel & Conference Centre, Brighton, U.K. Guests of Honour—Alfred Bester, Doris Lessing; Fan Guests of Honour—Joyce and Ken Slater; Artist Guest of Honour—Jim Burn Special Fan Guest—David Langford TM—Brian Aldiss Registration—Attending (until 30 September 1986) £25, $40, $A50; Supporting £10, $15, $A20. Info: ConSpiracy '87, Box 43, Cambridge CB1 3JJ, England, U.K. OR Bill & Mary Burns, 23 Kensington Court, Hempstead NY 11550 OR Justin Achroyd, GPO Box 2708X, Melbourne, Vic. 3001 Australia.

3-6 September 1987
CACTUSCON (North American SF Conference) at Hilton, Hyatt Regency, Convention Center, Phoenix, Ariz. Guest of Honor—Hal Clement, Fan Guest of Honor—Marjii Ellers. Registration—$15 supporting; $30 attending until 15 September 1986. Info: CactusCon, Box 27201, Tempe AZ 85282. (602) 968-5673.

—Anthony Lewis

Items for the Calendar should be sent to the Editorial Offices six months in advance of the event.

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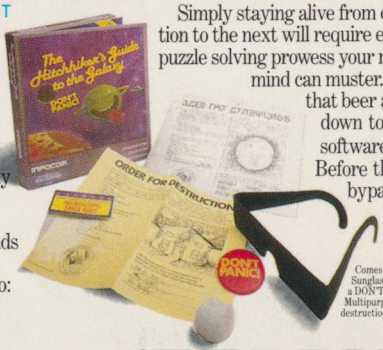

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