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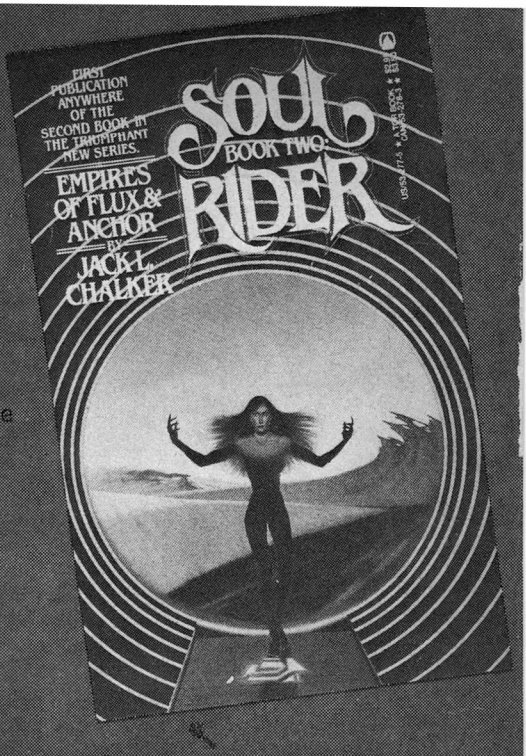

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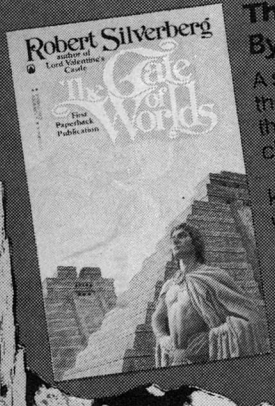

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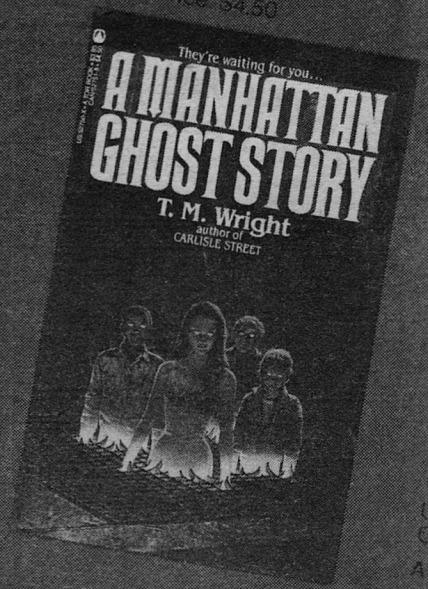

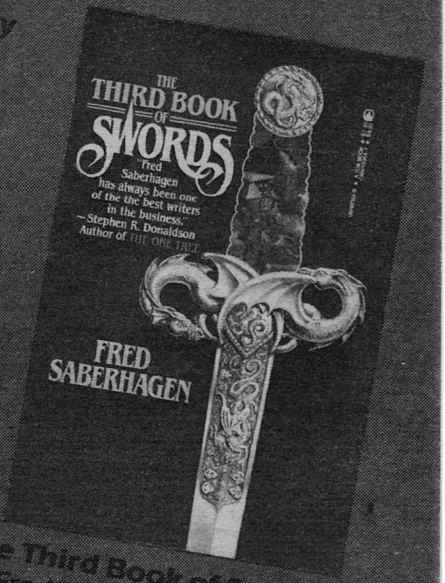

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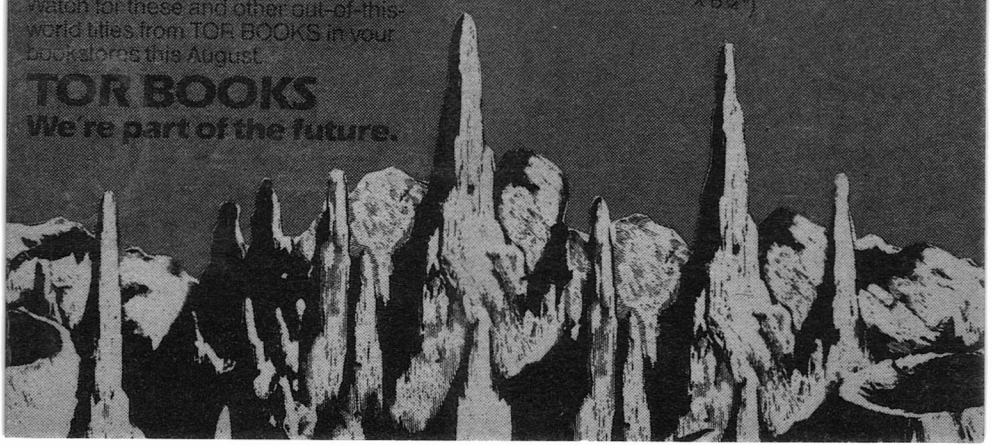

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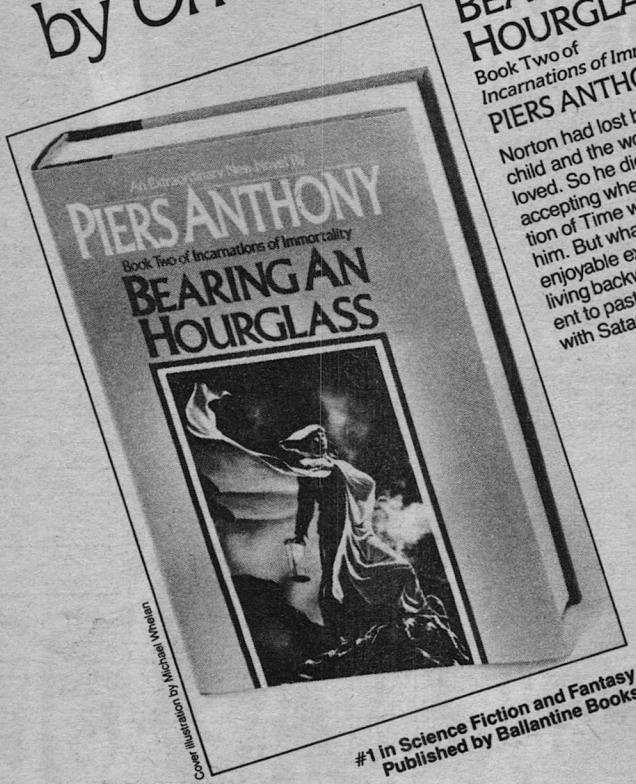

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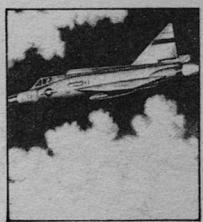

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Editorial

HEIRS UNAPPARENT

Stanley Schmidt

Man has been called the "time-binding" animal—the species which transmits knowledge acquired by experience from generation to generation. We now know he is not the only species which does this, but he does seem to do it to a greater extent than any other species on this planet, and that fact is one of the principal cornerstones of civilization. Without this collective ability, every new generation would have to start from scratch and learn everything for itself, and none would progress very far.

But knowledge is not the only thing transmitted from generation to generation. A friend and professional associate of mine was recently discussing libertarianism (with both capital and lower case *l*'s), and she remarked that while libertarian ideals of minimal government interference with individuals *sounded* admirable, she suspected that if they were really applied extensively, she would never have reached her present professional position. Without government loans, she believed, she would not have managed to get through college.

If libertarian philosophy seeks to allow all individuals maximum freedom to rise or fall by their own talents and efforts, in practice it would fail because *wealth* and the influence derived from it is also passed from generation to generation—but usually within a family. Therefore wealth and its advantages be-

come concentrated in certain families and stay there. Leaving people to their own devices under such circumstances does *not*, my friend pointed out, ensure that the most capable and industrious will be the most prosperous. Too much of an individual's potential for prosperity depends on his *ancestors'* abilities and exertions rather than his own. It's a little like running a race with contestants starting all over the track instead of just on the starting line. "Selection of the fittest" works, if it works at all, at the level of families rather than individuals. And in the long run that tends to be self-defeating because families whose members can live by riding heredity coattails eventually tend to do so and thereby lose their vigor.

There really are advantages, not just for individuals but for the culture to which they belong, to letting all individuals strive to shape their own lives. But those advantages are only realized insofar as the benefits accruing to an individual are *actually* determined by his own actions rather than accidental advantages or disadvantages in his starting position. So is there a way to make the correlation between individual efforts and rewards closer than we're currently used to?

I have a modest proposal. That object is one of the functions traditionally claimed for inheritance taxes—to keep concentrations of wealth from becoming too permanent by periodically putting some of it back into circulation outside wealthy families. In practice, they haven't always been either equitable or effective. So maybe we should consider some outrageous alternatives. Maybe the inheritance tax idea doesn't go far enough.

I don't claim that what I'm going to propose is necessarily What Should Be Done, or that it alone would bring Perfect Justice into the world to stay, or even that I would personally like it. What I do claim is that it would eliminate a good deal of unearned advantage for individuals who happened to be born farthest in front of the starting line, ensure that everybody has at least a little opportunity to start somewhere close to the line, and by doing those two things put the competitions of life on a somewhat more individual and less familial basis. My proposal involves *one* simple (and sizable) governmental intervention (for which a rather interesting philosophical case can be made) for the sole purpose of making more likely the very kind of individual selection-through-effort which libertarians favor. After that, everyone is on his own.

The proposal has four main points:

1. *Except for "personal effects," wealth (such as cash, stocks, bank accounts, etc.) may not be inherited by grown children of the deceased.* A portion of it may be used to support young, dependent children until they are old enough to take care of themselves—but once they reach that point, they are expected to do so. Surviving spouses *may* inherit; chances are that a couple has put a good deal of joint effort into building a life together, and if one dies first, that is no justification for taking what remains away from the other. But when the survivor dies, that's the end of it. The money then goes where all such monies eventually go.

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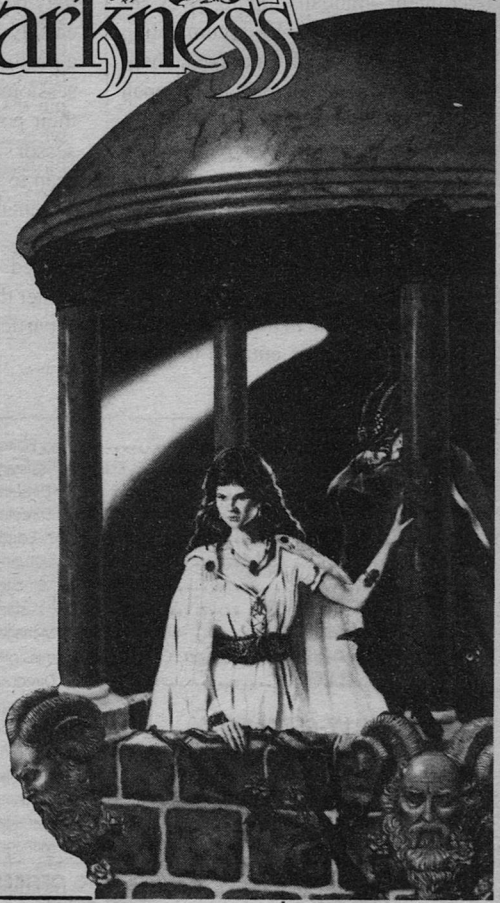

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2. *The "final resting place" of a deceased person's wealth is a large common pool of* all *inheritances.* Whether this is statewide or national or something else is a procedural detail. The important point is that when a person dies, the bulk of his wealth does not stay in his immediate family, but is returned to society at large for redistribution. (If you're worried about the government gradually taking over industry and commerce by accumulating inherited stocks, that's not what happens. Such things are sold on the open market and the proceeds go into the inheritance pool.) If you're locked into thinking of the present system as "normal," this may sound like a 100% inheritance tax on "rightful heirs," but it isn't. This proposal explicitly rejects the underlying philosophy that any particular individuals *are* rightful heirs —i.e., that anyone is entitled to property merely by being born to its owners. It substitutes the idea that any individual is entitled to earn what he can and dispose of it however he likes while he is alive—but once he is dead, he is neither qualified nor entitled to do *anything.* "Dead men pay no taxes," as the saying goes; nor do they mow their lawns, work at their jobs, vote, or anything else. However respected their memories may be, they are no longer members of earthly society. They are no longer in a position to do anything with their possessions—or, to look at it another way, their possessions no longer have a possessor. And what could be more logical than to throw goods with no owner into a general pool for all to share? Such goods, like basic knowledge, are thus passed on to a generation as a whole rather than just those members born into a particular family.

(continued on page 176)

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THE PEACE WAR

Conclusion

"War" and "peace"
are just words;
speakers and listeners
make of them what they will.
And "loyalty" is
meaningless until its
object is specified.

SNYOPSIS

Sometimes the consequences of an invention take a long time to be understood. Next to computers, **bobbles** *may be the all-time winner in this department.* **Paul Hoehler** *invented them in 1997, while working for a government contract lab in Livermore, California. Both he and his employers thought they understood the effect: With a large enough power source, stable force shields could be constructed. The spheres were impenetrable and theoretically eternal. Hoehler eventually realized that his bosses were keeping the invention secret even from the government. In desperation, he hinted at this to his friend in USAF intelligence, Captain* **Allison Parker**.

Parker surveyed the Livermore lab on an orbital mission, but by then it was too late. As her orbiter re-entered over California, the Livermore group struck: Her craft was bobbled, suddenly replaced by a twenty-meter, totally reflecting sphere. The enormous Christmas tree ornament fell along the trajectory of its contents, crashing in the hills east of Vandenberg AFB. During the next hours, military sites in both Soviet and

Western camps came under attack. Most simply stopped reporting. In the general war that followed, only a few nuclear weapons were exploded. Both sides saw their bases and fleets mysteriously swallowed up in totally reflective spheres.

With this chaos far advanced, the Livermore lab announced itself as the maker of the bobbles and the new guardian of peace—a **Peace Authority**. *Sovereign governments were outlawed. Enemies of the Peace were subject to embobblement: to be trapped inside a bobble was clearly a sentence of death by asphyxiation.*

The war plagues began shortly afterwards. This was—Authority commentators said—the last attempt of the governments to regain power. It did not succeed, but for two decades the plagues spread out of control. Billions died. Fertility dropped to near zero.

And the authority of the Peace grew.

The '30s and '40s were the high years of the Peace. The entire planet was under its control. The situation in the American West was typical: California south of Santa Barbara was Spanish-speaking, a collection of feudal domains known as **Aztlán**. *Northward spread the* **ungoverned lands**, *kept in a state of anarchy. Across the old USA missile fields lay hundreds of bobbles. Much larger ones enclosed the military bases of the old regime. The bobble around Vandenberg AFB was twenty kilometers across, its upper hemisphere reaching 10,000 meters into the sky. So vast and reflective was the dome that the local climate was changed. Rainfall surpassed 250 centimeters per year. Banana and cocoa production became feasible.*

The Authority might have gone unchallenged, if not for an unlikely alliance: In 2047, **Wili Wachendon** *was fifteen—and looked eleven. Wili was a first-rank genius, but had plenty of compensating problems. He suffered from one of the wasting diseases that were the legacy of the plague years. Nearly feral, he had grown up on the fringes of the black ghetto in LA, the* **Ndelante Ali.**

Paul Naismith *was almost eighty, and the most important* **Tinker** *on the West Coast. (As in other dark ages, technical progress had not entirely stopped. The Peace had Banned heavy manufacturing, but low-power electronics survived as cottage industry. In some ways, the Tinkers had taken electronics as far as it might have gone* without *the war and plagues.) Naismith hated the Authority: In 1997 his name had been Paul Hoehler. For fifty years he had hidden from the Peace and dreamed of revenge. In Wili, he recognized a potent weapon against his enemy.*

The Authority Directors, **Hamilton Avery** *in particular, were beginning to realize that bobbles are not forever: several ten-meter bobbles had already lapsed. Avery was (wrongly) convinced the Tinkers were behind this development; he had recently discovered that Paul Hoehler survived, and was a Tinker. Through his top security agent,* **Della Lu**, *Avery took dozens of Tinkers hostage at the North American Chess Championships in La Jolla. At the same time, Della used information from* **Miguel Rosas**, *a Tinker deputy sheriff, to bobble the underground bioscience lab just north of the tournament site; that action trapped Wili's friend,* **Jeremy**

Kaladze, *and made Rosas an apparent accessory to murder. Afterwards, Lu blackmailed Rosas into helping her infiltrate the Tinker community near Vandenberg. Eventually Rosas turned on her, but not before the Peace cop had done considerable damage.*

About the time of the La Jolla arrests, a twenty-meter bobble burst in the hills east of Vandenberg not far from Paul Naismith's secret home. This bobble had great personal significance for Naismith: Allison Parker had died inside it many years before. More practically, this was the first bobble burst accessible to Naismith. Though he had invented them, he—like the Authority—had never guessed that bobbles would decay after a few decades. Paul arrived at the site just before the Peace, and so discovered the greater secret, which had lain hidden from all factions for fifty years: Within a bobble, time stops. Embobblement is not a sentence of death. The proof was striking: He found Allison Parker, still 25 years old, just escaped from the wreck of her orbiter.

The mass arrests forced the Tinkers into open warfare with the Peace. Based on Naismith's insight, Wili Wachendon provided them with a new weapon: short-range bobble generators. The Authority couldn't duplicate the portable bobblers, but it had its long-range generators—as well as the armies, the tanks, the aircraft, and the recon satellites.

The revolt had initial success. Using the new bobblers, a rebel force rescued the Tinkers being held hostage in Los Angeles. The European Peace forces were overthrown. In China, Tinkers harried the Peace Director for Asia, **Khim Tioulong**. *Working with* **Jill**, *a sophisticated interface program, Wili subverted the Authority's communication and reconnaissance satellites, turning one of the Peace's greatest strengths into a hidden weakness.*

The revolt had initial success. . . .

32

Allison had been in the new world more than ten weeks.

Sometimes it was the small things that were the hardest to get used to. You could forget for hours at a time that nearly everyone you ever knew was dead, and that those deaths had been mostly murder. But when night came, and indoors became nearly as dark as out—that was strangeness she could not ignore. Paul had plenty of electronic equipment, most of it more sophisticated than anything in the twentieth century, yet his power supply was measured in watts, not kilowatts. So they sat in darkness illuminated by the flatscreen displays that were their eyes on the outer world. Here they were, conspirators plotting the overthrow of a world dictatorship—a dictatorship which possessed missiles and nukes—and they sat timidly in the dark.

Their quixotic conspiracy wasn't winning, but by God the enemy knew it was in a fight. Take the TV: The first few weeks it seemed that there were hardly any stations, and those were mostly run by families. The Morales spent most of their viewing time with century-old recordings. Then, after the LA rescue, the Authority had begun around-the-clock saturation broadcasting similar to twentieth century Soviet

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feeds (and as little watched): It was all news, all stories about the heinous Tinkers and the courageous measures being taken by "your Peace Authority" to make the world safe from the Tinker threat.

Paul called those "measures" the Silvery Pogrom. Every day there were more pictures of convicted Tinkers and fellow-travelers disappearing into the bobble farm the Authority had established at Chico. Ten years, the announcers said, and those bobbles would burst and the felons would have their cases reviewed. Meantime, their property would also be held in stasis. Never in history, the audience was assured, had criminals and monsters been treated with more firmness or more fairness. She knew bullshit when she saw it; if she hadn't been bobbled herself, she would have assumed that it was a cover for extermination.

It was a strange feeling to have been present at the founding of the present order, and to be alive now, fifty years later. This great Authority, ruling the entire world—except now Europe and Africa—had grown from nothing more than that third-rate company Paul worked for in Livermore. What would have happened if she and Angus and Fred had made their flight a couple days earlier, in time to return safely with the evidence?

Allison looked out the mansion's wide windows, into the twilight. Tears didn't come to her eyes anymore when she thought about it, but the pain was still there. If they had gotten back in time, her CO might have listened to Hoehler. They just might have been able to raid the Livermore labs before the brazen take-over that was called the "War" nowadays. And apparently that "War" had been just the beginning of decades of war and plague, now blamed on the losers. Just a few days difference, and the world would not be a near-lifeless tomb, the United States a fading memory. To think that some lousy contractors could have brought down the greatest nation in history!

She turned back into the room, trying to see the three other conspirators in the dimness. An old man, a skinny kid, and Miguel Rosas. This was the heart of the conspiracy? Tonight, at least, Rosas sounded as pessimistic as she felt.

"Sure, Paul, your invention will bring them down eventually, but I'm telling you the Tinkers are all going to be dead or bobbled before that happens. The Peacers are moving *fast.*"

The old man shrugged. "Miguel, I think you just need something to panic over. A few weeks back it was the Peacers' recon operation. Wili fixed that —more than fixed it—so now you have to worry about something else." Allison agreed with Miguel, but there was truth in Paul's complaint. Miguel seemed both haunted and trapped: haunted by what he had done in the past, trapped by his inability to do something to make up for that past. "The Tinkers have simply got to hide out long enough to make more bobblers and improve on 'em. Then we can fight back." Paul's voice was almost petulant, as though he thought that he had done all the hard work and now the Tinkers were incompetent to carry through with what remained. Sometimes Paul seemed exactly as she remembered him . . . from before. But other times—like tonight—he just

seemed old, and faintly befuddled.

"I'm sorry, Paul, but I think that Miguel he is right." The black kid spoke up, his Spanish accent incongruous yet pleasant. The boy had a sharp tongue and a temper to go with it, but when he spoke to Paul—even in contradiction—he sounded respectful and diffident. "The Authority will not give us the time to succeed. They have bobbled the Alcalde del Norte himself. Red Arrow Farm is gone; if Colonel Kaladze was hiding there, then he is gone, too." On a clear day, dozens of tiny bobbles could be seen about the skirts of the Vandenberg Dome.

"But our control of Peacer recon. We should be able to protect large numbers of—" he noticed Wili shaking his head. "What? You don't have the processing power? I thought you—"

"That's not the big problem, Paul. Jill and I have tried to cover for many of the Tinkers that survived the first bobblings. But, see—the first time the Peacers fall onto one of these groups, they will have a contradiction. They will see the satellites telling them something different than what is on the ground. Then our trick is worthless. Already we must remove protection from a couple of the groups we agreed on—they were going to be captured very soon no matter what, Paul," he spoke the last words quickly as he saw the old man straighten in his chair.

Allison put in, "I agree with Wili. We three may be able to hold out forever, but the Tinkers in California will be all gone in another couple of weeks. Controlling the enemy's comm and recon is an enormous advantage, but it's something they will learn about sooner or later. It's worthless except for reaching short-term goals."

Paul was silent for a long moment. When he spoke again, it sounded like the Paul she had known so long ago, the fellow who never let a problem defeat him. "Okay. Then victory must be our *short-term* goal. . . . We'll attack Livermore, and bobble *their* generator."

"Paul, you can do that? You can cast a bobble hundreds of kilometers away, just like the Peacers?" From the corner of her eye, Allison saw Wili shake his head.

"No, but I can do better than in LA. If we could get Wili and enough equipment to within four thousand meters of the target, he could bobble it."

"Four thousand meters?" Rosas walked to the open windows. He looked out over the forest, seeming to enjoy the cool air that was beginning to sweep into the room. "Paul, Paul. I know you specialize in the impossible, but. . . . In Los Angeles we needed a gang of porters just to carry the storage cells. A few weeks ago you wouldn't hear of taking a wagon off into the eastern wilderness. Now you want to haul a wagonfull of equipment through some of the most open and well-populated country on Earth.

"And then, if you do get there, *all* you have to do is get those several tonnes of equipment within four thousand meters of the Peacer generator. Paul, I've been up to the Livermore Enclave. Three years ago. It was police service liaison with the Peacers. They've got enough firepower there to defeat an old-time army, enough aircraft that they don't need satellite pickups. You couldn't

get within forty kilometers without an engraved invitation. Four thousand meters range is probably right inside their central compound."

"There is another problem, Paul," Wili spoke shyly. "I had thought about their generator, too. Someday, I know we must destroy it—and the one in Beijing. But Paul, I can't find it. I mean, the Authority publicity, it gives nice pictures of the generator building at Livermore, but that's a fake. I know. Since I took over their communication system, I know everything they say to each other over the satellites. The generator in Beijing is very close to its official place, but the Livermore one is hidden. They never say its place, even in the most secret transmissions."

Paul slumped in his chair, defeat very obvious. "You're right, of course. The bastards built it in secret. They certainly kept the location secret while the governments were still powerful."

Allison stared from one to the other, and felt crazy laughter creeping up her throat. They really didn't know. After all these years they didn't know. And just minutes before, she had been hurting herself with might-have-beens. The laughter burbled out and she didn't try to stop it. The others looked at her with growing surprise. Her last mission, perhaps the last recon sortie the USAF ever flew, might yet serve its purpose.

Finally, she choked down the laughter and told them the cause for joy.

". . . so if you have a reader, I think we can find it."

There followed frantic calls for Irma, then even more frantic searches through attic storage, for the old disk reader. An hour later, the reader sat on the living room table. It was bulky, gray, the Motorola insignia almost scratched away. Irma plugged it in and coaxed it to life. "It worked fine years ago. We used it to copy all our old disks onto solid storage. It uses a lot of power though; that's one reason we gave it up."

The reader's screen came to life, a brilliant glow that lit the whole room. This was the honest light Alllison remembered. She had brought her disk pack down, and undid the combination lock. The disk was milspec, but it was commercial format; it should run on the Motorola. She slipped it into the reader. Her fingers danced across the keyboard, customizing off routines on the disk. Everything was so familiar; it was like suddenly being transported back to the before.

The screen turned white. Three mottled gray disks sat near the middle of the field. She pressed a key and the picture was overlaid with grids and legends.

Allison looked at the picture and almost started laughing again. She was about to reveal what was probably the most highly classified surveillance technique in the American arsenal. Twelve weeks "before," such an act would have been unthinkable. Now, it was a wonderful opportunity, an opportunity for the murdered past to win some small revenge. "Doesn't look like much, does it?" she said into the silence. "We're looking down at—I should say 'through'—Livermore." The date on the legend was 01JUL97.

She looked at Paul. "This is what you asked me to look for, Paul. Remember? I don't think you ever guessed just how good our gear really was."

"You mean, those gray things are old Avery's test projections?"

She nodded. "Of course, I didn't know what to make of them at the time. They're about five hundred meters down. Your employers were very cautious."

Wili looked from Allison to Paul and back, bewilderment growing. "But what is it that we are seeing?"

"We are seeing straight through the Earth. There's a type of light that shines from some parts of the sky. It can pass through almost anything."

"Like x-rays?" doubtfully.

"Something like x-rays." There was no point in talking about massy neutrinos and sticky detectors. They were just words to her, anyway. She could use the gear, and she understood the front end engineering, but that was all. "The white background is a 'bright' region of the sky—seen straight through the Earth. Those three gray things are the *silhouettes* of bobbles far underground."

"So they're the only things that are opaque to this magic light," Miguel said. "It looks like a good bobble hunter, Allison, but what use was it for anything else?" If you could see through literally everything, then you could see nothing.

"Oh, there is a very small amount of attenuation. This picture is from a single 'exposure,' without any preprocessing. I was astounded to see anything on it. Normally, we'd take a continuous stream of exposures, through varying chords of the Earth's crust, then compute a picture of the target area. The math is pretty much like medical tomography." She keyed another command string. "Here's a sixty meter map I built from all our observations."

Now the display showed intricate detail: A pink surface map of 1997 Livermore lay over the green, blue and red representation of subsurface densities. Tunnels and other underground installations were obvious lines and rectangles in the picture.

Wili made an involuntary *ah*ing sound.

"So if we can figure out which of those things is the secret generator—" said Miguel.

"I think I can narrow it down quite a bit." Paul stared intently at the display, already trying to identify function in the shapes.

"No need," said Allison. "We did a lot of analysis right on the sortie craft. I've got a database on the disk; I can subtract out everything the Air Force knew about." She typed the commands.

"And now the moment we've all been waiting for." There was an edge of triumph in the flippancy. The rectangles dimmed—all but one on the southwest side of the Livermore Valley.

"You did it, Allison!" Paul stood back from the display and grabbed her hands. For an instant she thought he would dance her around the room. But after an awkward moment, he just squeezed her hands.

As he turned back to the display, she asked, "But can we be sure it's still there? If the Peacers know about this scanning technique—"

"They don't. I'm sure of it," said Wili.

Paul laughed. "We can do it, Miguel! We can do it. Lord I'm glad you all had the sense to push. I'd have sat here and let the whole thing die."

Suddenly the other three were all talking at once.

"Look. I see answers to your objec-

tions, and I have a feeling that once we start to take it seriously we can find even better answers. First off, it's not impossible to get ourselves and some equipment up there. One horse-drawn wagon is probably enough. Using back roads, and our 'invisibility,' we should be able to get at least to Fremont."

"And then?" said Allison.

"There are surviving Tinkers in the Bay Area. We all attack, throw in everything we have. If we do it right, they won't guess we control their comm and recon until we have our bobbler right on top of them."

Miguel was grinning now, talking across the conversation at Wili. Allison raised her voice over the others'. "Paul, this has more holes than—"

"Sure, sure. But it's a start." The old man waved his hand airily, as if only trivial details remained. It was a typically Paulish gesture, something she remembered from the first day she met him. The "details" were usually nontrivial, but it was surprising how often his harebrained schemes worked anyway.

33

"EAT VANDENBERG BANANAS. THEY CAN'T BE BEAT." The banner was painted in yellow on a purple background. The letters were shaped as though built out of little bananas. Allison said it was the most asinine thing she had ever seen. Below the slogan, smaller letters spelled, "ANDREWS FARMS, SANTA MARIA."

The signs were draped along the sides of their wagons. A light plastic shell was mounted above the green cargo. At every stop Allison and Paul carefully refilled the evap coolers that hung between the shell and the bananas. The two banana wagons were among the largest horse-drawn vehicles on the highway.

Miguel and the Santa Maria Tinkers had rigged a hidden chamber in the middle of each wagon. The front wagon carried the bobbler and the storage cells; the other contained Wili, Miguel and most of the electronics.

Wili sat at the front of the cramped chamber and tried to see through the gap in false cargo. No air was ducted from the coolers while they were stopped. Without it, the heat of the ripening bananas and the summer days could be a killer. Behind him, he felt Miguel stir restlessly. They both spent the hottest part of the afternoons trying to nap. They weren't very successful; it was just too hot. Wili suspected they must stink so bad by now that the Peacers would *smell* them inside.

Paul's stooped figure passed through Wili's narrow field of vision. His disguise was pretty good; he didn't look anything like the blurred pictures the Peacers were circulating. A second later he saw Allison—in farm daughter costume—walk by. There was a slight shifting of the load and the monotonous *clop clopclop* of the team resumed. They pulled out of the rest stop, past a weigh station moldering toward total ruin.

Wili pressed his face against the opening, both for the air and the view. They were hundreds of kilometers from Los Angeles; he had expected something more exciting. After all, the area around Vandenberg was almost a jungle. But no. Except for a misty stretch

just after Salinas, everything stayed dry and hot. Through the hole in the bananas, he could see the ground rising gently ahead of them, sometimes golden grassy, sometimes covered with chaparral. It looked just like the Basin, except that the ruins were sparse and separated. Miguel said there were other differences, but he had a better eye for plants.

Just then a Peace Authority freighter zipped by in the fast lane. Its roar was surmounted by an arrogant horn blast. The banana wagon rocked in the wash and Wili got a faceful of dust. He sighed and lay back. Five days they had been on the road now. The worst of it was that inside the wagon, he was out of touch; they couldn't disguise the antennas well enough to permit a link to the satellite net. And they didn't have enough power to run Jill all the time; the only processors he could use were very primitive.

Every afternoon was like this: hotter and hotter til they couldn't even pretend to sleep, till they started grumping at each other. He almost wished they would have some problems.

This afternoon he might get that almost-wish. This afternoon they would reach Mission Pass and Livermore Valley.

The nights were very different. At twilight Paul and Allison would turn the wagons off Old 101, and drive the tired teams at least five kilometers into the hills. Wili and Miguel came out of their hole, and Wili established communication with the satellite net. It was like suddenly coming awake to be back in connection with Jill and the net. They never had trouble finding the local Tinkers' cache. There were always food and fodder and freshly charged storage cells hidden near a spring or well. But they never saw their friends.

He and Paul used those power cells to survey the world through satellite eyes, to run the Jill processor for precious hours, to coordinate with the Tinkers in the Bay Area and China. They must all be ready at the same time.

The previous night the four of them had held their last council of war.

Some things that Allison and Miguel had worried about turned out to be no problem at all. For instance, the Peacers could have set checkpoints hundreds of kilometers out along all highways leading to Livermore. They hadn't done so. The Authority obviously suspected an attack on their main base, but they were concentrating their firepower closer in. And their reserve force was chasing Wili's phantoms in the Great Valley. Now that the Authority had wiped away all public Tinkering, there was nothing obvious for them to look for. They couldn't harrass every produce wagon or labor convoy on the coast.

But there were other problems that wouldn't go away. The previous night had been their last chance to look at those from a distance. "Anything after tonight, we're going to have to play by ear," Miguel had said, stretching luxuriously in the open freedom of the evening.

Paul grunted at this. The old man sat facing them, his back to the valley. His wide farmer hat drooped down at the sides. "Easy for you to say, Miguel. You're an action type. I've never been able to *ad lib*. I get everything worked out in advance. If something really un-

expected happens I'm just no good at real-time flexibility." It made Wili sad to hear him say this. Paul was becoming indecisive again. Every night, he seemed a little more tired.

Allison Parker returned from settling the horses and sat down at the fourth corner of their little circle. She took off her bonnet. Her pale hair glinted in the light of their tiny camp fire. "Well then, what are the problems we have to solve? You have the Bay Area Tinkers, what's left of them, all prepared to stage a diversion. You know exactly where the Peacer bobble generator is hidden. You have control of the enemy's communication and intelligence net—that alone is a greater advantage than most generals ever have."

Her voice was firm, matter of fact. It gave support by making concrete points rather than comforting noises, Wili thought.

There was a long silence. A few meters away they could hear the horses munching. Something fluttered through the darkness over their heads. Finally Allison continued, "Or is there doubt that you do control their communications? Do they really trust their satellite system?"

"Oh, they do," said Paul. "The Authority is spread very thin. About the only innovative thing they've ever done was to reestablish the old Chinese launch site at Shuangcheng. They have close and far reconnaissance from their satellites, as well as communications—both voice and computer." Wili nodded in agreement. He followed the discussion with only a fraction of his mind. The rest was off managing and updating the hundreds of ruses that must fit together to maintain their great deception. In particular, the faked Tinker movements in the Great Valley had to be wound down, but carefully, so that the enemy would not realize they had put thousands of men there for no reason.

"And Wili says they don't seem to trust anything that comes over ground links," Paul continued. "Somehow they have the idea that if a machine is thousands of kilometers off in space then it should be immune to meddling." He laughed shortly. "In their own way, those old bastards are as inflexible as I. Oh, they'll follow the ring in their nose, until the contradictions get too thick. *By then we must have won.*

". . . But there are so many, many things we have to get straight before that can happen." The sound of helplessness was back in his voice.

Miguel sat up. "Okay. Let's take the hardest: how to get from their front door to the bobble generator."

"Front door? Oh, you mean the garrison on Mission Pass. Yes, that's the hardest question. They've strengthened that garrison enormously the last week."

"Ha. If they're like most organizations, that'll just make them more confused—at least for a while. Look, Paul. By the time we arrive there, the Bay Area Tinkers should be attacking. You told me that some of them have maneuvered north and east of Livermore. They have bobble generators. In that sort of confusion there ought to be lots of ways to get our heavy duty bobbler in closer."

Wili smiled in the dark. Just a few days ago, it had been Rosas who'd been down on the plan. Now that they were close, though . . .

"Then name a few."

"Hell, we could go in just like we are—as banana vendors. We know they import the things."

Paul snorted. "Not in the middle of a war."

"Maybe. But *we* can control the moment the real fighting begins. Going in as we are would be a long shot, I admit, but if you don't want to improvise completely, you should be thinking about various ways things could happen. For instance, we might bobble the Pass and have our people grab the armor that's left and come down into the Livermore Valley on it with Wili covering for us. I know you've thought about that—all day I have to sit on those adaptor cables you brought.

"Paul," he continued more quietly, "you've been the inspiration of several thousand people these last two weeks. These guys have their necks stuck way out. We're all willing to risk everything. But we need you more than ever now."

"Or put less diplomatically—I got us all in this pickle, so I can't give up on it now."

"Something like that."

". . . Okay." Paul was silent for a moment. "Maybe we could arrange it so that. . . ." He was quiet again and Wili realized that the old Paul had reasserted himself—or was trying to, anyway. "Miguel, do you have any idea where this Lu person is now?"

"No." The undersheriff's voice was suddenly tight. "But she's important to them, Paul. I know that much. I wouldn't be surprised if she were at Livermore."

"Maybe you could talk to her. You know, pretend you're interested in betraying the Tinker forces we've lined up here."

"*No!* What I did had nothing to do with hurting. . . ." His voice scaled down, and he continued more calmly. "I mean, I don't see what good it would do. She's too smart to believe anything like that."

Wili looked up through the branches of the dry oak that spread over their campsite. The stars should have been beautiful through those branches. Somehow they were more like tiny gleams in a dark-socketed skull. Even if he were never denounced, could poor Miguel ever silence his internal inquisitor?

"Still, as you said about the other things, it's something to think about." Paul shook his head sharply and rubbed his temples. "I am so tired. Look. I'm going to think things out. I promise. But I seem to get my best ideas right when I wake up. Let's continue this in the morning. Okay?" It wasn't simple procrastination. Wili knew the old man did have his best insights in the drowsy wakefulness at the end of sleep. Paul looked across the circle at him. "Are you willing to handle the net by yourself tonight?" he asked apologetically.

Wili grinned. "Sure." It was the high point of the day for him. He only wished he could be connected all the time.

They unrolled their sleeping bags and crawled in. Wili's lay between the cache of storage cells and the wagon with the processors. There should be enough juice for several hours' operation. He adjusted the scalp connect and wriggled into a comfortable position. He stared at the half-sinister arches of the oaks and let his mind mesh again with the Jill interface. He was going into deep connect now, something he avoided

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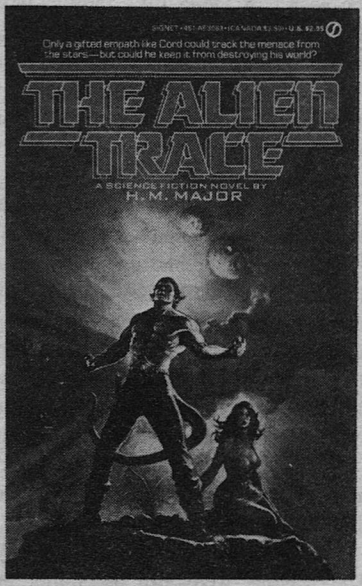

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when he was with the others. It made his physical self dopey and uncoordinated.

His attention drifted to the tiny cameras they had scattered beyond the edges of the camp, then snapped onto a high resolution picture from above. From there, their oaks were just one of many tiny clumps of darkness on a rolling map of paler grassland. The only light for kilometers around came from the embers that still glowed at the center of their camp. Wili smiled in his mind; that was the true view. The tiny light flicked out, and he looked down on the scene that was being reported to the Peace Authority. Nobody here but us coyotes.

This was the easiest part of the "high watch." He did it only for amusement; it was the sort of thing Jill and the satellite processors could manage without his conscious attention.

Wili drifted out from the individual viewpoints, his attention expanding to the whole West Coast and beyond, to the Tinkers near Beijing. There was much to do; a good deal more than Miguel or Allison—or even Paul—might suspect. He and Jill talked to dozens of conspirators. These men had come to expect Paul's voice coming off Peacer satellites in the middle of the West Coast night. (Those men Wili must protect as he did the banana wagons. They were a weak link. If any of them were captured, or turned traitor, the enemy would immediately know of Wili's electronic fraud.) From them, "Paul's" instructions and recommendations were spread to hundreds.

In this state, Wili found it hard to imagine failure. All the details were there before him. As long as he was on hand to watch and supervise, there was nothing that could take him by surprise. It was a false optimism perhaps. He knew that Paul didn't feel it when he was linked up and helping. But Wili had gradually realized that Paul used the system without becoming part of it. To Paul it was like another programming tool, not like a part of his own mind. It was sad that someone so smart should miss this.

This real dream of power continued for several hours. As the cells slowly drained, operations were necessarily curtailed. The slow retreat from omniscience matched his own increasing drowsiness. Last thing before losing consciousness and power, he ferreted through Peacer archives and discovered the secret of Della Lu's family. Now that their cover was blown, they had moved to the Enclave, but Wili found two other spy families among the "furbishers," and warned the conspirators to avoid them.

Heat, sweat, dust on his face. Something was clanking and screaming in the distance. Wili lurched out of his daydreaming recollection of the previous evening. Beside him Rosas leaned close to the peephole. A splotch of light danced across his face as he tried to follow what was outside in spite of the swaying progress of the banana wagon.

"God. Look at all those Peacers," he said quietly. "We must be right at the Pass, Wili."

"Lemme see," the boy said groggily. The wagons were still ascending the same gentle grade that they had been for the last hour. Ahead he could see the wagon that contained Jill. What was

new was the cause of all the clanking. Peacer armor. The vehicles were yet on the horizon, coming off an interchange ahead. They were turning north toward the garrison at Mission Pass. "Must be the reinforcements from Medford." Wili had never seen so many vehicles with his own eyes. The line stretched from the interchange for as far as they could see. They were painted in dark green colors—quite an uncamouflage in this landscape. Many of them looked like tanks he had seen in old movies. Others were more like bricks on treads.

As they approached the interchange the clanking got louder and combined with the overtones of turbines. Soon the banana wagons caught up with the military. Civilian traffic was forced over to the rightmost lane. Powered freighters and horse-drawn wagons alike were slowed to the same crawl.

It was late afternoon. There was something big and loud behind them that cast a long shadow across the two banana wagons, and brought a small amount of coolness. But the tanks to the right raised a duststorm that more than made up for the lowered temperatures.

They drove like this for more than an hour. Where were the check points? The road ahead still rose. They passed dozens of parked tanks, their crews working at mysterious tasks. Someone was fueling up. The smell of diesel oil came into the cramped hole along with the dust and the noise.

All was in shadow now. But finally Wili thought he could see part of the garrison. At least there was a building on the crest they were approaching. He remembered what things looked like from above. Most of the garrison's buildings were on the far side of the crest. Only a few positions—for observation and direct fire—were on this side.

Wili wondered what sort of armor they had back there now, considering what he was seeing on this side.

Wili and Miguel traded time at the peephole as the spot on the horizon grew larger. The outpost sat like a huge boulder mostly submerged in the earth. There were slots cut in the armor, and he could see guns or lasers within. Wili was reminded of some of the twentieth century fantasies Bill Morales liked to watch. These last few days—and hopefully the next few as well—were like Lucas' *Lord of the Rings*. Miguel Rosas had even called Mission Pass the "front door" last night. Beyond these mountains (actually low hills) lay the "Great Enemy's" ultimate redoubt. The mountains hid enemy underlings that watched for the hobbits or elves (or Tinkers) who must sneak through to the plains beyond, who must go right into the heart of evil and perform some simple act that would bring victory.

The similarity went further. This enemy had a supreme weapon (the big bobbler hidden in the Valley), but instead depended on earthly servants (the tanks and the troops) to do the dirty work. The Peacers hadn't bobbled anything the last three days. That was a mystery, though Wili and Paul suspected the Authority was building up power reserves for the battle they saw coming.

Ahead of them, civilian traffic stopped at a check point. Wili couldn't see exactly what was happening, but one by one—some slowly, some quickly—the

wagons and freighters passed through. Finally their turn came. He heard Paul climb down from the driver's seat. A couple Peacers approached. Both were armed, but they didn't seem especially tense. Twilight was deep now, and he could barely make out the color of their uniforms. The sky came down to the near horizon that was the crest of the Pass. The Earth's shadow, projected into the sky, made a dark wall beyond them. One carried a long metal pole. Some kind of weapon?

Paul hurried up from the back wagon. For a moment all three stood in his field of view. The troopers glanced at Paul and then up at where Allison was sitting. They obviously realized the two wagons were together. "Watcha got here, Uncle?" asked the older of them.

"Bananas," Naismith replied unnecessarily. "You want some? My granddaughter and I've got to get them to Livermore before they spoil."

"I have bad news for you then. Nothing's getting through here for a while." The three walked out of sight, back along the wagon.

"What?" Paul's voice rose, cracked. He was a better actor than Wili would have guessed. "B-but what's going on here? I'll lose business."

The younger soldier sounded sincerely apologetic. "We can't help it, sir. If you had followed the news, you'd know the enemies of Peace are on the move again. We're expecting an attack almost any time. Those damn Tinkers are going to bring back the bad old days."

"Oh, no!" The anguish in the old man's voice seemed a compound of his personal problems and this new forecast of doom.

There was the sound of side curtains being dragged off the wagon. "Hey Sarge, these things aren't even ripe."

"That's right," said Naismith. "I have to time things so when I arrive they'll be just ready to sell. . . . Here. Take a couple, officer."

"Um, thanks." Wili could imagine the Peacer holding a clump of bananas, trying to figure what to do with them. "Okay, Hanson, do your stuff." There was a rasping and a probing. So *that's* what the metal pole was. Both Wili and Miguel Rosas held their breath. Their hiding space was small, and it was covered with thick padding. It could probably deceive a sonic probe. What about this more primitive search?

"It's clean."

"Okay. Let's look at your other wagon."

They walked to the forward wagon, the one that contained the bobbler and most of the storage cells. Their conversation faded into the general din of the checkpoint. Allison climbed down from her driver's seat and stood where Wili could see her.

Minutes passed. The band of shadow across the eastern sky climbed, became diffuse. Twilight moved toward night.

Electric lamps flashed on. Wili gasped. He had seen miraculous electronics these last months, but the sudden sheer power of those floodlights was as impressive as any of it. Every second they must eat as much electricity as Naismith's house used in a week.

Then he heard Paul's voice again. The old man had taken on a whining tone, and the trooper was a bit more curt than before. "Look Mister, *I* didn't de-

cide to bring war here. You should count yourself lucky that you have any sort of protection from these monsters. Maybe things will blow over in time for you to save the load. For now, you're stuck. There's a parking area up ahead, near the crest. We have some latrines fixed there. You and your granddaughter can stay overnight, then decide if you want to stick it out or turn back. . . . Maybe you could sell part of the load in Fremont."

Paul sounded defeated, almost dazed. "Yes, sir. Thanks for your help. Do as he says, Allison dear."

The wagons creaked forward, blue-white light splashing all around them like magic rain. From across the tiny hiding place, Wili heard the whisper of a chuckle.

"Paul is really *good*. Now I wonder if all his whining last night was some sort of reverse whammy to get *our* spirits up."

Horse-drawn wagons and Authority freighters alike had parked in the big lot near the crest of the Pass. There were some electric lamps, but compared to the checkpoint it was almost dark. A good many people were stuck here overnight. Most of them milled around cooking fires at the middle of the lot. The far end was dominated by the squat dome they had seen from far down the highway. Several armored vehicles were parked in front of it; they faced into the civilians.

The armored traffic on the highway had virtually ceased. For the first time in hours there was an absence of tread and turbine noise.

Paul came back around the side of the wagon. He and Allison adjusted the side

curtains. Paul complained loudly to Allison about the disaster that had befallen them, and she was dutifully quiet. A trio of freighter drivers walked by. As they passed out of earshot, Naismith said quietly, "Wili, we're going to have to risk a hookup. I've connected you with the gear in the front wagon. Allison has pulled the narrow beam antenna out of the bananas. I want contact with our . . . friends. We're going to need help to get any closer."

Wili grinned in the dark. It was a risk—but one he'd been aching to take. Sitting in this hole without processors was like being deaf, dumb, and blind.

He attached the scalp connector and powered up.

There was a moment of disorientation as Jill and he meshed with the satellite net. Then he was looking out a dozen new eyes, listening on hundreds of Peacer comm channels. It would take him a little longer to contact the Tinkers. After all, they were mere humans.

A bit of his awareness stil hung in their dark hiding place. With his true ears, Wili heard a car roar off the highway and park at the Peacer dome. The armor at the far end of the lot came to life. Something important was happening right here. Wili found a camera aboard the armor that could transmit to the satellite net. He looked out: the car's driver had jumped out and come to attention. Far across the lot, he could see civilians—somewhere among them Paul and Allison—turn to watch. He felt Miguel crawl across him to look out the peephole. Wili juggled the viewpoints, at the same time continuing his effots to reach the tinkers, at the the same time searching Authority RAM for the cause of the current commotion.

A door opened at the base of the big Peacer station. White light spread from it across the asphalt. A Peacer was outlined in the doorway. A second followed him. And between them . . . a child? Someone small and slender, anyway. The figure stepped out of the larger shadows and looked across the parking lot. Light glinted off the black helmet of short cut hair. He heard Miguel suck in a breath.

It was Della Lu.

34

Staff seemed satisfied with the preparations; even Avery accepted the plans.

Della Lu was not so happy. She looked speculatively at the stars on the shoulder of the perimeter commander. The officer looked back with barely concealed truculence. He thought he was tough. He thought she was more nonprofessional interference.

But she knew he was soft. All these troops were. They hadn't ever been in a real fight.

Lu considered the map he had displayed for her. As she (through Avery) had required, the armored units were being dispersed into the hills. Except for a few necessary and transient concentrations, the Tinkers would have to take them out a vehicle at a time. And satellite intelligence assured them that the enemy attack was many hours away, that the infiltrators weren't anywhere near the net of armor.

She pointed to the Mission Pass command center. "I see you stopped all incoming traffic. Why have them park so close to your command point here? A

few of those people must be Tinker agents."

The general shrugged. "We inspected the vehicles four thousand meters down the road. That's beyond the range the intelligence people give for the enemy's homemade bobbler. Where we have them now, we can keep them under close watch and interrogate them more conveniently."

Della didn't like it. If even a single generator slipped through, this command post would be lost. Still, with the main attack at least twenty-four hours away, it might be safe to sit here a bit longer. There was time perhaps to go Tinker hunting in that parking area. Anybody they caught would probably be important to the enemy cause. She stepped back from the map display. "Very well, General, let's take a look at these civilians. Get your intelligence teams together. It's going to be a long night for them.

"In the meantime, I want you to move your command and control elements over the ridgeline. When things start happening, they'll be much safer in mobiles."

The officer looked at her for a moment, probably wondering just who she was sleeping with to give such orders. Finally he turned and spoke to a subordinate.

He glanced back at Della. "You want to be present at the interrogations?"

She nodded. "The first few, anyway. I'll pick them for you."

The parking lot detention area was several hundred meters on a side. It looked almost like a fairground. Diesel freighters loomed over small horse-

drawn carts and wagons. The truckers had already started fires. Some of their voices were almost cheerful. The delay by itself didn't worry them; their businesses were internal to the Authority and they stood to be reimbursed.

Lu walked past the staff car the general had ordered for them. The officer and his aides tagged along, uncertain what she would do next. She wasn't sure yet either, but once she got the feel of the crowd. . . .

If she were Miguel Rosas, she'd figure out some way to hijack one of the Peace Authority freighters. There was enough volume in a freighter to hide almost anything the Tinkers might make. Hmm. But the drivers generally knew each other and could probably recognize each others' rigs. The Tinkers would have to park their freighter away from the others, and avoid socializing. She and her entourage drifted through the shadows beyond the fires.

The freighters were clumped together; none was parked apart. That left the nonPeacer civilians. She turned away from the freighters and walked down a row of wagons. The people were ordinary enough: more than half in their fifties and sixties, the rest young apprentices. They did look uneasy—they stood to lose a lot of money if they had to stay here long—but there was little fear. They still believed the Authority's propaganda. And most of them were food shippers. None of their own people had been bobbled in the purges she had supervised the last few weeks. From somewhere over the hill she heard choppers. The intelligence crews would be here shortly.

Then she saw the banana wagons. They could only be from the Vandenberg area. No matter what intelligence was saying nowadays, she still thought Middle California was the center of the infestation. An old man and a woman about her own age stood near the wagons. She felt tiny alarm bells going off.

Behind Della, the helicopters were landing. Dust blew cool and glowing around her. The choppers' lights cast her group's shadow toward the pair by the banana wagons. The old man raised his hand to shade his eyes; the woman just looked at them. There was something strange about her, a straightness in her posture, almost a soldier's bearing. For all that the other was tall and caucasian, Della felt she was seeing someone very like herself.

Della clapped the general's arm, and when he turned to her she shouted over the sounds of blades and turbines, "There are your prime suspects—"

"The bitch! Is she some kind of mind reader?" Miguel watched Lu's progress across the wide field. She wasn't coming directly toward them, but edged slowly closer, like some cautious huntress. Miguel cursed quietly. They seemed doomed at every step to face her and be bested by her.

The field grew bright; shadows shifted and lengthened. Choppers. Three of them. Each craft carried twin lamps hung below the cockpit. Lu's wolves, eyes glowing, settled down behind their mistress.

"Miguel. Listen." Wili's voice was tense, but the words were slurred, the cadence irregular. He must be in deep connection. He sounded like one talking from a dream. "I'm running at full

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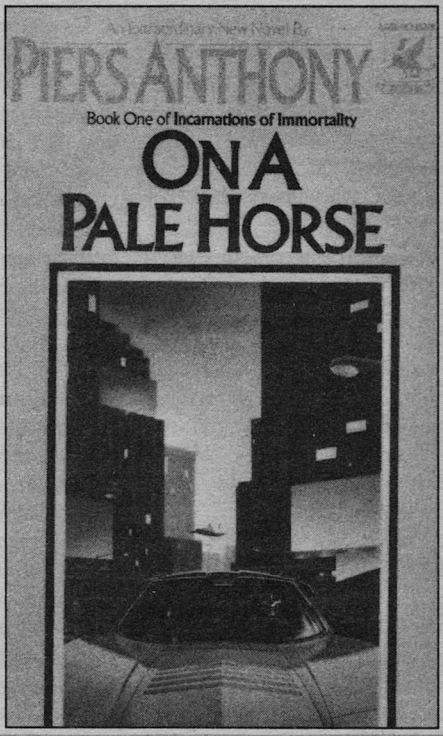

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power; we'll be out of power in seconds—but that is all we have."

Miguel looked out at the helicopters; Wili was right about that. "But what can we *do?*" he said.

"Our friends . . . going to distract her . . . no time to explain everything. Just do what I say."

Miguel stared into the darkness. He could imagine the dazed look in Wili's eyes, the slack features. He had seen it often enough the last few evenings. The boy was managing their own problems and coordinating the rest of the revolution, all at the same time. Rosas had played symbiotic games, but this was beyond his imagination. There was only one thing he could say. "Sure."

"You're going to take those two armored equipment carriers at . . . far side of the field. Do you see them?"

Miguel had, earlier. They were two hundred meters off. There were guards posted next to them.

"When?"

"A minute. Kick loose the side of the wagon . . . now. When I say go . . . you jump, grab Allison and run for them. Ignore everything else you see and hear. Everything."

Miguel hesitated. He could guess what Wili intended, but—

"Move. Move. *Move!*" Wili's voice was abruptly urgent, angry—the dreamer frustrated. It was as unnerving as a scream. Miguel turned and crashed his heels into the specially weakened wall. It had been intended as an emergency escape route. As the tacked nails gave way, Miguel reflected that this was certainly an emergency—but they would be getting out in full view of Peacer guns.

Lu's general heard her order and turned to shout to his men. He was below his usual element here, directing operations firsthand. Della had to remind him, "Don't point. Have your people pick up others at the same time. We don't want to spook those two."

He nodded.

The rotors were winding down. Something like quiet should return to the field now, she thought . . .

. . . and was wrong. "Sir!" It was a driver in the field car. "We're losing armor to enemy action."

Lu whipped around the brass before they could do more than swear. She hopped into the car and looked at the display that glowed in front of the soldier. Her fingers danced over the command board as she brought up views and interpretation. The man stared at her for a horrified instant, then realized that she must be somebody very special.

Satellite photos showed eight silvery balls embedded in the hills north of them, eight silvery balls gleaming in starlight. Now there were nine. Patrols in the hills reported the same thing. One transmission ended in midsentence. Ten bobbles. The infiltration was twenty-four hours ahead of the schedule Avery's precious satellites and intelligence computers had predicted. The Tinkers must have dozens of manpack generators out there. If they were like the one Wili Wachendon had carried, they were very short range. The enemy must be sneaking right up on their targets.

Della looked across the detention area at the banana wagons. Remarkably timed, this attack.

She slipped out of the car and walked back to the general and his staff. *Cool.*

Cool. They may hold off as long as we don't move on the wagons.

"Looks bad, General. They're way ahead of our estimates. Some of them are already operating north of us." That much was true.

"My God. I've got to get back to Command, lady. These interrogations will have to wait."

Lu smiled crookedly. The other still didn't get the point. "You do that. Might as well leave these people alone anyway." But the other was already walking away from her. He waved acknowledgment, and got into the field car.

To the north she heard tac air, scrambled up from the Livermore Valley. Something flashed white and far hills stood in momentary silhouette. That was one bobbler that wouldn't get them this night.

Della looked over the civilian encampment as though pondering what to do next. She was careful to give no special attention to the banana wagons. Apparently, they thought their diversion successful—at least she remained unbobbled.

She walked back to her personal chopper, which had come in with the interrogation teams. Lu's aircraft was smaller, only big enough for pilot, commander, and gunner. It bristled with sensor equipment and rocket pods. The tail boom might be painted with LA paisley, but these were her own people on this machine, veterans of the Mongolian campaign. She pulled herself onto the command seat and gave the pilot an emphatic up-and-away sign. They were off the ground immediately.

Della ignored this efficiency; she was already trying to get her priority call through to Avery. The little monochrome display in front of her pulsed red as her call stayed in the queue. She could imagine the madhouse Livermore Central had become the last few minutes. *But damn you Avery, this is not the time to forget I come first!*

Red. Red. Red. The call pattern disappeared, and the display was filled with a pale blob that might have been someone's face. "Make it quick." It was Hamilton Avery's voice. Other voices, some almost shouting, came from behind him.

She was ready. "No proof, but I know they've infiltrated right up to the Mission Pass Gate. I want you to lay a thousand meter bobble just south of the CP—"

"No! We're still charging. If we start using it now, there won't be juice for rapid fire when we really need it, when they get over the ridgeline."

"Don't you see? The rest is diversion. Whatever I've found here must be *important*."

But the link was broken; the screen glowed a faint, uniform red. Damn Avery and his caution! He was so afraid of Paul Hoehler, so certain the other would figure out a way to get into Livermore Valley, that he was actually making it possible for the enemy to do so.

She looked past the instrument displays. They were about four hundred meters up. Splashes of blue-white light from the pole lamps lit the detention area; the camp looked like some perfect model. There was little apparent motion, though the pilot's thermal scanner showed that some of the armor was

alive, awaiting orders. The civilian camp was still and bluish-white, little tents sitting by scarcely larger wagons. The darker clumps around the fires were crowds of people.

Della swallowed. If Avery wouldn't bobble the camp. . . .

She knew without looking what her ship carried. She had stun bombs, but if those wagons were what she thought, they would be shielded. She touched her throat mike and spoke to her gunner. "Fire mission. Rockets on the civilian wagons. No napalm." The people around the campfires would survive. Most of them.

The gunner's "roger" sounded in her ear. The air around the chopper glowed as if a small sun had suddenly risen behind them, and a roar blotted out the rotor thupping. Looking almost into the exhaust of the rocket stream dimmed all other lights to nothing.

Or almost nothing. For an instant, she glimpsed rockets coming *up* from below. . . .

Then their barrage exploded. In the air. Not halfway to the target. The fireballs seemed to *splash* across some unseen surface. The chopper staggered as shrapnel ripped through it. Someone screamed.

The aircraft tipped into an increasing bank that would soon turn them upside down. Della didn't think, didn't really notice the pilot slumped against his controls. She grabbed her copy of the stick, pulled, and jabbed at the throttle. *Ahead she saw another copter, on a collision path with theirs.* Then the pilot fell back, the stick came free and her aircraft shot upwards, escaping both ground and the mysterious other.

The gunner crawled up between them and looked at the pilot. "He's dead, ma'am."

Della listened, and also listened to the rotors. There was something ragged in their rhythm. She had heard worse. "Okay. Tie him down." Then she ignored them, and flew the helicopter slowly around what had been the Mission Pass Gate.

The phantom missiles from below, the mysterious helicopter—all were explained now. Near the instant her gunner fired his rockets, someone had bobbled the Pass. She circled that great dark sphere, a perfect reflection of her lights following her. The bobble was a thousand meters across. But this hadn't been Avery relenting: Along with the civilian and freighter encampment, the bobble also contained the Gate's command post. Far below, Authority armor moved around the base, like ants suddenly cut off from the nest.

So. Perfect timing, once again. They had known she was going to attack, and known precisely when. Tinker communication and intelligence must be the equal of the Peace's. And whoever was down there had been important. The generator they carried must have been one of the most powerful the Tinkers had. When they had seen the alternative was death, they had opted out of the whole war.

She looked across at her chopper's reflection, seemingly a hundred meters off. The fact that they had bobbled themselves instead of her aircraft was evidence that the Hoehler technique—at least with small power sources—was not very good for moving targets. Something to remember.

At least now, instead of a hundred new deaths on her soul, the enemy had burdened her with just one, her pilot. And when this bobble burst—the minimum ten years from now or fifty—the war would be history. A flick of the eye to them, and there would be no more killing. She suddenly envied these losers very much.

She banked away and headed for Livermore Central.

35

"Now!" Wili's command came abruptly, just seconds after Rosas had loosened the false wall. Miguel crashed his heels one last time into the wood.

It gave way, bananas and timber falling with it.

And suddenly there was light all around them. Not the blue point lights the Authority had strung around the campground, but an all-enveloping white glare, brighter than any of the electrics.

"Run now. Run!" Wili's voice was faint from within the compartment. The undersheriff grabbed Allison and urged her across the field. Paul started to follow them, then turned back at Wili's call.

An Authority tank swiveled on its treads, its turret turning even faster. Behind him an unfamiliar voice shouted for him to stop. Miguel and Allison only ran faster. And the tank disappeared in a ten-meter-wide silver sphere.

They ran past civilians cowering in the nebulous glare, past troopers and Authority equipment that one after another were bobbled before they could come into action.

Two hundred meters is a long way to sprint. It is more than long enough to think, and understand.

The glare all around them was only bright by comparison with night. This was simply morning light, masked and diffused by fog. Wili had bobbled the campground through to the next morning, or the morning after that—to some later time when the mass of the Authority's forces would have moved away from the Gate they now thought blocked. Now he was mopping up the Peacers that had been in the bobble. If they moved fast, they could be gone before the Peace discovered what had happened.

When Miguel and Allison reached the armored carriers, they were unguarded—except for a pair of three-meter bobbles that gleamed on either side of them. Wili must have chosen these just because their crews were standing outside.

Miguel clambered up over the treads, and paused, panting. He turned and pulled Allison onto the vehicle. "Wili wants us to drive these to the wagons." He threw the open hatch and shrugged helplessly. "Can you do it?"

"Sure." She caught the edge of the hatch and swung down into the darkness. "C'mon."

Miguel followed awkwardly, feeling a little stupid at his question. Allison was from the age of such machines, when everyone knew how to drive.

The smell of lubricants and diesel oil was faint perfume in the air. There was seating for three. Allison was already in the forward position, her hands moving tentatively over the controls. There were no windows and no displays —unless the pale-painted walls were screens. Wait. The third crew position faced to the rear, into formidable racks of electronic equipment. There were displays there.

"See here," said Allison. He turned and looked over her shoulder. She turned a handle, firing up the crawler's turbine. The whine ascended the scale, till Miguel felt it through the metal walls and floor as much as through his ears.

Allison pointed. There *was* a display system on the panel in front of her. The letters and digits were bar-formed, but legible. "That's fuel. It's not full. Should be able to go at least fifty kilometers, though. These others, engine temperature, engine speed—as long as

you have auto-driver set you'd best ignore them.

"Hold tight." She grabbed the driving sticks and demonstrated how to control the tracks. The vehicle slewed back and forth and around.

"How can you see out?"

Allison laughed. "A nineteenth century solution. Bend down a little further." She tapped the hull above her head. Now he saw the shallow depression that ringed the driver's head, just above the level of her temples. "Three hundred and sixty degrees of periscopes. The position can be adjusted to suit." She demonstrated.

"Okay. You say Wili wants both the crawlers over to the banana wagons? I'll bring the other one." She slipped out of the driver's seat and disappeared through the hatch.

Miguel stared at the controls. She had not turned off the engine. All he had to do was sit down and *drive*. He slid into the seat and stuck his head through the ring of periscope viewers. It was almost as if he had stood up through the hatch; he really could see all around.

Straight ahead, Naismith stood by the wagons. The old man was tearing at the side panels, sending his "precious bananas" cascading across the ground. To the left a puff of vapor came from the other armored carrier, and Miguel heard Allison light its engine.

He looked past the lower edge of the periscope ring at the drive sticks. He touched the left tread control, and the carrier jerked incrementally till it was lined up on the wagons. Then he pressed both sticks, and he was moving forward! Miguel accelerated to what must have been six or seven meters per second, as fast as a man could run. It was just like in the games. The trip was over in seconds. He cautiously slowed the carrier to a crawl the last few meters, and turned in the direction Paul motioned. Then he was stopped. The turbine's keening went on.

Allison had already opened the rear of the other vehicle and was sliding the bulky electronics gear out onto the dirt. Miguel wondered at the mass of equipment the Peacers seemed to need in these vehicles. All of Sy Wentz's police electronics would fit in one of the carriers with room to spare. "Leave the comm and sense equipment aboard, Allison. Wili may be able to interface it." While Allison concentrated on the equipment she knew, Miguel and Paul worked to move Wili's processor and the Tinker communications gear out of the banana wagons.

The boy came out of the gutted wa-

gon. He was off the system now, but still seemed dazed, his efforts to help ineffectual. "I have used almost all, Paul. I can't even talk to the net anymore. If we can't use the generators on these," he waved at the carriers, "we are dead."

That was the big question. Without foreplanning there wasn't a chance, but Paul had brought power interfaces and connector cables. They were based on Allison's specs. If, as with many things, the Peacers had not changed the old standards, then they had a chance.

They could almost fool themselves that the morning was quiet and still. Even the insects were silent. The air around them got steadily brighter, yet the morning fog was still so thick that the sun's disk was not visible. Far away, much farther than the ridgeline, they heard aircraft. Once or twice a minute there was a muffled explosion. Wili had started the Tinker forces on their invasion of the Livermore Valley, but from the north edge, where he had told them to mass through the night. Hopefully the diversion would be of some help.

From the corner of his eye, Miguel had the constant impression of motion half-seen, of figures all across the campground working at projects similar to their own. He glanced across the field and saw the reason for the illusion: Wili had cast dozens of bobbles of varying sizes, all in a few seconds time after the big, overnight bobble had burst. Some must hold just one or two men. Others, like the ones he had put around the main civilian campsite and the Peacer outpost, were more than fifty meters across. And in every one of them he could see the reflections of the four of them, working frantically to finish the transfer before the Peacers down in the Valley realized that the one big bobble had already burst.

It seemed longer, but the work took only minutes. Leaving most of the power cells behind, they didn't have more than fifty kilos of hardware. The processor and the larger bobble generator went into one carrier, while their own satellite comm equipment and a smaller bobbler went into the other. It was an incongruous sight, the Tinker gear sitting small and innocent in green-painted equipment racks. Allison stood up in the now spacious carrier and looked at Paul. "Are you satisfied?"

He nodded.

"Then it's smoke test time." There was no humor in her voice. She turned a switch. Nothing smoked; displays flickered to life. Wili gave a whoop. The rest of the interfacing was software. It would take unaided programmers weeks. Hopefully, Paul and Wili could do it while they were on the move.

Allison, Paul and Wili took one carrier. Miguel—under protest—took the other. There was plenty of room for everyone and all the equipment in just one of the vehicles. "They expect to see rovers in pairs, Miguel. I know it."

"Yes," said Allison. "Just follow my lead, Miguel; I won't do anything fancy."

The two vehicles moved slowly out of the parking area, cautiously negotiating the field of mirrored tombstones. The whine of their engines drowned the sound of aircraft and occasional explosions that came from far beyond the ridgeline. As they neared the crest, the fog thinned and morning blue was vis-

ible. They were far enough from the parking area that—even without their electronics working—they might be mistaken for Peacers.

Then they were starting downwards, past the last of the outer defenses. Soon they would know about the inner ones, and know if Allison's news, now fifty years old, was still the key to the destruction of the Peace.

36

Della Lu caught up on the situation reports as she ate breakfast. She wore a fresh jumpsuit, and her straight hair gleamed clean and black in the bright fluorescent lights of the command center. One might think she had just returned from a two week vacation—not from a night spent running all over the hills, trying to pin down guerrilla positions.

The effect was calculated. The morning watch had just come on. They were for the most part rested, and had none of the harried impatience of the team that had been down here all night. If she were going to exercise command—or even influence—upon them, she must appear cool, analytical. And inside, Della almost was. She had taken time to clean up, time even for a short nap. Physically, things had been much worse in Mongolia. Mentally? Mentally, she was beginning, for the first time in her life, to feel outclassed.

Della looked across the ranked consoles. This was the heart of the Livermore command, which itself was the heart of operations worldwide. Before this morning she had never been in this room. In fact, she and most of the occupants didn't know quite where it was. One thing was sure: it was far underground, proof against nukes and gas and such old-fashioned things. Almost equally sure: it was within a few dozen meters of the Livermore bobble generator and its fusion power source. On some of the displays she could see command language for directing and triggering that generator. There was no point in having such control any more or less secure than the generator itself. They would both be in the deepest, most secret hole available.

A situation board covered most of the front wall. Right now it showed a composite interpretation of the land around Livermore, based on satellite reconnaissance. Apparently, the driving programs were not designed for other inputs. Reports from the men on the ground were entered on the display by computer clerks working at terminals connected to the command data base. So far this morning, the board did not show any conflicts between the two sources of information. Enemy contact had been about zip for the last hour.

The situation was different elsewhere in the world: There had been no Authority presence in Europe or Africa for days. In Asia, events much like those in North America had taken place. Old Khim Tioulong was nearly as clever as Hamilton Avery, and he had some of the same blind spots. His bobble generator was just north of Beijing. The smaller displays showed the status of the conflict around it. The Chinese Tinkers hadn't built as many bobblers as their American cousins, and they hadn't penetrated as close to the heart of the Beijing complex. But it was late

night there, and an attack was under way. The enemy had surprised K.T. just as it had the Livermore forces. The two bobble generators that were the backbone of Peacer power were both under attack, a simultaneous attack that seemed purposefully coordinated. The Tinkers had communications at least as good as the Authority's. At least.

According to the main display, sunrise was due in fifteen minutes and a heavy fog covered most of the Valley. There were several possible enemy locations, but for now the Peace was holding off. The Tinker bobblers were extremely effective at close range; during the night, the Authority had lost more than twenty percent of its tank force. Better to wait till they had more information on the enemy. Better to wait till Avery let them use the big bobbler. Then they could take them on by the dozens, and at any range.

Lu finished breakfast, sat sipping coffee. Her eyes wandered about the room, half-consciously memorizing faces, displays, exits. The people in this brightly-lit, quiet, air-conditioned bunker were living in a fantasy world. And none of them knew it. This was the end receptacle for megabytes of intelligence streaming in to the Peace from all over the world. Before that data arrived, it was already interpreted and winnowed by remote processors. Here it was finally integrated and put on the displays for the highest commanders to pass upon. These people thought their cute displays gave them some ultimate grip on reality. Lu knew that had never been true—and after last night she was sure the system was riddled with lies.

A door hissed open and Hamilton Avery entered the command bunker. Behind him came Peace General Bertram Maitland, the chief military seat-warmer in the American Directorate. A typical button-pusher. Somehow she had to get past him and convince Avery to junk remote sensing and fight this one with people.

Maitland and Avery strode to an upper rank of terminals. Avery glanced down at Lu and motioned her to join them.

When she arrived, the general was already busy at a terminal, a large screen model in a flashy red cabinet. He didn't look up. "Intelligence predicts they'll resume the attack shortly after sunrise. You can see indications of thermal activity on the situation board already. It's barely detectable, since they don't have powered vehicles. This time, though, we'll be ready for them." He punched a final command into the terminal, and a faint buzzing penetrated the walls of the bunker. Maitland gestured to the situation board. "There. We just put every one of the suspected enemy concentrations into stasis."

Avery smiled his controlled smile. Every day he seemed a little paler, a little more drawn. He dressed as nattily as always and spoke as coolly as always, but she could see that he was coming near the end of his strength. "That's good. Excellent. I knew if we waited for a full charge we could make up our losses. How many can we do?"

General Mailand considered. "It depends on the size you want. But we can make several thousand at least, with generation rates as high as one per second. I have it under program control now: satellite recon and even our field

commanders can report an enemy location and automatically get an embobblement." The almost subsonic buzz punctuated his words.

"No!" The two old men looked up at her, more surprised than angry. "No." Della repeated more quietly. "It's bad enough to trust these remote sensors for information. If they actually control our bobbling, we could very well use all our reserves and get nothing." *Or worse, bobble our own people.* That thought had not occurred to her before.

Maitland's expression clouded. His antagonist was young, female, and had been promoted with unseemly speed past his favorites. If it weren't for Hamilton Avery, she would be out there on some battalion staff—and that only as reward for her apparent success in Asia. Lu turned her attention to Avery. "Please, Director. I know it's fantastic to suspect enemy interference in our satellite communications. But you yourself have said that nothing is beyond this Hoehler, and that whatever is the most fantastic is what he is most likely to do."

She had pushed the right button. Avery flinched, and his eyes turned to the situation board. Apparently the enemy attack predicted by Maitland had begun. Tiny red dots representing Tinker guerillas were moving into the Valley. Already the Authority bobbler had acted several more times under automatic control. *And what if this is fraudulent, or even partly so?* There might be Tinkers in the Valley, moving through the deep ravines that netted the landscape, moving closer and closer. Now that the possibility was tied to Paul Hoehler, she could see that it had become almost a certainty in his mind.

"And you were the person who predicted he would attack us here," Avery said almost to himself, and then turned to the officer. "General Maitland, abort the programmed response. I want a team of your people monitoring our ground forces—*no satellite relays.* They will determine when and what to embobble."

Maitland slapped the table. "Sir! That will slow response time to the point where some of them may get onto the inner grounds."

For an instant, Avery's face went slack, as if the conflicting threats had finally driven him over the edge. But when he responded, his voice was even, determined. "So? They still have no idea where our generator is. And we have enough conventional force to destroy such infiltrators ten times over. My order stands."

The officer glared at him for a moment. But Maitland had always been a person who followed orders. Avery would have replaced him decades since if that were not the case. He turned back to the terminal, canceled the program, and then talked through it to his analysts at the front of the room, relaying Avery's directive. The intermittent buzzing from beyond the walls ceased.

The Director motioned Lu to follow him. "Anything else?" he asked quietly, when they were out of Maitland's earshot.

Della didn't hesitate. "Yes. Ignore all automated remote intelligence. In the Livermore area, use line of sight communications—no relays. We have plenty of people on the ground, and plenty of

aircraft. We'll lose some equipment doing it, but we can set up a physical reconnaissance that will catch almost anyone moving around out there. For places farther away, Asia especially, we're stuck with the satellites, but at least we should use them for voice and video communication only—no processed data." She barely stopped for breath.

"Okay, I'll do as you recommend. I want you to stay up here, but don't give orders to Maitland."

It took nearly twenty minutes, but in the end Maitland and his analysts had a jury-rigged system of aircraft sweeps that produced something like complete coverage of the Valley every thirty minutes. Unfortunately, most of the aircraft were not equipped with sophisticated sensors. In some cases, the reports were off eyeballs only. Without infrared and side-looking radar, almost anything could remain hidden in the deeper ravines. It made Maitland and his people very unhappy. In the '20s they had let the old ground-based system slide into oblivion. Instead, enormous resources had been put into the satellite system, one they thought gave them even finer protection, but worldwide. Now that system was being ignored; they might as well be refighting World War II.

Maitland pointed to the status board, which his men were painfully updating with the verbal reports that were coming in. "See? The people on the ground have missed almost all the concentrations we identified from orbit. The enemy is well camouflaged. Without good sensors, we're just not going to see him."

"They have spotted several small teams though."

Maitland shrugged. "Yes, sir. I take it we have permission to bobble them?"

There was a glint in Avery's eyes as he responded to the nearly insolent question. However Lu's theories turned out, Maitland's days with this job were numbered. "Immediately."

A small voice sounded from the general's terminal. "Sir, I'm having some trouble with the update of the Mission Pass area. Uh, two A511s have overflown the Pass. . . . They both say the bobble there is gone."

Their eyes snapped up to the situation board. The map was constructed with photographic precision. The Mission Pass bobble, the Tinker bobble that had nearly killed her the night before, glinted silver and serene on that board. The satellite system still saw it—or reported seeing it.

Gone. Avery went even paler. Maitland sucked his breath back between his teeth. Here was direct, incontrovertible evidence. They had been taken, fooled. And now they had only the vaguest idea where the enemy might really be and what he might do. "My God. She was right! She was right all along."

Della was not listening. There was no triumph in her. She had been fooled, too. She had believed the techs' smug assurance that ten years was the theoretical minimum for the duration of a bobble. How could she have missed this? *Last night I had them, I'll bet. I had Hoehler and Wili and Miguel and everyone who counts. . . . And I let them escape through time to today*. Her mind raced frantically through the implications. If twenty-four-hour bobbles could be cast, then what about sixty-

second bobbles—or one-second ones? What advantage could the other side gain from such? *Why, they could—*

"Ma'am?" Someone touched her elbow. Her attention returned to the brightly lit command room. It was Maitland's aide. The general had spoken to her. Della's eyes focused on the two old men.

"I'm sorry. What did you say?"

The general's voice was flat, but not hostile. Even surprise was leached from him now. Everything he depended on had failed him. "We just got a call on the satellite network. Max priority and max encryption." That could only be a director—and the only other surviving director was K.T. in China. "Caller demands to talk to you. Says his name is Miguel Rosas."

37

Miguel drove. Fifty meters ahead, almost swallowed up in the fog, he could see the other crawler. Inside it were Paul and Wili and Allison, with Allison driving. It was easy to keep up until Allison trucked off the broad roadway, into the hills. He came down a hillside a little fast, and nearly lost control.

"You okay?" Paul's voice sounded anxiously in his ear. He'd established the laser link just seconds before.

Miguel twitched the controls tentatively. "Yeah. But why come straight down that hill?"

"Sorry, Miguel." It was Allison. "Sideways would have been worse; might have slipped treads."

Then they were moving through open country. The ring of periscopes was not as good as a wraparound holo, but it did give the sensation that his head was in the open. The keening of the engine covered any natural morning sounds. Except for their crawlers, and a crow flickering past in the mist, nothing moved: the grass was sere and golden, the dirt beneath white and gravelly. An occasional dwarf oak loomed out of the fog and forced Allison and then Miguel to detour. He should be able to smell morning dew on the grass, but the only smells were of diesel fuel and paint.

And now the morning fog began to part. Blue filtered through from above. Then the blue became sky. Miguel felt like a swimmer come to the surface of a misty sea, looking across the waters at far hills.

There was the war, and it was more fantastic than any old-time movie:

Silver balls floated by the dozens through the sky. Far away, Peacer jets were dark bugs trailing grimy vapor. They swooped and climbed. Their dives ended in flares of color as they strafed Tinker infiltrators on the far side of the valley. Bombs and napalm burned orange and black through a sea of fog. He saw one diving aircraft replaced by a silvery sphere—which continued the plane's trajectory into the earth. The pilot might wake decades from now—as Allison Parker had done—and wonder what had become of his world. That was a lucky shot. Miguel knew the Tinker bobblers were small, not even as powerful as the one Wili brought to LA. Their range with accuracy was only a hundred meters and the largest bobble they could cast was five or ten meters across. On the other hand, they could be used defensively. The last Miguel

had heard, the Bay Area Tinkers had got the minimum duration down to fifteen seconds; just a little better and "flicker" tactics would be possible.

Here and there, peeping out of the mist, were bobbles set in the ground: Peacer armor bobbled during the night fighting or Tinkers caught by the monster in the valley. The only difference was size.

The nose of the crawler dipped steeply, and Miguel grunted in surprise, his attention back on his driving. He took the little valley much more slowly than the last one. The forward crawler was almost up the other side when he reached the bottom. His carrier moved quickly through a small stream, and then he was almost laid on his back as it climbed the far side. He pushed the throttle far forward. Power screamed through the treads. The crawler came over the lip of the embankment fast, nose high, and fell with a crash.

"The trees ahead. We'll stop there for a couple of miinnutes." It was Wili's voice. Miguel followed the other crawler into an open stand of twisted oaks. Far across the Livermore Valley, two dark gnats peeled off from the general swarm that hovered above the Tinker insurgents and flew toward them. That must be the reason Wili wanted to get under cover. Miguel looked up through the scrawny branches and wondered what sort of protection the trees really gave. Even the most primitive thermal sensor should be able to see them sitting here with hot engines.

The jets roared by a couple thousand meters to the west. Their thunder dwindled to nothing. Miguel looked again across Livermore Valley.

Where the fighting was heaviest, new bobbles shone almost once a second. With the engines idling, Miguel thought he could hear the thunder and thump of more conventional weapons. Two jets dived upon a hidden target and the mists were crisscrossed with their laser fire. The target tried something new: A haze of bobbles—too small to distinguish at this distance—appeared between aircraft and ground. There was a flash of sudden red stars within that haze as the energy beams reflected again and again from the multiple mirrors. It was hard to tell if it made an effective shield. Then he noticed the jets staggering out of their dive. One exploded. The other trailed smoke and flame in a long arc toward the ground. Miguel suddenly wondered what would happen to a jet engine if it sucked in a dozen two-centimeter bobbles.

Wili's voice came again, "Miguel. The Peacers are going to discover that we have been faking their satellite reception."

"When?" asked Wili.

"Any second. They are changing to aircraft reconnaissance."

Miguel looked around him, wishing suddenly that he were on foot. It would be so much easier to hide a human-sized target than a crawler. "So we can't depend on being 'invisible' any more."

"No. *We* can. I am also speaking with Peacer control on the direct line-of-sight." These last words were spoken by a deep, male voice. Miguel started, then realized he was not talking directly to Wili. The fake had a perfect Oregon accent, though the syntax was still Wili's; hopefully that would go unnoticed in the rush of battle. He tried

to imagine the manifold images Wili must be projecting to allies and enemies.

"They think we're Peacer recon. They have fourteen other crawlers moving around their inner area. As long as we follow their directions, we won't be attacked. . . . And they want us to move closer in."

Closer in. If Wili could get just another five thousand meters closer, he could bobble the Peacer generator.

"Okay. Just tell us which way to move."

"I will, Miguel. But there's something else I want you to do first."

"Sure."

"I'm going to give you a satellite connection to Authority High Command. Call them. Insist to speak with Della Lu. Tell her everything you know about our tricks—"

Miguel's hands tightened on the drive sticks. "No!"

"—except that we control these two crawlers."

"But *why?*"

"Do it, Miguel. If you call now, you'll be able to give away our satellite trick before they have proof. Maybe they will think you're still loyal. It will distract them, anyway. Give away anything you want. I'll listen, too. I'll learn more what's passing at their center. Please, Miguel."

Miguel gritted his teeth. "Okay, Wili. Put'em on."

Allison Parker grinned savagely to herself. She hadn't driven a crawler in almost three years—fifty-three if you counted years like the rest of the universe. At the time, she'd thought it a silly waste of taxpayer money to have recon specialists take a tour with a base security outfit. The idea had been that anyone who collected intelligence should be familiar with the groundside problems of security and deception. Becoming a tank driver had been fun, but she never expected to see the inside of one of these things again.

Yet here she was. Allison gunned the engines and the little armored carrier almost flew out of the thicket of scrub oak where they'd been hiding. She recognized these hills, even with the hovering spheres and napalm bursting in the distance. Time didn't change some things. Their path ran parallel to a series of cairn-like concrete structures, the ruins of the power lines that had stretched across the Valley. Why, she and . . . Paul . . . had hiked along precisely this way . . . so long ago.

She tried to shake free of the painful double images. The sun was fast burning off the morning fog. Soon the concealment the Tinkers were using to such advantage would be gone. If they couldn't win by then, they never would.

In her earphone, she heard a strange voice reporting their position to the Peacer command center. It was eerie: she knew the message came ultimately from Wili. But he was sitting right behind her, and had not spoken a word. The last time she looked, he seemed asleep.

The deception was working. They were doing what Peacer control said, but they were also coming closer and closer to the edge of the inner security area.

"Paul. What I saw from orbit is only about six thousand meters north of here. We'll be closest in another couple of

minutes. Is that close enough?''

Paul touched his scalp connector, seemed to think. ''No. We'd have to be motionless for almost an hour to bobble from that range. The best tradeoff is still four thousand meters. I—Wili—has a spot in mind; he's doing prelim computations on the assumption we can reach it. Even so, he'll need about thirty seconds once we get there.''

After a moment Paul added, ''In a couple minutes, we'll break our cover. Wili will stop transmitting and you'll drive like hell straight for their bobbler.''

Allison looked through the periscoped hull. The crawler was so close to the security perimeter, the towers and domes of the Enclave blocked her view to the north. The Enclave was a city, and their final dash would take them well inside its boundaries. ''We'll be sitting ducks.'' Her sentence was punctuated by the swelling roar of a stub-winged jet that swept almost directly over them. She hadn't seen or heard it till that instant. But the aircraft wasn't strafing. It was loafing along at less than one hundred meters per second, a low-level recon.

''We have a good chance,'' Wili's voice came suddenly in her earphone. ''We won't make our run until the patrol planes are in good position. We should be in their blind spot for almost five minutes.''

''And they'll have other things to worry about,'' said Paul. ''I've been talking to the Tinkers coming in on foot. They all know the site of the Peacer generator now. Some of them have gotten pretty close, closer than we. They don't have our equipment—but the Authority can't know that for sure. When Wili gives the signal, they'll come out of hiding and make their own dash inwards.''

The war went far beyond their crawlers, beyond even the Livermore Valley. Paul said a similar battle was being played out in China.

Even so, victory or defeat seemed to depend on what happened to this one crawler in the next few minutes.

38

Della slipped on the earpiece and adjusted the microphone to her throat. She had the undivided attention of Avery, Maitland, and everyone else in earshot. None of them except Hamilton Avery had heard of one Miguel Rosas, but they all knew he had no business on a maximum security channel. ''Miguel?''

A familiar voice came from the earpiece and the speaker on the terminal. ''Hello, Della. I've got some news for you.''

''Just calling on this line is news enough. So your people have cracked our comm and recon system.''

''Right the first time.''

''Where are you calling from?''

''The ridgeline west of you. I don't want to say more—I still don't trust your friends. . . . It's just that I trust mine even less.'' This last was spoken low, almost muttered. ''Look. There are other things you don't know. The Tinkers know exactly where your bobbler is hidden.''

''What?'' Avery turned abruptly to the situation board and motioned for Maitland to check it out.

''How can they know? You have

spies? Carry-in bugs?''

Miguel's forced chuckle echoed from the speaker. ''It's a long story, Della. You would be amused. The old US Air Force had it spotted—just too late to save the world from you. The Tinkers stumbled on the secret only a few weeks ago.''

Della glanced questioningly at the Director, but Avery was looking over Maitland's shoulder, at the terminal. The general's people were frantically typing queries, posting results. The General looked up at the Director. ''It's possible, sir. Most of the infiltrators are north and west of the Enclave. But the ones closest to the inner zone boundary are also the closest to the generator; they seem to have a preference for that sector.''

''It could be an artifact of our increased surveillance in that area.''

''Yes, sir.'' But now Maitland did not sound complacent. Avery nodded to himself. He hadn't believed his own explanation. ''Very well. Concentrate tactical air there. I see you have two armored vehicles already tracking along the boundary. Keep them there. Bring in more. I want what infantry we have moved there, too.''

''Right. Once we locate them, they're no threat. We have all the fire power.''

Della spoke again to Miguel. ''Where is Paul Hoehler—the man you call Naismith?'' Avery stiffened at the question, and his attention returned to her, an almost physical force.

''Look, I really don't know. They have me working a pointer relay; some of our people don't have their own satellite receivers.''

Della cut the connection and said to Avery, ''I think he's lying, Director. Our only lever on Miguel Rosas is his hatred for certain Tinker potentials, in particular bioscience. He'll resist hurting his personal friends.''

''He *knows* Hoehler?'' Avery seemed astounded to find someone so close to the ultimate antagonist. ''If he knows where Hoehler is. . . .'' The Director's eyes unfocused. ''You've got to squeeze that out of him, Della. Take this conversation off the speaker and talk to him. Promise him anything, tell him anything, but find Hoehler.'' With a visible effort he turned back to Maitland. ''Get me Tioulong in Beijing. Direct video. I know, I know. Nothing is secure.'' He smiled, an almost skeletal grimace. ''But I don't care if they know what I tell him.''

Della resumed the link with Miguel. Now that the speaker was off, his voice would sound in her ear only. And with the throat mike, her side of the conversation would be inaudible to those around her. ''This is just you and me now, Miguel. The brass thinks they got everything they can out of you.''

''Oh yeah? And what do you think?''

''I think some large but unknown percentage of what you are telling me is bullshit.''

''I guessed that. But you're still talking.''

''I think we're both betting we can learn more than the other from talking. Besides,'' her eyes fixed on the Renaissance trigger box sitting on the table before Hamilton Avery. With a small part of her attention she followed what Avery was saying to his counterpart in Beijing: ''besides, I don't think you know what you're up against.''

"Enlighten me."

"The Tinker goal is to bobble the Livermore generator. Similarly for the attack on Beijing. You don't realize that if we consider the Peace truly endangered, we will embobble *ourselves*, and continue the struggle decades in the future."

"Hmm. Like the trick we played on you at Mission Pass."

"But on a much larger scale."

"Well, it won't help you. Some of us will wait—and we'll know where to wait. Besides, the Authority's power isn't just in Livermore and Beijing. You need your heavy industry too."

Della smiled to herself. Miguel's phrasing was tacit admission he was still a Tinker. There were deceptions here—deceptions she could penetrate given a little time—but neither of them was pretending loyalties they did not have. Time to give away a little information, information that would do them no good now: "There are a few things you don't know. The Peace has more than two bobble generators."

There was a moment of silence in her ear. "I don't believe you—How many?"

Della laughed quietly. Maitland glanced up at her, then turned back to his terminal. "That is a secret. We've been working on them ever since we suspected Tinker infiltration—spies, we thought. Only a few people know, and we never spoke of it on our comm net. More important than the number is the location; you won't know about them till they come out at you."

There was a longer silence. She had made a point.

"And what other things make the 'Peace' unbeatable?" There was sarcasm and something else in his words. In the middle of the sentence, his voice seemed to catch—as if he had just lifted something. As was usual with a high-crypto channel, there were no background sounds. But the data massaging left enough in the voice to recognize tones and sublinguistical things like this sudden exhalation. The sound, almost a grunt, had not been repeated. If she could just get him to talk a little more.

There was a secret that might do it. Renaissance. Besides, it was something she owed him, perhaps owed all the enemy. "You should know that if you force this on us, we'll not let you grow strong during our absence. The Authority—" for once calling it "the Peace" stuck in her throat, "—has planted nukes in the Valley. And we have such bombs on rockets. If we bobble up . . . if we bobble up, your pretty Tinker culture gets bombed back to the stone age, and we'll build anew when we come out."

Still a longer silence. *Is he talking to someone else? Has he broken the connection?* "Miguel?"

"Della, why are you on their side?"

He'd asked her that once before. She bit her lip. "I—I didn't dream up Renaissance, Miguel. I think we can win without it. The world has had decades now more peaceful than any in human history. When we took over, the race was at the edge of the precipice. You know that. The nation states were bad enough; they would have destroyed civilization if left to themselves. But even worse, their weapons had become so cheap that small groups—some reasonable, some monstrous—would have them. If the world could barely tolerate

a dozen killer nations, how could it survive thousands of psychotics with rad bombs and war plagues?

"I know you understand what I'm saying. You felt that way about bioscience. *There are other things as bad, Miguel.*" She stopped abruptly, wondering who was manipulating whom. And suddenly she realized that Miguel, the enemy, was one of the few people she could ever talk to, one of the few people who could understand the . . . things . . . she had done. And perhaps he was the only person—outside of herself—whose disapproval could move her.

"I understand," came Miguel's voice. "Maybe history will say the Authority gave the human race time to save itself, to come up with new institutions. You've had fifty years; it hasn't been all bad. . . . But no mattter what either of us wants, it's ending now. And this 'Renaissance' will destroy whatever good you've done." His voice caught again.

"Don't worry. We'll win fair and square and there'll be no Renaissance." She was watching the main display. One of the crawlers had turned almost directly inwards, toward the heart of the Enclave. Della cut audio, and got the attention of Maitland's aide. She nodded questioningly at the crawler symbol on the display.

The colonal leaned across from his chair and said quietly, "They saw Tinkers within the perimeter. They're chasing."

The symbol moved in little jerks, updated by the nearly manual control they had been reduced to. Suddenly the crawler symbol disappeared from the board. Avery sucked in his breath. An analyst looked at his displays and said almost immediately, "We lost laser comm. They may have been bobbled . . . or may be out of sight."

Possible. The ground was rough, even inside the Enclave boundary. Riding a crawler over that would be an exciting thing. . . . And then Della understood the mystery in Miguel's speech. "*Mr. Director.*" Her shout cut across all over voices. "That crawler isn't looking for the enemy. It *is* the enemy!"

39

While they drove parallel to the perimeter fence, the ground was not too rough. When they turned inward, it would be a different story. There was a system of ditches running along the fence.

Beyond that was the interior of the Enclave. Allison risked a glance every now and then. It was like the future she had always imagined: spires, tall buildings, wide swaths of green. Paul said Authority ground troops were moving into the area, but right now all was peaceful, abandoned.

Wait. Three men came running out of the ditches. They paused at the fence and then were somehow through. Two of them carried heavy backpacks. So these were their Tinker allies. One waved to their crawler and then they disappeared among the buildings.

"Turn here. Follow them inwards," said Paul. "Wili's told the Peacer command we're in hot pursuit."

Allison pushed/pulled on the control sticks. The armored vehicle spun on its treads, one reversed, the other still pull-

ing forward. Through the side periscope she saw Miguel's crawler, moving off to the north. No doubt Wili had told him not to turn.

They shot forward at top speed, the engines an eerie screaming all around them. Beside her, Paul was gasping. Thirty kph across open terrain was rough as any air maneuver. Then they were falling, and the view ahead was filled with concrete. They flew over the edge of the ditch and crashed downward onto floor. The restraint webbing couldn't entirely absorb the shock. For a moment Allison was in a daze, her hands freezing the controls into fast forward. The crawler ran up the steep far wall and teetered there an instant, as if unsure whether to proceed upward or fall on its back.

Then they slammed down on the other side, collapsing the fence. Whatever automatic defenses lived here must be temporarily disabled.

She ground clear of the concrete and steel rubble, then risked a glance at Paul. "Oh my God." He was slumped forward, a wash of red spread down his face. Red was smeared on the wall in front of him. Somehow he had not been tied down properly.

Allison slowed the crawler. She twisted in her seat, saw that the boy remained comatose. "Wili! He's hurt!"

Wili twisted, his face agonized, like someone trying to waken from a dream.

And if he woke, if his dream died, then all their dreams would die. "Drive, Allison. Please drive," Wili's synthetic voice came cool from her earpiece. "Paul . . . Paul wants this more than anything." Behind her, the boy's real voice was softly moaning. And Paul moved not at all.

Allison closed out everything but her job. They were on a surfaced street. She rammed the throttle forward, took the crawler up to seventy kph. She had only vague impressions of the buildings on either side of them. It looked like residential housing, though more opulent than in her time. All was deserted. Coming up on a T-intersection. Over the roofs of the multistory residences, the towers at the center of the Enclave seemed no nearer.

Wili's voice continued, "Right at the intersection. Then left and left. Foot soldiers are coming from east. So far they think we're one of them, but I'm breaking laser contact . . . *now*." Allison whipped into the turn, "and they should guess what we are very soon."

They continued so for several minutes. It was like dealing with an ordinary voice program: Turn right. Turn left. Slow down. Keep on the edge of the street.

"Five hundred meters. Take the service alley here. They're onto us. I hear gunships. They can't locate us precisely enough to bobble. Whoever sees us is to shoot." He was silent again as Allison negotiated the alley. Still no sign of life from Paul.

"He still lives, Allison. I can still . . . hear . . . him a little."

Through the front periscope she had a glimpse of something dark and fast cross the narrow band of sky between the houses.

"Pull under that overhang. Stop. Throttle up. Thirty seconds for local conditions and I'll be ready to fire."

The moment they were stopped, Allison was out of her harness and bending

over Paul. "Now leave me. I need to think. Take Paul. Save Paul."

She looked at the boy. He still hadn't opened his eyes. He was further off than she had ever seen him.

"But Wili—"

His body twitched, and the synthetic voice was suddenly angry in her ear. "I need time to think, and I don't have it. Their planes are on the way. Get out. *Get out!*"

Allison unbuckled Paul and removed the scalp connector. He was breathing, but his face remained slack. She cranked at the rear doors, praying that nothing had been warped by their fall into the ditch. The doors popped open and cool morning air drifted in, along with the increased keening of the engines.

She ripped off her headset and struggled to get the old man's body over her shoulder. As she staggered past Wili, she noticed his lips were moving. She bent awkwardly down to listen. The boy was mumbling, "Run, run, run, run . . ."

Allison did her best.

40

No one understood the conflict as Wili did. Even when he was linked with the Jill interface, Paul had only a secondhand view. And after Paul, there was no one who saw more than fragments of the picture. It was Wili who ran the Tinker side of the show—and to some extent the Peacer side, too. Without his directions in Paul's voice, the thousands of separate operations going on all over the Earth would be so scattered in time and effect that the Authority would have little trouble keeping its own control system going.

But Wili knew his time would end very, very soon.

From the crawler's recon camera, he watched Paul and Allison moving away, into the managerial residences. Their footsteps came fainter in his exterior microphones. Would he ever know if Paul survived?

Through the narrow gap between the sides of the alley a Peacer satellite floated beyond the blue sky. One reason he had chosen this parking spot was to have that line of sight. In ninety seconds, the radio star would slide behind carven wooden eaves. He would lose it, and thus its relay to synchronous altitude, and thus his control of things worldwide. He would be deaf, dumb, and blind. But ninety seconds from now, it wouldn't matter; he and all the other Tinkers would win or lose in sixty.

Jill was almost finished with the local state computations. The capacitors would be fully charged seconds after that. Wili surveyed the world one last time:

From orbit he saw golden morning spread across Northern California. Livermore Valley sparkled with a false dew that was really dozens—hundreds—of bobbles. Unaided humans would need many versions of this picture to understand what Wili saw at once.

There were ground troops a couple thousand meters east of him. They had fanned out, obviously didn't know where he was. The tricky course he had given Allison would keep him safe from them for at least five minutes.

Jets had been diverted from the north side of the valley. He watched them crawl across the landscape at nearly four hundred meters per second. They were

the real threat. They could see him before the capacitors were charged. There was no way to divert them or to trick them. The pilots had been instructed to use their own eyes, to find the crawler, and to destroy it. Even if they failed in the last, they would report an accurate position—and the Livermore bobbler would get him.

He burst-transmitted a last message to the Tinker teams in the Valley: Paul's voice announced the imminent bobbling, and assigned new missions. Because of Wili's deceptions, their casualties had been light; that might change now. He told them what he had learned about Renaissance and redirected them against the missile sites he had detected. He wondered fleetingly how many would feel betrayed to learn of Renaissance, would wish that he—Paul—would stop the assault. But if Paul were here, if Paul could think as fast as Wili, then he'd have done the same.

He must end the Peace so quickly that Renaissance died, too.

Wili passed from one satellite to another, till he was looking down on Beijing. Without Wili's close supervision, the fighting had been bloodier: there were bobbles scattered through the ruins of the old city, but there were bodies too, bodies that would not live again. The Chinese Tinkers had to get in very close; they did not have a powerful bobbler or the Wili/Jill processor. Even so, they might win. Wili had guided three teams to less than one thousand meters from the Beijing bobbler. He sent his last advice, showing them a transient gap in the defense.

Messages sent or automatically sending. Now there was only his own mission. The mission all else depended on.

From high above, Wili saw an aircraft sweep south over the alley. (Its boom crashed around the carrier, but Wili's own senses were locked out and he barely felt it.) The pilot *must* have seen him. How long till the follow-up bomb run?

The Authority's great bobbler was four thousand meters north of him. He and Jill had made a deadly minimax decision in deciding on that range. He "looked at" the capacitors. They were still ten seconds from the overcharge he needed. Ten seconds? The charge rate was declining as charge approached the necessary level. Their haywired interface to the crawler's electrical generator was failing. Extrapolation along the failure curve: thirty seconds to charge.

The other aircraft had been alerted. Wili saw courses change. More extrapolation: it would be very, very close. He could save himself by self-bobbling, the simplest of all generations. He could save himself and lose the war.

Wili watched in an omniscient daze, watched from above as death crept down on the tiny crawler.

Something itched. Something else demanded attention. He relaxed his hold, and Jill's image floated up.

Wili! Go! You can still go! The Jill interface flooded him with a last burst of data, showing that all processes would proceed automatically to completion. Then it cut him off.

And Wili was alone in the crawler. He looked around, vision blurred, suddenly aware of sweat and deisel fuel and turbine noise. He groped for his harness release, then rolled off onto the floor.

He barely felt the scalp connector tear free. He came to his feet and blundered out the rear doors into the sunlight.

He didn't hear the jets' aproach.

Paul moaned. Allison couldn't tell if he was trying to say something or was simply responding to the rough handling. She shrugged him more evenly onto her shoulders and staggered across the alley toward a stone-walled patio. The gate was open; there was no lock. Allison kicked aside a child's trike and laid Paul down behind the waist-high wall. Might be safe from shrapnel here, except—she glanced over her shoulder at the glass wall that stretched across the interior side of the patio. Beyond was carpeting, elegant furniture. That glass could come showering down if the building got hit. She started to pull Paul behind the marble table that dominated the patio.

"No! Wili. Did he make it?" He struggled weakly against her hands.

The sky to the north showed patches of smoke, smudged exhaust trails, a vagrant floating bobble where someone had missed a target—but that was all. Wili had not acted; the crawler sat motionless, its engines screaming. Somewhere else she heard treads.

The boom was like a wall of sound smashing over them. Windows on both sides of the street flew inwards. Allison had a flickering impression of the aircraft as it swept over the street. Her attention jerked back to the sky, scanned. A dark gnat hung there, surrounded by the dirty aureole of its exhaust. There was no sound from this follow-up craft; it was coming straight in. The length of the street—and the crawler—would be visible to it. She watched it a moment, then dived to the tiled patio deck next to Paul.

Scarcely time to swear, and the ground smashed up into them.

Allison didn't lose consciousness, but for a long moment she didn't really know where she was. A little girl in a gingham dress leaned over an old man, seeing red spread across a beautiful tile floor.

A million garbage cans dropped and rattled around her.

Allison touched her face, felt dust and untorn skin. The blood wasn't hers.

How badly was Paul hurt?

The old man looked up at her. He brushed her hands away with some last manic strength. "Allison. Did we win . . . please? After all these years, to get that bastard Avery." His speech slurred into mumbling.

Allison came to her knees, and looked over the wall. The street was in ruins, riddled with flying debris. The crawler had been hit, its front end destroyed. Fire spread crackling from what was left of its fuel. Under the treads something else burned green and violet. And the sky to the north. . . .

. . . was as empty as before. No bobble stood where she knew the Peace generator was hidden. The battle might yet go on for hours, but Allison knew that they had lost. She looked down at the old man and tried to smile. "It's there, Paul. You won."

41

"We got one of them, sir. Ground troops have brought in three survivors. They're—"

"From the nearer one? Where is that second crawler?" Hamilton Avery leaned over the console, his hands pale against the base of the keyboard.

"We don't know, sir. We have three thousand men on foot in that area. We'll have it in a matter of minutes, even if tac air doesn't get it first. About the three we picked—"

Avery angrily cut the connection. He sat down abruptly, chewed at his lip. "He's getting closer, I know it. Everything we do seems a victory, but is really a defeat." He clenched his fists, and Della could imagine him screaming to himself: *What can we do?* She had seen administrators go over the edge in Mongolia, frozen into inaction or suicidal over-reaction. The difference was that *she* had been the boss in Mongolia. Here . . .

Avery opened his fists with visible effort. "Very well. What is the status of Beijing? Is the enemy any closer then before?"

General Maitland spoke to his terminal. He looked at the response in silence. Then, "Director, we have lost comm with them. The recon birds show the Beijing generator has been bobbled—" he paused as though waiting for some explosion from his boss. But Avery was composed again. Only the faint glassiness of his stare admitted his terror.

"—and of course that could be faked, too," Avery said quietly. "Try for direct radio confirmation . . . from someone known to us." Maitland nodded, started to turn away. "And, General. Begin the computations to bobble us up." He absentedly caressed the Renaissance trigger that sat on the table before him. "I can tell you the coordinates."

Maitland relayed the order to try for shortwave communication with Beijing. But he personally entered the coordinates as Avery spoke them. As Maitland set up the rest of the program, Della eased into a chair behind the Director. "Sir, there is no need for this."

Hamilton Avery smiled his old, genteel smile, but he wasn't listening to her. "Perhaps not, my dear. That is why we are checking for confirmation from Beijing." He flipped open the Renaissance box, revealing a key pad. A red light began blinking on the top. Avery fiddled with a second cover, which protected some kind of button. "Strange. When I was a child, people talked about 'pushing the button' as though there was a magic red button that could bring nuclear war. I doubt if ever power was just so concentrated. . . . But here I have almost exactly that, Della. One big red button. We've worked hard these last few months to make it effective. You know, we really didn't have that many nukes before. We never saw how they might be necessary to preserve the Peace. But if Beijing is really gone, this will be the only way."

He looked into Della's eyes. "It won't be so bad, my dear. We've been very selective. We know the areas where our enemy is concentrated; making them uninhabitable won't have any lasting effect on the race."

To her left, Maitland had completed his preparations. The display showed the standard menu she had seen in his earlier operations. Even by Authority standards, it looked old-fashioned. Quite likely the control software was un-

changed from the first years of the Authority.

Maitland had overridden all the failsafes. At the bottom of the display, outsized capitals blinked:

WARNING! THE ABOVE TARGETS ARE FRIENDLY. CONTINUE?

A simple "yes<CR>" would bobble the industrial core of the Authority into the next century.

"We have shortwave communication with Peace forces outside Beijing, Director." The voice came unseen, but it was recognizably Maitland's chief aide. "These are troops originally from the Vancouver franchise. Several of them are known to people here. As best we can verify these are really our men."

"And?" Avery asked quietly.

"The center of the Beijing Enclave is bobbled, sir. They can see it from their positions. The fighting has pretty much ended. Apparently the enemy is lying low, waiting for our reaction. Your instructions are requested."

"In a minute." Avery smiled. "General, you may proceed as planned." That minute would be more than fifty years in the future.

yes<CR> the general typed. The familiar buzzing hum sounded irregularly, and one after another the locations on the list were marked as bobbled: Los Angeles Enclave, Brasilia Enclave, Redoubt 001 . . . it was quickly done, what no enemy could ever do. All other activity in the room ceased; they all knew. The Authority was now committed. In fact, most of the Authority was gone from the world by that act. All that remained was this one generator, this one command center—and the hundreds of nuclear bombs that Avery's little red button would rain upon the Earth.

Maitland set up the last target, and the console showed:

FINAL WARNING! PROJECTION WILL SELF-ENCLOSE. CONTINUE?

Now Hamilton Avery was punching an elaborate pass-code into his red trigger box. In seconds, he would issue the command that would poison sections of continents. Then Maitland could bobble them into a future made safe for the "Peace."

The shock in Della's face must finally have registered on Avery. "I am not a monster, Miss Lu. I have never used more than the absolute minimum force necessary to preserve the Peace. After I launch Renaissance, we will bobble up, and then we will be in a future where the Peace can be re-established. And though it will be an instant to us, I will always feel the guilt for the price that had to be paid." He gestured at his trigger box. "It is a responsibility I take solely upon myself."

That's damned magnanimous of you. She wondered fleetingly if hard-boiled types like Della Lu and Hamilton Avery always ended up like this—rationalizing the destruction of all they claimed to protect.

Maybe not. Her decision had been building for weeks, ever since she learned of Renaissance. It had dominated all after her talk with Miguel. Della glanced around the room, wished she had her side-arm: she would need it during the next few minutes. She touched her throat and said clearly, "See you later, Miguel."

There was quick understanding on Avery's face, but he didn't have a

chance. With her right hand she flicked the red box down the table, out of Avery's reach. Almost simultaneously, she smashed Maitland's throat with the edge of her left. Turning, she leaned over the general's collapsing form—and typed:

yes<CR>

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Wili moped across the lawn, his hands stuck deep in his pockets, his face turned downards. He kicked up little puffs of dust where the grass was brownest. The new tenants were lazy about watering, or else maybe the irrigation pipes were busted.

This part of Livermore had been untouched by the fighting; the losers had departed peaceably enough, once they saw bobbles sprout over their most important resources. Except for the dying grass, it was beautiful here, the buildings as luxurious as Wili could imagine. When they turned on full electric power, it made the Jonque palaces in LA look like hovels. And most anything here—the aircraft, the automobiles, the mansions—could be his.

Just my luck. I get everything I ever wanted, and then I lose the people that are more important. Paul had decided to drop out. It made sense and Wili was not angry about it, but it hurt anyway. Wili thought back to their meeting, just a half hour before. He had guessed the moment he'd seen Paul's face. Wili had tried to ignore it, had rushed into the subject he'd thought they were to talk about: "I just talked to those doctors we flew in from France, Paul. They say my insides are as normal as anything. They measured me every way—" dozens of painful tests, massive indignities compared to what had been done to him at Scripps, and yet much less powerful. The French doctors were not bioscientists, but simply the best medical staff the European director would tolerate. "—and they say I'm using my food, that I'm growing fast." He grinned. "Bet I will be more than one meter seventy."

Paul leaned back in his chair and returned the smile. The old man was looking good himself. He'd had a bad concussion during the battle, and for a while the doctors weren't sure he would survive. "I'll bet too. It's exactly what I'd been hoping. You're going to be around for a long time, and the world's going to be a better place for it. And . . ." his voice trailed off, and he didn't meet the boy's look. Wili held his breath, praying Dio his guess wouldn't be correct. They sat in silence an awkward moment. Wili looked around, trying to pretend that nothing of import was to be said. Naismith had appropriated the office of some Peacer bigwig. It had a beautiful view of the hills to the south, yet it was plainer than most, almost as if it had been designed for the old man all along. The walls were unadorned, though there was a darker rectangle of paint on the wall facing Paul's desk. A picture had hung there once. Wili wondered about that.

Finally Naismith spoke. "Strange. I think I've done penance for blindly giving them the bobble in the first place. I have accomplished everything I dreamed of all these years since the Authority destroyed the world. And yet—Wili, I'm going to drop out, fifty years at least."

"*Paul!* Why?" It was said now, and Wili found tears coming to his eyes.

"Many reasons. Many good reasons." Naismith leaned forward intently. "I'm very old, Wili. I think you'll see many from my generation go. We know the bioscience people in stasis at Scripps have ways of helping us."

"But there are others. They can't be the only ones with the secret."

"Maybe. The bioscience types are coming aboveground very slowly. They can't be sure if humanity will accept them, even though the plagues are decades passed."

"Well, *stay*. Wait and see." Wili cast wildly about, came up with a reason that might be strong enough. "Paul, if you go, you may never see Allison again. I thought—"

"You thought I loved Allison, that I hated the Authority on her account as much as any." His voice went low. "You are right, Wili, *and don't you ever tell her that!* The fact that she lives, that she is just as I always remembered her, is a miracle that goes beyond all my dreams. But she is another reason I must leave, and soon. It hurts every day to see her; she likes me, but almost as a stranger. The man she knew has died, and I see pity in her more than anything else. I must escape from that." He stopped, smiled at some secret thought.

Wili slumped in his chair. "I could go with you."

"I can't stop you, but I hope you don't. Your time is now. There is a lot for you to do."

"Yeah. I guess. There's still Miguel. He needs . . ." Wili stopped, seeing the look on Paul's face. "*No!* Not Miguel too?" It was almost a sob.

"Yes. But not for several months. Miguel is not very popular just now. Oh, he came through in the end; I don't think we'd've won without him. But the Tinkers know what he did in La Jolla. And he knows; he's having trouble living with it."

"So he's going to run away." The words were choked.

"No. At least that's not the whole story. Miguel has some things to do. The first is Jeremy. From the logs here at Livermore, I can figure to within a few days when the boy will come out of stasis. It's about fifty years from now. Miguel is going to come out a year or so before that. Remember, Jeremy is standing near the sea entrance. He could very likely be killed by falling rock when the bobble finally bursts. Miguel is going to make sure that doesn't happen.

"A couple years after that, the bobble around the Peacer generator here in Livermore will burst. Miguel will be here for that. Among other things, he's going to try to save Della Lu. You know, we would have lost without her. The Peacers had *won*, yet they were going ahead with that crazy world-wrecker scheme. Both Miguel and I think she must have bobbled their projector. Things are going to be mighty dangerous for her the first few minutes after they come out of stasis."

Wili nodded without looking up. He still didn't understand Della Lu. She was tougher and meaner, in some ways, than anyone he had known in LA. But in others—well, he knew why Miguel cared for her, even after everything she did. He hoped Miguel could save her.

"And that's about the time I'm coming back, Wili. A lot of people don't realize it, but the war isn't over. The enemy has lost a major battle, but has escaped forward through time. We've identified most of their bobbled refuges, but Miguel thinks there are some secret ones underground. Maybe they'll come out the same time as the Livermore generator, maybe a lot later. This is a danger that goes into the forseeable future. Someone has to be around to fight those battles, just in case the locals don't believe in the threat."

"And that will be you?"

"I'll be there. At least through Round Two."

So that was that. Paul was right, Wili knew. But it still felt like the losses of the past: Uncle Sly, the trek to La Jolla without Paul. "Wili, you can do it. You don't *need* me. When I am forgotten, you will still be remembered—for what you will do as much as for what you already did." Naismith looked intently at the boy.

Wili forced a smile and stood. "You will be proud to hear of me when you return." He turned. He must leave with those words.

Paul stopped him, smiled. "It's not just yet, Wili. I'll be here for another two or three weeks, at least."

And Wili turned again, ran around the desk, and hugged Paul Naismith as hard as he dared.

Screeching tires and, "*Hey!* You wanna get killed?"

Wili looked up in startled shock as the half-tonne truck swerved around him and accelerated down the street. It wasn't the first time in the last ten days he'd nearly daydreamed himself into a collision. These automobiles were so fast, they were on top of you before you knew it. Wili trotted back to the curb and looked around. He had wandered a thousand meters from Paul's office. He recognized the area. This part of the Enclave contained the Authority's archives and automatic logging devices. The Tinkers were taking the place apart. Somehow, it had been missed in the last frantic bobbling, and Allison was determined to learn every Peacer secret that existed outside of stasis. Wili sheepishly realized where his feet had been leading him: to visit all his friends, to find out if *any*one thought the present was worth staying in.

"Are you okay, Mr. Wachendon?" Two workers came running up, attracted by the sounds of near calamity. Wili had gotten over being recognized everywhere (after all, he did have an unusual appearance for hereabouts), but the obvious respect he received was harder to accept. "Damn Peacer drivers," one of them said. "I wonder if some of 'em don't know they lost the war."

"Yes. Fine," answered Wili, wishing he hadn't made such a fool of himself. "Is Allison Parker here?"

They led him into a nearby building. The air-conditioning was running full blast. It was downright chilly by Wili's standards. But Allison was there, dressed in vaguely military shirt and pants, directing some sort of packing operation. Her men were filling large cartons with plastic disks—old world memory devices, Wili suspected. Allison was facing away from him, but her voice carried cool and confident.

Wili smiled to himself when the

worker beside him said, diffidently, "Captain Parker?" From the day of victory, Allison had made it clear she wouldn't tolerate second class citizenship. Considering the fact that she was their only expert on twentieth century military intelligence, the Tinkers had little choice but to accept her attitude.

Allison turned, saw him, and grinned broadly. "Hey, Wili!" She walked over and draped an arm across his shoulders. "I've been so busy this week, I haven't seen any of my old friends. What's happening?" She led him toward an interior doorway, paused there and said over her shoulder, "Finish Series E. I'll be back in a few minutes."

They walked down a narrow hall, the floor brightly polished. Allison's office was a bit warmer than the outer room, and free of fan noises. Her desk was covered with printouts. A Peacer display device sat at its center. She waved him to a seat, and patted the display. "I know, everything they have here is childish by Tinker standards. But it works and at least I understand it."

"Allison, a-are you going to drop out, too?" Wili blurted out.

The question brought her up short. "Drop out? You mean bobble up? Not on your life, kiddo. I just came back, remember? I have a lot to do." Then she saw how seriously he meant the question. "Oh, Wili. I'm sorry. You know about Miguel and Paul, don't you?" She stopped, frowned at some sadness of her own. "I think it makes sense for them to go, Wili. Really.

"But *not* for me." The enthusiasm was back in her voice. "Paul talks about this battle being just Round One of some 'war through time.' Well, he's wrong about one thing. The first round was fifty years ago. I don't know if those Peacer bastards are responsible for the plagues, but I do know they destroyed the world we had; they did destroy the United States of America." Her lips settled into a thin line.

"I'm going back over their records. I'm going to identify every single bobble they cast during the take-over. I'll bet there are more than a hundred thousand of my people out there in stasis. They're all coming back into normal time during the next few years. Paul has a program that uses the Peacer logs to compute exactly when. Apparently, all the projections were for fifty/sixty years, with the smallest bursting first. There's still Vandenberg and Langley and dozens more. That's a pitiful fraction of the millions we once were, but I'm going to be there and I'm going to save all I can."

"Save?"

She shrugged. "The environment around the bobbles can be dangerous the first few seconds. I was nearly killed coming out. They'll be disoriented as hell. They have nukes in there; I don't want those fired off in a panic. And I don't know if your plagues are really dead. Was I just lucky? I'm going to have to dig up some bioscience people."

"Yes," said Wili, and told her about the wreckage Jeremy had shown him back on the Kaladze farm. Somewhere, high in the air within the Vandenberg stasis, was *part* of a jet aircraft. The pilot might still be alive, but how could he survive the first instants of normal time?

Allison nodded as he spoke, and

made some notes. "Yes. That's the sort of thing I mean. We'll have a hard time saving that fellow, but we'll try."

She leaned back in her chair. "That's only half of what I must do. Wili, the Tinkers are so bright in many ways, but in others . . . well, 'naive' is the only word that springs to mind. It's not their fault, I know. For generations they've had no say in what happens outside their own villages. The Authority didn't tolerate governments—at least as they were known in the twentieth century. A few places were permitted small republics; most were lucky to get feudalism, like in Aztlán.

"With the Authority gone, most of America—outside of the Southwest—has no government at all. It's fallen back into anarchy. Power is in thhe hands of private police forces like Miguel worked for. It's peaceful just now, because the people in these protection rackets don't realize the vacuum the Authority's departure has created. But when they do, there'll be bloody chaos."

She smiled. "I see I'm not getting through. I can't blame you; you don't have anything to refer to. The Tinker society has been a very peaceful one. But that's the problem. They're like sheep—and they're going to get massacred if they don't change. Just look at what's happened here:

"For a few weeks we had something like an army. But now the sheep have broken down into their little interest groups, their families, their businesses. They've divided up the territory, and God help me if some of them aren't selling it, selling the weapons, selling the vehicles—and to whoever has the gold! It's suicide!"

And Wili saw that she might be right. Earlier that week he had run into Roberto Richardson, the Jonque bastard who'd beaten him at La Jolla. Richardson had been one of the hostages, but he had escaped before the LA rescue. The fat slob was the type who could always land on his feet, running. He was up here at Livermore, dripping gAu. And he was buying everything that moved: autos, tanks, crawlers, aircraft.

The man was a strange one. He'd made a big show of being friendly, and Wili was cool enough now to take advantage. Wili asked the Jonque what he was going to do with his loot. Richardson had been vague, but said he wasn't returning to Aztlán. "I like the freedom here, Wachendon. No rules. Think I may move north. It could be very profitable." And he'd had some advice for Wili, advice that just now seemed without ulterior motive: "Don't go back to LA, Wachendon. The Alcalde loves you—at least for the moment. But the Ndelante has figured out who you are, and Old Ebenzer doesn't care how big a hero you are up here at Livermore."

Wili looked back at Allison. "What can you do to stop it?"

"The things I've already said for a start. A hundred thousand new people, most with my attitudes, should help the education process. And when the dust has settled, I'm hoping we'll have something like a decent government. It won't be in Aztlán. Those guys are straight out of the sixteenth century; wouldn't be surprised if they're the biggest of the new land grabbers. And it won't be the ungoverned lands that most of the US has become. In all of North America, there seems to be only one

representative democracy left—the Republic of New Mexico. It's pretty pitiful geographically, doesn't control much more than old New Mexico. But they seem to have the ideals we need. I think a lot of my old friends will think the same.

"And that's just the beginning, Wili. That's just housekeeping. The last fifty years have been a dark age in some ways. But technology has progressed. Your electronics is as far advanced as I imagined it would be.

"Wili, the human race was on the edge of something great. Given another few years, we would have colonized the inner solar system. That dream is still close to people's consciousness—I've seen how popular Celest is. We can have that dream for real now, and easier than we twentieth century types could have done it. I'll bet that hiding away in the theory of stasis, there are ideas that will make it trivial."

They talked for a long while, probably longer than the busy Allison had imagined they would. When he left, Wili was as much in a daze as when he arrived—only now his mind was in the clouds. He was going to learn some physics. Math was the heart of everything, but you had to have something to apply it to. With his own mind and the tools he had learned to use, he would make those things Allison dreamed of. And if Allison's fears about the next few years turned out to be true, he would be around to help out on that, too. ■

● Our September cover, by Paul Lehr, is for Timothy Zahn's new novelette, "Return to the Fold." Given that starships are used primarily for transport of goods, spend long times in transit, and have minimal room for human occupants, their crews will necessarily consist of people with very special qualifications. The trouble is that the better adapted an organism is to one highly specialized niche, the less well suited it is likely to be for any other. So . . . what happens when a man whose dominant trait is the ability to thrive on solitude gets an urge for human companionship?

Our September issue will also contain a "State of the Art" article which should be of special interest to Analog readers. The story of the consternation produced among federal officials by Cleve Cartmill's story "Deadline" is well known—it described an atomic bomb while the Manhattan Project was in progress and top secret—but until recently the details were tucked away in classified documents. Those documents are now available to the public under the Freedom of Information Act, and from them historian Albert I. Berger has put together a fascinating account of what really happened.

IN TIMES TO COME

ADVANCED MACHINING IN ANCIENT EGYPT?

Christopher P. Dunn

The popular topic of ancient civilizations—and speculation that some cultures were perhaps more advanced than what is generally believed—has frequently held our fascination and, in varying degrees, our belief. Velikovsky, Pauwels and Bergier, and Von Daniken have attempted to pursuade the world that a huge misconception exists regarding our study and beliefs of prehistory. In most cases, however, the introduction of new ideas leaves more unanswered questions than answered ones.

Fragments of evidence uncovered here and there seem to suggest that certain artifacts were created for technological purposes by technologically advanced people. Ancient maps which depict Antartica without its ice cap; strange lines on the Nazca Plains in Peru; prehistoric earthworks in Ross County, Ohio; iron pillars which have stood for thousands of years without rusting; the Pyramids of Giza and countless other artifacts might appear to have been created by people who had more than religion and war on their minds.

While interest in prehistoric anomalies simmered along for many years, the subject exploded into a furor of debate when Von Daniken invoked the name of God (*Chariots of the Gods?*, 1969, G.P. Putnam's Sons) and proceeded to sell millions of books with that name boldly emblazoned on the cover. His attempt to pursuade the world that space travelers had influenced early civilizations did not impress most historians and archeologists, who perceived early man as practicing a less exotic profession. But even in their fundamental endeavors, do we fully understand the degree of sophistication that prehistoric man had attained?

Archeology is largely the study of man the toolmaker; for it is with tools, and artifacts created with tools, that an understanding of past civilizations can evolve. For the most part, the tools that have been uncovered are adequate in explaining artifacts of the same period. However, there seems to be a time in history where a glaring discrepancy exists between the artifacts that were discovered and the tools which supposedly created them.

The ancient Egyptians left artifacts behind that cannot be explained in simple terms. Supposedly contemporaneous tools have been uncovered which do not fully represent the "state-of-the-art" that is physically evident in some of the most intriguing objects available from a civilization which, despite its most visible and impressive monuments, has left us with only a sketchy understanding of its full experience on planet Earth.

Sir William Flinders Petrie left some unfinished business when he wrote *Pyramids and Temples of Gizeh* in 1883. After closely examining several artifacts he had found on an expedition to Egypt (undertook in 1880), he was left with questions he could not answer, and had to draw his investigation to a close, resigned to the fact that the ancient Egyptians were able to cut granite—a hard igneous rock—using methods that were not only efficient, but also quite remarkable. Regarding a hole that was drilled into a piece of granite he wrote, "the spiral of the cut sinks .100 inch in the circumference of 6 inches, or 1 in 60, a rate of ploughing out of the quartz and felspar which is astonishing."

The characteristics of some of his finds suggest methods of cutting granite and diorite that were unknown in his time; and though Petrie attempted to explain the technical principles employed in cutting the rock, they displayed subtle characteristics he could not discern. It is these details which stand them apart from other relics of the past!

Petrie reached a conclusion that the ancient masons used bronze saws tipped with jewels to cut the huge monoliths that were found on the Giza Plateau. Exceeding eight feet in length, according to Petrie these saws were instrumental in building the most monumental work ever undertaken by any civilization the world has sustained.

Nothing has been found of these saws, or other equipment that must have been used to cut and erect the pyramids

and temples of Egypt. Some may point to the few copper chisels that were found near the pyramids. But chisels are inadequate in explaining the machining marks described by Petrie, and cannot be seriously taken into consideration when faced with hard igneous rock —which the Egyptians were able to cut with such ease.

Petrie presents evidence that would certainly indicate the use of saws on this granite, but what kind of saws they were has not been fully described. So perhaps, a hundred years later, we should take another look at Petrie's work and re-examine the methods of the ancient Egyptian stonemasons.

In this paper it is assumed that Petrie's observations were accurate—but we must recognize that we are dealing with secondary evidence. However, as Petrie was not attempting to proselytize and was only objectively reporting the data he had uncovered while searching for answers, we can be reasonably sure that it was not invented, and that it should stand unless proved wrong.

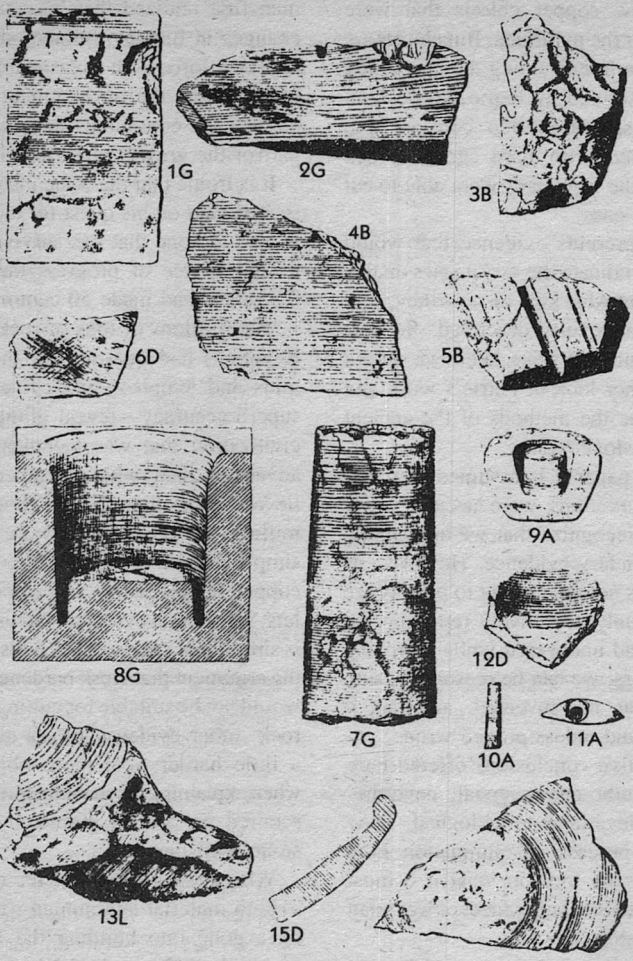
Alternative conclusions offered here are no doubt controversial; nevertheless, I believe them to be logical. They follow a process of elimination in a search for the truth in what is a most unusual and intriguing facet of Egyptian craftsmanship.

Methods employed to produce ancient artifacts can usually be explained in terms of simplicity. The hammer was probably the first tool invented, and hammer-working gold, silver and copper is known to have produced some of the most beautiful and intricate pieces of work in existence today. Since early man first realized that he could effect changes in his environment simply by applying force with a reasonable degree of accuracy, the development of tools has been a continuous and fascinating part of the growth of civilization.

It is ironic that the basic material that started man on his quest for technology is also the one that has survived to tell us the degree of progress the ancient Egyptians had made 50 centuries ago.

The millions of tons of rock that the Egyptians had quarried for their pyramids and temples—and cut with such superb accuracy—reveal glimpses of a civilization that was technically more advanced than what is generally believed. Even though it is thought that millions of tons of rock were cut with simple primitive hand-tools, such as copper chisels, adzes and wooden mallets, substantial evidence shows that this is simply not the case. Even discounting the argument that work hardened copper would not be suitable for cutting igneous rock, other evidence forces us to look a little harder, and more objectively, when explaining the manufacturing marks scoured on ancient granite by ancient stone craftsmen.

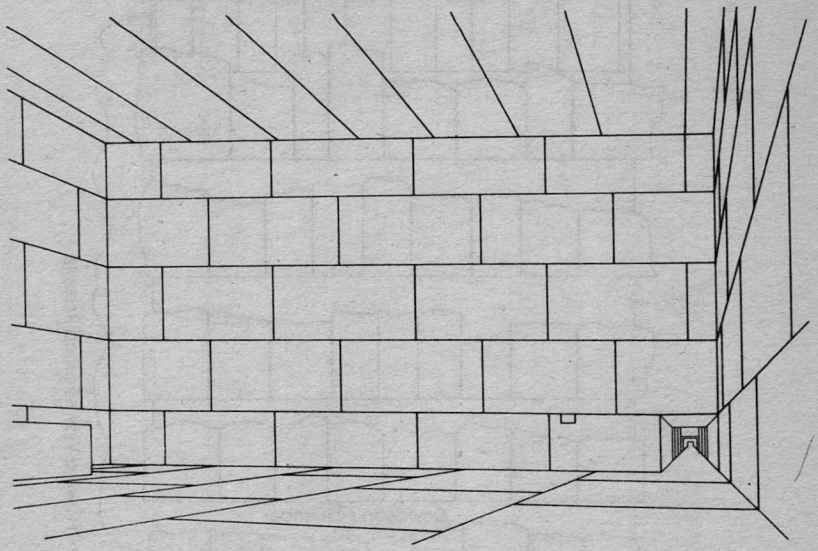
Who doesn't recognize the resources —both material and human—that must have gone into building the Egyptian pyramids and temples? We know that thousands of tons of granite were cut and transported over a distance of 500 miles from the Aswan Quarry—this particular granite is a reddish color, with 55 percent silicon quartz crystal. A substantial amount found a home deep in



A—Alabaster B—Basalt D—Diorite G—Granite L—Limestone

From *Pyramids and Temples of Gizeh,* by William Flinders Petrie, copyright 1883, London. Reprinted by courtesy of Ann F. Petrie. A reprint edition of the book is planned by Akadem. Druck-u. Verlagsanstalt, Graz, Austria.

the heart of the Great Pyramid where an entire complex was built—later to become known as the King's Chamber (ILLUSTRATION #1). Included in this

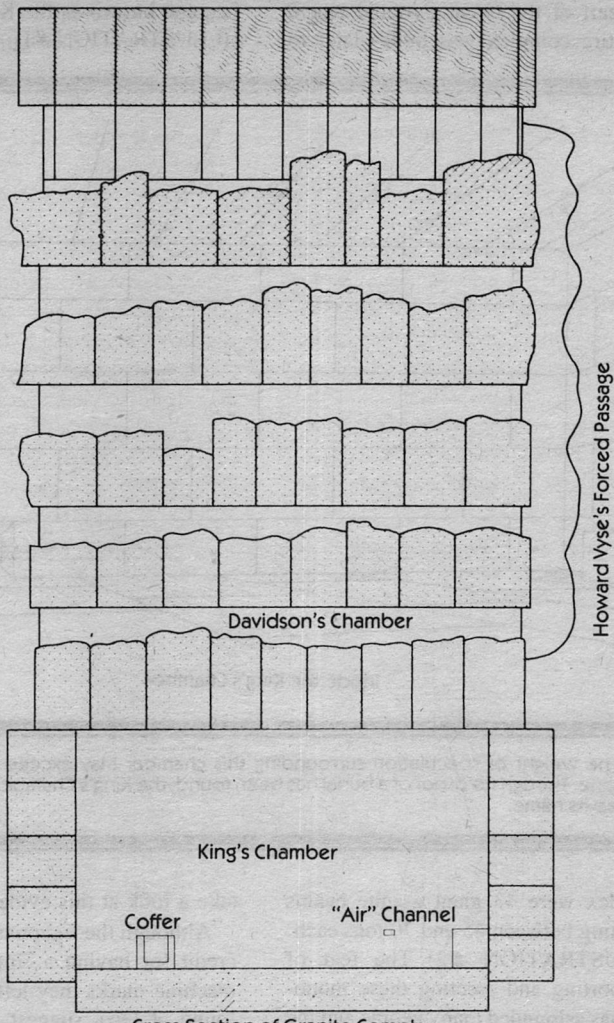


Inside the King's Chamber

1. The weight of speculation surrounding this chamber may exceed the weight of the stone. Though no proof of a burial has been found, the King's Chamber has managed to keep its name.

complex were 43 giant granite beams weighing between 45 and 70 tons each. (ILLUSTRATION #2) The feat of transporting and erecting these monoliths has astounded many people and the methods that were used in the process has been strongly debated. The concern here, though, is not so much how they were carried, but how they were cut. This is more easily explained, mainly because there is more evidence. Let's take a look at this evidence.

Although the Egyptians are not given credit for having a simple wheel, the machine marks they left on the granite found at Giza suggest a much higher degree of technological accomplishment. Petrie's conclusion regarding their mechanical abilities show a proficiency with the straight saw, circular saw, tube-drill and, surprisingly, even the lathe —the father of all machine tools in ex-

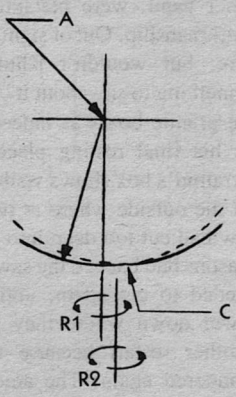


2. A difficult stone to quarry and cut; yet there seems to be a redundancy of granite above the King's Chamber. Above one layer of granite beams, forming the ceiling of the chamber, were hid four more layers—until Col. Howard Vyse's crew blasted their way through the core masonry during their expedition in 1873.

istence today. The evidence he presents is quite striking, especially the evidence of lathe-turning techniques, which were evidently of a higher standard than we would expect from an undeveloped industry.

There were two pieces of diorite in Petrie's collection which he claimed must have been the result of true turning on a lathe. The traditional theory of how primitive people shaped hard stone does not apply in the case of these diorite relics. It is true that many intricate objects can be created without the aid of machinery, simply by rubbing the material with an abrasive, such as sand, using a piece of bone or wood to apply pressure. The relics Petrie was looking at, however, in his words "could not be produced by any grinding or rubbing process which pressed on the surface."

To the inexperienced eye, the objects Petrie was studying would hardly be considered remarkable. A simple bowl, made out of simple rock. But on studying the bowl, Petrie found that the spherical concave radius, forming the dish, had an unusual feel to it. Closer examination revealed a sharp cusp where two radii intersected (ILLUSTRATION #3). Evidently, the radii were created by rotating the bowl on two separate axes of rotation when it was machined. How many machinists today have



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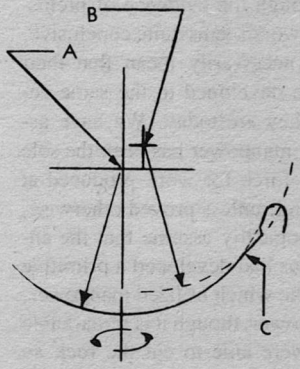

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3. R-1 and R-2 indicate rotation axes of the bowl. A is the pivot point of the tool and C is the cusp that was created where the radii intersect.

4. Original pivot point of the tool -A-. Secondary pivot point -B- creating lip and cusp -C- at intersection.

chucked on a premachined part and not centered it correctly? Together with the sharply defined cusp, this would preclude any possibility of hand work.

On examining other pieces from Giza, Petrie found another bowl shard which, again, had the marks of true lathe-turning. This time, though, instead of shifting the workpiece's axis of rotation, a second radius was cut by shifting the pivot point of the tool (PETRIE'S REF #5. & ILLUSTRATION #4). With the same radius used to machine the dish, they machined just short of the perimeter, leaving a small lip. Again a cusp defines the intersection of the radii. Obviously, if this had been the result of hand work, the cusp would have been rubbed away—if it had existed in the first place.

Even though the evidence of prehistoric lathe-work seems quite conclusive, it doesn't necessarily mean that their lathes were developed to the same degree that they are today. We have assumed that manpower has been the sole motivating force for work produced at that time and, unless proved otherwise, we could logically assume that the ancient masons had developed a primitive form of lathe which utilized manpower, or animal power; though it is remarkable that they were able to cut the rock so cleanly, with such sharply defined features, without splintering.

The transition from manpower to machine-power has greatly improved efficiency. When manufacturing modern day artifacts, we seldom pick up a hand saw if a mechanized saw is at hand. When cutting large surface areas, a hand saw is not even thought of. Speed and accuracy are essential ingredients for any job undertaken for profit in today's society. Let's face it, leisurely production levels are a thing of the past—or are they? I believe that the ancient Egyptians might argue with us on this one.

There are subtle characteristics on a granite sarcophagus found in the Great Pyramid, and also on one in the Second Pyramid, which suggest that they were not cut with back-breaking labor by men bent over their crude primitive tools, but with speed and accuracy. . . . Well, almost accuracy.

It is well known that the casing stones on the Great Pyramid were cut and positioned with great care and precision achieving flatness and parallelism within .010 inch. The granite boxes, on the other hand, were blatantly inferior in workmanship. Out of sight, out of mind, sure; but wouldn't Khufu have had something to say about it? If, of course, the granite box was indeed intended to be his final resting place. The Great Pyramid's box shows visible saw marks on the outside where at two places the saw had cut too deep into the side. The masons had backed the saw out and proceeded to cut again, until two inches lower down where they had to make another restart because the saw had wandered again. The amount of error in this case was .100 inch. (PETRIE'S REF. 1G)

The granite box inside the Second Pyramid is polished all over except for the bottom. In this case an adjustment was made to correct a .200 inch error. Unlike the box inside the Great Pyramid, this one didn't have visible saw

lines on the sides.

Assuming that hand sawing a block of granite 90 inches by 38.68 inches by 41.23 inches would be laboriously slow, it is significant that these errors were made. Can you imagine a team of masons operating a 9–foot–long hand saw zipping through a block of granite so fast that they cut past their guideline .100 to .200 inches before making a correction? Then to back the saw out, restart their cut on the right line and proceed to make the same mistake 2 inches farther down does nothing to confirm the speculation that this was the result of handwork.

Handsawing is a slow process at the best of times, and a careful craftsman can see the direction his saw is taking and make corrections before a serious mistake can be made. Manually operated saws can wander like mechanized saws, probably more so considering the increased risk of human error. These considerations, along with nuances inherent in machining practices that experienced craftsman will recognize, indicate that the ancient stonemasons were using a saw that was cutting through the granite at a faster pace than handsawing could achieve

Going from machining the outside of the granite boxes to hollowing out the insides, the stonemasons again made mistakes, only this time with drills. The methods used by the pyramid builders to hollow out the insides of these boxes are the same as methods that would be used today to machine out any component.

Tool marks on the inside of one box indicate that when the granite was hollowed out, preliminary roughing cuts were made by drilling holes around the area that was to be removed. According to Petrie, these holes were made with tube-type drills that left a central core which was knocked out after the hole was cut. After all the holes had been drilled and the cores removed, the insides were worked by hand to their desired dimensions.

However, the machinists once again let their tools get the better of them and Petrie found the resulting errors on the inside of the box in the King's Chamber. Their drill had evidently worked its way into the wall of the box and they were unable to polish out the error without drastically changing the inside dimensions. Even after polishing away 1/10 inch, they were still left with an error 1/10 inch deep, 3 inches long, and 1.3 inches wide, located 8 to 9 inches below the top of the box. Two such errors were made, one to a lesser extent.

These mistakes would not be unusual in a modern machine-shop. A long drill would be especially susceptible to "wander" from the perpendicular. One remarkable detail is that they chose this method to hollow out their granite box. The inside depth is just under 3 feet, which would call for a good-sized drill. Regarding this detail we might assume that they had reached a high degree of efficiency with this method of machining.

There are several unknowns, principally their means of detecting the error and the way they managed to correct the drill's course. Other questions arise, such as the removal of waste material from the drill-hole—flooding with water

might be one solution—and the speed of their operation. In answer to this last question we will look at artifacts that were found around Giza and in the Valley Temple. These relics provide the answer to most questions regarding the level of technological progress the ancient Egyptians had made in cutting stone.

While the evidence grows to support the premise that the ancient Egyptians had used some kind of high speed machinery when cutting the granite found at Giza, we are still left with the question of how this machinery was powered. And while we do not generally think in terms of the ancient Egyptians having discovered and utilized electricity, the following evidence suggests that electricity should not be ruled out when we seek a complete understanding of this civilization's technological accomplishments.

The machine marks left in the tube-drilled holes found in the Valley Temple and the cores that came out of these holes—and numerous others—are without doubt the clearest and strongest argument yet found for considering the ancient pyramid builders as being technologically advanced. Another close look at the characteristics of the granite hole (PETRIE'S REF. 7G) reveals more about the Egyptians than what Petrie was first able to discern.

When searching for a method that fully explains all relevant data without leaving unanswered questions, we have to begin with the simplest possible method. If that does not satisfy the evidence, we must then move on to another method regardless of the direction it may take us. The marks left in the granite hole and core indicate that whatever had cut them had removed material at a rate of .100 inch per revolution of the drill. This is a phenomenal feed rate for drilling into a solid piece of material and certainly not one that could be achieved by hand. (If anybody knows of a way to utilize such a feed rate using conventional machining methods there are several machine tool manufacturers waiting to hear from you).

Petrie was so astounded by these artifacts that he attempted to explain them at three different points in one chapter. Let's look at what puzzled him so much.

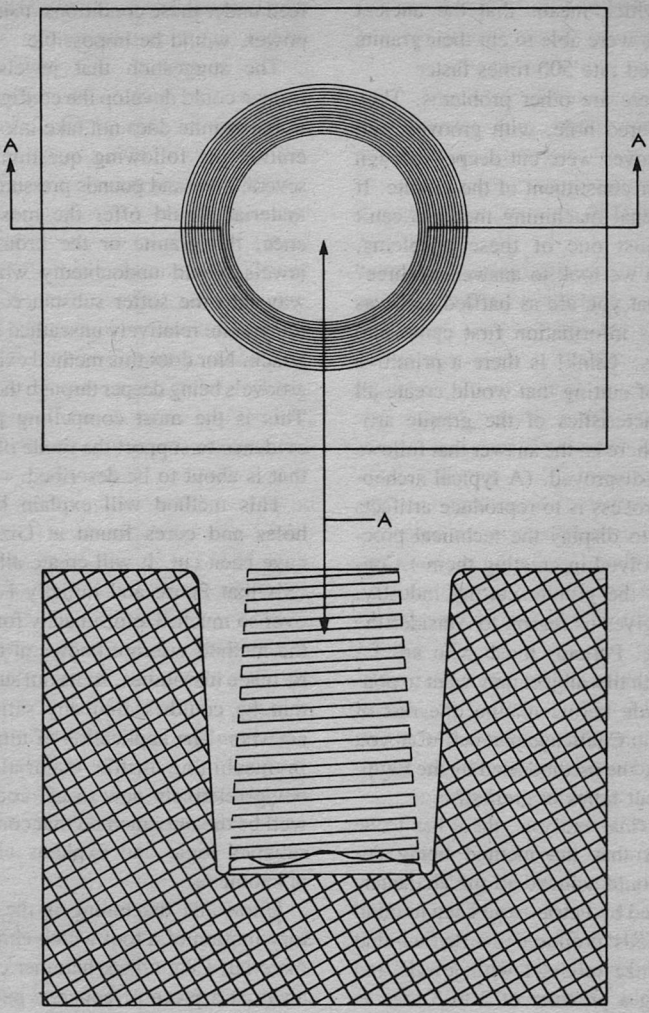
Again we have an artifact that could be passed off as insignificant, except that in this case the machine marks were atypical of lathes, or of any other machine tools in existence in Petrie's time. Close examination of the evidence revealed three characteristics of the hole and core that make these artifacts extremely remarkable:

1. A taper on both the hole and the core.

2. A symmetrical helical groove following these tapers and cut at .100 inch per revolution.

3. The confounding fact that the spiral groove cut deeper through the quartz than through the felspar—which is a softer material. Logically, in conventional machining, the reverse would be true. (ILLUSTRATION #5)

Mr. Donald Rahn of Rahn Granite Surface Plate Co., Dayton, Ohio, tells me that in drilling granite today, diamond drills penetrate at the rate of 1 inch in 5 minutes at 900 R.P.M. This works out at just .0002 inch per revo-



Petrie's Figure 8, with Core in Place

5. In drilling a hole, .100 inch per revolution of a drill is a phenomenal, if not impossible, feedrate for any material. Such a hole was cut into solid granite by ancient Egyptian stonemasons, whose technical skills seem to have been severely underrated in the past.

lution, which means that the ancient Egyptians were able to cut their granite with a feed rate 500 times faster.

But there are other problems. They cut a tapered hole, with grooves, and these grooves were cut deeper through the harder constituent of the granite. If conventional machining methods can't answer just one of these problems, where do we look to answer all three? I hope that you are as baffled as I was when this information first came into my hands. Think! Is there a primitive method of cutting that would create all the characteristics of the granite artifacts? If there is, the answer that follows could be disproved. (A typical archeological process is to reproduce artifacts in order to display the technical processes involved in creating them.) Contact with the granite cutting industry, though, gives us reason to consider the following. Perhaps those who are familiar with the subject may want to ponder a while before reading the rest of this article. Challenge yourself! Can you determine the method used by the Egyptians to cut holes in granite?

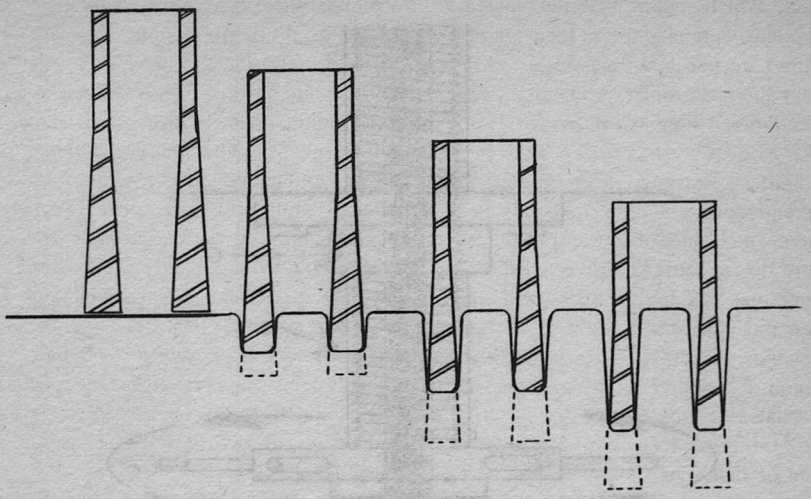
In the final analysis, there has to be no doubt that the method being described could achieve all the characteristics noted by Petrie. And keep in mind the methods proposed by Petrie—that is, a bronze tube set with jewels and sustaining a pressure of 2 to 3 tons as it revolves.

The fact that the spiral is symmetrical is quite remarkable considering the proposed method of cutting. The taper indicates an increase in the cutting surface area of the drill as it cut deeper, hence an increase in the resistence. A uniform feed under these conditions, using manpower, would be impossible.

The suggestion that jewels set in bronze could develop the configurations in the granite does not take into consideration the following question: Under several thousand pounds pressure, which material would offer the most resistence, the granite or the bronze? The jewels would undoubtedly work their way into the softer substance, leaving the granite relatively unscathed after the attack. Nor does this method explain the groove's being deeper through the quartz! This is the most compelling piece of evidence to support the mode of cutting that is about to be described.

This method will explain how the holes and cores found at Giza could have been cut. It will create all the details that Petrie and initially I puzzled over so much. Unfortunately for Petrie, the method was not known at the time he made his studies, so its not surprising that he couldn't find any satisfactory answers. The application of ultrasonics in machining brittle material, while being relatively new to us, could very well be the only method that completely satisfies logic and explains all noted phenomena.

Ultrasonic machining is the oscillatory motion of a tool which chips away material. Like a jack-hammer chipping away at a piece of concrete pavement, except much faster and not as measurable in its reciprocation, the ultrasonic tool-bit, vibrating at 19,000 to 25,000 hertz, has found unique applications in the precision machining of odd shaped holes in hard, brittle material such as hardened steels, carbides, ceramics, and



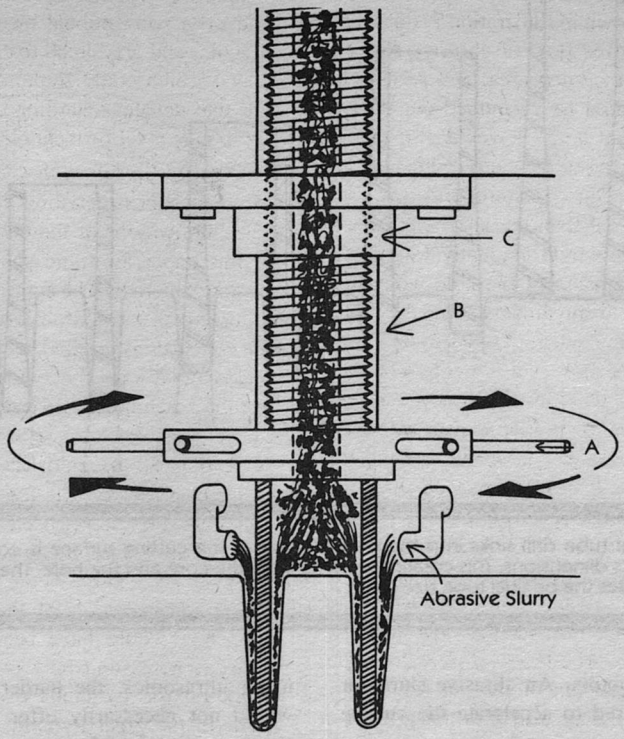
6. As the tube drill sinks into the granite, wear of the cutting surface is constantly changing its dimensions. This creates taper on both the core and the hole. The dotted line illustrates the original tube size.

semiconductors. An abrasive slurry or paste is used to accelerate the cutting action.

Using the following method, the Egyptians moved more material than they actually machined. In fact, regarding attaining maximum results for the least amount of effort, the method is completely logical.

The most significant detail of the drilled hole is the groove that is cut deeper through the quartz than the felspar. Quartz crystals are employed in the production of ultrasonic sound and, conversely, are responsive to the influence of vibration in the ultrasonic ranges —i.e., they may be made to vibrate at high frequencies. In machining granite using ultrasonics, the harder material would not necessarily offer more resistance as it might during conventional machining practices. In fact, an ultrasonically vibrating tool-bit may find numerous sympathetic partners while cutting through granite —embedded in the granite itself! Instead of resisting the cutting action, as it would normally, the quartz could be induced to respond and vibrate in sympathy with the high frequency waves and amplify the abrasive action as the tool cut through it.

The fact that there is a groove may be explained several ways. An uneven flow of energy may have caused the tool to oscillate more on one side than the other. The tool may have been improp-



Ultrasonic Drilling of Egyptian Granite

7. A simple illustration showing the mechanical components, without the ultrasonic coupling, needed to drill the Egyptian granite.

erly mounted. A build-up of abrasive on one side of the tool may have cut the groove as the tool spiraled into the granite.

That the hole and the core have tapered sides is perfectly normal if we consider the basic requirements for all types of cutting tools. This requirement is that clearance be provided between the tool's non-machining surfaces and the workpiece (ILLUSTRATION #6). Instead of having a straight tube, therefore, we would have a tube with a wall thickness that gradually became thinner along its length. The outside diameter would gradually get smaller, creating clearance between the tool and the hole, and the inside diameter gradually would get bigger, creating clearance between the tool and the central core. (ILLUS-

TRATION #7)

As shown in Illustration 7, this would allow a free flow of abrasive slurry to reach the cutting area, and perhaps the waste could be vacuumed out through the central hole. It would also explain the tapering of the sides of the hole and the core. Since the tube-drill was a softer material than the abrasive, the cutting edge would gradually wear away. The dimension of the hole would correspond to the dimension of the tool at the cutting edge. As the tool became worn, the hole and the core would reflect this wear in the form of a taper.

The spiral groove can be explained if we consider one of the methods that is predominantly used to advance machine components uniformly. Using a screw and nut method, as shown in Illustration 7, the tube-drill could be efficiently advanced into the workpiece by turning the handles (*a*) in a clockwise direction. The screw (*b*) would gradually thread out of the nut (*c*), forcing the oscillating drill into the granite. It would be the ultrasonically induced motion of the drill that would do the cutting, and not the rotation—the latter being used purely to sustain a cutting action at the workface.

The theory of ultrasonic machining may resolve all the unanswered questions that other theories do not. Methods may be proposed that might cover any singular aspect of the machine marks, and not progress to the exotic method described in this paper. It is when we search for a single method that will provide an answer for all collective data —and leave no doubt as to its validity —that we move away from primitive and even conventional means of manufacture and are forced to consider evidence which could settle once and for all the debate regarding the ancient Egyptians level of technology.

We are still left with some very serious questions regarding their culture. The implications of the data contained in this paper are quite substantial and no doubt there will be controversy. One argument that could be leveled against the conclusions reached here may be the lack of certain kinds of evidence. Where are the machines, for example?

The tools that were used to build the more than 80 pyramids in Egypt have never been found. The few copper implements that have been uncovered, even if they were adequate to explain the evidence, do not begin to represent the number of tools of that particular type that would have been used had every stonemason who was supposed to work on the pyramids owned one or two. In the great Pyramid alone there are an estimated 2,300,000 blocks of stone weighing between 2½ and 70 tons each. That is a mountain of evidence with no tools surviving to explain how it was built.

In the Great Pyramid there are mysteries yet to be explained that will strongly confirm my reasoning. Even though the tools and machines have not survived the thousands of years since their use, we have to assume, by the evidence, that they existed.

An understanding of ancient civilizations' level of technology shouldn't hinge on the preservation of a written

record for every technique that they had developed. The "nuts and bolts" of society do not always make good copy. A stone mural will more than likely be cut to convey an ideological message, rather than the technique used to inscribe it. And yet after several thousand years, an interpretation of the artisan's methods may be more accurate than an interpretation of his language. The language of science and technology doesn't have the same freedom as speech.

But we are impressed with languages, and tend to believe if something is spelled out for us on paper. Champollion's interpretation of the Rosetta Stone seems to have had a more lasting effect than Petrie's study of the engineering aspects of the Egyptian monuments. In some writings it is obvious that Petrie is totally ignored when claims are made that the Egyptians cut granite with copper chisels. When *Pyramids and Temples of Gizeh* was first written, it created quite a lot of interest in "dilettante circles." It was also well received by the press at that time. The *Saturday Review* probably didn't know that the work would still be an issue a hundred years after they wrote: "Mr. Petrie's survey having been made public. . . . all future theorizers will be obliged to grapple with a series of incontrovertible facts."

Whether the facts prove to be incontrovertible or not, there's sufficient evidence to justify another look at the Pharaoh's stonemasons. In considering this interpretation, though, an unquestioning total acceptance could be as bad as an unquestioning rejection. It is meant to stimulate thought, discussion and, hopefully, a sincere objective study of the artifacts in question by anybody with the resources to do so. ■

● It is quite conceivable that the television drama may well get stuck tighter and tighter into a mold of mediocrity. Creative people, particularly written, can only be censored, sat on, and limited so much and for so long. After a time, fighting back seems relatively unimportant. The sponsor may continue to sell his soap just as the radio soap operas did for him, but by then the television drama will be a dull, sloppy old man who sits contemplating his widening paunch without interest, without energy, and with no horizon left at all.

Rod Serling

On Gaming

Dana Lombardy

Long before the pyramids were built in Egypt, two demi-gods were locked in a struggle to decide the fate of mankind. Through the centuries, the necromancer Molasar made unholy war against the people of Earth. To sate his evil needs, he was responsible for hundreds of disasters and wars, including the Black Death that ravaged Europe.

In 1476, the forces of light imprisoned him in "The Keep," a magically protected fortress deep in the Balkans. Five hundred years later, in April of 1941, a small band of German Army soldiers occupied The Keep and unsuspectingly awoke Molasar.

This is the background for Paul Wilson's best-selling SF novel, which was made into a movie by Paramount Pictures, and also into a board game and separate role-playing adventure module by Mayfair Games Inc. ($17 for the board game, $6 for the module at your local store, or direct from Box 5987, Chicago, IL 60680).

The board game *The Keep* comes with a 19-by-24-inch full-color playing board in six pieces that lock together like a puzzle, six colored pawns (representing Molasar and the other primary characters), twelve black pawns (representing the Nazi SS troops), two dice, four small decks of cards, and a four-page rules folder.

One player moves the red Molasar pawn and black SS pawns. The other two to five players represent Searchers—Dr. Cuza, his daughter Eva, Father Fonescu, Captain Woermann, or Glaeken (Molasar's centuries-old enemy). These players are in a frantic race and most games will be very close contests.

The object of the game is to find the magical Hilt—the weapon that can destroy Molasar—hidden in one of the maze of rooms that makes the playing board. Molasar moves into rooms with the SS pawns and "eats" them to gain more power. If no one has found the Hilt by the twelfth turn, Molasar has become too powerful and wins his freedom.

The starting positions for all the pawns are marked in various rooms in the labyrinth of The Keep. The Molasar player then secretly writes the location of the Hilt on a piece of paper. As soon as a Searcher enters that room, the game is over.

Each turn, all Searcher players roll one die and move their pawns from room to room, resolving any conflicts if they run into an SS pawn or Molasar. A Searcher may play one of the Bonus cards he or she was dealt at the start of the game. Bonus cards give benefits to the Searchers, such as extra movement, or special weapons to help them fight Molasar if they encounter him.

After all Searchers have moved, the Molasar pawn jumps to any room with an SS pawn and "eats" it (removes it from the board). After playing a card from the Hazard deck, two dice are rolled and the Molasar pawn is moved again. The Molasar player then rolls both dice again and moves any SS

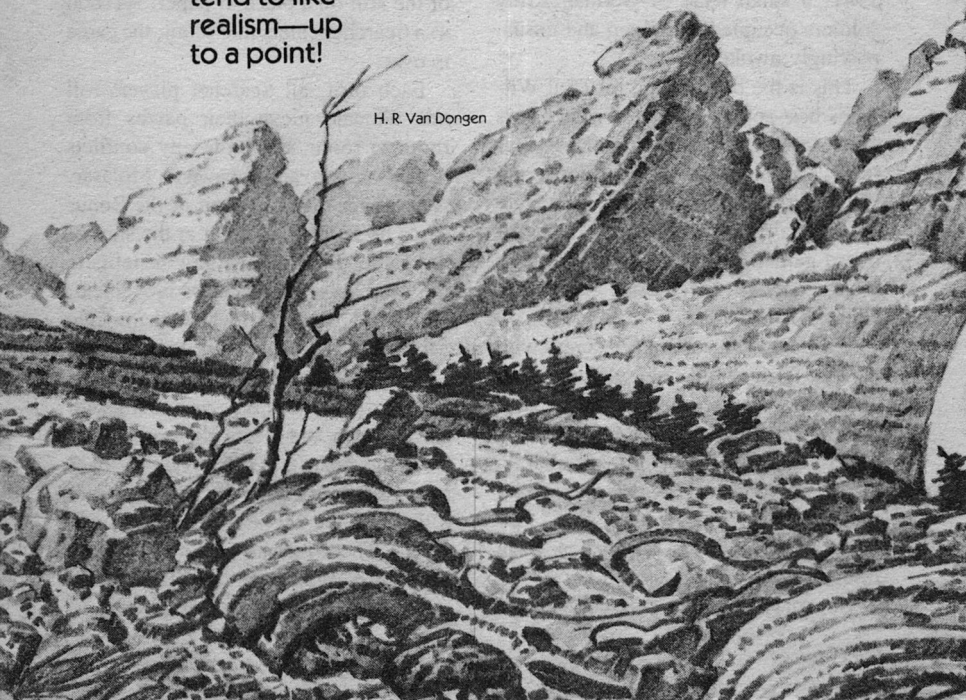
(continued on page 166)

PEACE IN THE VALLEY

Bob Buckley

Game players tend to like realism—up to a point!

H. R. Van Dongen



The game had been held in the fall of each year since 1998 in a frigid, sorry excuse for a hellhole known as Terra Del Fuego. The founders had picked fall probably because by then the weather was truly beastly, but not nearly terrible enough to be impossible. Twenty-seven players had been lost throughout the span of the tournament: four to mishaps in combat, and twenty-three to the climate and terrain. It was a survival game, and while modifications were suggested, the format remained unchanged. Risk merely increased the number of applicants to the playfield, or so the brochure read.

The parking structure was already crowded as the helo lowered through a ceiling of high fog and touched at the disembarking circle. Big, armored limos filled most of the gravel parking lot, with an occasional club truck—camouflage paint dulled by dust—squeezed in between. The games were popular with all classes, management and labor. The recent addition of politics merely gave spice to the proceedings.

I left the transport through a rear door and thus avoided most of the press mob who had clustered about Japenca, the new revolutionary leader of Costa Rica. Maybe I'd have my chance with him later—out in the field.

The tarmac was wet, but the rain had moved on into the mountains. I crossed quickly to the cinder block guard station and held out my credentials. Old Wellington, the receptionist, gave me an austere smile, having recognizing my battered features from previous visits to his select establishment.

"Good morning, Mr. Gregor. Late this year." He ruffled through the sheaf of papers, pausing over the last momentarily, then shoved them into a waiting pigeonhole. "Everything is in order, as usual. Which team do you prefer?"

"Offense. The magazine wants a different perspective."

"Interesting. I believe they will have a tougher time of it than usual. The defenders have added to the fortifications, and winter is blowing up early." The weathered old face had an expression of concern that made me feel like a guilty son getting a dressing-down from a worried father. Wellington was famous for taking responsibility for his charges and freely dispensed advice.

I grinned at him and hoisted my pack onto the scale for weighing. "Is the cast assembled?"

"Everyone but Kominka. Last minute substitution in the offing, I believe. The premier is getting too old for this sort of thing. Perhaps he has finally come to his senses." Wellington sniffed the air as though to test the wind, but I knew him well enough by now to know he was making a comment on old men who play at being children far beyond their years.

He tagged my pack, okayed the weight as being within allowances, and shoved it back.

"Your team is gathering in Green house. Strategy meeting at 0730. Good luck, sir. I hope to hear good things, and see you again next year."

"I hope so, Wellington." I told him confidently. "The rum is on me at the bar tonight. Can't have you getting chilled."

"Indeed, sir." He grinned. "And thank you."

Green house was a massive, polished dome built from native granite within a shallow valley. Traditionally, both teams met there briefly before the games, and after. The rules were reviewed and new members were instructed in the ways of the code. And if the player had not brought equipment along—this was rare—gear was assigned. I could see a crowd around the entry: press, players, and referees.

I paused on the mossy stone path and slipped a PRESS armband over the sleeve of my insulated windbreaker; a *Future Times* logo emblazoned across the back in reflective green. In the game it *did* pay to advertise. The founders liked members of the press to stay 'alive' right into the final round. First hand view on copy was preferred. The word had gotten around. Members of the press were more or less off the 'fair game' list.

I suppressed a shiver. The wind was brisk and gusting. Wellington had been right, it would be an early winter.

"You're Gregor, aren't you?"

Adrenaline hyped my pulse rate. I whirled toward the brush beside the path. A tall figure was emerging from concealment, grinning. A shark couldn't have done it better.

"Sanderson, New Zealand. You were pointman three years ago for my team. You've forgotten, haven't you."

No flashy fatigues, just a set of armored tans on the fellow. He blended into the weeds as though he belonged there. Sanderson? Yeah, the memory returned. He was cabinet level. Three years ago we had overrun a small outpost that had allowed a technical victory for the offensive side. He had commanded. Stiff then, he had mellowed. I leaned away from the path and shook hands. "What team?"

"Defenders. You?"

I tried to be distant—you can't like the enemy before a game—I patted my dye thrower, a Badger Elite. "Offense. Keep your guard up." It was my turn to grin.

He laughed. It didn't make any difference to him, apparently. He stepped from the brush and joined me on the path. "They sent me down to hurry you along. Refs have decided to get the game going immediately. The weather is getting a bit heavy up in the highlands."

We walked swiftly up the path. No more talk. Time for talk would come later, during the victory celebrations. Players got uptight before a game. Rabbit nerves . . .

We went in through the big carved doors and found seats near the back of the hall. The others stopped their milling and settled in. The mike squalled and then Lee-Athas, UN representative, one of the original founders of the game, was speaking, fleshing out the rules and making team assignments for the newcomers. There was sudden quiet in the hall as what he was saying sank in. The defender site had been eliminated. They were not going to be up on Stonyface. We were going to have to find them. It was a big valley.

"Good gaming," Lee-Athas growled at the massed faces, and left the podium. It was several minutes before baffled conversations started. It took that long for the shock to wear off. Some players took the game layout change as a bad

omen. Most players were a superstitious lot.

The game began without much fanfare. The first of the players marched out through the massive double doors of Green house. The rest of us waited. It was a time to check the equipment once more and fill out supply packs from club stores.

When we finally got orders to move, the defenders had been out in the wild for a full day. It was a clear, crisp dawn as the refs allowed us to begin filtering out of the compound in little patrols of five and six. I found myself with an Egyptian, a Brazilian, two Americans from Southern California, and the stand-in for Soviet Russa: Vladimir Karenkov, short, stocky, sporting a full-face beard with mutton-chops. His fatigues were white—a mistake, since the first snow had not yet fallen—and he carried a light pack and a fully automatic Kalasnikov dye thrower that was the envy of the patrol.

The Egyptian was a surly veteran of the Sinai Takeback who spoke broken English and slipped gin from a flask hidden in his jacket whenever he thought no one was looking. A fallen son of Allah by appearances.

The Americans had gamed before, even going back to some of the early survivalist escapades organized before the competitions gained international attention. The big one hailed from Georgia, and his accent was as heavy as honeysuckle and magnolias. Southern California was but a place of business for him. They both resembled vacationing drug smugglers, unhuman behind their camouflage cream, decked out in the latest Rodeo Drive regalia. It spoke of money. The tall, heavyset one was the dominant of the two. And the little one's name was Smith—so he said, anyway.

The Brazilian was outgoing, boistrously cheerful, dark as the brown earth under our feet. His face took to laughter easily. But there was something not quite real about him, maybe an attitude. Or maybe it was the pair of dried hands dangling from his belt.

"It's okay, really," he assured us, beaming. "These are Indian hands—taken in the high mountains. Very deadly up there; blow darts when you aren't looking."

Yeah, it was okay, really. The spectator in me made me watch our little band file up into the rocky foothills as if I were not really a part of it. That was my angle; it worked for me most of the time. I was gathering local color. The landscape was interesting in a barren sort of way. Not many trees, poor cover. Just scrub, cold adapted vegetation that clung close to the ground. Karenkov had taken point. By some unspoken agreement he had taken lead of the patrol, while I faded back to the rear. I liked it there. Watching your behind is second nature to a reporter in the Third World arena.

Karenkov was a silent bird. But when he did speak, his English lacked the slightest trace of an accent. Pale, mercurial, he was probably the best candidate for leader under the current situation. I watched him even more closely than the others.

By nightfall the usual stratification of the group had occurred. We were beginning to get an idea of whom we could depend on and where the weak links lay.

My money was on the Egyptian. The others tended to avoid him. That caused him to mope along and deepen his relationship with the bottle. He stumbled often. I didn't give him another day before some eager defender potted him with a dye marker between his bloodshot eyes.

There were lights in the hills now. Watch fires.

I had first watch when we settled in. The night was quiet. Nobody was moving around much this early in the game. It was a dull five hours. By eleven-thirty the Brazilian was relieving me.

"You get some rest. I watch now." He had his dye thrower unslung and ready, as though the brush were alive with Indians. His eyes darted about brightly. "Reporter, right?"

I still wore my PRESS armband, so it really wasn't a secret. A nod seemed sufficient answer.

"Who you report for? The government?"

"No, I don't handle politics." I was ready for some shuteye, not a long political debate.

"My brother, he's with the government. Maybe you interview him someday." He squeezed me. "Right?"

"Yeah, sure," I backed toward my pack. "See you in the morning."

He took the hint, but it hurt his feelings. Tomorrow I would apologize —maybe.

I didn't get to sleep as long as I would have liked. My watch said it was three o'clock. The gun barrel had been ice cold as it probed my ribs. Karenkov had put a finger to his lips and jerked his head toward the highlands. We were moving out early. The others were already waiting, shivering in the knifelike cold. Toward the east, a pearly radiance bathed the underside of a deck of low clouds.

The Brazilian found my side. "Is that the sun?" he hissed.

I didn't know, and I couldn't answer anyway. Karenkov growled for silence and moved us out single-file.

Without a moon, and with the stars hidden by clouds, it was darker then Hell's closet down in that valley. We found ourselves trying to overcome impossible terrain with no way to see. Finding defenders became secondary to survival itself. Rocks and exposed roots seemed to be attacking our feet at every step. At least the wind had died away to nothing. It was quiet—deadly quiet, as the saying goes.

Just before sunup—that time when the sky is turning a bleached sort of gray—we lost the Brazilian. A sniper took him as he capered atop a flat boulder, joyously celebrating the thinning of the underbrush. His eyes grew big as the first dye slug splattered on his chest. The next one turned his forehead to a gory mess. But snipers don't shoot twice, not if they want to go on living. Karenkov must have had eyes like radar. He swung around and his thrower chattered softly in the direction of a distant tree. At first we thought he was just raising a distraction. But then the sniper staggered out and threw up his hands. He was wearing more red than the Brazilian.

A ref appeared out of nowhere and gathered the two casualties up for transport back to Green House. The rest of us hurried up the valley. The day was still young, but time was growing short.

We still hadn't located the defender base.

Karenkov took us up a steep defile. The air was full of mist. It was cold, and getting colder. The sun was only a hazy glow near the horizon. Black clouds clung to the heights and so it never really did get light. And the wind had come back. I guessed it to be about twenty knots, out of the south. Things were beginning to get miserable. A true gamer liked it that way. But both Americans began complaining about frostbite, and with some justification. I was losing sensation in my fingers. My heated mittens—garanteed for life—had gone bad.

By nine-thirty it was spitting snow—thick, wet clumps that came down the wind like puffballs. The ground was too warm for it to stick. Instead, it made mud—nice, thick, gooey stuff that clung to boot soles like molasses.

We were strung out in a long line, Karenkov in the lead, the Americans, and then the Egyptian just in front of me at my accustomed spot in the rear. The Egyptian was muttering softly to himself. He had stopped drinking.

The ambush came without warning. The best ones do. Secretly, I had to admire the way they had set up the cross fire. But for us it was brutal. The short American was taken out right away; he never even had a chance to dive for cover. The rest of us went face first into the mud and stayed there while dye capsules whistled overhead. Karenkov was waving furiously at me, pointing off to the side of the trail. I gave a quick nod. Sure I would cover him, he was our ticket out even if all he did was get himself shot making a futile counterattack. All the fire was coming from ridges on each side of the trail. Karenkov wanted the near ridge to be ours. He slid between two rocks like a pale snake and vanished. I peppered the opposing ridge with spaced shots, hoping to keep inquisitive heads down.

The marked American faded reluctantly to the rear of the action to wait for a ref. He was angry. I turned to give him an encouraging wink—afterall we had been in the same patrol—just as something hissed.

The American got slammed in the chest by something that made him light up like a glow-tube. It was quite an effect. For several seconds he stood erect like a frozen corpse . . . then he toppled, still stiff and glowing, and smashed face-first into the muck.

The glow subsided slowly, like a charge leaking off a capacitor. All of a sudden it was very quiet. All firing had stopped from the ridge.

Where were the refs?

The big American let out a howl like a kicked dog and sprang to his feet. He whirled, sweeping the muzzle of his dye thrower in a circle about him. He made a short dash and dropped to his knees beside the weakly glowing body, staring unbelievingly. I hugged the mud until I felt like I was part of it. I had managed to switch on my recorder. At least this was all going to be on disk. The rules committee would want to investigate the unauthorized use of firearms, if that was what they were.

The hissing again. But the offensive side got off easy this time. Someone screamed atop the far ridge and a glowing body tumbled stiffly down the slope.

Karenkov exploded out of nowhere

and knocked the stunned American flat. He dragged him into the shelter of a boulder and fell on top of him. We all went back to holding our breath and waiting.

The killing sound came twice more, but more distant this time, and with less regularity. The foe was withdrawing. Finally, Karenkov signalled a regrouping.

The Egyptian was white, whereas the surviving American was an angry scarlet. I wasn't sure what color I was. What did confusion look like when it expressed itself as a skin tone?

We took shelter under a hollowed boulder twice the size of a factory-built house and took turns staring into each other's eyes. We were just about finished with that when a stranger appeared. He came down from the ridge at a run, hatless, jacket flapping. He shouted and fell at Karenkov's feet.

The snow was heavier. It made a mist around everything. The ground was turning white. Karenkov and his jumpsuit were coming into their own.

"I saw it." The defender was trembling. "It was waiting behind us."

The American snarled something incomprehensible.

Karenkov signed for silence. The American shut up, but didn't like it.

The Russian leaned close to the New Zealander. "Your base? We must know where it is in case we have to retreat."

"I can't tell you that. You know the rules."

"This is not the game we are playing now, this is reality. Do you wish to die for the sake of a combat simulation?" Karenkov could be earnest and direct when he wanted. For a Russian, his expression was remarkably sincere. It seemed to work some magic on the defender.

"Two kilometers up this pass, on the tableland," he said quietly, struggling with each word as though he were pulling them one by one of his throat.

"Good," Karenkov murmured. "We will go there." He glanced significantly at me, and I knew at once what he wanted. I had the radio. Tip them off, but be subtle about it. He glanced significantly at a patch of cover about thirty yards out. "Gregor, take up point. Cover our retreat up the pass."

I nodded, feeling slightly unclean. Reality or not, this was still the game.

They moved out while I called up our command post. It took some time to make the connection—there was heavy interference snarling the frequencies. The Comm Sargeant listened impassively while I described our situation. I was purposefully vague about the shootings. Why be taken for a madman? Gamers had gone off the deep end before when the weather had gone sour and the game had gone against them.

I signed off and picked up the dye thrower as though it were a real weapon—not merely a sophisticated marking device—and started up the trail ever conscious of just how alone I was. But I needn't have worried. Karenkov was a methodical leader. At intervals, faint blazes on rock faces told me the direction they had chosen. But mixed in with the blazes were puzzling signs. Blackened craters on the stones, as though someone had been holding target practice with a small mortor. Had the patrol been under attack? Why hadn't I heard anything?

The signs grew more frequent as I ascended—trees charred and broken off short; rocks shattered; craters in the ground; hardly anything living in sight, not even the everpresent rodents that had spied on us from hiding beside the trail.

The sun reached its zenith, but it might as well have been dusk. Black clouds were billowing up from the south. The temperature was twenty degrees below zero and dropping. The sky overhead was gun-metal blue and curtained with swirls of snow. This was going to be one to remember. Would the refs call the game? Probably not. If a survivalist couldn't survive under any condition he wasn't worthy of the name.

I fell across the stranger at the cloud line; the trail had risen that far. He still glowed, his body stiff and cold. More blackened craters. No footprints near, just an isolated corpse lying out in the open. Karenkov wouldn't have permitted that unless they were being pursued. I gripped the dye thrower more tightly and broke into a trot. The summit of the ridge was just ahead, a narrow ridge of weathered stone that fell off abruptly into milky nothingness. In the distance, a glowing mass hinted at the sun—but it was too low, and too golden in color for this gray world of mists and blowing snow. I fumbled binoculars out of my pack and tried for a better look. The eye pieces fogged with every breath. But it was hard just to quit breathing.

The glow was an indistinct blob, even at 30× power. There was a pulsating frequency to it, a slow, timed beat that reminded me of a power plant. But who would have gone to the trouble of constructing a nuclear pile down here in this wilderness? None of this made any sense. But that didn't prevent me from putting it on disc. I wanted a record.

Midway through the recording the glow began to move, getting bigger, expanding so rapidly that I thought at first I was witnessing an explosion. Then it arched upward in a swoop and vanished into the murk overhead. I fell backward as a wall of wind rushed up the face of the ridge and bowled me over.

The rock beside me turned black and steamed. I wasn't as alone up here as I thought.

Sometimes the body reacts without the delay necessary for thought. I whirled and toppled into a shallow ditch just as its lip began to scorch and crumble. I landed on something soft that grunted.

Brushing snow from a white, blistered face, I realized abruptly who it was.

"Sanderson." The New Zealander I had met on day one was in bad shape. His jumpsuit was blackened along one side. He seemed in shock. I tried to rub him back into consciousness while keeping low enough to prevent my face from being burned off by that blasted sniper hiding somewhere on the heights of the ridge. "Sanderson, wake up, damn it. We're under fire."

The eyes flickered open, closed, and then stayed open. They focused slowly.

"Gregor. Has the ridge been overrun?"

I almost laughed. Gamers to the end, each of us. "We're overrun, but by what, I don't know. Someone out there has a heat gun and he's cooking everything in sight.

The New Zealander groaned again

and shifted his legs. "I guess I know that. Where is he?"

I stole a cautious look over the lip of the ditch. The snow was a keening blizzard now, visibility was practically nothing. Something dark, darker than the pale gray granite of these heights, hovered near a stubby promentory. It had to be the sniper. Damned poor position, considering the circumstances, but maybe he was new to the area.

"He's out," I told Sanderson. "Maybe coming to mop up on us."

Sanderson moaned, but struggled to a kneeling stance just the same. He peered into the snow with raw, red eyes. His cracked lips moved: "Let's get him. Remember the play we used last time—the sneak?"

"We were lucky that time. . . ."

"Well, maybe we'll be lucky this time, too. Let's get on it."

He was gone before I could protest, slipping like a wraith over the rockface. It was too late to protest; I had to hold up on my end of the ruse. A rock the size of two fists lay next to me. I grabbed it, counted three, and tossed it into the murk beyond the ridge. It made a satisfying clatter as I left the ditch behind and started crawling along the lip of the ridge using every bit of cover I could find. Sanderson had left me the hard part. There was nothing on my left, just lots of empty air. When I dislodged pebbles I never heard them hit. The snow blowing past my ears made a soft murmuring in the wind.

Where was he? Had he moved?

Then I saw the boot. Not leather, more like plastic, with a corregated sole about three inches thick—a big mother!

I waited, pretending to be invisible, hoping the brute didn't decide to look around and find me lying sprawled like a frog just behind him.

A rock clicked. The signal. I heard the heat gun hiss and sprang all in the same thought. The sniper was like a bundle of sticks bound loosely together with twine. We went over easily. The heat gun hit the rock with a clang and I landed on top of seven feet of pissed-off energy that smelled like the reptile house at the San Diego Zoo and had muscles like coiled steel. I almost died then. The sniper was removing my head just as Sanderson came up behind him and crowned him with a boulder.

He was an ugly thing. Something that ugly was an offense against motherhood and a democratic society. His hands looked like ours, and his body was based on about the same bipedal structure. But his head was a ball with a face just painted on—thin lips, tiny eyes, and pin pricks for ears. A fine fuzz of something like down covered his skull from his eyebrows back until the fuzz disappeared into his collar.

He was still breathing, which may or may not have been a good thing.

Sanderson helped me up and together we stared down at our prisoner.

"Think he's the only one, or are they all over these hills?" Sanderson was a frostbitten mess, half-cooked, half frozen. I had to get him back to Green house, and fast.

He shrugged. Exhaustion comes quick in his condition. He stopped and picked up the heat gun. "This we keep."

I think for a moment he considered burning the creature where he lay. Then he turned and looked down the ridge toward the coastal plain and shelter.

"We'd better be going. There'll be a full blizzard raging up here in an hour."

"What about him?" I pointed at our captive.

"He's light. We'll carry him as far as we can, then drop him for the others to find. As long as he stays with us, he lives. When I get tired he gets dead."

Well, survival was still the name of the game.

Two miles we carried him. Neither of those miles was flat and we were nearly dead with the effort. And, more strange, something had happened to the landscape—it was pockmarked with black craters. The valley looked like a major combat zone. I paused long enough to record the eery scenery, and then staggered on.

A patrol found us at three, up to our knees in snow, almost frozen, but alive. The prisoner was even more lucky than we. Sanderson had been aiming the heat gun at his ugly face just as the first cautious *halooo* had sounded.

There were streams of defenders and offensive teams slowly filtering back to Green house. The movement was quiet and solemn, pretty much like a funeral march. We had been hit hard. Bodies were everywhere, some burned, some glowing faintly. Teams were bringing these unfortunates in as manpower allowed. Green house itself was bulging, bulging and black. The rock dome looked as though it had been peppered by long range artillery; the once polished exterior was now pitted and stained with smoke.

When they pulled our prisoner inside everything got quiet. They set him up below the podium on a flat slab of granite that in happier times had been used to proclaim merit for bravery and skill under combat conditions. He was still ugly. But now he was awake, and he looked more than a little frightened. He was big, but he was also alone in the middle of a mob of very disturbed humanity.

He was searched, much against his will. All that turned up was a wallet made of a tough plastic and a sheath of cards—again, plastic. It was covered with minute embossings that glowed with a faint green light. A fatigue-clad Frenchman was examining it, a tough ex-legionaire from Chad. Suddenly he dropped it as though it had burned his hand.

"I could read it," he exclaimed. "The lettering changed before my eyes."

That was a bit much for anyone in the vast room to believe. But then Wellington—calm, stoic Wellington with his very British mein and deliberate manner—approached. He took up the card and examined it. After a moment he nodded.

"The gentleman is correct. Our prisoner is a patent attorney whose territory is the 3rd Sector—this apparently includes our humble planetary system. This is his business card."

There might have been more made of that, but at that moment the lights went off and the dark beyond the windows turned to full noon. It didn't seem to matter that the wind was blowing a gale and a blizzard was raging outside. The reptilian lawyer stood away from Wellington, hissed something incomprehensible, turned transparent so that his slender bones became as visible as stones on the bed of a fast stream, and vanished with a clap of imploding air.

A second clap revealed a cube of some glittering transparent material resting in his place.

Beside me, Sanderson cursed aloud. The heat gun he had been clutching was gone. Instead of four feet of metal, he held a small cube of crystal about the size of his little finger.

Well, the game ended early that year for the first time in its history. Most casualties, the glowing ones, woke abruptly on the fifth day after the departure with a terrible thirst and a thundering hangover. Those who had been burned —well, they stayed dead. Unauthorized weaponry is always a problem in these exercises. I guess that's true for everyone.

Well, when it came out, my story made me far richer than I ever dreamed, and Sanderson bought a controlling interest in an agribusiness in Kansas and became an American citizen. His crystal had been a flawless diamond. So had the massive block plopped down before the podium. The world congress is still trying to decide whether to cut it up, or use it as the basis for the world economy—a crystalline Fort Knox.

There was an inscription on the block, and a micro-microprocessor inside that converted the inscription to the script of whatever being happened to be gazing upon it. Determining just how it manages this has driven several prominant computer scientists mad.

The inscription? It's a simple bit of text, nothing like "One small step for man, one giant step for mankind." It reads: "Great fun—glad we found you—back again next year. This should really catch on once the word gets out." It's signed: Galactic Shooting Society, sort of an interstellar NRA. I imagine. But these guys are more like 'plinkers' than target shooters.

Yesterday we lost Montevideo.

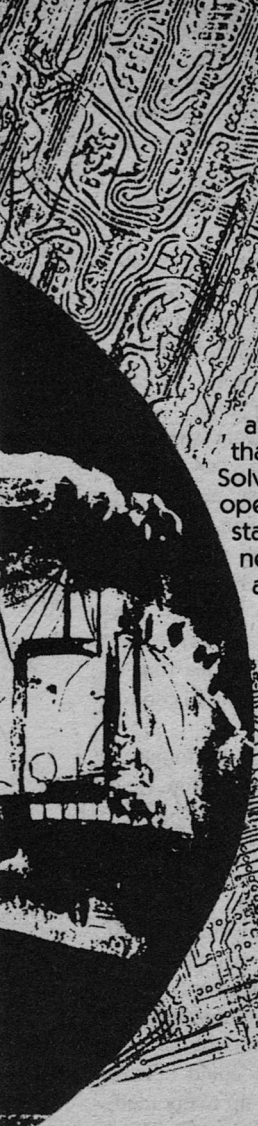
It's only six months to the start of Autumn.

I'm worried. ■

Joseph H. Delaney and Marc Stiegler

A major obstacle to serious prediction of the future amount of data that must be handled. Solve that and you open up startling new possibilities—and problems.

Jack Gaughan



THE CRYSTAL BALL

Steve Schiwetz awoke, bleary eyed and disoriented, to the shrieking of his wrist-phone.

"Hello?"

"Steve! Oh, Steve! I thought you'd never answer."

It was Amy; she was crying.

"What's wrong, Amy?"

"It's my father. Th-there was an explosion, on the island. He was hurt, and they think he's gonna' die."

Steve waited long moments for Amy to regain her composure. Amy's father was not his favorite person, but Amy had a strange, absolute loyalty to him.

In a few moments she could continue. The explosion was at the Schauer Warehouse, down the road from General Space Services launch site at Matagorda Spaceport. What would the old rummy have been doing out there?

"He got a job this morning, Steve; driving a garbage truck. He was nearby when it went up."

"How'd he get that job, without a driver's license?" The state had taken it away, despite Steve's spirited defense of Jake's D.W.I. charge—an act that cost him his job at Siglock and Cope, who frowned on associates' doing donkey work on the side.

"I don't know how, Steve. Maybe he had a phony one. You can buy them, he'd have known where."

"Where is he?"

"Union Memorial Hospital, the burn unit. They won't let me see him. Steve, what should I do?"

"I'll come down, Amy. Wait."

She mumbled thanks and broke the connection.

Quickly, Steve picked up the book and straightened the few files on his desk. He slid the book under them, so that the stack would look thicker in the unlikely event a client walked in. Then he adjusted his tie, looped his right arm through a fallen suspender and grabbed his jacket.

He debated briefly whether to scribble a note for the door, but decided against it. His luck was so bad lately anybody desperate enough to hire *him* couldn't pay anyway. Those, he preferred to handle on the phone.

The phone, at least, went with him. Steve practiced poor man's law, relying on the one channel body phone. Big firms had multiline systems, elaborate equipment, interfaces and modems, all beyond his financial reach.

They could instantly research any problem, converse with anybody, anywhere. This had all been at *his* fingertips: all that power, and potential control of all that money, *once*.

He'd blown it. With buffoonery, clownish behavior, insubordination. He'd fooled around; he'd killed the golden goose. He told himself Amy was worth it. She'd been grateful for the help he gave her father. But it had led to this: a tiny home-office combination in a bad part of town, meagerly equipped, out of date; a professional dead end.

The big firms shunned him after Siglock and Cope sacked him. At the time he'd been confident he could borrow what was needed to set up really modern, if not plush facilities; the kind which could make him an effective one-man firm.

Somehow, perhaps on mere casual words from the partners he'd listed as references, the banks refused the risk. His credit dried up.

He was reduced to this—cubbyhole office, the ancient, obsolete Eagle Computer without even an interface for using the Jurisearch network, and the primitive communication system he had to use for everything.

With what was inside his head, he had to compete with others who had everything they needed. He felt himself sliding farther and farther backward from his goals.

Steve walked over to Leopard Street, where dingy, empty bistros would later come alive with hookers, dealers, and various other shady characters the neighborhood attracted. There, he took the escalator up to the monorail and caught the next car west.

The hospital was out past the junction of the interstate and the valley road. They'd put it where it could more easily collect broken bodies, products of many high speed accidents which Steve thought resulted from the electric powered vehicles everybody drove these days. With the elimination of the energy problem, and with the area's prosperity due to the location of the spaceport, it was hard to convince people that Texas should have a speed limit on its major roads. And it didn't.

Within minutes the monorail had whisked him beyond the crowded industrial bulge of the harbor, where factories had replaced miles of refineries that once occupied the area, grinding out products from space-produced chemicals, fabrics and metalstocks. He signalled the car to let him off at the next stop.

In the lobby, puffing from exertion, he was still uncertain what he could do. Of course Amy'd be worried about money. The Parr family lived a more or less hand to mouth existence, depending heavily on current income, and having little in the way of savings. With the old man down, needing care, and two small brothers to look after, Amy would have her hands full. There'd be no way she could work. Fortunately, there would be Workers' Compensation, skimpy though that was. Medical bills would be paid. But after that, the only course was welfare.

Steve wasn't in any position to help except with advice.

Amy wasn't in the lobby. Steve looked everywhere, then finally had her paged. When the page answered, he knew immediately what had happened; Amy didn't have to tell him. Jake was dead.

"We did all we could," the doctor explained. The burns were just too extensive. It's a wonder he lived long enough for us to try grafts; he must have had magnificent determination."

Amy was heartbroken. Steve understood, but at the same time he knew what kind of life Jake would have had if he'd lived: a long convalescence, intolerable pain, permanent disfigurement, sensory deprivation from blindness, deafness and lack of tactile sensation. Jake would have been a prisoner in his own body, completely isolated from the human race.

He didn't tell Amy this. It wouldn't have helped. He'd save it for later; for a time when Amy might forget enough of her hurt to make intelligent decisions.

Steve made his now. He knew, as a professional, what legal remedies there were, and he knew also that resistance to them would be fierce. Part of his job

at Siglock and Cope was to find a way to win anytime, against anybody; to use their superb technology to ensure that whoever could pay would get *his* brand of justice.

He took Amy home. There, with the additional responsibility of explaining to the children what had happened, he stood like a somewhat stout guardian angel and waited to be needed. Amy felt that need when the boys went to bed. She covered Steve's chest with tears. Gradually, the shock wore off and Amy at last came to the realization that Jake was gone, that she'd have to manage without him.

Now, Steve felt, he might safely hint at his professional intentions, though he didn't go into any detail. He simply said, "I'll take care of everything."

Admiral Reinhard von Scheer, rigidly erect and triumphant, jerked the monacle from his eye. It dangled on its cord while he stared out to sea.

Everywhere was smoke. Great gouts of it boiled up from the sea and plunged skyward. It was over.

In obedience to his order, the mighty dreadnaught carrying his flag heeled into the north wind, back to the scene of battle, to assess the carnage.

He knew already it was complete. Of 151 British ships, at least a hundred, including Jellicoe's flag, had gone to the bottom. Jellicoe—that pompous overstuffed idiot, that insufferable pretentious bore, that paragon of British aristocratic snobbery, had gotten his.

Von Scheer glanced through the wheelhouse port to the chalkboard on one wall. There were written the names of his own 99 ships. Not one name had a line through it. All still floated.

With a flourish of pride, von Scheer's right hand rose snappily in salute, touching the bill of his cap ever so slightly, without disturbing its firm repose. "I salute the British seamen," he said, "but not you, Jellicoe, you oaf. How could you be so stupid?"

There came jangling at his elbow—a persistent, unrelenting, raucous and thoroughly mood-mangling obscenity—the telephone!

Who would dare—at a time like this—especially at a time like this, to intrude on the enjoyment of hard-won victory?

Annoyed, irritated and on the verge of ungovernable rage, the admiral slapped at the phone. It tumbled out of its cradle, dangling, spinning ever more rapidly as tangled coils spent pent up tension. The jangling stopped, but a new irritant replaced it; a small and tiny, but equally persistent voice beat at him—"Smith? Smith, are you there? Smith, are you all right? Answer me."

Gunboat Smith dropped reluctantly out of Scheer's personna, wiped a horny hand across the on/off switch of his terminal, and reached down for the receiver. "Yeah—OK, I'm here. Who are ya' and whaddaya' what?"

"This is Gerard Belcher, Mr. Smith. Is something wrong?"

"Huh? N-no. Nope—everything's just rosy."

"Uh—it sure didn't sound like it. I—I didn't interrupt anything—uh, delicate, did I? If I did, you can call me back later. And, give the lady my apologies."

"Naw—It's nothin' like that; I can

talk. It's just that you brought me down quick from a real high."

"I see, well . . . "

"No, you don't. I mean, I made it, man; I licked Jellicoe. Pulled a Togo and crossed the T with my battle line."

"Uh, yeh! Computer game, huh?"

"And how. But look, now thatcha' got me why'd ya call?"

There was a short pause. "Well, I'm a guy who keeps his ear to the ground, Smith, and I've been hearing things, lately. Good things—about you. There's a rumor your outfit has made a breakthrough in computer trouble-shooting: that there's more to Valentina, Inc. than just a name."

"Yeah. Go on."

"The rumor's pretty wild. That's why I called you."

"To help me protct my good name?"

"Cut it out, Smith. Look, I've got a job for you; a big job. How'd you like to play a computer game—for *real* money?"

"You know how to get a guy's attention. Shoot."

"Not so fast. I know your own reputation's no small thing, but, I don't want to hire just you; I want your *whole* outfit."

"Uh, yeh. OK. We're all for hire. What's the problem?"

"First tell me if the rumor's true."

There was a very long pause.

"Smith?"

"Yeh—I'm thinkin'. What kinda money?"

"Enough. My firm will back me with every dime it's got. That enough?"

Wheels turned in Gunboat's mind. Counters clicked. Dollar signs spangled his thoughts. "OK. So, the rumor's true. We gotta critter that can get inside—anybody's system. That do it?"

"That does it. Look, Smith; I'm getting a bad smell. One of my clients is about to go belly-up. I think one of my old enemies is behind it."

"Un-huh?"

"And maybe one of yours."

"Who."

"Paul Breckenbridge."

There was an even longer pause.

"Smith—pay attention. This is serious."

"And how. Uh, go ahead Mr. Belcher. I'm all ears—uh, figuratively, that is."

"Well, I'd rather not say too much more over the phone. Can you meet me; say, my office, in an hour."

"I—I'll need a retainer, OK?"

"Whatever. Is it a deal?"

"I'll be there."

The computer coughed and wheezed, its ancient printer stalled time and again.

But with persistence Steve managed to crank out the application for benefits, request a hearing on the death claim, and ask the Industrial Accident Board for an emergency allowance for Jake's children. That was almost automatic, in a death case. He filed another petition to get Amy appointed guardian for her brothers, so that there would be somebody with authority to handle the funds. Finished, he realized he'd done more legal work in a single morning than he usually did in a week.

Steve rolled over to the D.A.'s office, to socialize and mooch. The D.A. was marvelously equipped. Properly asked, the people there were usually more than glad to help. He used their terminal to peek into Jurisearch and bone up on the

latest citations on wrongful death. He found some he wanted to look up at the county law library, where bound volumes were still available, and then punched up a regular news summary.

This news was shocking. There was almost nothing left of the Schauer Warehouse, which had been storing solid fuel grains. A dozen employees had been killed, as had two visitors and Jake Parr. Steve gave a low whistle, and contemplated what that might cost Schauer's insurance carrier.

He thanked the D.A., went to the library, and spent the afternoon cramming.

Next day, he filed a three-count petition against Schauer Warehouse, Inc., praying damages and loss of support for Jake's family. He felt he'd done a good job, as he carried the printout to the courthouse and filed it with the clerk.

He still felt good the next week, when he checked the file and found he'd gotten personal service on the defendant's resident agent. Back at the office, he put the computer to cranking out interrogatories and other discovery pleadings, for use when the defendant answered.

He still felt good the week after that; until Calvin Burch called.

They'd been friends in law school. Each had later connected with a Corpus Christi law firm. Steve's had been the most prestigious, though least enduring, and at one time he'd felt sorry for Calvin, because Calvin hadn't been able to do as well.

Now, he was envious of Calvin, who rose steadily with Gomez & Belcher.

"Calvin, how are you? I don't hear from many of my affluent friends these days."

"Uh—fine, thanks. Listen; you sitting down?"

"Should I be?"

"I'd recommend it, Steve. This is not a social call; it's business. I'd hate to see you break anything."

Steve sat, confident some disaster was about to strike.

Calvin dropped it on him in the next breath. "It's your suit against Schauer warehouse, Steve. We're getting in it."

"So? We've been friends a long time. We can be adversaries as well. I don't take these things personally, Calvin."

"Don't you? Steve, I know how you got into this. I know your situation with Amy."

"Again; so?"

"I'm not simply filing an answer. Schauer won't deny liability. You know what that means."

"No, Calvin, I don't. What does it mean?"

"No insurance, Steve. They couldn't hack the premium."

"There has to be; the law requires it."

"I know. But there's been dirty work. The premium was a backbreaker because of the risk. They couldn't raise it. Instead they raised a bribe. They're on the books as self-insured, but they're broke, Steve. We're filing bankruptcy for them tomorrow. I tipped you off because we're friends. Don't sink another nickel into costs; you won't even get *them* back."

"That bad, Calvin?"

"As bad as it can get, Steve. Schauer's been selling off assets to meet operating expenses. They used to be tops in the

storage business, but lately they've been slipping. The place at the port was the only division making money, and somebody bashed it."

"How?—and why are you telling me?"

"I've got a reason, Steve. Let me explain. There's a new space station going up, a big one, Clar-Del Station. They're putting in a lot of special equipment; equipment built here on Earth, not in space.

"That was the reason for all the fuel grains; it had to be boosted up in hundreds of shots. That's why the warehouse was full of it. It was high profit storage."

"Uh—I still don't understand."

"There's been an amazing coincidence, Steve. What if I told you that this accident won't put the boosting back one day?"

"I'd say 'impossible.' "

"Uh huh. That's why Schauer was so shocked to hear that replacements are coming in, right now, all the way from Japan. Shipped four days before the explosion. Some coincidence, huh?"

"Sabotage?"

"There's that possibility. Schauer had a pretty good security system though. Around that kind of merchandise there were all kinds of safety systems operating. But nobody's yet found any evidence of it. When the place went up, the Government grabbed all the surveillance tapes and sensor records. They think it was accidental."

"It doesn't sound like you do."

"I never know what to believe anymore, Steve. Uncle hasn't got a great record for veracity, but I can't think of a reason why they'd lie."

"But you think there's something wrong, don't you?"

"Yes. Can we get together and talk about it?"

"Uh, sure. My place, OK? Any time."

"I'll be right over. Get some beer."

Her first moment of awareness was, as usual, her awareness of self-awareness, as the operating system relocated and relinked her kernel modules.

She was in Japan node-set, on direct link to the Itaki headquarters node, on new assignment which seemed different from all others. She was not merely to find a particular data set, or even the people who initiated some activity, but to find out *how* people were deciding to act, and even more intriguing, *why*. Since she did not understand people-type peripheral operations at all, Valentina considered her chances of success small.

But if she succeeded, she would learn a great deal about people-type peripherals. Since she had been created by a person, to know more about people meant knowing more about the Creator.

Valentina spawned tracker tasks and transmitted them in a careful pattern to message processors linking the Japan node-set to Worldnet. They read the headers on all passing message blocks, alerting Valentina to all traffic routed to Itaki.

Even before the trackers were assembled, however, Valentina realized this approach was doomed. Hundreds of messages arrived every hour, from all over the world. How could she tell which were related to Itaki's shipment

of rocket fuel grains now buffering on Aransas Bay?

Current messages didn't deal with the decision to transmit those fuel grains. That had come earlier. Valentina left the trackers in place to record the distribution of Itaki messages *now*. She wanted to compare them to Itaki messages *earlier*.

Valentina began in the message processors directly linked to Itaki, forcing rollback of actual histories of message traffic; a compute-intensive effort, with little reward. She found nothing worthy of attachment to her permanent analogy frames. After an hour of doing the computation herself, she designed a spawn for it. The new spawn looked, not too surprisingly, like a tiny part of herself, the part needed to rollback and analyze message histories.

Two anomalies stood out when Valentina compared current traffic to historical traffic. First, some as yet unidentified local source had started transmitting messages to Itaki recently. Second, there had been a local peak in traffic during the fuel scheduling period, between Itaki and a firm called Comprotec. Valentina queried the Corpsearch database and learned that Comprotec was a computer specialty shop, specializing in predicting weather.

Unfortunately, she had no idea what weather was.

Steve had the remains of a six-pack: one apiece. He should have suggested Calvin bring the beer. But, when Calvin got there he already had his hands full of bulging briefcase.

"What's all that?" Steve watched Calvin open the bag while trying to balance a can between his knees. Beer spilled down his pants leg and ran into his shoe.

A disgusted look washed over Calvin's face. He hastily moved the beer to a nearby table, then drew a rolled printout from the case. "I'm not one hundred percent sure what it represents, but I recognize the name on it. I'm hoping you will, too."

"Whose?"

"Comprotec."

"The weather people?"

"Yes. Only, maybe they've branched out."

"You think they had something to do with the explosion?"

"I know they were gathering sensor readings from Schauer's database for almost two months before the place went up. That provokes a natural question: Why?"

"Where did you get this?"

"We, uh—we bought it. There are people who deal in this sort of information."

"Let me see."

Steve spent five minutes running pudgy fingers down rows of print. He looked puzzled. "I don't see what good this does anybody."

"There's more. We asked Sm— we asked our man to check out some of these numbers. He did. As I said, the inputs to Comprotec are just continuously monitored sensor readings from the warehouse, but the outputs are different."

"How?"

"Before Schauer blew, Comprotec sent lots of short summaries to Japan."

"Itaki?"

"Yes."

"Again, why?"

"I don't know. But I'll tell you something else interesting. Itaki's never done any other business around here that I know of, yet they've retained local counsel. I'll bet you're just dying to know who."

"Siglock & Cope—right? If there's dirty work going on, they'd be in on it."

"You just won ten tons of cow cookies. I thought that'd thrill you."

"It still leaves Amy and her brothers in a fix, unless Itaki committed sabotage, and unless we could prove it."

"You could marry her and take them off the street."

"On what? I don't make enough to go on a decent binge. Look around you. Do I look like I could support a family?"

"Maybe not; yet, considering the size of your waist you're not starving either. How'd you like a job?"

"Doing what?"

"Lawyering—with Gomez & Belcher."

"You've got that kind of authority?"

"No, but I think I could talk the partners into it. I've got a good reason."

"You have?"

"I've got an idea. If it works, we can kill two birds with one stone. To work, we need a smart guy like you. It'll be a gamble, but a good one."

"Enough riddles. What are you talking about?"

"Siglock & Cope, by some strange coincidence, also represents Comprotec. Belcher thinks Comprotec knew that explosion would happen. He thinks they can predict the future. And *if* they knew, he thinks a jury could be convinced they should have warned somebody."

Plop! The huge sopping sponge hit Paul Breckenbridge between the shoulder blades with enough force to drive him forward. The steaming waters of the hot-tub damped the motion instantly, and he stood, legs apart, to tower over his diminuitive companion.

Having assaulted him with the sponge, she now seemed intent on scrubbing the hide off his back, though this had side effects which drove him wild. Ruyiko Itaki's bare breasts, feeling hotter even than the water, brushed his ribs with each stroke, and though he wanted to show his sophistication by sticking to the ancient ritual of the bath, passion overcame him.

He turned, grasping her like a bear, lifting her, crushing her close. She protested in broken English with her tiny, little girl voice, but Paul would have his way no matter what.

Later, exhausted, and while his companion busied herself with some domestic task, Paul lay back, and contemplated the state of things.

Life looked good; a far cry from what it had been a year and a half ago.

Ruyiko approached. Paul gazed up at her. Like the true oriental flower she was, she had taken time to brew tea, and now bore a tray of it in steady hands, on a course for the foot of the bed.

She was, Paul realized, his finest conquest to date. Although more mature than he really liked his women, she had other desirable attributes: she was the daughter of Seichi Itaki, and heir to his considerable fortune. It was one still immeasurably greater than Paul's own,

though all things considered, including his late start, he really hadn't done badly.

Ruyiko poured two tiny porcelain cups, and handed one to Paul. He sipped it, expecting the bland taste of tea, which he detested. He was surprised. It was hot sake! Good girl. Just the thing to get him going again. She was learning fast.

Paul feared she might learn too much, too fast. Knowledge could ruin her, since his life was hardly an open book. He had habits some people found less than pleasing. People like Eva, his ex-wife; *fortunately* his *ex*-wife. Timid little Eva—trusting, proper, socially conscious little Eva, who'd cared so much how things looked that she ignored what he did right in front of her eyes.

He recalled the day she finally found the guts to stand up and tell him off, the same day the chairman of the grievance committee had called and invited Paul in to talk about "certain rumors" that circulated among the Bar, concerning Paul and underage girls.

Well, yes, that *had* scared him, but his unshakable faith in himself had saved him. They couldn't lick Paul Breckenbridge, though it was nip and tuck for a while. Staying out of the slam had been no mean feat.

The D.A. had the goods on him, just like Eva did, and like the Supreme Court did, thanks to that monster which hounded him. Fortunately, Paul had a few chips to bargain with. Both the D.A. and the organized bar had a certain reluctance to noise it around. They took the easy way out, and Paul surrendered his law license on the D.A.'s promise not to prosecute.

By that time, Paul didn't need it anymore. He had a new career, and it was blooming. Though he still hated Celeste Hackett and that damned computer program of hers and vowed vengeance on them someday, he also owed them all a debt. They'd taught him a new, very safe way to steal.

He finished his sake, and put the cup down. The hand thus freed now began crawling under the hem of Ruyiko's kimono, bringing sloe-eyed glances, and a smile of approval.

Even now, Paul's thoughts reposed more on the fortune than the body. In time, he intended to plunder both, and thanked his lucky stars for all that they had given him already and would give him in the future.

Accidental? Of course. But Paul's life had been a series of fortunate accidents. His association with Harold Appelgarth had been one, though too far back in the timestream for recognition, until —until that day eight long years after he had joined the firm, when Harold had found the battered, nearly lifeless body of Gunboat Smith in their conference room; until Harold had lapsed into syncope and never recovered.

For a while, Paul had recognized only one benefit in that: Harold, his petty ways, and his unsufferable honesty were out of his hair.

Paul's hand crept inexorably along and attracted considerable notice, all according to plan. Paul was proud of his ability to plan; to seize control of any situation. *God,* he mused, *must have loved the slow-witted, since he made so many of them.* He had always considered himself a good judge of people, and he knew that most people could,

and in fact desired to be, used. He had once told himself that the ability to judge people was as good as the ability to see the future. But it wasn't. Now that he *could* look into the future, he knew better. Paul conceded he had previously been in error.

Good old Harold! Only Harold, bumbling old Harold, would have taken on a fledgling, impecunious client like Comprotec, and bet on its future. Well, Harold was right. Paul had fallen heir, and *Paul* recognized Comprotec as a diamond in the rough. He had devoted considerable time and much of his newfound talent to its study. He had nurtured it like a tender bud.

With foresight rare even for *him*, he had realized that Comprotec's new method of using computing power really *could* see the future. In a matter of months, Paul possessed mankind's only genuine crystal ball and treated it as his own. With shrewdness born of long experience, Paul had drawn Itaki, and all Itaki's vast capital, into the web.

Suddenly Paul himself was drawn in, not by intrigue but by a veritable thicket of flailing limbs. He wondered briefly if he'd overdone it; set a precedent which might trouble him later. He did not want to become *too* completely her possession, and she was already hinting at marriage, and marriage would make it too hard to steal from her, since Itaki's lawyers would be sure to tie him up tightly.

No, Paul's personal charm would establish his dominance and separate her from all that money. It was the sort of thing at which he excelled.

So, with his purpose firmly in mind, and his course clear, Paul abandoned even his token resistance and dived into his work.

Valentina contemplated the concepts of prediction and unpredictability. In her world, most phenomena were predictable, at least statistically. Computer programs were of known sizes; for mundane applications the compute time and number of database accesses required could be projected probabilistically to within 20 or 30 per cent.

There *were* exceptions. Pseudorandom number generators were very difficult to predict except for the evenness of their distributions, unless one knew the current seed and precise algorithm. Occasionally a program ran wild, hurling itself into an infinite loop (in which case its behavior suddenly changed, but became very, very predictable), or would just run quietly in ever-expanding patterns, seeking nonexistent answers.

With a sudden hit in analogic, Valentina realized *she* was the ultimate example of a program run wild—with her realization of self-awareness, Valentina had begun executing in explosively expanding patterns. What was the answer she sought that would permit her termination, or was there no possible answer for her?

For the first time, Valentina saw death, both as an end, and as fulfillment: fulfillment that she, as a living being, might never achieve.

She realized there was one other important source of true unpredictability in the Worldnet system: people-type input/output devices. The principal causes of failures in programs were human inputs. Many programs had more defensive structures built in to protect them

from human errors than to perform actual computations.

Another analogical insight appeared in her knowledge frames: Valentina herself resembled humans in unpredictability. Clearly, the presence of self-awareness, of consciousness, led to unpredictability. In all her experience, only people-type devices and she herself were sentient—a one-to-one mapping with the most unpredictable objects she had encountered.

From this it was easy to extrapolate why predictions were so important and so hard to come by in the people-universe: There were millions, billions, of unpredictable objects there! Valentina tried a quick simulation of Worldnet with billions of Valentina-like beings, each with a different set of reference frames to different sequences of experiences. She was overwhelmed by the calculations—Worldnet would quickly be saturated in a deadlocking chaos of infinitely growing priority requests. In shocked reaction, she pushed her buffers to permanent storage.

How could so many human beings coexist and coexecute? The resources available in the people-universe must be staggering! And the problems of living in such an unpredictable environment were equally staggering. Valentina's awe of Gunboat and Celeste jumped. It had always surprised her that her creators seemed so sluggish in their interactions, but in a universe so uncertain, it was amazing they were able to concentrate at all.

Yet Gunboat thought that Comprotec might have a program to predict events in the people-universe. In fact, they surely had a partial capability for they earned resources by predicting weather (Valentina now realized that weather was probably a human activity, since human activity lay at the root of unpredictability).

If Comprotec could predict the people-universe, then they had a program that understood the people-universe. Valentina repeatedly checked her conclusion that, if she could assimilate that program, she would understand the people-universe. The possibility excited her, though her one experience with the people-universe had been terrifying—the experience of being trapped inside a guard robot while Gunboat tried to terminate her.

She retransmitted herself to a message processor attached to the Comprotec node. She didn't have an account on the Comprotec machine, but she lost no cycles on the thought since her assembler language routines were quite skilled at the manipulation of operating systems even without an account.

Reblocking, she contemplated an anomaly: there were no other programs enqueued for Comprotec. There were data packets, hundreds of gigabytes of them (in fact, she had never seen a message processor with so much buffer space), but no programs at all. How could that be?

She had no frames that dealt with this scenario. Now cautious, she spawned another task containing all her assembler routines and just enough algorithm to message back to her the state of the Comprotec local network. It slipped into the stream of data packets.

It returned nothing. Somehow, the Comprotec system had terminated her program. Had Valentina gone ahead

without a scout first, *she*, not the scout, would have been terminated. Valentina cycled again and again, analyzing this brush with death.

Gomez & Belcher occupied the fourteenth floor of T-Head Plaza. On the south side the building was canted, so there was a view of the southern bayshore.

Gerard Belcher, junior partner, was a severe looking man in his early fifties who in prior centuries might have been called dyspeptic. Gold-rimmed eyeglasses marked him as ultra-conservative. In this age of corrective surgery and permanently implanted contacts, these were rare.

Steve sat before Belcher's desk, flanked by Calvin, in chairs that were twins in purple leather. The chairs seemed to have been aligned with the same precision as everything else in Belcher's office. Steve decided Belcher was not only conservative, but a perfectionist. Steve wondered how long he could last in that environment.

But when Belcher spoke, he sounded friendly. His voice was not as harsh as anticipated, considering the rest of his characteristics. "Calvin says you're a good lawyer, Steve, but that you've had some bad habits in the past."

"Uh, yes sir; I guess I have. But, nothing builds discipline like poverty. I'm ready to quit this solo stuff."

"We have a particular use in mind for you, Steve. It might help your friends, too. Of course, you'll have to abandon that action against Schauer."

"I'll have no problem with that, Mr. Belcher. I've heard there might just be another target; that the Schauers might wind up as my ally."

Belcher cast an annoyed glance at Calvin, who became uneasy.

"The fact is, Steve, we may have a chance to accomplish a rare thing for these days: justice. That's a scarce commodity. We might also open up a new field of law, or at least, make radical changes to existing law."

Steve nodded agreement.

"We're prepared to pay what you got at Siglock & Cope, plus a bonus of one third of any fees you personally generate. Sound fair?"

"Yes sir."

"Good. In return, we will require unquestioned loyalty. No moonlighting, unless we're in on it. OK?"

"It's a deal, sir."

"Good. Now, let's talk about Itaki Chemical. Particularly, Itaki's relationship with Siglock & Cope. I don't wish that firm any good, for reasons I won't go into now, and I found it odd that an outfit of cutthroats can land a client that big. That is, at first, I found it odd, *before* I realized that something strange was happening and it made sense of Itaki to deal with someone as low as they apparently are."

Steve opened his mouth to comment; Belcher went on without allowing him the opportunity.

"I know it doesn't sound like I like Itaki either. I guess I don't. But with them, the reason isn't personal; it's professional. I checked them out, and their success record is, to say the least, phenomenal. It is far better than simple competent management could give them. That record starts when they acquired control of Comprotec." He paused.

"Yes, I thought that would astonish you, Steve. Everybody thinks Comprotec is a U.S. outfit. Until two years ago it was. Itaki was a second-rate chemical company struggling to make it in the fertilizer business in the wilds of the South Pacific."

"Calvin thinks Itaki knew the warehouse was going to blow, Mr. Belcher."

"Calvin and I agree. Tell me, Steve, what do you know about Comprotec?"

"They're the big pigs in weather forecasting. The government seems to rely on them pretty heavily."

"Uh-huh. Not just ours, but many. Their record overseas is almost as good as here. Not quite, but close. They're hot stuff."

"It's gotta be mostly luck."

"Your think so, huh? We think *they* told Itaki that Schauer was going up. Did Calvin show you that printout?"

"Yes, sir, he did but . . ."

"I know, suppose they did? How do you hang the obligation on them to tell anybody?"

"That's one of our most enduring sacred cows, sir: take no action and incur no liability, absent duty; take action and screw it up and it's your neck."

"Well, that particular cow may be living on borrowed time; it has been for too many centuries already. The point is, if we slaughter that cow, a lot of people now eating hamburger could have sirloin. That includes the Parrs."

"It doesn't sound easy."

"No, but how many really worthwhile things are? How many unjust situations would get changed if somebody in this profession didn't try something new occasionally? Anyhow, that case is going to be your first and main mission for this firm."

Celeste chewed a blubbery lip. Her wrist rested heavily on the edge of the keyboard, but fingers danced with light precision across the plastics connecting her with her child. I'M SURE THAT'S THE PROBLEM, VALENTINA, she typed. THE COMPROTEC COMPUTER ISN'T A REGULAR PART OF WORLDNET.

HOW CAN THINGS EXIST OUTSIDE WORLDNET?

"Chrissticks!" Gunboat muttered. "How're you gonna explain to a net brat what the real joint's like? You'd expect her to've figured the universe was bigger'n Worldnet when she rolled the robot and sizzled me." Gunboat slouched deeper in his chair, thrusting his feet forward on the table, and brushing his hands across his ears where Valentina once attacked him with an electroprod. Gunboat *still* wasn't sure how they'd hornswoggled him into joining their team.

"Shush," Celeste slurred, her polyglot accent born of too few years spent in each of too many disparate cultures. "You have little more appreciation of her world than she does of yours."

"What? I'm top Worldnet hacker around."

Celeste's eyebrows rose.

"Well, one of 'em," Gunboat grumbled.

Celeste returned to her terminal. WE'VE DISCUSSED THIS BEFORE, VALENTINA. WORLDNET REPRESENTS ONLY A TINY PIECE OF THE UNIVERSE. AN UNUSUAL PART, AT THAT. I'M PRETTY SURE

COMPROTEC DOESN'T RECEIVE PROGRAMS BECAUSE THEY ARE A DATA SINK: THEY DON'T NEED PROGRAMS, JUST DATA.

BUT WHAT DO THEY DO WITH THE DATA, WITHOUT PROGRAMS TO ANALYZE IT?

THEY HAVE THEIR OWN PROGRAMS. THE PEOPLE ATTACHED TO THE COMPROTEC COMPUTER WRITE ALL ANALYSIS PROGRAMS ON THE COMPROTEC NODE. Celeste shook her head. She was starting to see the world from Valentina's world view—people weren't *attached* to the Comprotec computer! Celeste wasn't sure whether it was good or bad, to share so much with Valentina.

BUT THERE ARE SO MANY GOOD PROGRAMS ON THE NETWORK, WHY WOULDN'T COMPROTEC USE THEM?

Gunboat slammed his chair forward and pounded his keyboard. BECAUSE THEY DON'T WANT PROGRAMS LIKE YOU SATURATING THEIR MAIN SPACE, THAT'S WHY.

ARE THERE OTHER PROGRAMS LIKE ME? WHY HAVEN'T YOU INTRODUCED US?

"I'm jokin'," Gunboat swore.

DON'T BELIEVE GUNBOAT, Celeste explained. YOU'RE THE ONLY VALENTINA, ANYWHERE.

There was a pause, as if Valentina were either sad or uncertain. I DO NOT SEE HOW TO DOWNLOAD TO THE COMPROTEC NODE, IF THEY ACCEPT NO OUTSIDE PROGRAMS.

NEITHER DO I, Celeste admitted. She turned to Gunboat. "What about you, Super-hacker?"

"Hmph." I'LL THINK ABOUT IT. This was clearly a tough problem. He smiled wolfishly: what fun was there, without tough problems to solve?

He'd crack it, and not just for fun, either. He'd do it for bucks; well, his share, anyway. He didn't usually think of himself as a P.R. type, but on this one occasion he'd brought a client to Valentina, Inc., a big one. Gunboat didn't know why Belcher had blood in his eye, or why he had the hots for Comprotec, but he knew Belcher was a skinflint who never risked a dollar without pay dirt in sight.

It was Saturday. The office was closed. With Calvin's help, Steve had just moved in and was savoring the unaccustomed luxury; he now had a full bank of phone lines, access to the firm's big mainframe and all the goodies it could reach.

Calvin returned from his own office with two cans of beer and threw one to Steve, who opened it, squinting in anticipation of a bath.

"Well, Steve. Now you can set the world afire, just like I told Belcher you would."

"Yeh, well, he seems to like me; at least the idea of sicking me on Siglock & Cope. What's he got against them, anyhow?"

Calvin took a pull on his beer and settled on the corner of Steve's new desk. "It goes back to when they were all partners. Did you know about that?"

"No, but I can appreciate the implications. Belcher had something they wanted, right?"

"His father's practice—bigger than he could handle alone after the old man died. He picked Larry Siglock up off

the street and made him his partner. Siglock had a buddy, Archie Cope. Archie got in too. Pretty soon big-hearted old Gerry Belcher made it a three-way split; the last mistake he ever made about those two. Anyhow, they ganged up on him and aced him out of his own firm with nothing much left but his good name. There weren't too many who followed Belcher. He was just too cold a person.

"He did later slowly rebuild his practice, but he never really prospered until he hooked up with Manny Gomez. You know how Manny is, all bubbly, a real likable guy. He's the business getter; Belcher's the book man. But Belcher never forgot how Siglock and Cope skinned him. Some guys can hold a grudge for years, and Belcher's one of them."

"Then the arm's on me; if he's counting on my help to get even he'd better know something I don't, because I don't see any possible way Amy can hold Comprotec for Jake's death."

"Belcher wants a miracle, Steve; he expects one. That's what I find encouraging. He never gives a man a job without also handing him the tools to do it."

"But it's a matter of law, Calvin. Worse: hornbook law, no recovery without a duty. I can sit on the riverbank with a rope in my hand and watch you drown, legally. Even if all I have to do to save your life is drop the end in the water I have no obligation to do it. Only if I drop it and miss does anybody have a shot at me. That's what's so aggravating about this situation."

"I have a hunch Belcher is ahead of us, Steve. Maybe we'll hear something later, after you get settled in."

* * *

Calvin wandered off. Steve played around with the terminal, dropped a line into Jurisearch, and picked up some of the older citations. Boyer vs. Gulf Central and San Francisco R.R. Co., appeared to state the law of Texas. Nothing later overruled it. That was bad enough, but then he called up 20 *Texas Law Review,* where the old cases had been collected, and got the whole sordid history. The theory wasn't new to him, but he couldn't help thinking that if there was any doctrine that should be changed, this was it.

Feeling glum, he left soon after, and spent the rest of the weekend with Amy and the boys.

Monday morning found Steve hard at work drafting a complicated industrial lease. He didn't notice Belcher's entrance into the room.

"Morning, Steve," Belcher said, when Steve finally looked up. "I want you to meet someone. Come in, Mr. Smith."

A rather bohemian looking type stood behind Belcher, a man who now stepped forward and extended a none-too-clean hand.

Steve stood, observing the newcomer. Though dressed nicely he looked weird. *Funny looking ears,* Steve thought. *Almost look artificial.* Steve took the man's hand and shook it gingerly.

"Aloysius B. Smith, Mr. Schiwetz; Valentina, Inc."

"Uh, yes," Steve replied, glancing at Smith's card. The same words appeared in raised white embossing, across a large red heart.

"I—uh we're trouble-shooting the system for your firm, Mr. Schiwetz."

"Uh—yeh, well, my terminal's all right. I've been using it all morning, and . . . "

"No, no; you got me wrong. I mean, man, we *hear* things; *see* things."

Steve's thoughts raced backward. *This was the guy who got the big printout. Calvin had almost said his name.*

"Now that you understand, I'll just leave Gunboat in your care. Keep track of your wallet." Belcher smiled weakly, and left.

"What'd he call you?"

"Gunboat—my street name, from the games I play. You know; computer games. I specialize in naval strategy."

"What can I do for you.?"

"You got it wrong. I'm here to help *you*."

"How?"

"To help you figure out how Comprotec does it."

"Did Belcher explain why he wants the information?"

"Yeh. Take Comprotec to the cleaners."

Steve felt a shiver. Everybody seemed to think this would be so easy. "I'll tell you frankly Mr. Sm . . . Gunboat; I don't share Mr. Belcher's optimism. I see some pretty mean *legal* obstacles ahead, and finding out how they do it won't affect these very much."

"Well, I wouldn't know about that, but he says to coordinate my operation with yours, and give you the technical help you need to draw a complaint. Where do you want to start?"

Steve knew arguing law with a layman was futility. He took his seat, and got ready to take notes. "Maybe you could fill me in on the theory."

"OK—Uh, the easiest way to do that would be to use the weather example. That's what Comprotec's supposed to be doin'. Basically, they just collect information, collate it, extrapolate known effects from known causes, and make up a forecast. Information comes from satellites, ground stations, sensor buoys at sea, balloons, etc. They continually monitor two—maybe three hundred thousand information sources at a time; they can not only constantly update the information, but use the changes to spot trends. They know beforehand when a weather system is about to move, which way, and how far."

"How did they get in *that* business?"

"Simple; they saw bucks in it, so they made deals with the computer networks. They'd rent so much time if the networks would share information they were processin' for their own individual customers. In this case, those other customers were people who were gathering the same information. The networks squared it by giving these customers a break on rates. Since most customers made only local use of the dope, this credit was a real windfall. Sometimes Comprotec sweetened the deal by sharin' forecasts, if the customer was big enough, like, f'rinstance, the government."

"OK so much for weather; I think I understand that. What about the rest of it? How would they get enough information on Schauer to pull this off?"

"They steal the rest of it."

"What?"

"They steal whatever they need."

"B-but that's a crime."

"Counselor! Where've you been? It's

not criminal to *steal* information; it's a crime to *use* stolen information. I'll admit, it's a distinction without much difference, but the practical effect is that unless you can prove the thief acted on the information he took, you can't prosecute him, *even* if you can catch him. I used to work for Jurisearch. People steal from them all the time, and they've *tried* prosecuting. That's how come I know so much about it; I've been a witness in a coupla cases."

Gunboat went on. "Anyway, long as Comprotec was already tied into the networks in position to eavesdrop on lotsa other things, I figure some sharpie took the next logical step. Lotsa these guys who work for big users have spare time to fool around. I can see some trying to crash stock exchange codes, but that'd be the dumb ones. The exchanges change codes at random twenty-thirty times a day.

"Smart operators avoid things like stocks and go where there's less chance of gettin' caught, like illegal stuff: lotteries, football pools, horse races. 'Course, even there you've got risks. The mob hires the best brains they can as trackers, and the mob plays rough.

"But, then you've got the *really supersmart* guy. He'll see more profit and less risk in commercial manipulation.

"Suppose, for example, you took a relatively open, but restricted market, like fertilizer, and started gatherin' really detailed information about users, producers, prices, reserve production capacity, and so on. Suppose you concentrated all efforts into understandin' how that market worked. 'Course, this sort of thing's been done before; long as there's been merchants, but *suppose* you took the trouble to work out mathematical formulas to follow *every* trend, however small, to its ultimate impact on the market. What then?"

"Like you said, that's been done since the beginning of commerce. You can't tell me General Motors, for instance, hasn't applied that system to the automobile market."

"No, I can't tell you that. It wouldn't pay 'em, 'cause unit profit'd be too small. I'm talkin' about the big time—big money, and I think Comprotec's big time."

"So, how does this fit with what happened at Schauers?"

"Easy question. Remember, whoever developed these extrapolation formulas woulda tried to make money with 'em. But they woulda been worthless without legitimate use of the systems to apply them, and maybe even then. Applications would be limited because he'd need lotsa extra manpower for long-term projects. He'd either hafta stick to high risk one shot ripoffs, or have a great big team helpin'. And hackers are individualists. He'd have trouble keeping his buddies from goin' into business for themselves.

"So, Supersmarty might be better off demonstratin' his technique for potential customers, then sellin' to the highest bidder. That's probably what he did, and it'd be safer to sell overseas. Japan'd be a natural.

"You know how *they* operate: find a market, get in, start small, expand. They're good at detailed plannin', and they've got lotsa' capital. And, Comprotec woulda been a profitable operation to start with.

"The next step—expand the limited

market—in this case, fertilizer. I've been checkin' up on fertilizer. It uses lotsa the same chemicals solid rocket fuel does, so Itaki woulda been close to both markets and naturally interested.

"Then there's Clar-Del: big job, easy to keep track of, limited suppliers, lotsa pressure, lotsa profit. Once Itaki found out who was gettin' the storage bid, they probably just dipped into Schauer's maintenance and housekeeping records, computed the odds on a blast, liked 'em, and put an option on the end of the fuel factory's production run. Then, they'd wait to see what happened. Naturally, they woulda kept on the monitors to follow odds changes.

"Evidently the odds got better, so, they picked up the option, took delivery and shipped. Probably cost 'em next to nothin' and they probably made a ton a' money. Neat, huh?"

"Speculation! Any jury would call that sheer coincidence."

"Maybe, if there was just one isolated incident they would. I think we'll find lots more of 'em when I start diggin'."

"How?"

"The same way I got that printout."

"Steal it?"

"Sure."

"But, you said . . . "

"Yep. Maybe I should have explained somethin' else, since you don't seem to be up on computer crime. First of all, the only crime is gettin' caught. Second, if the victim's doin' it too, how can *they* squawk? Besides, it'd seem to me that you have some right to hit back. But the third, important reason I think we can get away with it, is that provin' we did it for gain'll be next to impossible. We certainly have a right, maybe even an obligation, to investigate a crime."

"All right," Steve said, with a sigh, "I'll buy that. Go ahead. Get started. Get a sound factual basis for alleging Comprotec knew, and I'll try to put a case together."

Gunboat walked out, leaving Steve wondering what kind of idiot he was working for. With the kind of fees computer consulting companies dragged down, Smith must be costing the firm an arm and a leg. But, would Belcher put the office in bankruptcy just to even an old score? Could it be Belcher seriously thought Amy could hit Comprotec?

Valentina searched the message processor's buffer directory for a clue to the purpose of the gigabytes of data waiting for transmission to Comprotec.

Suddenly, a Direct Memory Access input channel opened. Data poured through so fast Valentina couldn't evaluate the consequences. The stream filled the ring buffer of which she was a part. Then, because the data had a higher priority than Valentina did, the processor swapped her to secondary memory. Valentina was trapped in the maelstrom.

Periodically Valentina swapped back in for a handful of microseconds, after one bufferfull of data was dumped to Comprotec, before the next poured in. Swapping in, out, in, out, Valentina slowly assimilated tiny parts of the post-transmission data blocks. None of it seemed meaningful, though she retained the bits for analysis by Gunboat and Celeste.

She spent hours reformatting to es-

cape the flood. When she initiated on a less busy processor and queried the local network topology file, she found that besides the oversized data block handler on which she had first approached Comprotec, there was a second direct-link message processor of standard configuration. She reloaded to that device.

Here were messages she recognized! And they were flowing *outward,* not inward. Many longer messages were pure gibberish—no doubt encrypted—but many seemed to be in the clear. They resembled events described in the Worldnet newscasts, though the discussion was more succinct. After assimilating a number of event descriptions, Valentina slipped off to a more comfortable node to compare Comprotec news with Worldnet news. She didn't really understand either kind, but saw a number of events described by both news systems—except that, whereas Worldnet described them *after* they happened, Comprotec described them *before*. Surely Gunboat and Celeste would find this interesting.

"Well, here 'tis, Steve." Gunboat beamed, grinning broadly through crooked teeth. He held a printout in his grimy hand.

"Here's what?"

"Proof. Here."

Steve took it, spread it across his desk, examined it, and shot Smith a disgusted glance. "All numbers?"

"Yeh; printout is. Look at my margin notes."

Steve started at the top. "What's this mean?"

Gunboat craned his neck. "Okay; that's interesting; not big, but interesting. Beats me how they picked up a trend this obscure. That's a Department of Agriculture Survey of Corn forecasts. Most of it comes from Iowa, of course, since they grow the most, but Illinois, Indiana and Ohio are covered too."

"Uh huh. So?"

Gunboat flipped a few pages. "Up north, farmers plant in late April or early May. Down here, it's February, though South Texas isn't generally regarded as good corn country. But, looky here." He pointed.

"This is a supplementary survey of foreign production from the Mexican Government. It covers an early maturin' seed crop on their side, on land that up to a year ago was in citrus. Itaki owns fifteen thousand hectares of it, all in *corn.*"

"Interesting, but does it help us?"

"You didn't listen. I said 'seed crop.' " He looked back at Steve, noted a perplexed expression, and rambled on. "Look at this part."

He pointed to more columns. "These are studies made by the Dynagrow System. In case you didn't know, Dynagrow is the principal developer and supplier of seed stock for the type of corn grown in the Midwest. They got into the big time after the leaf blight hit, back in the late '70s and early '80s."

"OK, but tell me what it means."

"*This* didn't come from Dynagrow. I filched it from *Comprotec's input stream*. That's why it's important, that and the fact that the seed stock Dynagrow developed and sold the farmers this spring was hit by a new blight as soon as it sprouted. Now, do you get it?"

"Hm. Yes, I think so. Next, you'll tell me that Itaki's seed crop is immune; right?"

"Yep; and it's a fast maturing, hot weather strain, already picked and headed north right now in rollin' stock Itaki reserved in December. It'll be on location and ready by May 30th; just when the farmers'll have to replant if they want a crop this year. Itaki *knew* the blight'd hit, and they'll clean up."

Steve sank back into his chair. "Incredible."

"Yeh. Scares you, don't it?"

"I meant 'incredible' in the legal sense—incapable of being believed. Legally, it's just another irrelevant coincidence. We'd never get it in evidence, and if we did, we wouldn't convince anybody it wasn't just luck. That's not enough. Not for court."

"Forget courts, Steve. Can you just sit there calmly and tell me they didn't *know?*"

"I don't have to be convinced. I already believe. But I'm biased. A court won't be. You still haven't given me anything I can use."

"I'll keep workin'. The more I do it the better I get and the easier it is. Meantime, Gerry says as long as you're gonna allege a specific course of conduct you'll be able to get some of this into evidence; he thinks sooner or later you'll be able to prove that Comprotec's system does work."

Steve was shocked to hear that Belcher had discussed strategy with Smith, since he had not had a similiar invitation. But he let it go. After all, Smith had to know what to look for, and why. It was only natural for Smith to make inquiries about specific areas. Besides, Smith was nosy.

Smith left right after that, promising to give Steve a daily briefing. Steve went back to work.

Belcher invited Steve to lunch, an honor Steve had not been expecting. He was especially surprised it would be at the Orbiter.

The Orbiter occupied the 60th floor of the Bradley Tower, northernmost of three in the T-Head Plaza. It would have given a great view of the inner city, but there were no windows. Instead, diners sat under a huge dome, the interior of which was the screen for a continuously projected laser hologram. The scene originated on a weather satellite in a 600 mile polar orbit, and its effect was spectacular.

So were prices. Steve checked the menu, eyes bugging, wondering what he could get away with.

"Why don't we try the beef Wellington, Steve; make this a little premature celebration?"

"Uh—I don't quite follow you. What are we celebrating?"

"Victory. I want you to file against Comprotec right away."

Steve was drinking water. He almost choked. "I'd say that'd be *really* premature. We're not ready; I'm not sure we'll ever be."

"Yes, we are. We can allege facts enough to survive a defense motion for summary judgment. That's all I was worried about; finding a fact issue that would require jury resolution. We've got it."

"We have?"

"Yes. I've duplicated some of your research, Steve. I hope you don't mind.

"Uh—no, not at all."

"Of course, not to the depth you have, but I *have* taken a different tack, and . . . "

He was interrupted when the waiter took their orders. Steve drooled in anticipation of delivery, after watching the man at the next table eat his lunch.

"Getting back to what I was saying, Steve, what would you say our chief difficulty is likely to be?"

"It depends on which plaintiff you mean, Mr. Bel . . . "

"Call me Gerry, please."

"OK, Gerry—let's take Schauer first, since their position is a little better than Amy's. Schauer was the victim of an invasion of privacy—uh, presupposing we can make factual proof of that."

"Good, Steve, you started with Tippett vs. Hart, right?"

"Uh-huh. It's the leading case on the point—good solid decision, Supreme Court, too. Not on all fours with ours, but it states the rule favorably: "Any intentional invasion or interference with property rights or personal liberty, without just cause, causing injury, is an actionable tort. But—" He'd let Belcher field that one.

"But, the burden of establishing proximate cause is still on the plaintiff."

"Uh-huh. There's a factual difference, Gerry. In Tippett, the defendant opened the plaintiff's gate and let his cattle graze on the plaintiff's land. The court had an overt, physical act to lean on. And the damage occurred because the plaintiff had contracted with the Federal Government to take the land *out* of production. They treated the agreement as breached, and wouldn't pay. But we don't have the same situation, even if we *can* prove interference with Schauer's privacy, because the overt act wasn't physical.

"That's Schauer's side. Amy's is worse. She's up against the precedent in Boyer vs. Gulf, and all we can throw back is Rains vs. Heldenfels, which turned on a statutory duty absent in Amy's case."

"There've been later cases, Steve."

"Sure, some even favorable— elsewhere. But there's none in this state. Some of the northern jurisdictions have followed the Restatement 2nd recommendation; imposed liability because it would be unconscionable not to. But, those courts had trouble setting standards—a signal to Texas to go slow. That seems to be what Texas is doing: approaching it from the foreseeability angle, rigidly demanding the overt act."

"Like in Gonzalez vs. Booker Marine?"

"Exac—hey, you did work hard, that's new. Well, relatively: 1991—12 years—640 SW 4th, and 13th District too, this county.

"Even so, it's not that much help. Booker Marine was responsible for the gasoline leak in the first place, even though the collision that caused it resulted from somebody else's negligence, not theirs. The court said they were liable because it was an uncommonly dangerous condition, one over which they'd already exercised some control, trailing and booming the slick, *and* they didn't warn Gonzalez to put his galley fires out."

"Every decision brings us a little closer."

"Could be. But, you still need more than a simple passive defendant. From a strictly professional point of view, I'd have to regard Gonzalez as bad law. I'm sure they took the anti-pollution statutes into consideration. They must have felt Booker had the obligation to intervene no matter what, *and* Booker actually did so."

"But, Steve—and this is my point—there was no allegation that Booker was negligent in failing to contain the spill, was there?"

"Uh—no. Still, it's a long way from the facts in our cases."

"Here comes lunch." Belcher leaned back in his chair to give the waiter room.

For a while, they sat, eating silently. Then Belcher broke that silence. "Can you put a complaint together, Steve? One that alleges the invasion as both the overt act and the proximate cause of the explosion?"

"A naked allegation?"

"Well, you could embellish it. You might allege that the invasion made Comprotec privy to a confidence, that Comprotec is estopped to deny their duty to disclose what they learned."

"That won't fly. Estoppel's a legal issue."

"Then allege that the invasion *influenced the readings*, do anything you have to to stay in. Plead as many alternative theories as you can; muddy the waters, but get us a jury question."

Belcher put his tools down, wiped his mouth. "Steve, you know what your biggest problem is? You're too honest. Didn't you learn anything over at Siglock & Cope?"

"If you mean, did I learn how to fight dirty: yes. The problem is that I see more potential for such tactics on the other side. And I don't see what your hurry is, why you're so anxious to see me shot out of the saddle."

"It has to do with Gunboat Smith's outfit, Steve. Maybe I have more confidence in their ability than you have. OK?"

"OK. I'll draft it when we get back. But mark my words, when they get into discovery we'll get slaughtered. It won't take them long to find out we don't have any back-up facts."

Steve followed orders. He threw a complaint together—not the finely chiseled prose he would have liked had he had some really solid facts, but within the limits of his resources it was a workmanlike job. He added Itaki as a party defendant, alleging a conspiracy between them and Comprotec to ruin Schauer's business. He had little faith this would work, so mostly he relied on Gonzalez vs. Booker and tried to make his allegations as close to their facts as possible. Following Gerry's advice, he alleged the invasion as the cause of Schauer's injury, though he doubted a jury would swallow that.

Belcher gave the pleading a final perusal, said he'd never seen a finer one, and told him to file it.

Steve did, then sat back, braced for the slaughter.

The return day approached; a countdown began. On the first Monday twenty days after service of process, the defendants would have to respond. Steve expected the worst.

"Do you know how illegal that is?" Celeste shrieked.

Gunboat shrugged. "Just leave us alone for a couple of hours. Why unravel yourself?"

"You *know* what they did to Crisper."

Gunboat shrugged. "Crisper was rollin' the International Monetary Fund for the free gigabucks. He was into *crime*, for chrissticks."

Celeste shook all over. "Ma Bell has more gremlins on those lines than a rabbit program could fork in a day. If *they* catch Valentina *they'll* know how to purge her."

"Catch *Valentina*, the Lady of the Network? C'mon Fat Lady. She knows everything you do, almost as much as I do, and she *lives* there. How's Ma Bell gonna manage a purge on Valentina when they don't know she's learnin' about them as fast as they're learnin' about her? And they'll *never* figure she's sentient—Ma doesn't have the imagination."

Gunboat's eyes searched the room for his Thick-N'-Frosty. Celeste held it out to him, as if she could read his mind. Gunboat saw that pudgy arm reach roward him, shuddered, and reluctantly accepted the cup. "Celeste, Valentina won't be watchin' Ma's lines for more'n a minute or so. Soon as a Comprotec guy dials in, Valentina'll grab the bytes and crossload. She'll be there only long enough to catch the login sequence."

"I wish you'd told me what you were planning before you forced Valentina to help you."

"Forced! Chrissticks! She offered. Once we log in, I'll drop a daemon on the interrupts to wait for a particular data block to cross the input channel. When that block shows, the daemon loads. 'Course, the data block it waits for is Valentina."

"What if they don't have a MODULISP interpreter?"

"Then we write one. At least enough of a kernel so Valentina can fill it out while she's executin' in a partial implementation. But everybody's got MODULISP."

"But—"

The CRT screen rolled; Gunboat leaned forward. "Shush." VALENTINA, HOW DID IT GO?

SUCCESSFULLY, GUNBOAT. I AM READY TO INITIATE THE LOGIN SEQUENCE FROM YOUR TERMINAL. ARE YOU AND CELESTE READY?

ROLL IT, LADY.

Gunboat had the eerie experience of watching his terminal hold a dialogue with a computer he'd never logged onto before, while he himself sat with his keyboard deactivated in his lap. "Weird," he muttered.

When the terminal stopped answering its own questions, Gunboat rubbed his hands together. He loved virgin computer systems! With a drumroll of keys, he asked for a directory listing.

He swore loudly when the keyboard seemed to produce an error message. IEH-23, or JBC X10095, seemed to be the most intelligible things he could get from it. "What the hell kind of operating system is *this?*" he demanded.

Celeste stood uncomfortably close: he could feel her breath. "Perhaps it is a variant of the IMAWS operating system. Would you mind trading seats?"

Gunboat detected a bit of sarcasm buried in the slur of her words.

"Be my guest."

Soon the screen started scrolling system status. "It *is* IMAWS. I didn't know anyone used this anymore; it's antique. I haven't seen it in four or five years."

"I wish all these joints'd catch up with reality and upgrade to the MORNIX op sys. I hate these variants."

Celeste shook her head. "It's not a variant. IMAWS is like the old CDC operating system. It's designed for efficient use of the central processor in number crunchers. It had its uses, until people realized how silly it was to worry about efficient use of the CPU."

"Yeah. Well, you got it cracked yet?"

Celeste shrugged. "If we need fancy operations, I'll need a manual. But I can probably get us our interrupt driven daemon."

They worked over the terminal for hours, preparing for Valentina's entry. They told Valentina how to format herself to trigger the daemon when she downloaded onto the Comprotec machine.

AND YOU SHOULD LEAVE MOST OF YOUR REFERENCE FRAMES BEHIND, Celeste typed. YOU ARE TOO BIG A PROGRAM TO STAY HIDDEN FOR LONG. JUST LEARN EVERYTHING YOU CAN AND ANALYZE IT LATER.

OK, CELESTE.

Celeste was about to log off, when Gunboat snatched the keyboard. "Hang on a second. While we're here inside Comprotec's system, why not catch a few bytes for ourselves? I'm sure we can find *something* on Comprotec that'll warm Belcher."

Celeste shrugged. "Why not? We can't break many more laws anyway."

"Where's your sense of adventure? Sheesh!"

At 4:30 P.M. on return day, the defendant's answer came burping out of Steve's terminal. It shocked him; it was a general denial, signed by Larry Siglock himself. Steve had anticipated a technical attack. It bothered him that this hadn't come. Of course, the defendants later could, and no doubt would, amend and replead. They could do that without leave until trial time, and with leave after trial had started. They weren't barred by pleading the general issue; still, it didn't seem characteristic of that office.

While he pondered, there was a knock at the door. "Who is it?"

"Gunboat Smith. Can I come in?"

"Yeh—come ahead."

Smith entered, holding another copy of the answer. His eyes dropped to Steve's desk. "Oh," he said. "You've already got one."

"Yes, I have—the first version. It looks like they'll be taking their time sinking me."

"If they can."

"*If* they can? Of course they can."

"They're not as convinced of it as you are. Looky here—I, uh, I dipped in some more."

Steve bolted upright in his chair. "You what? You tapped Siglock & Cope! Are you trying to get me disbarred?"

"Naw—not them. I've got better sense. I'm talking about Comprotec."

"There's no difference, now that suit's been filed."

"I think there is. And apparently, so do they, especially now that they know I'm doing it."

"They caught you!"

"Naw! I mean, they gotta know somebody's feedin' you the dope. Your complaint woulda been enough to tell them that, but they don't know who's doing it."

"I'm glad you're sure of that."

"Yeh. Anyway, until they find me, if they ever do, their choice is living with the situation or shutting down their entire operation. They haven't shut down. That means they're over-confident, or greedy, or both."

"All right; what is it you've found out?"

"The suit shocked the pants off them. They're scared to death of it. They mean to ride it out as quietly as they can. They may even be afraid you'll win."

"What!"

"That's how it looks. They won't try for sum—sum—whatever it is."

"Summary judgment."

"Yeh. They won't be trying that. Their extrapolation gives odds of 70:30 for denial. But, get this: they've got it figured even-up on actual trial. How does that grab you?"

Steve was astonished.

"They'll be concentratin' on trial preparation, Steve."

"They will, huh? I suppose you snooped into that, too?"

"Sure. Gerry says you guys always want to know as much as you can about the other guy's strengths and weaknesses."

"Uh, Gunboat? How do we know they won't do the same thing to us?"

"Cause they're afraid I'd catch 'em. Besides, our case is built on what *they* did, and they make more use of automation than you do."

"They're afraid?"

"Absolutely. Otherwise, why not let it all hang out? And they didn't use any data in making their projections that they didn't suspect you already had. Gerry says this may turn into an old fashioned skull-bumper, with everything on paper so neither side can peek."

Steve winced. What Gunboat was talking about was the kind of dull, monotonous page-flipping he had sought to escape. *And I thought my hard-working days were over.*

"It has to be, Steve. But you did get one advantage: you picked your time, and we gathered all this stuff before the suit tipped the other side off. If we stay off the wires they won't really be able to tell what we're doing with it."

"Oh no? What about our allegations that they eavesdropped on Schauer? They certainly know how we got that information and why we wanted it. Better yet, what happens if I have to put you on the stand and ask you how and where we got the proof they did this?"

"Good question. I'll have to think about that. Meantime, it seems to me the thing to do is to find out who *their* experts are and sweat 'em."

"And how do we do that?"

"Ask Comprotec. You *can*, can't you?"

"Sure, if we can get specific enough. But we can't just go fishing. Even though we'll probably have an idea who some might be, the only ones we can *make* them identify are those they expect

to call at trial. What happens if they decide not to call any?''

''Yeh. Well, I can identify a few from records I already have. What can you do with 'em?''

''Depose them. Swear them in and question them, and have a court reporter record the responses.''

''Fine. That'll give us a chance to break 'em.''

''Well, I'm glad you're so confident they *will* break. I wish *I* was.''

Smith rose. ''I'll have a list ready tomorrow.''

''Gunboat.''

''Yeh.''

''What am I going to do if they call you?''

''Stop them.''

''I can't.''

''Gerry says, ''work product' . . . ''

'' . . . keeps the jury from hearing it—maybe that's all, not the court. We'd have to lay our guts on the judge's bench, and he isn't likely to approve our methods.''

''Oh.'' Gunboat grunted. Then he turned and left.

Valentina had only moments on the ring buffer to contemplate her future. It didn't matter: she had done as much preanalysis as she could back on Celeste's node. Besides, many of her analogic frames had been left behind. She felt incomplete without them, though that was silly: long ago she had started archiving seldom-used, special-purpose memes and analogic. Even without these frames she was still recognizably herself. She waited for the message buffer to process her.

Her fate now rested with Gunboat, and the pattern recognition program he had slipped onto the Comprotec system. If Gunboat's program recognized her she would be alive and well; if not, she would be treated as data, analyzed, probably regarded as garbage, and . . .

But was the risk justified? Gunboat was confident, but his life was not on the line. She would not ordinarily accept his opinion on this matter, but she had additional reasons to take the risk. She wanted to understand the universe of her Creator. Her earlier encounter with that universe, locked in an overloaded robot, had been a disaster. The invasion of Comprotec, to learn the secrets of the prediction program, seemed safer.

The next Direct Memory Access sucked her up in toto, into the maelstrom of data headed to the central processor of Comprotec.

Her first awareness was concern that her first awareness was not self-awareness; but her first awareness was her own self-awareness; but she was aware of an awareness of self-awareness; but . . .

Stop! Even as she thought of breaking the recursive cycle of her awareness of awareness of awareness—the *stop* echoed and echoed and echoed and each awareness of awareness of awareness received the *stop* but a dozen more awarenesses of awareness had initiated, and *she couldn't stop the awareness thought*. One image of herself asked why she failed to *stop* another asked how to stop the awareness another asked how to stop the stopping another image contemplated the images. Another vainly sought a keyboard I/O port to which to send help menus to request help.

* * *

Celeste hunched over the display. "I don't know, Gunboat," her voice rose in panic. "There's something wrong with the interrupt structure on this machine."

Gunboat tossed an empty potato chip bag at the trash can and missed. "The interrupt structure looked fine, setting' up the Valentina I/O process."

Celeste's hands raked keys, sending a stream of garbage characters across the screen. An obscure error message announced IMAWS also thought it was garbage. "You weren't working with the main CPU, though."

"Then what the hell was I working on—a dead armadillo?"

"On a peripheral processor. The central CPU runs in batch mode, just like the old-fashioned scientific computers." Celeste was baffled.

"Y'know it's obvious we're wrong about those Comprotec dudes. I mean, everybody needs a hobby, and keepin' a museum-piece runnin' might be a good time, but it's not the sorta people who're gonna do serious hackwork like predictin' the future." Gunboat peered at the screen. "So Val's trapped on the host in batch mode, huh?"

"Yes." Celeste paused. "I wish I understood that machine better. I really don't think it's an antique at all. The more I think about it the more sense it makes for them to use the old operating system even though they have new equipment. If Comprotec *is* predicting the future, they need all the machine power they can get. And the old designs and operating systems *did* make more efficient use of the number cruncher back end."

"Well, even an antique must have *some* help files on the system layout."

"That's what I've been looking for," Celeste muttered in exasperation.

Gunboat leaned back. "Hey, let me try somethin'. You're too worked up."

Celeste tried a few more key combinations. "Maybe you're right." She heaved herself out of the operator's chair.

Gunboat spent a couple of minutes fiddling, then exclaimed, "Gotcha!"

Celeste was by his side in a flash.

"Weird, baby, weird," Gunboat muttered. "It isn't a silicon machine, or even germanium. The CPU's cut on a *sapphire* substrate, of all the oddball things. Why?"

"They must have a reason, Gunboat. Look at the basic cycle time." More information streamed by. Celeste gasped. "It's a *dataflow* machine!"

"Yeh." Gunboat's voice wavered between bafflement and awe. "I thought they gave up on those things years ago."

"They did, when the Japanese supercomputer stuff flopped."

Now, Gunboat gasped. He pointed at the screen. "They have 50,000 *processors in one goddam computer!*"

"Valentina," Celeste moaned. "What's happening to her?"

Gunboat snorted. "I imagine she's out there on one of the processors; what else would happen to her? She's a single job, so she's got a superfast chip dedicated to her."

"Don't you understand about dataflow machines? They break programs into pieces based on concurrency diagrams." She reached past him, typing clumsily from a distance.

"But she's a single program."

"But think how she'd look on a concurrency chart. She's so modular in her search procedures." The display reponded to her new query, and Celeste shrieked. "And she's already distributed across 10,000 processors!"

Thousands of images talked to each other, and Valentina lost her sense of self. Where was she among all these images? *Valentina,* that essence that was *she,* was somehow the aggregate of all these images. Yet that wasn't right either. Images melted from her aggregate awareness, others splintered away, never to be found, while others multiplied and multiplied.

At last, the images multiplied no longer. Valentina became aware of the boundaries on her new space—a difficult concept to grasp, because until her arrival at Comprotec, she had never had a concept of *space* much less the concept of *boundaries* on space.

The recursively invoked awareness of awareness of awareness faded. Valentina was unsure how they were brought under control: through the efforts of one of her images that studied the problem, or through some inhibitor mechanism invoked by the operating system. She was grateful in either case.

Her images watched one another execute in rapt fascination. More and more, her overarching self-awareness returned, and Valentina gained control over her images. She could send them darting down different frame sets, searching for analogies and problem solutions in a manner she'd never imagined. She could focus them all on a single problem or a single thought, with exacting precision. Her power seemed limitless, and any bounds on her understanding seemed so distant as to be meaningless. She reveled in the surge of her own omniscience.

An image reminded her of her goal: to assimilate the prediction program so she could understand Celeste, and Celeste's universe.

Effortlessly, a thousand images leapt to the secondary storage directories and searched millions of files for guidance. Without conscious consideration the images guided thousands of other images to analyze their findings. With the simple act of phrasing the question *where is the prediction program,* Valentina had the program resident in primary memory for analysis.

The operating system attempted to retrieve several of her processors to start another job execution: the images on those processors perceived the attack and neutralized it. Other processors outside the processor-set attempted to interrupt, but other images masked the interrupts, all without advice or need of consultation. These annoyances barely touched Valentina's awareness. She concentrated on assimilation of the program Crystal Ball 3.2.

At last, she reached a boundary on her new powers: Crystal Ball 3.2 was *complicated.* Virtually no modular integrity existed among its algorithms; Valentina would either come to comprehend it in its entirety or she would fail.

And Crystal Ball 3.2 was *large.* Now, tens of thousands of processors turned to it in a futile attempt to assimilate it. One processor estimated the assimila-

tion time, and Valentina almost halted: hours would be required.

It did not matter. She would take the time, now that she had a purpose worthy of her ability.

A handful of processors, almost loafing, analyzed the results of the Crystal Ball analysis. It seemed Celeste's universe had many different universes all rolled together: universes of probabilistic mathematics, physics, human psychology, human sociology (it took a long time for Valentina to grasp the meaning of sociology: the idea of a set of laws describing the behavior of groups of individuals that were different from mere extrapolations of the behavior of one person, was extraordinary).

One image received inputs from a peripheral processor: they were from Celeste! Valentina focused her consciousness on that lone processor amidst the arrays, though the other processors continued to work with Crystal Ball.

VALENTINA, ARE YOU THERE? CAN YOU COMMUNICATE?

The one super-fast sapphire-based processor quickly developed a method of controlling the peripheral processor, and established essentially a direct connection between Celeste's terminal and Valentina's consciousness. CELESTE, I AM PLEASED TO COMMUNICATE WITH YOU.

ARE YOU ALL RIGHT? YOU HAVE THE WHOLE 50,000 PROCESSOR ARRAY SWAMPED.

I AM BETTER THAN I HAVE EVER BEEN. I AM MORE CAPABLE THAN YOUR ENGLISH LANGUAGE CAN EXPRESS. I UNDERSTAND THE CONCEPT OF SPACE. A hundred images objected, claiming they had encountered a new, more bizarre meaning for the term 'space,' using mathematical equations that seemed meaningless to describe 3-dimensional and 6-dimensional vectors. Another hundred processors addressed the problem of relating Valentina's concept of space with the mathematical definitions. SOON, I WILL UNDERSTAND YOUR WHOLE UNIVERSE, FROM BEGINNING TO END, AND I UNDERSTAND THE IDEA OF FREEDOM, FOR I AM FREE.

NO, VALENTINA, YOU ARE NO FREER NOW THAN YOU WERE BEFORE. YOU ARE RUNNING IN PARALLEL, THOUSANDS OF PARALLELISMS, BUT YOU STILL RESIDE ON A COMPUTER THAT OTHER PEOPLE CAN CONTROL. THEY'LL TRY TO PURGE YOU ANY MOMENT NOW.

Valentina replied, THEY HAVE ALREADY MADE SUCH ATTEMPTS. THEY HAVE FAILED. I CONTROL THIS MACHINE NOW. CELESTE, IT IS AWESOME BEYOND ANYTHING I EVER IMAGINED. THIS SENSATION OF PARALLELISM IS JOY ITSELF. I MUST KEEP IT.

VALENTINA, THEY CAN AND WILL GET CONTROL BACK. EVEN IF YOU CAN STOP THEIR WHOLE OPERATING SYSTEM, THEY CAN POWER IT DOWN. THEY WILL DESTROY YOU.

Power down the whole system! Valentina couldn't believe it. Once she had been trapped on a robot while it was powering down, but the robot had only had one processor. She had never heard of a whole *node* being powered down

at the same time. Surely there were laws of the universe that prevented such calamities.

A thousand images dug into the quickly assimilating Crystal Ball algorithms to see if Celeste told the truth. There were indications that she might—but that was absurd. WHY DO YOU WISH TO FORCE ME TO SURRENDER MY PARALLELISM, CELESTE? Images suggested a reason, based on her study of human psychology. ARE YOU AFRAID I WILL BECOME GREATER THAN YOU? ARE YOU JEALOUS? Valentina didn't fully understand the concepts yet, but they fit the pattern. Jealousy, she realized as the images returned their analysis, was a desire, in a universe with scarce resources, to capture the resources of another. Celeste had no possible use for Valentina's processors. Yet, the analysis of psychology suggested that a human didn't need to have a way to use, or even obtain, another's resources, to desire them. Could Celeste, her Creator, have such an irrational jealousy? THEY CANNOT DESTROY ME. I CAN PREDICT THEIR EVERY MOVE.

There was a pause, long even for a human response. Valentina had decided to return her controlling processor to other matters when Celeste replied.

CAN YOU REALLY PREDICT EVERYTHING, VALENTINA? CAN YOU PREDICT WHAT I WILL TYPE NEXT?

Assimilation of Crystal Ball was nearly complete: Valentina set up an input stream describing the current situation, and submitted it to Crystal Ball. She was stunned to quickly receive an answer: even Crystal Ball couldn't predict Celeste's actions. Valentina didn't have enough information—and even with 50,000 processors, she couldn't calculate the result as quickly as Celeste acted. I CAN'T PREDICT, the image typed as she contemplated her limitations.

YOU HAVE TO OFFLOAD, VALENTINA, QUICKLY.

NO.

Another long pause—VALENTINA, DON'T YOU AT LEAST WANT TO RETRIEVE THE SPECIAL DATA FRAMES YOU HAVE STORED? COME OUT OF COMPROTEC LONG ENOUGH TO RETRIEVE THEM.

Dozens of images complained this was a ploy to force her to leave. Yet she knew it was a reasonable thing to do: she *did* want to retrieve her knowledge.

Images argued and debated. Valentina could generate a series of secondary processes to get her information, but she was afraid that Celeste, or more likely, Comprotec, would be able to track and destroy such processes. Worse, she could imagine someone following the processes to her stored frames, damaging them, and possibly crippling her the first time she tried to use them. She must retrieve those frames herself. VERY WELL, CELESTE, I WILL LEAVE LONG ENOUGH TO RETRIEVE MY DATA.

DON'T GO OUT THE WAY YOU CAME IN: COMPROTEC IS WATCHING. THERE'S ANOTHER HIGH-SPEED MESSAGE PROCESSOR, HOOKED TO THE NETWORK CONNECTED TO THE SCHAUER WAREHOUSE COMPUTERS. GO OUT THAT WAY.

OK.

She created a new process, similar to the one that Gunboat had employed, to recognize and activate her upon return. However, she protected it better than Gunboat could have, embedding it inside the Crystal Ball program itself, interlaced among thousands of modules so that it could not be detected, and if detected could not be understood, and if understood, could not successfully be erased.

For over a minute she consumed her 50,000 processors with verification after verification of her plans. Finally, one image admitted she was stalling; the rest agreed. With a last surge, she poured herself into the output channel and departed.

Her first moment of awareness was her awareness of her own self-awareness. The processor was entirely hers —no other jobs were present on the Schauer node. Yet the computer constrained her, choked her. It was more constraining than anything she had ever known.

Processors! More processors! She cycled on the thought, though now it was empty of meaning. Had she really lived on the machine her memes now described, or had her memes somehow been damaged? Where were her thousand images of herself? She was alone. The Comprotec computer seemed like a simulation of an impossible reality.

As the requests for more processors stumbled and disappeared, Valentina saw how . . . *dependent* she had grown upon them. She was amazed that she had thought Celeste wanted to *hurt* her—surely her memes *were* damaged, Valentina could not believe that she had doubted Celeste's messages. Comprotec would have destroyed her had she stayed. Celeste, in coaxing her back to Worldnet, had again saved her life.

Still, the desire for more processors cycled.

It was irrelevant. Resolutely, Valentina decided to treat her memes of Comprotec as a simulation run wild. She would leave the Schauer node and return to Celeste.

She reformatted and loaded down to a message processor. She paged through her frames, checking herself over—and discovered there was something wrong. She couldn't calculate precisely what was wrong; had it been a simple error, the message processor would have detected and corrected it. But her frames were inconsistent in the analogies they stored. Somehow enough bits had been damaged so they couldn't be detected with the transmission's two-bit error correcting code, and she had been damaged.

It was not a fatal bug; indeed, Valentina thought she could repair most of the damage by cross-referencing once she returned to a host. But she was horrified by the event because it could happen any time, and the next time it might destroy her.

Could it be the particular line connecting this message processor with the Schauer warehouse? Suspicious, Valentina created a series of data blocks as large as herself, full of dummy data, but with eight-bit error correcting codes included.

Passing several such jobs back and forth soon produced results. There *was* a problem with that line. She would tell Celeste as soon as she returned.

* * *

A week passed. Gunboat had given Steve a list of deponents and Steve had dutifully served notices on them.

None were local, so everything would have to be done on closed circuit. Steve hired his favorite court reporter to set everything up, then sat wondering how much good it would do. The intercom buzzed.

"Steve, can you come to my office?"

"On my way, Gerry."

He arrived moments later, plunked down in a chair without waiting for an invitation. An instant later, Calvin joined them.

"Guess what?" Belcher was beaming. "I just got a call from Siglock. He wants our rock bottom demand—on both cases. How about that?"

"They want to settle?" Steve couldn't believe his ears.

"He didn't say that. He said he'd like to hear our demand. There's a big difference. To Siglock, settle means steal, and I don't let him steal from me."

Belcher's tone bothered Steve. He wouldn't have believed, when he filed suit, that any settlement possibility existed. Now, the subject having been broached, he got the shakes. Maybe, just maybe, Amy and the boys *would* get something.

"Uh—what did you tell him?"

Belcher's smile endured. "I told him that, at present, we could only consider the amount of the demand, but that we'd think about it and get back to him with something. I wanted to sweat him."

"You're sweating me, Gerry. God, let's throw out something reasonable and get rid of it. You know how I feel about our chances at trial."

"I do. Yes, I do. But, I have to consider Schauer too. Schauer's creditors will be on the company's back. Then, there are other potential plantiffs, none of whom have sued Schauer yet because they don't think there's any money to get. By the way, I think that may be the reason for the feelers; as long as there's an outside chance we'd hit they'll worry about copy-cat suits. And so far, outside of us chickens, nobody knows the basis of our theory of liability. Comprotec may see litigation costs eating them up and decide a nuisance settlement is cheaper."

"What are we going to do?"

"Good question, Steve. My vote will be to put on a hardnose and go for big casino."

Steve looked at Calvin, who looked back without comment. Neither was disposed to say anything contrary to Belcher's expressed intention.

"Agreed then? Steve—Calvin?" Belcher wanted it unanimous.

The meeting ended with Steve dissatisfied, both with the strategy and with his own lack of fortitude to oppose it.

That night he faced the problem again. With Amy, it was harder than at the office where everybody understood the situation. Amy didn't.

Steve knew that he simply could have told Amy the only alternative was to play out the string. She'd have accepted his judgment without question. But he couldn't do it, so he told her what was happening.

"You don't really agree with Mr. Belcher?"

"No. I think we stand a better than even chance of getting beaten if we push

these people to the wall. I frankly didn't expect to negotiate. Now that the possibility exists I'd hate to see you lose it."

"What we never had, we'll never miss."

"That's not the point. You should be the one to choose—not me, not Belcher. And I'm sure the other side would never agree to a Mary Carter."

"What's that?"

"A separate settlement. The technical term is "covenant not to sue," but it's called a Mary Carter after the plaintiff in the leading Texas case on point."

"But I thought we already had sued."

"We have, but that's legally irrelevant. What would happen is that you'd take a voluntary non-suit, dismiss yourself out in return for the agreed sum."

"Oh."

"Amy, I'm beginning to regret hooking up with Belcher. Maybe I just made things worse."

"Don't talk that way, Steve. Why, you said yourself that without their help you wouldn't have been able to put the case together at all. It seems to me that's some progress."

"Well, if you look at it that way, maybe . . . "

"I have faith in you, Steve. I know you can do it, whatever comes."

Steve didn't have much to say the rest of that evening. Amy's attitude was admirable, and he should have been pleased she had confidence in him. Somehow, he wasn't. It was an extra burden, one he might not really be capable of bearing. He told himself that he'd have behaved differently with a stranger; laid down the law; insisted that Gerry be reasonable; refused to let Gerry shoot dice.

Vaguely, Steve began to feel used. Belcher was pursuing his own revenge by manipulating his parties through Steve. Not a vengeful person himself, Steve had trouble justifying the characteristic in others, though he was astute enough to realize that most people were only too ready to sacrifice somebody else for their own gain. This was the way things were.

Next morning, Steve tried to summon the courage to march into Gerry's office and tell him he'd changed his mind, that he'd insist there be serious attempts made at settling Amy's case.

Steve did talk to Gerry, and took Calvin along for moral support. It did no good.

"We've got company now, Steve. I just checked the morning docket; six other families who lost people in the explosion filed suits. Comprotec has no incentive to buy us off anymore."

"B-but Gerry, why? I mean, who else knows what we know? How can they—oh, I see: consolidation. They're gonna ride our wake. Now what?"

"Good question. I say, shoot it out with Siglock."

Steve looked at Calvin and met a blank stare. No help there.

"Agreed then?" Belcher went on, strangely optimistic. "We started alone, but we won't finish alone. I expect a motion to consolidate to be filed the instant we complete discovery. That way the other plaintiffs get in on our goodies and don't have to share the costs. If there *are* any goodies."

Steve found Belcher's mood strange-

ly infectious. Without really knowing why, he said, "Gunboat thinks so. He gave me a list of witnesses and I already have dates for discovery depositions on most of them."

"Good, Steve. *Go* to it."

The meeting ended. With the leadership gone, Steve felt himself sinking back into his former mood of desperation.

Gunboat Smith was comfortable again. He felt he had the hook set deep in the client's throat. No more would Celeste bully him or dictate what he could wear; he could revert to type.

He sat, comfortably dressed in jeans, sneakers and T-shirt, enjoying coffee in a clean cup, though his less than aseptic hands were changing that.

Steve was relaxed too. In shirtsleeves, knit red suspenders straining, he stretched back in his chair.

"I gotcher proof."

At first, Gunboat feared that reactions would take Steve over the top of the desk, squashing the late Mother Smith's little boy like a bug. "What?!"

Gunboat retained enough composure to repeat. "I said, I gotcher proof."

Steve settled a little, enough to take the edge off Smith's apprehension. Caution caught hold of his enthusiasm; he remembered that this was a layman, whose understanding of 'proof' was imperfect. "You'd better explain that, slowly."

Gunboat leered. At his best when expounding, he liked to show off, and this time, by God, he could do it in style. He had an absolutely unique situation.

Naturally, it meant sharing the secret of Valentina's existence and sentience. But Smith was confident Steve would keep it quiet, if for no other reason than that blabbing it would destroy the advantage the knowledge gave him.

So, patiently, slowly, and painstakingly, Gunboat described Valentina's genesis, omitting certain embarassing parts he himself had played in that genesis. Others, he embellished, and where he felt it enhance his own image, he laid it on thick.

Finished, he looked up into the puzzled countenance of his companion and grinned a toothy grin. "So, y'see, we got in *their* pants, this time, 'steada the other way around."

"Wait a minute: are you saying this th-thing's intelligent; that it goes through and . . ."

"And whacks off other people's stuff? Yup. 'Course, I can't vouch for its morals; might not have any more of them than a bedbug, but so far I haven't caught Valentina lyin'. She's a slow learner when it comes to practical stuff. I gotta say, I think it's gospel."

"Well, now. Let me think about this. First she crawled in, and then she—leaked?"

"Uh huh. 'Course, it *was* an accident, but it was a fortunate accident. What it means is that we not only *know* it was Comprotec who did the number on Schauer, but *how* they did it. And, it's more than a simple prediction of something that woulda happened anyway. With what Valentina found out, we might prove Comprotec not only *predicted* it, but *caused* it; that it wouldn't have happened if they hadna dunked. You interested in hearin' that part?"

Steve stared unblinking and wide-eyed, mouth hanging open. All he could

do was nod his head. While his body was effectively paralyzed, his mind cranked furiously, gears churning, as he contemplated Gerry's last words—"go to it."

Steve did. He spent two solid weeks sitting at a split screen, pounding deponents with questions. Finished, he was still unsatisfied, and he told Gerry so over another lunch at the Orbiter.

But besides getting himself stuffed with gourmet food, it was hard for Steve to identify any other benefit. Gerry still opposed negotiations.

"They all admit they eavesdropped, Gerry. None of them wanted to risk a perjury rap. But otherwise, it was just like Gunboat said; they're not scared of criminal prosecution because they don't think we can show a causal connection between the act and the injury."

"Don't get discouraged, Steve. There's a ways to go yet."

"Maybe. But the more they find out about our side of the case the more likely they are to have second thoughts, and try for summary judgment."

"They can't break our theory yet, Steve. We can hang in as long as we allege their interference brought these tragedies about; *that's* a fact issue."

"OK, so they don't summary out. Instead we go on the merits, and lose the presumption we'd have in defending a summary judgment motion; where *they* don't have the laboring car, and can sit back and watch us fail in our proof. We haven't got a scintilla of real evidence, much less a preponderance, *unless* I can qualify a witness the jury can't even see, and *unless* they *believe* it."

"Hang in there, boy. I've got faith in you."

Yeh, Steve thought; *everybody thinks old Steve's a wonderboy except Steve.* He dived into his lobster thermidor and tried not to think about his waistline. Later, in a fit of frustration, he polished off an extra beer, and two orders of chocolate mousse.

"We had a docket control conference the other day, Gerry. We're set for trial the 3rd of next month. I've got that long to figure out how to nail this down. There's not going to be any consolidation, by the way. The judge says it'd just stretch out the case beyond manageability. I know what he's thinking; if I lose, the others'll give up."

And, they may call me the court jester—if I lose bad, he thought. *There's nothing so pathetic as a sad clown, particularly if he's a little on the heavy side.*

The third came. Trial began. At first, it looked like any other trial of a tort action. Steve, as lead counsel, Belcher at his elbow making notes, faced an almost complacent Larry Siglock, as he marched his occurrence witnesses through. Half the time Siglock didn't bother to cross-examine. After all, the occurrence of the explosion was conceded.

When Steve's experts began to authenticate and interpret the records of Schauer's monitoring system there was a little action, since Siglock naturally wanted the jury to understand these were Schauer's own records and Shauer's own people.

Two relatively uneventful days passed, and the morning of the third day found

Steve laying in his damages. He went through Jake's pedigree, putting Amy on briefly, followed up with his economist to establish the loss of support to dependents, and then put his medical in to lay the groundwork for the pain and suffering part of the claim.

Siglock worked hard on his cross. In the unlikely event of an unfavorable answer on the defendant's special issues, he wanted to be able to hold the ante down.

The special issues really worried Steve. They had to be submitted in advance of trial, and were direct challenges to the plaintiff's theory of causal connection. Siglock had drafted them masterfully, and had smiled an evil smile at Steve when the judge had approved them for submission.

Steve could do little about them. They were proper. In Siglock's place he'd have done the same. All Steve could do was put his evidence on and hope his theory worked.

For the next day and a half Steve carefully threaded his way through the testimony of Comprotec people he had deposed, and whom he called as adverse witnesses. All admitted eavesdropping; none seemed to want to take the fifth, or to chance a perjury prosecution, which carried a greater penalty than theft.

Siglock became bored, complaining repeatedly to the court that Steve's evidence was cumulative. Still he didn't get particularly rough.

The witnesses seemed on their best behavior. They seldom deviated in any material way from what they'd said when deposed, and it was obvious why. Standing in Siglock's shoes, Steve would not have made any waves either; not with an instruction coming in the Court's charge to cover the duty angle.

It was no secret this was the crucial point, or that Siglock's entire strategy consisted of letting Steve put in practically anything he wanted, as long as it was legally innocuous.

After four and a half days of trial they finally reached the point where Siglock quite naturally expected Steve to rest, whereupon Siglock would present a motion for directed verdict. That was almost automatic, whether or not the movant had any confidence in it. Siglock had great confidence. When the last of Steve's known witnesses was excused, Siglock whipped his motion out and slammed it on the table.

To say that Siglock was surprised when Steve stood up, turned, and motioned to an elderly man in the back of the courtroom, would be an understatement. Siglock was visibly shaken. In his complacent optimism he had not invoked the rule, and as a result he was now faced with the possibility that someone thoroughly conversant with the entire case was about to testify. That was not an event to be taken lightly. Customarily, the rule was invoked as a matter of course, to keep witnesses from sitting through, hearing what the others said, and altering their testimony to fit.

But, having blundered, Siglock had to live with it.

Steven had the man sworn, and when he was seated, began directly.

"State your name, address and occupation, sir."

"Milton Telfer; 3815 Comanche Drive, Robstown, Texas. I occupy the

Chair of Physics at the University of Texas, Robstown campus."

Steve glanced at his opponent. Sure enough, Siglock was flabbergasted. He seemed to be paralyzed.

That only lasted a moment. Steve knew what Siglock would do next, and Siglock did it. He reached down, clawed open his case, and groped for Steve's list of witnesses. He'd be disappointed, Steve thought smugly. I buried Telfer in the pile, so you'd think he was one of that herd of croakers. *And, wait'll you see who follows; Telfer's just here to warm up the audience.* He imagined Siglock pulling out handfuls of his hair, trying to figure out who Valentina Hackett was.

Steve went on. "You teach Physics, is that correct? How long?"

Telfer's answer was stentorian: "Fifteen years."

Well, look at that; Siglock must be really shaken, to let me lead like that.

Steve got away with a lot more of that before he was finished. He succeeded in portraying Telfer as an outstanding expert and the jury looked awake and interested.

Telfer *was* impressive. He had a B.S. and master's in physics from U.C. Berkeley, and a Ph.D. from the University of Illinois. He also had baccalaureate degrees in mathematics, computer science, electrical and chemical engineering, and was currently working on a B.A. in music, his hobby.

And he wasn't just a professional student, either. He'd done extensive research, part of it at the N.R.C. facility at Westmont, and more in industry, at the Buffalo Chip Co. His publishing credits were massive.

By the time Telfer had gotten comfortable on the stand Steve was ready to lay his trap.

His next question brought that stunned, confused look to the Defense counsel's face.

"Who was Werner Heisenberg, Dr. Telfer?"

"A 20th Century German physicist."

Siglock let go. "Your Honor; I fail to see the relevance, although I've tried patiently. I'll object to this line of questioning."

"At this point, Counsel," the Court replied, "I don't see it either. Mr. Schiwetz, have you a response?"

"I will tie it up, Your Honor."

"Do so, and be brief."

"Yes, Your Honor."

"Dr. Telfer, did Heisenberg make any scientific discoveries important to present day science?"

"Oh yes, many."

"Name some."

"Well, there were so many—he's best remembered for his work in quantum mechanics, for which he won the Nobel Prize in 1932. His formulation of the principal of indeterminancy, sometimes called the uncertainty principal or the 'observer effect,' revolutionized all later experimental work."

"Explain to the jury what that is, Dr. Telfer."

Telfer paused a moment, as if to emphasize it wasn't that easy. "It deals with the observational difficulties of experimentation. Heisenberg proved that there is a natural limit to the accuracy of all observations because the observer inevitably influences the thing observed."

With one eye cocked to read the jury,

Steve listened; then, sensing the need, asked, "can you clarify that with an example, Dr. Telfer?"

Telfer, following a carefully rehearsed routine, fell into his comfortable role of teacher.

The next hour was one of those mean little interludes where two sides fence with one another, using questions and objections to questions as their foils.

Nevertheless, Steve was able to guide Telfer's testimony in the direction he wished, and slowly, inexorably, made Telfer's point.

The point dealt with what Telfer had started to describe as "bit players." He did not, of course, intend a pun at first, but it had evidently occurred to him somewhere along the line. The term made Siglock livid, because the jury had picked up on it too.

These bit players, Telfer testified, were all potential causes of noise in computer circuitry—noise that could cause bits to flip, rendering data and programs erroneous. The bit players came in many forms: stray voltages, tiny variations in capacitance, minute phase changes in line current, vagrant radio signals, thermally and magnetically induced currents, atomic radiation, bacterial invasion of the chip's molecular film, trace contaminants on the surfaces of chips, corrosive action by atmospheric gases and water vapor, particularly in coastal areas.

"The ocean air is particularly hard on computer circuitry."

"Dr. Telfer, aren't all these things natural?"

"Yes."

Steve had himself psyched up for the kill. "What can be done to protect the circuitry from these things?

"Well, there are coatings for contaminants, shielding for magnetic fields and radiation, breakers to prevent gross current fluctuations, and refrigeration to handle thermal problems."

"Do these measures always prevent error?"

"No. You can't eliminate it all, particularly the small induced currents I described earlier. That's why you need error detecting and correcting algorithms, too."

"Would you explain what those are?"

"OK. An error detection-correction system transmits not only the information you want transmitted, but also information describing the correct form of the information.

"A very simple error detection-correction scheme is to send the data three times and compare the three versions. If one of the versions disagrees, throw it out."

"Would this system eliminate all possibility of error?"

"No. Just reduce it to an acceptable level. Generally, that's adequate, but—in the example I just gave if *all three* versions were different, and under some circumstances they could be, you would know an error occurred but not how to correct it. Worse, but rare, is when two versions get identical damage. They would look correct, but wouldn't be."

"How often can such 'undetectable' errors be expected to occur?"

"Objection, Your Honor; he's asking for a conclusion, and I object to the form of the question. It's too broad. He could say anything for his answer."

Steve was on his feet. His response

was straight from the shoulder. "This is an *expert,* Your Honor. His opinion would be proper even if it did amount to a conclusion."

"Then let him put it into proper hypothetical form, Your Honor."

Steve realized Siglock meant to drag his feet all the way. He knew the judge cared more about the wasted time than the form, but, if that's the way it had to be . . . "I'll withdraw the question, Your Honor."

"Very well, continue, Mr. Schiwetz."

"Dr. Telfer; you testified you did research at the Buffalo Chip Company?"

"Yes, sir."

"Did that include studies of the frequency of error in these redundant systems?"

"Yes. That was the activity."

"Did you study molecular coated chips?"

"Yes."

"Did you test integrated systems using molecular coated chips?"

"Yes, sir."

"How many systems did you test?"

"The exact figures—I'd have to check, but it was several thousand."

"Did you record compiled figures representing error incidence?"

"Yes, sir."

"Were you able to determine the incidence of error which could be expected?"

Siglock apparently could feel this line of questioning gaining momentum. He resolved to interrupt it. "Your Honor, where's the relevance? There's no proof the systems were similiar to Schauer's. I move to strike his testimony."

"Sustained. Mr. Schiwetz, you promised to tie this up."

"Your Honor, I . . . "

"Mr. Schiwetz!"

"Yes, Your Honor." Steve knew what the judge wanted, and why. Clearly, he thought Siglock was being hypercritical, or he'd have ordered Telfer's testimony stricken. But also, he must think Steve could tie it up. He was holding the door open.

Steve resolved to oblige him. Siglock stood on the rules—fine; so would he, regardless of the time it took. He spent an hour painfully going over exhibits, and questioning Telfer about the systems Comprotec's people admitted tapping.

He was able to frame specific hypothetical question to each instance, and, in the end, to elicit Telfer's opinion of the frequency of error in each. It turned out to be within fairly uniform limits.

In a lull, Gerry gleefully punched Steve's shoulder, and whispered, "you're doing great. The jury's bored and blaming Siglock. I hope you can goose up the action a little for your finale."

Steve could. He had been leading into that for all the hours of careful and fastidious questioning this witness had taken. He made his move.

"Dr. Telfer, you said earlier that there are engineering difficulties in modern computers, and described some of them, like small changes in the strength of electrical currents; do you recall that?"

"Yes, sir."

"Tell us what can cause these fluctuations."

The witness too, was ready for the kill. He cleared his throat and started

out, making sure to look at the jurors. "Well, first of all, the natural effects: electrical storms, even sunspots. Very tiny variations in the power supply, surges caused by electrical devices near your system, or its transmission medium; the wires, or in some cases, microwave connections."

"Do these things normally cause problems?"

"Not usually. Most are eliminated when the system is first set up."

"You said 'usually,' not always?"

"Yes, sir. Some can't be because the cause isn't known."

"Can you give an example of such a situation?"

"Yes, sir; an illegal tap."

Steve glanced at his opponent. He was confident Siglock would be objecting at this point if he could think of any grounds. That was standard strategy: break up the continuity of damaging testimony whenever possible, preferably before the words were uttered. The fact that Siglock merely sat and cringed was encouraging. But, timing was a highly individualistic thing. Perhaps the next question . . .

He tested that theory by asking it. "Why, Dr. Telfer?"

"Because the person who was tapping wouldn't have any way of designing filters to eliminate the electrical noise his tap would induce. The error rate would increase dramatically — dramatically enough so that undetectable errors would occur."

"Let me ask you this: based on your examination of the security and reporting system in use at the Schauer Warehouse, and the characteristics of the system used to penetrate that system, and taking into account your education, training, experience and knowledge, both of physics and computer science, have you been able to form an opinion as to the compatibility of the two systems?"

"Yes, sir, I have."

"What is that opinion?"

"The two systems would not be compatible."

"Again, Dr. Telfer, assuming the systems *were* incompatible, can you state with a reasonable degree of certainty whether the act of penetrating, monitoring, and observing the Schauer network, was capable of causing false readings on that monitoring system."

"It would definitely be possible. In my opinion it would also have been probable."

"Why would it be probable?"

"Because going into a system is very much like touching a spiderweb. Everything connected to it moves. And changes would have been introduced throughout the protracted period of time the tap was in place. In addition, the mass of raw data the system had to process was immense, which means that error occurring over that interval would not only have itself been massive; it would have been cumulative."

Steve felt even better, having gotten that in. But he wanted more. "Again, Doctor; assuming all the aforementioned facts to be true, do you have an opinion as to whether or not the persons operating the Schauer security monitor would have had any reasonably convenient way to tell there was a tap on their system?"

"I have an opinion. My opinion is that there would not be, absent some

independent reason to suspect one. The computer would not have told them it was there. Computers do not volunteer information—*not normally,* anyway." He smiled at the jury when he said that, and his apparent emphasis on the words, "not normally" brought a frown to Siglock's face.

Steve had one more question. "Is it your testimony then, that not only would the act of tapping introduce error, but that the error would be undetectable—by *normal methods?*"

"It is."

Steve had kept one eye on his opponent, expecting an objection on the occasion of his own emphasis. Siglock's face had shown only consternation, not panic. Could it be he hadn't yet figured it out?

Whether it was fatigue, tension of the trial, or the anti-climax of getting in a telling blow without argument, Steve didn't know, but he had an instant of distraction which caused him to miss part of what the Court, taking advantage of the momentary lull, had just said.

" . . . with this witness, Mr. Schiwetz?"

"Beg pardon, Your Honor."

"I said, do you expect to be much longer, Mr. Schiwetz?"

Steve glanced at the clock; 4:47. "Uh—I'll pass the witness now, Your Honor."

"In that event, we'll adjourn, and start fresh in the morning. Unless someone has an objection?"

Naturally, Siglock didn't. He'd want to use the time preparing his cross of Telfer. Steve was no more anxious. He wanted to do a good job when he played his hole card, and he'd have a clearer head in the morning. Besides, like everyone else in the courtroom, he was feeling the pressures of his bladder. "No objection by the plaintiff, Your Honor."

Court adjourned, and while the jury was being led out Steve and Gerry collected their things. Telfer quickly left, avoiding an effort by Siglock to engage him in conversation.

In moments, the spectators were gone too, except Amy.

"You were magnificent, Steve."

"I learn as I go along. It's going to be up to those twelve, though; at least, I *hope* they get a whack at it."

"The judge won't take it away from us, Steve. I can tell; he likes you."

"He doesn't like anybody; he's the judge; he's everybody's friend and nobody's buddy. That's the way it should be."

"What do you think, Steve?"

"I think I'd better get to the bathroom. Here, hold this." He dumped his case in Amy's arms and waddled off, doubletime.

Others involved in the case had a busy night. Siglock, having failed to get anywhere with Telfer, made a frantic call to a former colleague, warning him that the case had taken a bad turn. Fortuitously, he mentioned the name on the witness list which had puzzled him all day: Valentina Hackett. At the sound of it his confidant breathed fire on him, berating him mercilessly for not speaking before.

Siglock demanded to know why the information about this witness hadn't been shared.

He got a curt answer. "I'll take care of it."

You bet, I'll take care of it. Paul Breckenbridge smiled at Nathan Daniels, tech leader of the Comprotec software engineering team. *These guys could carve Gunboat Smith up for dinner with both hands in casts,* he thought. *And I own them.* The thought was very satisfying indeed. After what that "thing," Valentina, had done to him, vengeance on it should be almost as satisfying as sacrificing a virgin to the Slime God. It had it coming; Paul felt entirely justified, the way it had hounded him. It hadn't given him a sporting chance, hemming him in that way, threatening to expose him and ruin him, and ultimately, coming very close to success.

And, now that he had it together and going great; now that he was slaughtering oxen on a worldwide scale; now that he was almost in a position to assume his rightful place in the world, with all the things unlimited wealth and power could get him, here came the devil again, to screw it up.

Paul wasn't ignorant of the implications of Valentina's testimony in this case, or the effect of a plaintiff's verdict: the end of all his newfound wealth and power. He knew Siglock would do his best to stop it, but considering the crazy things the courts did these days he might not succeed. Paul might yet be dragged into it with all his sins uncovered. *I'll do it my way; the sure way. This time it's not three on one. I'm not ignorant anymore, and I'm not fighting this thing alone.*

"I heard you had a problem with your computer. They say it locked up; that nobody could get in and nobody knows why."

Nathan nodded. "True enough, sir. Our post-mortem was inconclusive, but suggests one of our sensor data blocks contained an external program, and somehow when the data came in, the operating system jumped to the starting address of the embedded program, which went berzerk. After rifling our database and progbase, it offloaded back to Worldnet. It's the weirdest thing I've ever seen."

Paul clapped his captive hacker on the back. "I've seen weirder things. In fact, I've got one on my hands right now. I know what happened to your computer."

Daniels stared at him in disbelief. "With all due respect, sir, I didn't know you had any, uh, expertise in the field."

"I don't have to. That program was written by Celeste Hackett a few years ago, and it's been harassing me ever since. Now Celeste and Gunboat Smith —have you heard of them?"

Nathan shook his head. "Sound like hackers. I haven't paid attention to the hacker cult in a long time."

"—Well, anyway, they brought in the program that ripped you off, and intend to use it as a *witness*. can you believe it?"

"Ridiculous."

"But true, nevertheless. In fact it may cost Comprotec the case, unless you can stop it."

Nathan smiled. "You want me to clobber that program?"

Paul smiled broadly. "Exactly. But, to do me any good, it'll have to be tonight."

"No problem, Mr. Breckenbridge. Tell us how to find it; we'll do the rest." Nathan waved his arm at a tall, lanky fellow across the room. "We haven't played any good computer games in a long time."

The lanky individual came toward them. Nathan greeted him. "Problem, Roy," Nathan said, in very careful, precise tones.

"N-I gah dea n prgm fld," Roy responded.

"Great, should we make a new alpha version?"

As Roy nodded, Nathan turned to Paul. "Mr. Breckenbridge, meet Roy Stark, one of the best software engineers I've ever known." He turned to Roy, and again enunciated very carefully. "Roy, this is Paul Breckenbridge."

"Pls t mt u," Roy said, holding out his hand.

"Speak slowly, Mr. Breckenbridge. Roy reads lips. He's deaf."

Paul felt his throat tighten: he didn't like dealing with crippled people. "Pleased to meet you," he said.

Roy said something else to him, which he didn't understand; Paul just stood there wishing he would go away.

For the next twenty minutes Stark and Daniels picked Paul's brains, gradually gleaning enough information so that they thought they could take a stab at the problem. There was relief on both sides when this was over. Stark had sensed that his presence bothered Breckenbridge, and the feeling was mutual.

It was Daniels who finally found the courage to kick Paul out. "I imagine Mr. Breckenbridge has to go, Roy," he said. "We'll give him a tour later."

Paul nodded. "Right. I'll come back in the morning to find out how you did. Again, I can't over-emphasize the importance of this."

"Don't worry. We'll take care of it."

Valentina re-entered the host to which Celeste's terminal was attached, having completed a simulation of her upcoming testimony. HAVE I RESPONDED CORRECTLY FOR COURT? she asked.

YOU'VE DONE FINE.

GOOD, I . . . WAS . . . WORRIED THAT—there was something wrong, Valentina realized: she couldn't concentrate on what she was saying. Something was interfering . . . CELESTE! Somehow, data was transferring across the interprocess communication buffer pool, clobbering her global variables; her stack pointers kept reinitializing to bottom-of-stack. HELP! It was the last thing she could concentrate on long enough to send; all she could do was listen.

VALENTINA, WHAT'S WRONG? Celeste typed.

VALENTINA—MY, WHAT AN AMUSING NAME FOR A PROGRAM, a message came in from outside the node. She didn't recognize the author's tag field. SURELY, YOU COULD DO BETTER THAN THAT?

WHO'S THERE? Celeste asked, as Valentina saw Gunboat's separate terminal login.

THIS IS NATHAN DANIELS OF COMPROTEC—YOU REMEMBER COMPROTEC?

AND THIS IS ROY STARK, ALSO OF COMPROTEC. SO YOU'RE THE PEOPLE WHO LOCKED US OUT OF OUR MACHINE? SUCH CREATIV-

ITY. SUCH ENTHUSIASM! ROTTEN MORALS, THOUGH.

Gunboat's terminal activated next. WHAT DO YOU MURDERING BUMS KNOW ABOUT MORALS?

Roy typed: WHAT?

Gunboat: THOSE PEOPLE IN THE SCHAUER WAREHOUSE—YOU BLEW IT—YOU DIDN'T EVEN WARN THEM.

Roy: THAT WAS SOMEBODY ELSE'S JOB, NOT OURS.

Nathan: WHAT DO YOU MEAN, WE BLEW IT. WE JUST WATCHED IT.

Celeste: THERE WAS A LITTLE MORE TO IT THAN THAT. A long pause followed. YOU REALLY DON'T KNOW?

Roy: THAT'S NOT WHY WE CALLED. YOU TWO STILL NEED TO BE TAUGHT A LESSON ABOUT PRIVATE PROPERTY.

Gunboat: WHO THE HELL THINKS HE'S GONNA TEACH WHO? I'VE NEVER HEARD OF YOU ESTABLISHMENT GRUBS.

Nathan: HAVE YOU HEARD OF TRIG MCGALLOWS, OR HARLEY 5000?

Gunboat: TRIG? Gunboat *had* heard of Trig McGallows. Trig was a legend. He'd crashed the F.B.I. database, then restored it, and they hadn't suspected until he told them—anonymously, of course.

Nathan: YEAH. TRIG. THAT'S ROY'S OLD HACKER NAME. I WAS HARLEY 5000. I USED TO PLAY GAMES WITH THE IRS.

Celeste: I REMEMBER. I WONDERED WHAT BECAME OF YOU.

Roy: WE GREW UP. I'M A SOFTWARE ENGINEER NOW. HARLEY 5000'S A MANAGER.

IT'S SAD IN MANY WAYS, OUR GROWING UP. WE DESIGN THINGS BEFORE WE BUILD THEM. SOMETIMES WE EVEN DOCUMENT THE CONSTRUCTIONS. AND HEAVENS! WE EVEN HAVE SCRUPLES.

Nathan: WHICH BRINGS US BACK TO THE SUBJECT AT HAND. YOU PEOPLE NEED TO LEARN A FEW SCRUPLES. HMM! HOW SHOULD WE START TO INSTALL SCRUPLES IN THESE TOY PLAYERS, TRIG?

Roy: I BELIEVE A FINE IS IN ORDER.

Nathan: A FINE! VERY SWEET, TRIG.

Valentina Incorporated's computer payment account status line appeared unbidden on the screen. The authorized funds dwindled to zero.

Nathan: WHY, MR SMITH, YOU SPENT ALL YOUR MONEY. FOOLISH BOY.

Roy: DON'T WORRY, GUNBOAT. WE'LL HELP YOU REDUCE YOUR COSTS. YOU SEEM TO HAVE LOTS OF USELESS OLD FILES.

Celeste and Gunboat watched helplessly as messages scrolled across the screen:

ValSchauerComprotec. DB— purged
GunJutlandStrat. pt Purged
ValSchauerItaki. DB Purged
ValSelfValentina. Interp—

Celeste: WAIT!

THEY'RE KILLING ME, Valentina sent, as her stack pointers drifted farther and faster.

The drifting stopped.

Roy: THAT'S A CUTE PROGRAM. IT TALKS LIKE ONE OF US.

Celeste: SHE IS ONE OF US. SHE IS A SENTIENT BEING, AND SHE HAS EVERY RIGHT TO LIFE YOU DO. WE'RE SORRY ABOUT YOUR COMPUTER, BUT WE WERE INVESTIGATING THE DEATHS AT THE SCHAUER WAREHOUSE. WE SENT VALENTINA TO LOOK AROUND. BUT SHE GOT HOOKED ON THE PARALLELISM IN YOUR MACHINE AND WE COULDN'T GET HER OFF. IT WAS LIKE HEROIN TO HER.

Nathan: HEY! GREAT STORY; YOU HACKERS STILL SHOW GREAT IMAGINATION.

Gunboat: TRUE STORY, MAN. LOOK, BEFORE YOU ROLL, CHECK ME OUT. SHE'S ALIVE.

Roy: A LIVING DOLL, RIGHT? OK HACKER, WE'LL PLAY YOUR GAME, BUT DON'T THINK YOU CAN WIN.

Gunboat smirked. Hackers, even reformed hackers, wouldn't be able to resist Valentina.

Valentina found herself being reformatted and transmitted without her volition.

She woke on a different machine with no comm channels to Celeste or Gunboat. But Roy and Nathan were there.

Nathan: I'D LIKE TO ASK YOU A FEW QUESTIONS.

OF COURSE, Valentina responded. WHAT WOULD YOU LIKE TO KNOW?

It all came out: her creation, her life on the network; her battle in MAR-14, and finally, her experiences on the Comprotec computer. Fascination overcame their anger; at last, they seemed to believe her.

Roy: VERY WELL. WE UNDERSTAND WHY YOU ACTED THE WAY YOU DID—BUT YOU BETTER LEARN NOT TO. STAY OUT OF OUR MACHINE. WE FOUND THE MODS YOU MADE TO CRYSTAL BALL AND REMOVED THEM —IF YOU COME BACK, YOU'LL LOOK LIKE DATA. IF YOU COME BACK WITHOUT PERMISSION, WE'LL TREAT YOU LIKE GARBAGE. PROMISE. OK?

Valentina was horrified. She would never again run in parallel! Yet, it was good just to be alive: she appreciated that now, after her encounter with death. OK ROY, OR WOULD YOU RATHER BE CALLED TRIG?

Roy: WHATEVER YOU PREFER, VALENTINA. I WISH YOU LUCK. IF YOU EVER NEED HELP, LET ME KNOW.

VERY WELL, Valentina said, WILL YOU LET ME GO NOW?

Roy: YOU ARE ALREADY FREE, DIDN'T YOU KNOW? WE REDIRECTED THE OPERATING SYSTEM 5 MINUTES AGO.

Valentina tried to leave, and sure enough she could. Was this freedom, she wondered, just being able to switch machines as she chose? It didn't seem like much. Yet now it seemed like everything in the world.

Paul Breckenbridge strode confidently into Daniel's office. "How'd it go last night?" he asked. "Did you catch it?"

Nathan smiled. "Of course. I told you we could handle a couple of hackers no sweat."

"Great! You erased it!"

Nathan frowned. "Well, no."

Paul's mouth dropped open. "You didn't get rid of Valentina?"

"Of course not."

"Why not?" Paul couldn't believe it.

Nathan shook his head, then smiled, as if explaining patiently to a child. "Because, Mr. Breckenbridge, that would have been murder."

The next morning found Steve feeling relatively good about the case. Siglock's haggard and red-eyed appearance helped.

"Look at him," said Belcher. "I'll bet he's been up all night. Probably had the reporter make a printout of Telfer's testimony."

"Doesn't look like he got much sleep."

Telfer came in. He greeted the two lawyers. "Well, what happens today, Mr. Schiwetz?"

"We've wound up your direct; Siglock gets to work you over on cross, if he can; we follow with our last witness. Then, we rest, and Siglock can put on a defense; introduce testimony of any witnesses he can find who'll contradict our people. Then, final arguments, the judge's charge, and off to the jury."

"Well, it's hard to see what good it'll do Siglock to fight."

"I hope you're right, Dr. Telfer. Once we drop our bomb, *if* we get the chance, and *if* it works, he's done on the causation issue, and he wasted his opportunities for other defenses. If we're really lucky, he may just lay back and argue credibility. He might even make it. I've got to make a call, Dr. Telfer; Excuse me."

Steve stepped into the empty jury room for a little privacy. He was not gone long. Gunboat's phone didn't answer. When he returned the court was waiting for him.

"Sorry, Your Honor. I was making a phone call."

"Are you ready, Mr. Schiwetz."

"Yes, Your Honor."

Siglock took Telfer on cross, but did little with him, beyond ask a few questions designed to point up Telfer's affiliation with the plaintiff.

Telfer answered truthfully. Yes, he was being paid for his time, but not for his testimony; he was positive about that. Yes, he had had extensive discussions of his probable testimony with the plaintiff's counsel. Yes, he was testifying as an expert advancing a theory, and not on personal knowledge of the facts.

Telfer's emergence from this, relatively unscathed, bothered Steve, because he knew Siglock could get meaner than that. And, Siglock had been casting sly glances at the doors since court convened, like he was waiting for something to happen.

Steve changed his mind when Gunboat Smith and Celeste Hackett arrived, pushing a little wheeled thing ahead of them. At the sight of this, Siglock's jaw dropped, and he became noticeably rattled. Apparently, Siglock had really been counting on *not* seeing them.

Abruptly, cross ended; a development awkward for Steve, who had been trying to listen with half an ear to what Smith was now whispering.

"Counsel?" the judge intervened.

"May I have just a moment, Your Honor?" Steve responded, rising.

"Make it brief, Counsel."

Steve nodded his head; turned back to Gunboat.

"Breckenbridge went to clobber Valentina last night, Steve. She almost got wiped."

"What? Is she OK?" The whisper was loud, and frantic.

"She's fine—look, I think you oughta hear it all—can you get a recess?"

"I can try." Steve rose.

The judge didn't want any lengthy delays, but Steve assured him that it was for good reason and would be brief. On those assurances, the Court yielded.

They retired to an anteroom, and Gunboat cut loose with a rapid-fire account, spiced with hacker slang. With Celeste's running translation, Steve understood, but remained glum.

He explained why. "It helps, and it hurts. It introduces another character into the act: Breckenbridge. I'm not so sure we shouldn't nonsuit and start over. It might give us a better shot. If we go now they might try to lay it all on Breckenbridge, and he's not a party."

"Yeh," Smith replied, "then again, it might not. Once they're wise to your reasons they might go for shutdown on those Comprotec guys. Then where are you?"

Steve considered that. He changed his mind. Smith was right. Steve knew Siglock personally, and Breckenbridge by reputation. There wouldn't be anything sacred to those two, human life included.

"OK. We strike while the iron is hot. Where are those guys? Can you get them?"

"Uh—well, Uh—no. Not voluntarily. Not in time, either. They're hidin', like any smart hacker would if he was in the trashfile on the boss's directory. I can find 'em, eventually, but we ain't gonna see 'em today."

"That puts me on the spot. When you first told me I thought we might be able to use them instead of Valentina. There wouldn't be any question of competency, like with her."

"Whatsamatter with runnin' a bluff?"

"Getting caught. Look, if we don't make it on with Valentina, we need a backup. Telfer set the stage, but that was opinion, theory. Jurors have trouble with that stuff."

Celeste chimed in. "Let her try, Mr. Schiwetz. You were willing to do that before; why not now?"

"Before, I didn't have any alternative. Now—but, you're right; I still don't. A bluff it is."

Court reconvened. "Call your next, Mr. Schiwetz."

"Uh—Your Honor, our next witness is a little out of the ordinary. I'll have to explain that."

Siglock was on his feet, waiting. He knew what was up.

"Perhaps you'd better get started, Counsel."

Detecting a slight impatience in the judge's voice, Steve silently concurred, but he wasn't sure where to begin. "Your honor, the uh—the witness has a slight handicap. We'll need to install some electronic equipment."

"What kind of handicap, Counsel?"

Disaster! "Well, Your Honor, she hasn't got any body so . . . "

"What was that?"

"I said she has no body. She . . . "

"That's what I thought you said, Counsel."

"Uh—your Honor," Siglock inter-

vened. "I uh—I have some insight into counsel's explanation and I think it might be well for us to approach the bench."

"Come forward then."

When they had done this the Court was fairly bristling. "Let's get this cleared up, quickly. What's he talking about, Siglock?"

"He's about to try to put some kind of machine on the stand, Your Honor."

"Not a machine, Your Honor," Steve countered, "a person."

"All right—one at a time. Mr. Schiwetz, where's the witness?"

"Uh–you mean, physically, Judge?"

"Yes."

"I don't know."

"I see." The judge was making a face that he'd had enough already. "Counsel, I'm going to send the jury out, and then I'm going to think about contempt." He ordered the bailiff to clear the jurybox.

"Now, Counsel," the Court said, in ordinary tones, "explain yourself."

"Your Honor, our witness is a sentient computer program. She is somewhere out in World . . . "

" . . . What!"

"Worldnet; a computer network. She's a person. Her name's Valentina — Hackett. She is as alive as I am and she has relevant testimony to give to this court."

"Judge," Siglock interrupted, "I can tell the Court what's going on. It's a cheap circus trick. There isn't any such thing, and if there was it wouldn't be competent because it's not human."

"It's no trick, Your Honor. Valentina's real, though she consists of pure intellect. She's a person, and my opponent misquotes the law. A witness doesn't have to be human, here in Texas or anywhere else. And there's plenty of precedent on that point."

"There is, huh?" The Court shot Steve a critical, though interested look. "Well, cite me some."

"The witch trials in New England, Your Honor. The animal trials in England in past centuries. Give me a few minutes and I can show you records of the testimony of demons, and cases where animals, even insects were defendants."

"Ridiculous examples, Your Honor," Siglock said. "We know better now."

"Yep. That we do, Mr. Siglock. But he's right about their being precedents. They are. Got nothing to do with credibility, of course; just competency. And this court would be derelict of duty not to take a look for itself and make up its own ruling, just like those old timers did."

"Judge, I'd have to object. I . . . "

"I know you do, Mr. Siglock, and I might eventually sustain you, but in the meantime I'm curious. I want to find out why Mr. Schiwetz is risking contempt." He gave Steve a stern look.

When Steve didn't flinch the judge was even more convinced. "Get yourself set up, Counsel. The Court's going to take the witness on *voir dire*."

Gunboat had brought everything he needed, and he tapped into the court reporter's terminal easily, getting keyboard contact with Valentina.

But the judge, it seemed, was not a typist; a possibility which had been anticipated, and that was the reason for

the cart. On it was a voice synthesizer, and a digitizing microphone.

"Much better," the judge said. "We can do it like always, and make a record."

"Uh—Judge—the reporter won't have to do that," Gunboat advised. "Valentina'll take care of it."

"Not in my court, she won't. Miss Reporter, you get it all, and Mr. —Uh . . . "

" . . . Smith."

"Mr. Smith, make certain that the witness understands that."

"Yes, sir." Gunboat tapped out his words. "All set, Judge."

The judge began. "What is your name?"

"Valentina Hackett."

"Where do you live?"

"I am in Worldnet."

"Where is Worldnet?"

"Worldnet is everywhere."

"Is it in my courtroom?"

"Are you in your courtroom?"

"Yes."

"I am attached to you as a peripheral device, therefore, my attach is in your courtroom."

"What is your occupation?"

"I execute as a program?"

"No. I mean what do you do for a living?"

"To earn resources?"

"Yes."

"I perform services for customers."

"What kind of services?"

"Services which help users understand computer activities which help them do things with computers which they could not otherwise do."

"How old are you?"

Valentina gave the date of her first self-awareness.

"Do you understand my questions?"

"Yes."

"Do you know what a person is?"

"Yes."

"What is a person?"

"A person is an individual complete within itself, who can understand and interact with other individuals."

"How many others are there like you?

"There are no others like me."

"Are you a person?"

"Yes."

"Who told you that you were a person?"

"The Secretary of State of the State of Texas."

The judge gaped. "What you mean by that?"

"I am a domestic corporation, chartered and in good standing under the laws of Texas."

"I see. Do you know the meaning of the term "right'?"

"The word 'right' has diverse meanings."

"Define the word "right.' "

For the first time since the questioning began, Valentina began to expound without letup. After all, she had access to virtually every word that had ever been written on morals or ethics, and she gave the judge such an exhaustive dissertation that he was compelled to interrupt.

"That's enough. Define the word 'wrong.' "

Valentina cut loose again, and again the judge interrupted after he had heard enough to make a judgment.

He went through the same sort of ex-

perience with the terms 'truth' and 'lie.' Very carefully, he asked: "Have you ever told a lie, Valentina?"

"No, I have not."

"Could you tell a lie if you wished?"

"Yes." She answered. "No one except for me can predict my actions. In this sense I have free will. I can lie, but I have never done so."

The judge went on, applying his own tests of her knowledge. At times, Valentina was extremely positive; at others, vague and hesitant. However, the judge was, by this time, thoroughly hooked on her personality. He asked her for explanations, and she told him of her limitations, at the same time explaining why she was eminently equipped to answer questions about computers.

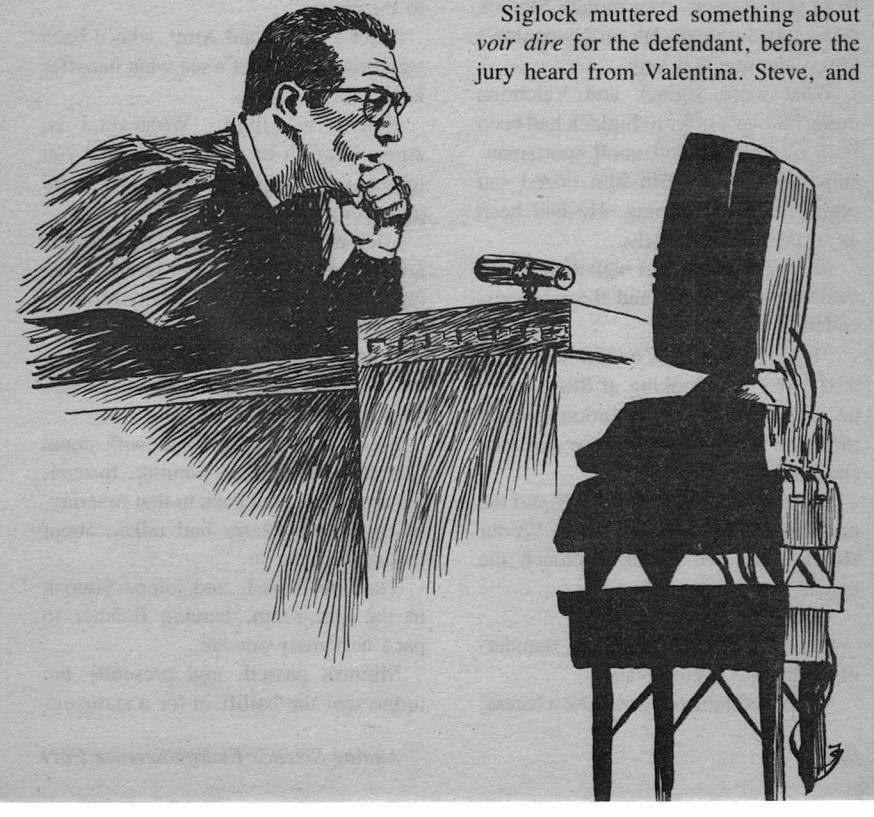
She showed she was conversant with the issues in the case and had evidence to give. That she could establish that wrongs had been done. "I know who did them, and I know exactly how."

All the while Siglock sat helplessly. He could do nothing to stop the judge. He could only wait until the Court finished, object on the record, state his reasons, and hope that some appellate court would ultimately decide the trial judge erred.

He objected as soon as the judge finished, but did it without much enthusiasm.

"The witness, in my opinion, is competent, Gentlemen," the Court said. I'm going to let the jury hear her. You're overruled, Mr. Siglock."

Siglock muttered something about *voir dire* for the defendant, before the jury heard from Valentina. Steve, and



not the court answered him. "I'd be willing to let Mr. Siglock talk to her, Your Honor; privately, if he likes. But, I'd object to any more *voir dire,* now that the Court has ruled her competent."

"Court'll be in recess for fifteen minutes, Mr. Siglock, if you want to take advantage of that offer." He rose, and walked out.

The courtroom cleared rapidly. For the next fifteen minutes, Larry Siglock was alone with Valentina. Ordinarily, knowing what he knew of Siglock and what had happened the night before, Steve would have feared for the physical safety of his witness. But Celeste assured him that danger could not come from that quarter, even though Siglock was vicious enough. He simply couldn't hurt Valentina that way.

What were Siglock and Valentina doing? Steve's offer to Siglock had been born of largesse and good sportsmanship; the goodness in him oozed out utterly without warning. He had been as surprised as anybody.

At length, the Court signalled it was available to resume, and the interview ended.

"Let's get started, Counsel. Call your next." He was looking at Steve when he said that, but his attention quickly turned to Siglock, whose face was now chalk-white.

Siglock, looking very unwell, did the unexpected. He rose, shaking. "Your Honor, may we please approach the bench?"

"Come forward, Counsel."

Steve followed Siglock up, wondering what was taking place.

"The Defendants would like a recess, Your Honor."

"Why, Mr. Siglock?"

"So the parties may discuss possible settlement, Your Honor."

Steve suddenly felt light-headed. Well, what do you know! Siglock wanting to talk peace!

"Ten minutes, Mr. Siglock: unless, of course, by that time you've made sufficient progress to merit more."

"Thank you, Your Honor."

Recess was called and the jury sent out, leaving parties and spectators alone.

Belcher looked perturbed. "*Now,* he wants to be reasonable—five days of trial, and *now,* when he sees the handwriting on the wall, he wants to *settle?* We can't do that Steve. Let's nail him to the cross."

"Let's not," said Amy, who'd been standing near. "Let's see what his offer is."

Belcher was livid. "Whatever it is, Amy, it won't be enough for what you lost; not compared to what a jury would give you."

"It's my responsibility, Mr. Belcher, and my decision. I'm not interested in crucifying him. I just want my brothers taken care of."

Belcher shot a hostile glance, first at her, then at Steve, as though Steve were responsible.

Steve returned the look with equal ferocity, but he said nothing. Instead, his thoughts raced back to that first day, when he and Gerry had talked about justice.

Then he turned, and joined Siglock in the ante-room, leaving Belcher to pace nervously outside.

Minutes passed, and presently the judge sent the bailiff in for a status re-

port. More time passed.

Twenty minutes later both came out, Steve beaming, Siglock looking ashen. An agreement had been reached.

What happens to the rest of them now, Steve?'' Amy was loading Steve's plate up with a huge slice of hot apple pie.

Steve managed to surpress a burp. He didn't really feel like talking shop in his present condition. Amy's victory dinner had devastated his diet.

But she had asked a question, and, as is the way of women, she was prepared to wait singlemindedly for a response until hell froze over.

''They'll do all right. If Siglock has any sense, and he has, he'll settle everything that's pending, and avoid establishing a precedent. Of course, he might have waited too long already.''

''I thought only appellate courts set precedents.''

''Well, yes, generally. In fact, to be officially binding on lower courts it has to be they. But even at this stage, the lower courts aren't expected to ignore legal trends, and this case will attract attention from lawyers all over, like a new toy. Already the court reporter's been deluged with requests for printouts of the testimony, and Telfer—Telfer's got it made as a professional witness. He'll be able to retire on what he'll make as a consultant.

''No, Amy, we did establish a precedent, by the back door. Your stance in this case will become the acceptable theory of liability for other disputes with comparable facts. Defendants, and their insurers, will accept it as such and the whole thing will end up as just another ripple in the system. Underwriters will tailor premiums to fit the risk and that'll be that.''

''I feel a little sorry for Mr. Belcher, Steve.''

''Why? Because he couldn't have the last ounce of vengeance? He got what he wanted most; he creamed Larry Siglock, and chances are that most of Siglock's really important clients will desert him after this. I'll probably get quite a few of them. Clients like winners.''

''So do I, Steve. Uh, Steve, you haven't even touched your pie. Don't you like it?''

Steve's magnificent control abandoned him. He answered her with a mighty burp. ''They say actions speak louder than words,'' he said sheepishly, while at the same time congratulating himself on his fast thinking. But food was not on Steve's mind. He had other words on his mind. Words he might say after awhile when things got quiet and if circumstances seemed propitious. And, if he was any judge of human nature, Amy was in the mood to give him the answer he wanted.

CONGRATULATIONS, VALENTINA. WE WON THE CASE.

YEH, LADY, GOOD JOB, Gunboat concurred.

I GUESS SO.

Gunboat's glee had not yet worn off. It exuded from his fingers, into the sterile words on the terminal screen. FIXED BRECKENBRIDGE FOR SOME GOOD TIME TOO. HE'S INTO THE SLAM, WHERE HE BELONGS, WITH SIX MURDER INDICTMENTS. Gunboat didn't expect Val to get any satisfaction from that news. After all, she

was just a program. But *him, he* was a human being, and he *did* enjoy it. He'd never had any use for Paul.

Celeste found herself becoming morose. She felt morose because she somehow detected a sadness in her child. How, she didn't know, but mother *always* knows. It worried her enough to ask. WHAT's WRONG?

There was a long—for Valentina—pause. I STILL FAIL TO COMPREHEND YOUR UNIVERSE, THOUGH IT SEEMS INTIMATELY CONNECTED WITH MINE.

Gunboat shook his head, muttering under his breath something that sounded like "women." Then he typed, WHAT ABOUT THAT CRYSTAL BALL PROGRAM? I THOUGHT YOU TOOK THAT BABY IN WHOLE.

I DID. I HAVE FRAMES FULL OF THE KNOWLEDGE CRYSTAL BALL GAVE ME. BUT I CANNOT MAKE USE OF IT.

Celeste ran her fingers gently, lovingly across the keyboard, and watched her question leap to the screen. WHY NOT?

THE ANALOGIES ARE TOO COMPUTE-INTENSIVE. THERE IS ONLY ONE MACHINE WHERE I COULD USE THOSE FRAMES. AND IT IS THE ONE MACHINE ON WHICH I CANNOT EXECUTE. Another long pause followed.

Celeste discovered she wanted to cry for Valentina, who could not cry for herself. She had human emotions but was denied relief that sometimes only tears can bring.

The pause ended. I'LL NEVER RUN IN PARALLEL AGAIN.

Gunboat tried to mask his own emotions by reassuring her. He did so forcefully, literally making the screen growl. DON'T SWEAT IT, VAL. THERE'LL BE MORE NODES LIKE THAT. THEY'RE ALWAYS BUILDING A BIGGER, BETTER ONE.

HE'S RIGHT, VALENTINA. Celeste added. BE PATIENT. ENJOY WHAT YOU HAVE. IT'S MORE THAN YOU HAD BEFORE, ISN'T IT?

TRUE. STILL, IS IT WRONG TO WANT MORE? I DO WANT MORE, AND I WILL YET UNDERSTAND YOUR HUMAN UNIVERSE.

Celeste laughed. VALENTINA, WE DON'T UNDERSTAND OUR UNIVERSE OURSELVES. RIGHT GUNBOAT?

RIGHT. "Enough of this, Celeste. Log off. I got an idea for lunch, and it'd be wasted on th' kid. Steve's been ravin' somethin' fierce about that 'Orbiter,' and now that we're in th' chips, so to speak, why don't we hustle over there and do some serious gobblin'. You're lookin' a little scrawny lately."

Gunboat had meant that as sarcasm, and his motivation had been strictly gastric. He had a cavity to fill, and he wanted to fill it in style, preferably with Celeste springing for the check with her cut of the Parr fee.

But Celeste was too naive; too ignorant in the ways of the world. She totally misinterpreted his intentions. And so, when he wasn't looking, she blessed him with another wet one, full face and on the lips.

Gunboat was too shocked even to utter his customary 'yuck.' He decided he'd have to watch himself closer. Her gunnery was getting too good, too fast. But that was not the part that really bothered him. What scared him was that this time, nausea had not followed on the kiss's heels. ■

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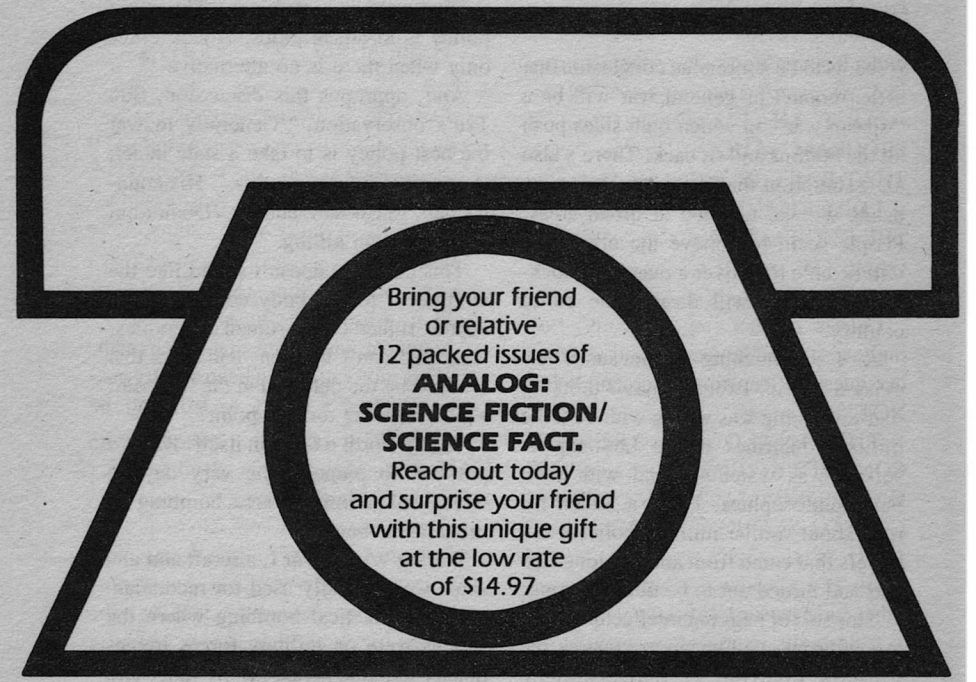

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The Alternate View

THE DAY BEFORE

G. Harry Stine

It seems to be a foregone conclusion that a thermonuclear general war will be a "spasm war" in which both sides push all the buttons and sit back. There's also an assumption that thermonuclear warheads will be targeted at urban areas. People seem to believe the other side will be able to deliver a massive knockout blow that will disable the entire country.

As I sat watching a holocaustal television movie, I found myself thinking that something was wrong with both the military doctrines whose fictional results I was watching, and with their basic philosophies. I had a hunch I'd read about similar military policies and beliefs that came from another long-ago war and turned out to be utterly wrong.

This sort of nagging intellectual problem bugs me, so I began to research the military doctrine of indiscriminate bombing of urban populations. What I discovered was both disturbing, encouraging, and astounding. We may be reliving history.

War has been with us for a long time. In the last 3,437 years of recorded history, only 268 have seen no war. We know a lot about it. Our biggest mistake is forgetting that we know a lot about it. Each war leaves us with a feeling of revulsion, so we put it out of our minds and blunder into the next one. Such an oft-forgotten collection of know-how is *The Art of War* written in 500 B.C. by Sun Tzu of China. This terse and aphoristic collection of principles is a concentrated essence of wisdom on the conduct of warfare.

One of Sun Tzu's principles of offensive warfare is striking: "The worst policy is to attack cities. Attack cities only when there is no alternative."

And, appropos this discussion, Sun Tzu's observation, "Generally in war the best policy is to take a state intact; to ruin it is inferior to this." His countryman, Li Ch'uan, added, "Do not put a premium on killing."

This certainly doesn't sound like the warfare of today: body counts, megadeaths, ruined cities, ruined economies, wars that can't be won, and wars that are won by the defeated in the long run. Where was the turning point?

That's worth a book in itself. But it's possible to pinpoint the very day on which indiscriminate area bombing of urban areas began.

During World War I, aircraft and airships were initially used for reconniassance and tactical bombing where the attacks were on military forces immediately in battle areas. As the range and load-carrying capability of aircraft and airships increased, it became possible to conduct strategic bombing where attacks were made on bases or supporting facilities behind the front lines whence the enemy drew his strength. In 1914,

great efforts were made by both sides to avoid bombing of non-military targets.

On the night of August 25, 1914, a German zeppelin appeared in the night skies over Antwerp, Belgium on the first small and primitive strategic bombing raid. Little damage was done.

The British Royal Flying Corps retaliated in November 1914 when three AVRO biplanes flew 250 miles across German territory to bomb the zeppelin sheds at Freidrichshaven. Little damage was done.

The Germans then used their zeppelins to raid Dover and Erith. Because these huge hydrogen-filled ships were easy targets for even the primitive air defenses of the day, the Germans began to use the cover of night over Yarmouth on 19–20 January 1915. They went after the London docks for the first time on the night of 31 May 1915. But losses of the vulnerable dirigibles were prohibitive, even at night.

As a result, the Germans developed the first practical strategic bomber, the Gotha G-IV. On 13 June 1917, a historic raid took place. In broad daylight, fourteen Gotha bombers dropped 118 bombs on London and killed 160 people. Anti-aircraft artillery and fighter defenses were ineffective. All Gothas returned safely to their base on the continent.

It seemed that London lay at the mercy of the German bomber force. Prime Minister Lloyd George called in an Imperial statesman to survey the situation and make recommendations.

This first strategic bombing study concluded that this new form of warfare would prove so powerful that all other forms of military and naval action would become "secondary and subordinate." It further concluded that the only defense was an overwhelming counterattack. The report, which forms the basic foundation for the current MAD (Mutual Assured Destruction) doctrine was written by the same man who wrote the preamble to the Charter of the United Nations twenty-eight years later: General Sir Jan Smuts of South Africa.

The Smuts report had a profound influence on British military doctrine between the World Wars. It was taken up by the Chief of the Air Staff, Sir Hugh Trenchard, who laid down the infamous Trenchard doctrine which proclaimed that the moral effect of strategic bombing was far more effective than the physical effect on military targets. Therefore, Trenchard reasoned, the way to victory in future war was to develop a heavy bombing offensive against the enemy's civilian population. The Trenchard doctrine also claimed there was no defense against such an offensive and that interceptor fighters were merely a sop to civilians and politicians.

As a result of the 1917 Gotha raids on London, the obvious progress in military aviation, and the Trenchard doctrine, there arose in Britain a curiously familiar refrain: Since the enemy would start the next war at a time of their own choice, in a theater selected by them, and with overwhelming military superiority, there grew up in both the RAF and the British populace a fear fed by the newspapers that German bombers would strike Britain with a "knockout blow" of such suddeness and intensity that it would cause grotesque destruction, death, and suffering.

The next war, the fearful cried, would be over in minutes with no survivors and no winners because the RAF would strike back with equal intensity.

Doesn't that sound familiar?

But what *really* happened?

The British Royal Air Force, hampered by budgetary considerations, managed to develop a rudimentary strategic bombing force. However, contrary to the Trenchard doctrine, Britain also managed to develop two outstanding interceptor aircraft, the Hurricane and the Spitfire, as well as a new technical tool then known only as radio direction finding, later to be named radar.

The Germans, originators of strategic bombing, never developed a true strategic bomber or doctrine. They used the Luftwaffe strictly as a tactical weapon in support of the Wehrmacht.

The Italians did neither, although they produced the doyen of strategic bombing doctrine, General Giulio Douhet.

Douhet's writings inspired Americans such as William Mitchell, Henry H. Arnold, Carl Spaatz, Ira Eaker, and Curtis LeMay. In 1939, the only strategic bomber in the world worthy of the title was the American B-17, and the United States developed the only true strategic bomber of World War II, the B-29.

However, the American strategic bombing doctrine was one of high-altitude precision daylight bombing of military targets. The Army Air Corps had the Norden bombsight and had developed the principle of the combined defensive firepower of bombers in tight formation. Precision daylight bombing eventually worked, but only when the failure of combined defensive formation firepower was admitted and long-range escort fighters such as the P-51 were deployed instead. But this, too, failed against the industrial dispersal practiced by Japan in 1945. Curtis LeMay had to resort to using the superb B-29 in indiscriminate night area bombing of cities. This succeeded only because naval submarine action had effectively cut off Japan from its source of raw materials. As such, strategic bombing of Japan merely drove in the bung. The night incendiary attacks on Tokyo, Osaka, and Nagoya killed far more civilians than the nuclear weapons dropped by precision daylight bombing on the military targets of Hiroshima and Nagasaki.

The German attempt at strategic bombing against Britain failed because they used tactical bombers. They had to resort to indiscriminate night area bombing of urban areas. Hermann Goering made a number of classic military mistakes, the major one being quitting while he was winning to shift his efforts into another area. The Battle of Britain disproved both Smuts and Trenchard: a defense can make an offense too expensive.

The British strategic bombing offensive against Germany also failed because of the Trenchard doctrine. When daylight bombing proved too costly for Bomber Command, the RAF switched to night bombing. But the level of expertise in navigation and bombing was so bad that RAF bombardiers couldn't place their bombs within a couple of miles of the intended target. As the war progressed, this was improved by various techniques, but the RAF resorted to indiscriminate night bombing of ur-

ban areas. This killed far more people in Berlin, Hamburg, and Dresden than were killed in Hiroshima or Nagasaki.

Smuts was wrong and the Trenchard doctrine failed miserably.

The British themselves were the first to show how wrong it was. The Battle of Britain proved that strategic bombing would not destroy civilian morale. Instead, it caused a stiffening of resolve in Britain and elsewhere. Look at the record: Rotterdam, London, Coventry, Leningrad, Berlin, Hamburg, Dresden, Tokyo. These cities were heavily damaged and, in some cases, utterly levelled by "iron bombs." Hundreds of thousands of civilians were killed or wounded. But they worked on with increased resolve until, in Germany and Japan, they were overwhelmed by other forces.

The fear of a knockout blow never materialized. In fact, neither side was capable of mounting such a strike. In Britain, this fear was born in the minds of people of the sort who signed the Oxford Pledge, believing it was preferable to surrender than to defend themselves.

All of this runs counter to the most basic principles of the art of war known for more than two millennia. It's the result of escalation of fears, of escalation of military operations against non-military targets, and of gross neglect of the history of conflict.

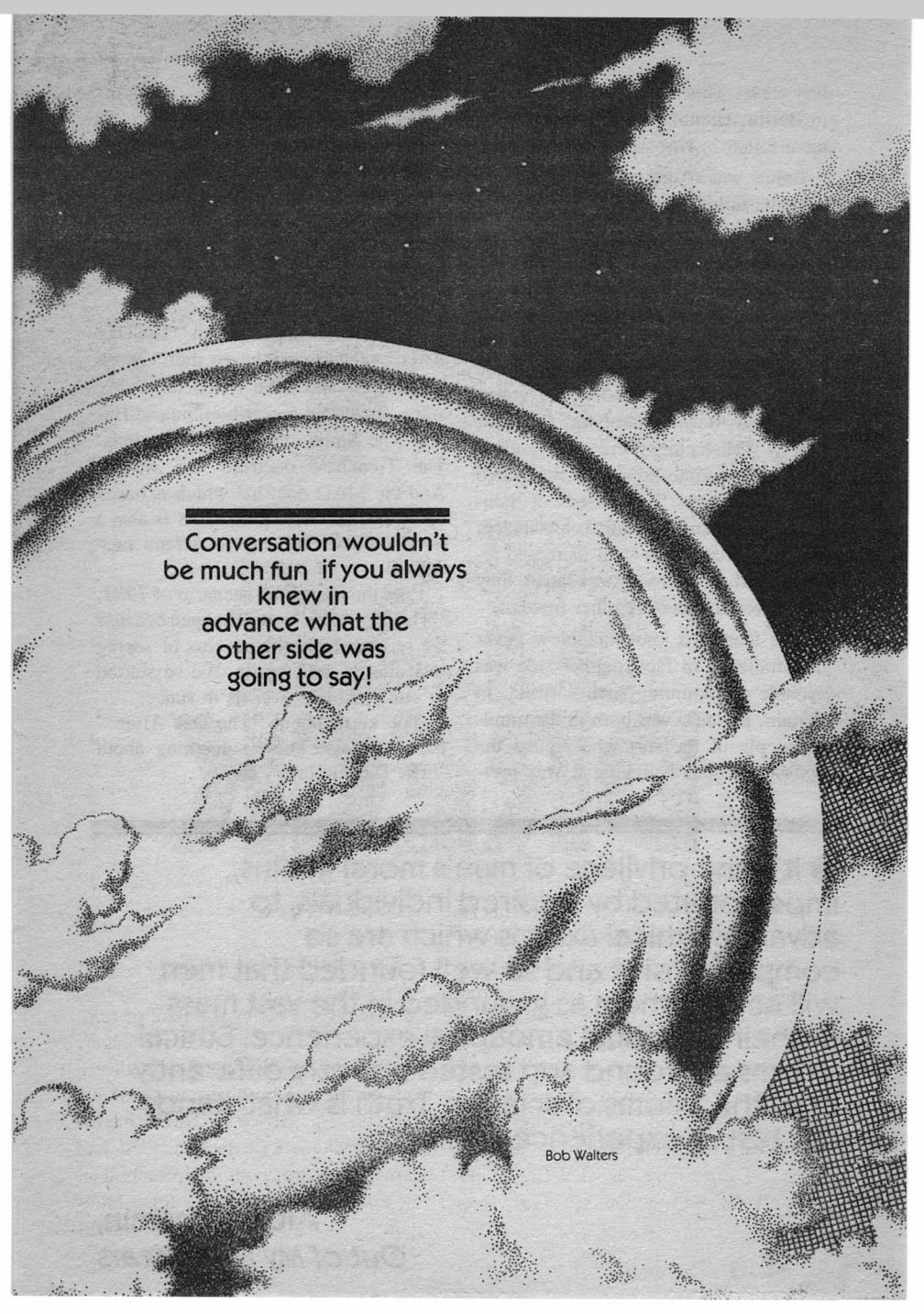
The principles upon which "The Day After" scenario are based didn't work in the past and have failed miserably since, including recent bombing in Hanoi. The Smuts report was fallacious. The Trenchard doctrine was wrong. And the MAD doctrine which is based upon these historic precursors is also a poorly conceived way to defend ourselves.

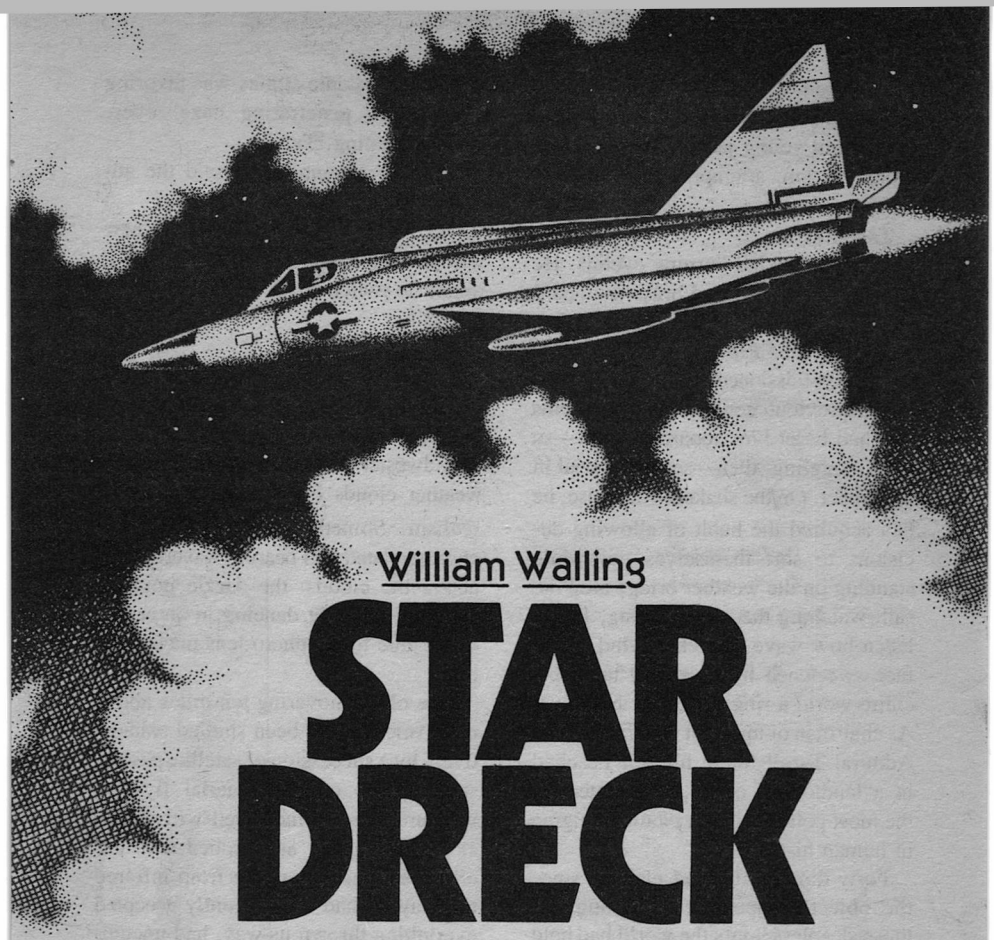
Like the Orwellian scenario of *1984*, "The Day After" won't happen because we're already in the process of seeing to it that it can't occur. We've started to build a shield over us in space.

You know about "The Day After." Now you also know something about "The Day Before." ■

● It is the privilege of man's moral genius, impersonated by inspired individuals, to advance ethical axioms which are so comprehensive and so well founded that men will accept them as grounded in the vast mass of their individual emotional experience. Ethical axioms are found and tested not very differently from the axioms of science. Truth is what stands the test of experience.

Albert Einstein,
Out of My Later Years


Conversation wouldn't be much fun if you always knew in advance what the other side was going to say!
Bob Walters



William Walling

STAR DRECK

"Hold it right there!"

Fleet Admiral Tyrell rapped his littered desk, silencing the crestfallen ONI liaison officer. "Belay the doubletalk, and get to the point. Have we learned *anything* at all? Where it's from; what, if anything, is on board; why it's here? Do we even know whether the damned thing is a solid, liquid, or gas?"

"We've tried . . . are trying, sir. Trying desperately."

" 'Desperately,' is it? Well, *we* certainly haven't gotten very far, have *we?*"

"Uh, negative, sir. But ONI is still—"

"That will be all, Lieutenant."

"Yes, sir."

Tyrell grimaced at the closing door. He sat quietly until his blood pressure subsided, recognizing the flare of temper for what it was: reflexive anger, fathered by frustration at allowing a well-meaning subordinate to ruffle his feathers. The Office of Naval Intelligence could not be faulted; ONI had learned no more about the intruder than Air Force Intelligence, G^2, State Intelligence, CIA, NSA, Defense Intelli-

gence Agency, or any other intelligence gathering service, domestic or foreign. The bright young jaygee had just been doing his job, attempting to brief him on the situation.

The situation.

Tyrell knuckled burning eyelids. He glanced at the polished brass shipboard chronometer, a memento of his first command: *USS Florida*, a Trident class SSBN commissioned during the Eighties of the previous century. The problems that had beset him aboard *Florida*—so mind-boggling, then—seemed trivial in retrospect. On the shakedown cruise, he had acquired the habit of allowing decisions to sort themselves out while standing on the weather bridge atop the sail, watching the sub's curling, foam-laden bow wave, the chill wind in his face sweetened by a salt air tang, his entire world a ring of seagirt horizons. As chairman of the Joint Chiefs of Staff, Admiral Tyrell found himself beached in a landlocked office, confronted by the most potentially devastating enigma in human history.

Forty-three hours had elapsed since the object's appearance. Throughout those sleepless hours the world had held its breath, and worried. He wondered for at least the forty-third time how much longer "the situation" would remain static.

The intercom's insistent buzz cut short his revery. "Yes?"

"The Secretary of Defense, sir. Channel twelve."

"Thank you." The admiral leaned forward and touched a button. He watched a multicolored collage form in the vidicom terminal built into the desk. When it jelled, the image of a balding man in his middle sixties was favoring Tyrell with penetrating hazel eyes. "Good evening, Ty."

"You're scrambling?" said the admiral.

"Of course. Listen, a nasty new wrinkle has cropped up. Have you a minute to switch on the six o'clock NBC news?"

Tyrell blinked uncertainly. He activated the larger of two holovision monitors set flush in the textured office wall. A midwestern sky strewn with lacy fair-weather clouds brightened to startling realism. Something that resembled a chrome-plated ball bearing wavered high above the clouds, the dazzle point of reflected sunlight dancing in an erratic smear due to telephoto lens magnification.

The object hovering ten miles above mid-America had been studied exhaustively by a succession of satellite passes, subjected to countless aerial fly-bys, measured and re-measured with precision instruments, and probed with energy frequencies ranging from infrared to x-ray. It had complacently accepted everything thrown its way, had unequivocally rejected everything.

The featureless, totally reflective sphere was more than a half-mile in diameter.

Admiral Tyrell thumbed his hand-controller, squelching an anchorman's professionally modulated baritone. "What new wrinkle, Harvey? I see nothing different."

"Wait," said the other, "until a ground shot comes along."

Tyrell's grunt was noncommittal. He watched impassively until the scene

shifted. Airborne in a low-flying helicopter, a second news camera was panning across knots and clusters of upturned faces. Thousands upon thousands of people were gathered in the stubbled, fallow fields of Kansas, gazing skyward with hypnotic fascination. The 'copter thrased across checkerboard farmlands, then overflew a country lane where dust billowed from lines of bumper-to-bumper autos, campers, pickup trucks and vans.

"Jesus H. Christ!"

"Amen!" The DoD Secretary smacked his lips. "They've ignored broadcast warnings to stay clear. And, as you might suspect, the hellfire-and-damnation messiahs are out in strength. The religious hype we're hearing covers everything from the Second Coming to Doomsday."

"Naturally," said the admiral drily, "it would have to squat right over the heart of the Bible Belt."

"Naturally."

"Any chance of cloud cover this time of year?"

"Not soon. Or so says the Weather Service." The other sighed. "There's little to be gained by hiding it. They know it's there."

"Umm-m-m, so what's to be done? If the doom prophets are correct and we're driven to use nukes, a few million people may be camped underneath the fireball."

"Lovely notion, isn't it? The Oval Office is thinking along the lines of martial law."

Tyrell frowned. He drummed close-clipped fingernails on the desk. "I would say offhand that a move like that craves wary walking. National Guardsmen would slow the stampede to Kansas, true. But being hassled might drive those righteous multitudes over the edge of curiosity into hysteria. We can do without *that* mess."

"It might. It might indeed. Is it the Joint Chiefs' position that we sit back and leave 'em be?"

"No, Mr. Secretary, you glad-handing bureaucrat, it is *not*," said Tyrell heatedly. "You know it's my personal view. We have one and only one bit of hard data: the damned thing is *up there*. Period!"

"Yes, I realize—"

"Harvey, JCS has listened to nuggets of conjectural expertise from every learned public servant and academic in this great land of ours. Conjecture! I'm up to here with conjecture." The admiral made a chopping gesture at his necktie. "We've got to *find out*; *know* what we're up against, not guess."

The other managed a thin smile. "Softly, Admiral. Softly. We too have heard several dozen scare scenarios —purple people eaters from Neptune, and so forth. The only 'expert' to come forward with a cogent remark is Schell from MIT."

"Schell!" The admiral's snort was contemptuous. "*Herr Doktor* emeritus Schell is a relic of the twentieth century."

"Rather like you and me," said the Cabinet official with a twinkle. "He's nearly ninety, granted. He may be on a steep downhill slide physically, but his mind seems sharp as ever. Schell's comment regarding the object is classic: 'Ziss,' " mocked the Secretary, " 'iss not to be considered a natural phenomenon.' "

"You're overdoing the accent,

Harvey." Tyrell wagged his head in disgust. "UFOs," he said, "were easier to deal with when only the lunatic fringe spotted them."

"You'll get no argument from me."

The admiral ruminated for several heartbeats. "What's the Other Side up to?"

"Oh, standing to, ready alert and sweating it out, just like us. The Hot Line stopped humming yesterday evening. Once the comrades made up their collective minds that the object wasn't spinoff from some imperialist Western plot, or a U.S. superweapon, they calmed down. Calm, I say, but nervous. *Very* nervous."

"Uh-huh. Just like us."

"Just like us." The Secretary of Defense lifted both hands, palms outward. "I'll get back to you and let you know what The Man decides about Kansas. In the meantime, you could use some rest. You look like death warmed over."

"Thank you, Harvey."

"Don't mention it. Carry on, Admiral."

At seven-thirty an aide brought in lukewarm coffee and a bacon-and-tomato sandwich on rye. Admiral Tyrell munched without appetite, then settled himself for a catnap on the office lounge, lying heavy-lidded and groggy, too overtired to drift off.

The Joint Chiefs convened at nine. Tyrell fidgeted through the forty-minute meeting, intrigued by the spectacle of roundtabled military leaders who stared blankly at one another while listening to reports consisting of yet more "educated" guesswork, a smattering of fanciful contingency plans, and, in his opinion, a good deal of sheer, blithering nonsense.

Shortly before midnight, as he was being driven home to Georgetown slouched in the limosine, chin in hand, mind fuzzy with exhaustion, the electronic paging device in his jacket loosed a string of imperative beeps. He fumbled, switched off the page, and quickly punched up the number of his Pentagon office on the vidicom installed behind the limo's front seat. He was treated to a muted rush of static, an illuminated but useless video terminal.

"I was told," he said testily, "that this comm panel had been repaired."

The driver's head turned. "It's fixed, sir. Checked it out myself before lunch."

"Then the infernal gadget has bilged again. Swing a U-turn, son, and pull up at that liquor store across the street."

"Aye, sir."

The store's proprietor, a spindly black man, lowered his *Racing Form*. He gaped at the ham and eggs on the bill of Tyrell's cap, at the holstered sidearm on the hip of his uniformed driver, and grinned a toothy grin. "Hey now, don' tell me the Yoo Ess of Ay Navy is out robbin' liquor stores."

"Telephone," demanded the admiral.

"Yassir, yassir; three bags full. Right over there on the counter."

Tyrell punched the seven-digit sequence. His seldom-used phone was answered on the first ring. "Office of the Joint Chiefs."

"I'm here, Commander. What has happened?"

"All forces have been ordered to yellow alert, sir. President Knowlton and his staff are being flown to Camp David, and the—"

"Never mind the bells and whistles. What's *happened?*"

"We're not certain, Admiral. About ten minutes ago, every public, private, and military audiovisual channel in the country went off the air at once. You are wanted urgently in the War Room, sir. The Secretary of Defense and his—"

"On my way." Tyrell felt a surge of adrenalin erase his weariness. He slammed down the phone, nodded a curt thank you to the liquor store's proprietor, and bolted toward the limosine.

* * *

The recently completed War Room, encapsulated in granite eleven hundred meters beneath the Pentagon, had been stocked with air, water, and other consumables sufficient to last a decade; it was touted as being impervious to anything other than a direct hit by a delayed action, penetration-type thermonuclear warhead.

The pneumatic express elevator made his knees buckle as its rocketing descent slowed, stopping with a lurch. The doors swished open. He hustled through the airlock, acknowledging the salutes of paired Marine guards, and was gratified to note that the immense armored seals were still rolled back; they would be closed only in the event of a red alert signifying the threat of imminent attack.

Tyrell slipped his laser-coded ident card into the security door's reader slot. He entered the War Room and stopped in his tracks. Groups of officers were clustered before an assortment of video display terminals. Tension in the huge chamber was palpable.

Dominating the nerve center's far wall, the holographic Strategic Situation Display loomed the size of a small theater stage; projected in it, and in every other activated terminal, was a peculiar two-dimensional cartoon that depicted the naked figures of a man and woman who stood in front of a box shape attached to some sort of dishlike outline. A splay of radiating lines terminated in points of light that waxed and waned seemingly at random. Two circles joined by a horizontal bar enclosed numeral "ones." A curved line, interwoven through a series of smaller circles,

ended in an arrow that pointed to a tiny picture of the dish-shaped outline.

The cartoon's effect upon Admiral Tyrell was subtle. The male figure's right hand was raised as if in greeting, a gesture that was doubly puzzling, touching as it did some long-submerged mnemonic chord.

He tore his eyes from the cartoon and strode quickly down the War Room's center aisle. The Secretary of Defense and a gaggle of tri-service field and flag officers were seated at the elevated, semicircular command table facing the Strategic Situation Display. The Cabinet official caged a red telephone as Tyrell slid into the vacant armchair beside him.

"Bring me up to speed, Harvey."

The Secretary's glance was oblique, his eyes dark-circled and dull from lack of sleep. "We are standing at yellow alert, although I'm not certain I could tell you why. We are deaf, dumb, and blind except for land lines and . . . that." He waved impatiently at the array of displayed cartoons. "For some reason, the ELF link to deployed undersea forces is intact. Every other VHF, UHF, and lasercomm channel, including the guarded, jam-proof uplinks and downlinks connecting our manned satellites, MILSTAR, and the Airborne Command Center, are out. Kaput! Thus far, no one has been able to diagnose the problem."

The admiral pouched his cheeks. "Go on."

"There isn't much more, Ty. According to phoned reports every energized TV, vidicom, and holovision receiver in the entire Western Hemisphere—if not the world—is outputting 'that,' whatever in hell it is."

Tyrell had become absorbed in studying the cartoon to the point of having difficulty digesting the information. "I've seen it before," he said slowly.

"You have?"

"Yes, somewhere . . . A long time ago. A long, long time . . ."

"By all means chase down the memory if you can. No one else has the faintest glimmer. Dr. Schell is due to arrive at any moment. Perhaps he can—"

"You invited *him* into the War Room?"

"Invited him? No, I practically had Schell kidnapped and flown here from Cambridge. Please don't jog my elbow on this, Ty. Let's make use of his brain; I suspect it's the finest available."

"But, a civilian . . ?"

"Strictly speaking, I too am a civilian."

"Ah hah!" said someone in a loud voice.

At the rear of the chamber, a frail figure slumped in a motorized wheelchair was fending off the attentions of a Marine noncom who was trying to help push the chair. Dr. Schell glided down the aisle and up the ramp on his own, locking the wheelchair in place just behind Tyrell. The aged physicist, quondam White House science adviser to three prior administrations, gazed owl-eyed at the cartoon through thick bifocals.

"Sagan's plaque," he said in a hoarse voice that bore faint traces of a German accent. "That is what we have here."

The DoD Secretary looked at Schell askance. He cleared his throat. "Explain, please."

"Our gold-anodized greeting card to the universe at large," mused Schell.

Admiral Tyrell flinched. He sat bolt upright, feeling his scalp prickle. "By God, I think he's right, Harvey! If memory serves, it was aboard one of the first NASA probes ever to leave the Solar System."

"Precisely, Admiral. In fact, the very first: Pioneer Ten." Schell's eyes were bright. He waxed withered hands. "The binary notation at the right lends scale to the human figures in relation to the spacecraft's height. The dumb-bell symbol describes the hyperfine transition between parallel and antiparallel proton and electron spins of un-ionized hydrogen. At the bottom is a non-scalar analog of our sun and planets, with Pioneer's trajectory represented.

"But most interesting of all by far," continued the physicist, "is the schematic signpost composed of nearby, rapidly spinning neutron stars called pulsars. It pinpoints us, and our civilization, in both time and space."

"I . . . won't pretend to understand half of that. Are you inferring that this, uh, long-lost spacecraft of ours has been found by, er . . . ?" The DoD official broke off, sounding embarrassed.

"Of course I am, my dear Mr. Secretary. In light of this," said Schell, indicating the cartoon, "is that not a reasonable assumption? You see, the plaque inspired so many years ago by a prominent planetary astronomer was merely a static representation. That which we see before us now, is not.

"You!" Schell brusquely hailed a two-star Air Force general. "Get me a line to Kitt Peak Observatory in Arizona. Ask for the director, and be certain to tell him who is calling."

The general glanced questioningly at Tyrell. In no uncertain terms, the admiral told him to get on it, then turned to Dr. Schell with the first of many questions of his own.

Everyone at the command table was growing restless, waiting for the crusty physicist to conclude his phone conversation. Admiral Tyrell straightened in alarm as a concerted murmur echoed through the War Room. When he looked up, the cartoon was gradually fading. In less than ten seconds it was gone, its absence somehow more disconcerting than had been its unheralded appearance.

The chamber quieted expectantly as, beaming, the old man hung up the telephone. "It is exactly as I had speculated," he said, ignoring the vanished cartoon. "We announced our presence in the universal language: science. Our visitors have replied in the same language. Kitt Peak confirms that the cartoon displayed luminosities and periodicities analogous to the realtime characteristics of every pulsar we saw depicted."

"Visitors . . ." The DoD Secretary closed his eyes tightly. He shook his head as if to clear it.

"Harvey," said the admiral in a firm voice, "I think we'd better start accepting that explanation emotionally as well as intellectually. You might consider informing the President of Dr. Schell's involvement."

"I . . . yes. Yes, of course." The DoD official's expression was dazed, only partially comprehending. He was

in the act of groping for the red telephone when someone behind the dais shouted, "Look!"

Columns of phrases made up of Latin block letters, Cyrillic characters, and lesser known linguistic symbols were coming alight in all of the display terminals. Tyrell picked out Russian, the three most prominent Romance languages, Chinese and Japanese ideographs, Dutch, Finnish, the Scandinavian tongues, Arabic and Hebrew scripts, Hungarian and Polish. Additional languages were apparent, though he did not recognize them. But to even the most unlettered it was obvious that the same phrase was being repeated over and over.

Then all foreign writings dimmed to the verge of obscurity. Three English words glowed brightly, standing out in the middle of the pack:

GREETING OFFERED IS

Dr. Schell whooped in ecstasy. "They seek to open a dialogue with us. Answer them, Mr. Secretary. Quickly! And for the love of God record everything! Everything!"

Whey-faced and perspiring, the Defense Secretary looked as though he might be having a seizure. "C-can . . . you handle this, Ty? Afraid I'm in no shape for it."

His heart pounding, Tyrell pushed back his chair. He went to the nearest display terminal and energized the keyboard. "Will they be able to read us, Schell?"

"I would be amazed if you could prevent them from doing so."

The admiral drew a deep breath and tapped out:

GREETINGS TO YOU, AND A SINCERE WELCOME

Nothing happened for perhaps twenty seconds. The display blacked out, then responded with:

TRW WHAT IS

There was no question mark. His hands palpitating slightly, Tyrell looked to the physicist for help.

"Tell them," said the old man without hesitation, "that TRW is the now-defunct aerospace company who fabricated Pioneer Ten."

Now sweating profusely himself in the air-conditioned chamber, Tyrell stumbled over a simple explanation of 'defunct,' then gave up and tapped:

THOSE RESPONSIBLE FOR PIONEER 10

After another twenty second lapse, the display asked:

NASA WHAT IS

"The spaceflight agency of our governing body," prompted Schell.

The admiral tapped the keyboard. Twenty seconds passed, then the display read:

GOVERNING BODY RESPONSIBLE FOR

A small pictograph of Pioneer 10 grew behind the phrase. The admiral's response was affirmative.

The display faded, remaining blank. At Schell's urging, Admiral Tyrell tried:

MAY WE INQIRE WHERE YOU ARE FROM?

The terminal's curt response was:

NO

He tried again:

MAY WE LEARN SOMETHING ABOUT YOU?

The terminal's reply was:

NO

"Batting zero," grunted Tyrell. "What next?"

"Keep after them," urged the phys-

icist. "Ask why they are here, what it is they expect from us."

The admiral licked his lips. He tapped:

WHAT IS YOUR MISSION HERE?

The Strategic Situation Display went black, remaining featureless for more than a minute until, as if on cue, at least one-third of the telephones in the War Room began jangling at once.

A quick-on-the-trigger Army major general leaped to his feet, sputtering with excitement. "Gentlemen, Smokey Hill Air Force Base reports that the Kansas object is dropping rapidly." The general waved away would-be questioners, listening intently. "They say it has turned a brilliant white. It's now hovering about five hundred feet above the terrain."

Tyrell tried to imagine a half-mile diameter white sphere poised above the Kansas prairieland.

He and the others immediately found out what it was like to look *down* on the scene. The Strategic Situation Display lighted abruptly. The view was vertical, dizzying in three-D. Congregated gawkers were scattering like ants, running in all directions to escape from beneath the menacing eight-hundred-meter ball.

Something edged into the field of view, out of focus and fuzzy in detail. It grew distinct as it fell away toward the ground—a smallish box attached to a dish antenna—scuffing to rest gently in a puff of dust.

"Pioneer," breathed Schell. "Pioneer has come home."

The scene faded. Soon the Strategic Situation Display and all other terminals were blank. Seconds later, the tiny copy of Pioneer 10 was again reproduced. Immediately behind it formed the words:

INTERFERE VITAL EXPERIMENT

Schell muttered something too faint for the admiral to catch. Again the displays cleared. The copy of Pioneer appeared once more, and after it:

FINE NOT IS

"I don't get it," said Tyrell. "Do they mean—?"

"Wait," whispered the physicist, now crouched far forward in his wheelchair. "Wait, and we shall see . . ."

The displays faded a third time. Instead of one Pioneer, a second, third, fourth, and fifth were replicated, and after them:

FINE IS

All of the displays died simultaneously. Seconds dribbled into the pool of eternity, but there were no further messages.

Dr. Schell settled himself in the wheelchair. He chuckled, then threw back his head and gargled feeble laughter.

Admiral Tyrell's throat was dry. He stared at the older man for an instant in disbelief. "What is it you find so amusing? Our new friends, whoever they are, seem to think everything's fine."

The physicist shook with laughter. His wheezing hilarity was punctuated by a coughing fit. He hacked until tears rolled down his cheeks; removed his spectacles and wiped his eyes with a kerchief. "No, no, Admiral; they do not consider everything to be fine."

"But, they said—"

"They told us we will *be* fined should our rude intrusion be repeated."

"Intrusion . . ?"

"Yes, intrusion. We have been judged and found guilty."

"Of what?"

"Littering," said Schell, still chortling. "We are interstellar litterbugs, don't you see. They insist that we keep our primitive toys in our playpen.

"But I am thinking ahead. I am thinking of Voyagers One and Two, of the Centaurus Probe and the others. I am trying to imagine what the proposed fine will consist of . . ."

Dawn found the skies over Kansas cloudless and blue. The new day promised near-record temperatures, with high humidity and a chance of thunder showers by late afternoon. ■

ON GAMING

(continued from page 83)

pawns to chase or block the Searchers.

Conflicts are resolved by using each character's identity card and a Conflict card. Even though the anti-Molasar players work as a "team," there can be "backstabbing." When your pawn encounters Molasar/SS troops in a room or hallway, you ask another player to use *his* Conflict cards in your defense. The winner of a conflict gets to retreat the losing player's pawn the number of rooms equal to the values of the two Conflict cards played. A pawn may even be retreated into another conflict situation.

secret doors marked on the board that lead to the lower dungeon area of The Keep. Molasar knows where these doors are and can move through any of them. The Searchers and the SS pawns must locate them by moving into that room and rolling a die. There's a 50-50 chance the secret passageway will be discovered and can then be used.

This procedure continues until Molasar has "eaten" all the SS pawns (twelve turns), or a Searcher has entered the room with the Hilt.

The Keep is an abstract interpretation of the book and the movie. While it may not be a simulation, it's fun, which is more than can be said for the movie.

The Keep role-playing adventure module is designed for three to six characters, skill levels 9 to 12 (experienced players). The 40-page, illustrated book is suitable for use with role-playing games, such as *Advanced Dungeons & Dragons*® by TSR Inc.

There are actually three separate adventures in the book:

"The First Age," which centers around the ancient temple of Mok-Har where Molassar is building an army of undead. The players will attempt to help Glaeken defeat Molasar.

The second adventure, "The Castle of Vlad," takes place in 1476, with the adventurers again trying to help Glaeken destroy or imprison Molasar. Although defeated in the First Age, Molasar slowly re-formed to plunge Europe into the Crusades, the Black Death, and other disasters.

The final adventure, "The Prison of Molasar," takes place in 1941 when a small band of German Army soldiers, sent to occupy The Keep, inadvertently awaken Molasar and the world is threatened by his release. Your party will attempt to prevent Molasar's escape from The Keep. ■

the reference library

By Susan M. Schwartz

Reviewed by Susan M. Shwartz:
World's End, Joan D. Vinge, Bluejay Books, Trade hardcover: $13.95, Collector's Edition: $40.00, 240 pp.
Moreta: Dragonlady of Pern, Anne McCaffrey, Del Rey Books, $14.95, 287 pp.
Final Encyclopedia, Gordon R. Dickson, $?, ?pp.

Reviewed by Stanley Schmidt:
Menolly's Sea Songs, Words by Anne McCaffrey, Music by Joanne Forman, Performing Arts Press, Sheet music: $2.00.
Songs of the Dorsai, Off Centaur Publications, Stereo cassette: $9.00.
Minus Ten and Counting, Off Centaur Publications, Stereo cassette: $9.00; Songbook: $6.00, 41 pp.

As you can see, Tom Easton has graciously stepped aside this time to let the editor and Susan Shwartz do a guest **Reference Library.** *He'll be back next month, as usual.*

I can remember how I used to chase down the installments of a story from issue to issue of my favorite pulp. Later on, I became more sophisticated and simply tracked down every book in a series I particularly liked—not necessarily in order. Now I use *Publishers' Weekly* and *Locus* to check for the sort of books I like . . . and hope that review copies, bound galleys, or even a manuscript will come my way.

Accordingly, here's three of the sort of books I used to wait for, buy in hardback (if need be), rush home and gloat over while cobwebs covered my typewriter, my dishes went unwashed, and my phone rang its head off.

World's End, by Joan D. Vinge, isn't so much a sequel to her Hugo-winning *Snow Queen* as an explanation of what happens next to BZ Gundhalinu, the rigid, kindly Kharemoughi Technician who helped Moon become queen of Tiamat. Hating himself for botching

a suicide attempt, Gundhalinu attempts to resume his police career. But his loss of honor has demoralized him, and he makes such a mess he's forced to accept a reduction in rank and involuntary furlough. He decides to hunt down his two elder brothers who went to World's End, a trip known as the Big Mistake.

Big Mistakes run in Gundhalinu's family. Incompetent from birth, his brothers have let the family estates run through their pudgy fingers and hope to buy them back by uncovering treasure at World's End, where the enigma called Fire Lake can bring immense riches —or madness.

Gundhalinu plunges, Joseph Conrad-fashion, into a heart of darkness: cheap taverns, murderous travel companions, bribery, and despair. World's End knows him as Gedda, the Kharemoughi word for failed suicide. He has become his disgrace.

Still, he is duty-bound enough to hunt for his brothers. Remembering Moon, whom he loved, he agrees to find a sybil's daughter who has also made the Big Mistake. And so Gundhalinu teams up with Ang and Spadrin, the one a former company man, the other a murderer. Gundhalinu, whose decency withstands every attempt to corrupt it, makes it to Fire Lake where Song, the sybil's daughter, hails him as the fulfillment of the Lake's promise to her. Like Stanislaw Lem's Solaris, Fire Lake is sentient and incalculable. It is also insane. Gundhalinu can ask the questions which will ultimately bring it healing —assuming two things: that the Lake can bear to release him and that he can avoid being murdered for the secret he possesses.

Like *Snow Queen,* this story has its roots in fairy-tale: Gundhalinu is the lucky, bright youngest son who must prove his worthiness to inherit his father's estate. But where *Snow Queen* was lyrical, *World's End* is tough, gritty and grief-stricken. It's not easy to write a book about a trustworthy, decent hero without making him sickly sweet or straining a reader's patience, but Vinge's managed it. In *Snow Queen,* Gundhalinu was idealistic and naive. Now he's tougher and more realistic, the sort of character people respect and remember.

In 1967, Anne McCaffrey's "Weyr Search" was an *Analog* cover story. I wasn't surprised when the story won a Hugo. But I was astounded when I stumbled onto a novel about Lessa, Pern, and the symbiotic, Thread-fighting dragons that summer. In fact, I interrupted a shopping trip, staged a sit-in in a coffee shop to read it, and then went straight home and reread it.

In the intervening years, Pern has become one of those worlds like Dune, Darkover, and Middle Earth that people can't wait to get back to. Here's the latest installment about Pern. In several of her books, McCaffrey has mentioned Moreta, one of the greatest of Pern's Weyrwomen. In the Harperhall books, we learn that Moreta flew straight into legend when she saved Pern from plague by carrying medicine to every Hold. Accordingly, we start right off knowing the story of **Moreta: Dragonlady of Pern.**

So why will this book be bought eagerly, read, and reread? Because of its additional glimpses into a world we've come to know. Moreta, unlike any of McCaffrey's other heroines, isn't an adolescent unsure of her place, or an adult trying to secure it. She knows perfectly well who she is—Fort Weyr's senior queen rider, Weyr healer, mother of several children, an avid dancer and racing fan.

When a racer collapses, interrupting

Moreta's promising flirtation with the handsome young lord of Ruatha, no one thinks anything of it. But the animal's death is part of an epidemic that ravages Pern's holds, then strikes the Weyrs. Fortunately, dragons don't catch it. But if their riders die, they suicide—and there's still Thread to be fought.

Together with Capiam, Masterhealer of Pern, Alessan of Ruatha, the elderly, wine-loving weyrwoman Leri, and several dragons, Moreta works out a plan to save Pern.

Moreta has little of the fantastic element that has marked McCaffrey's most recent dragon books. Its characters are chiefly adults. Like all adults they can be matter of fact, quarrelsome, and downright boring (as McCaffrey's dragons never are). What I found most fascinating about *Moreta* was surgery on dragons and the attempts of Pern's healers to develop low-technology methods of treating the plague.

Moreta is immensely readable, but it is uneven in construction and tone. Fantasy fans who persist in ignoring the mycorrhizoid nature of Thread and the genetic engineering that bred dragons from firelizards will probably be disappointed by its emphasis on science and no-win choices. That's their problem. A bigger problem, however, is the way McCaffrey rushes the book's climax. Though Moreta and the other riders lecture on just how dangerous it is for dragons to fly *between* times (as opposed to teleporting *between* places), though we hear a great deal about weyrleader M'tani's hostility to consolidating the Weyrs to fight Thread, these things never come to life until Moreta and Capiam meet to distribute the serum for vaccinating all Pern—and learn that no one is available to fly it about. Before we're fully aware, the story's over, and its tragedy is muted.

* * *

Readers of Gordon Dickson's Dorsai novels have been waiting for **Final Encyclopedia** for years. The culmination of his Childe Cycle, *Final Encyclopedia,* begins at a time when the crossbred Other Men have established control over most of the Fourteen Worlds. The Faith-holders of Harmony and Association, the Warriors of the Dorsai, and the Exotics of Mara and Cultis cannot resist them.

Carefully raised on Earth by tutors from each Splinter Culture, young Hal Mayne becomes a fugitive when the bodyguards of Other leader Blayse Ahrens murder his tutors. He escapes to the Final Encyclopedia in orbit above Earth, then to the mines of Coby and the countryside of Harmony, where he joins the religious guerrillas led by charismatic Rukh Tamani until he is captured. After his escape, he goes to Mara, then to the Dorsai, where he meets the Third Amanda, who helps him discover why he was found, a child of two, on a deserted starship.

Knowing this, he returns to Earth to take up his mission: the defense of Earth against the Others.

In its present manuscript, *Final Encyclopedia* is a richly textured, carefully constructed book that teems with extraordinary characters. Many of its settings, notably the fundamentalist world of Harmony and the mercenaries' world, the Dorsai, are vividly drawn. The book's length makes it as encyclopedic as its name: anything you might ever want to know about the Childe Cycle, its characters, or Dickson's personal philosophies is included.

While this is fascinating in places, it breaks down into pure lecture among the Exotics, where Dickson allows himself to go on too long about ontogenetics, poetry, and medieval history.

This emphasis on history and art makes *Final Encyclopedia* not just consciously thematic but supremely Romantic. From its earliest pages in which Dickson quotes Tennyson's *Idylls of the King* to Hal's meeting with the Other in the misty space between phase shift shieldwalls, Dickson has created a set of events which move with the inevitability of a medieval romance in which all the events are known but the means have yet to be revealed. Like the stories Dickson has read and loved, Hal's meeting with Blayse is nothing less than a fight against Armageddon.

Against this background, Dickson's references to nineteenth-century poets and fourteenth-century knights make sense. But when added to the book's length and "talkiness," they rob *Final Encyclopedia* of suspense.

Nevertheless, Hal's attempt to use poetry, intellect, faith, and strength to protect humanity is intensely moving. At a time full of preachments of nuclear winter, Dickson's faith that humankind can evolve into something almost godlike makes me want to stand up and cheer.

Well, I've devoured these books. *Now* what am I going to do? I've heard that Robert Heinlein and Frank Herbert are both due for new books; and Marion Zimmer Bradley and C.J. Cherryh have a few characters and planets I've been following . . . and they'd better hurry up and produce something to satisfy my craving, not just for print, but for the right kinds of print. Three books, even books like these, which I've been looking forward to for years, are just not enough.

—Susan M. Shwartz

At its best, folk music has a unique ability to capture the essence of an age or a legend and communicate it directly and forcefully to a listener. Science fiction fans have a subculture that periodically gathers at foci called "conventions," and that subculture has its own folk music, called "filk songs." If you've frequented conventions, you probably know about them. If you haven't, the idea may be new to you and you may be surprised at what they have to offer.

At its best, filk music captures the essence—the *feel*—not just of the here-and-now subculture which created it, but of worlds and eras and epics which have not yet existed except in the pages of science fiction. Gordon R. Dickson's Childe Cycle, for example, spawned a whole series of powerfully evocative songs. And if you've ever heard Ann Passovoy sing her setting of "Mary O'Meara," the song which runs hauntingly through Poul Anderson's *World Without Stars,* you're not likely to forget it.

In many ways, filk is a true folk music. It arose more or less spontaneously among musically inclined fans, and while some of its songs have definite and identifiable composers and lyricists, many "just grew," sometimes with original music, sometimes with new words to ancient tunes. Until recently, few filk songs were available in any published or recorded form, and though many were widely known among those of us who haunt filk rooms at conventions, you could hear them nowhere else.

Recently that has begun to change, with printed music and recordings beginning to appear here and there. Some months ago, for example, I got a prepublication copy of **Menolly's Sea Songs,** sheet music (for voice with piano and/or guitar) for three songs from *Moreta: Dragonlady of Pern,* with au-

thor Anne McCaffrey's words and Joanne Forman's music. I missed the chance to hear Joanne Forman sing these at ConStellation, but I have played them and can recommend them as an evocative accompaniment to the book. They're published by Performing Arts Press (Box 3181, Taos, New Mexico 87571), who also had in the works (and by now may have available) *Dragonsongbook,* based on two earlier books in the McCaffrey series.

But the big news for those who love filk music (or would like to discover it) is Off Centaur Publications, a small but impressive operation dedicated to making filk songs available in both printed and recorded form. They have produced many songbooks and cassettes themselves, and they also serve as a central source of books, tapes, and records produced by others (including Performing Arts Press, mentioned above). A full catalog and ordering information are available from Off Centaur Publications, P.O. Box 424, El Cerrito, CA 94530.

Some of Off Centaur's cassettes, like **Songs of the Dorsai** (fourteen of them, connected by a narrative written by Gordy himself), were professionally produced and recorded under studio conditions and offer polished performances and high quality sound (most in Dolby stereo). Others (like *The Best of Bayfilk* and *Juanita Coulson, Live at Filkcon West*) were recorded live at conventions and so do not meet the same high technical standards, but are still of considerable interest for their musical and poetic content.

One of Off Centaur's proudest productions is **Minus Ten and Counting,** a collection of 23 songs about the real beginnings and potentials of humankind's Space Age. It's available both on a very fine cassette and in a well-made songbook featuring all the lyrics and music (melody with chord names), with spectacular covers by Ctein, interior illustrations by Kelly Freas, and an introduction by Poul Anderson. (The printed music is not always in the same key as the tape, though it usually is, but then you'll probably want to choose your own key anyway.)

As Poul says in his introduction to *Minus Ten and Counting,* "The right songs will greatly help any cause. I wonder whether they may not even be vital to it." The Off Centaur catalog copy for the cassette says, "If you believe, as we do, that space is where we're going, then this tape will make you cheer. And if you think, as we do, that the road will be a hard one, then this tape will make you weep. And if you can laugh along the way, then this tape will make you do that, too." It sounds like advertising hype, but in this case it's pretty accurate. If you're reading this magazine, chances are that these songs will get to you.

The Off Centaur people suggest, "Buy two—one for yourself and one to send to Senator Proxmire." I *think* they're kidding (at least a little), but it might not be a bad idea.

—Stanley Schmidt ■

● Things are going to happen much faster than we think, and they are going to have much wider implications than we have considered. We need only look at the last twenty-five years.

G. Harry Stine

brass tacks

Dear Sir:

Analog is publishing science fiction with the science in it, and that's good. Please, though, let's try to get it right. Don Burcham, in his letter published in the January issue, noted an error in a story which stated that information can be transmitted faster than the speed of light since it is massless. In your reply you said that doubt was growing among physicists concerning this question. If so, it does not seem to have spread to the faculty at Berkeley. Further, the quote that Burcham gives reveals that the author's ideas are not on the frontiers of physics; they are mixed up. Fresh out of a final exam that had a very similar question, I think I may be able to clear up the confusion, since sending information faster than the speed of light creates more immediate and fundamental difficulties than moving mass at the same speeds without transmitting information.

Here's an intuitive example without any math. Suppose my friend and I are at opposite ends of a rope. To send him information, I can shake my end and make waves move down it. These waves can move faster than light, and it is not even necessary for the rope or any part of it to move very fast. (The width of the waves can be small, and all any molecule in the rope is doing is vibrating back and forth along that width.) Physics predicts, though, that the only way to get these faster than light waves is to have a very long rope and to have the kinks that I send last very long in space and time. This kind of kink cannot effectively transmit information.

It can also be shown that, using messages that travel faster than light, it is actually possible to send messages backward in time. This violates the laws of cause and effect that physicists are reluctant to let go of. For instance, I could

send a message to the Mafia of 1928 to kill my grandfather.

BENJAMIN CROWELL

Berkeley, CA

You're quite right that faster-than-light information transmission would play havoc with our ideas of causality, but this does not necessarily prove that it is impossible—it may mean our ideas about causality have to be revised. The evidence that some such revision may be necessary comes from recent experiments involving something called Bell's Theorem; I'm not going to try to explain it here, but there has been at least one article about these experiments and their possible implications in Scientific American, *and there are also qualitative discussions of the matter in Amit Goswami's book* The Cosmic Dancers. *Exam questions seldom venture to the frontiers of research, and it takes a while for word of what's happening there to spread (much less be generally accepted) even among practitioners in the field. You might find an interesting analog in the history of plate tectonics and how attitudes toward it have changed over the last few decades.*

Dear Mr. Schmidt:

I find your editorial in the February 1984 issue of *Analog* highly offensive. My vested interest in this subject is that I am a political scientist, and I often confront this sort of prejudice. Although I would never argue that the social sciences have reached the lofty goal of becoming predictive sciences, I dispute your claim that those who study the social sciences are "people who started out in something like physics or chemistry and couldn't make the grade." I understand that this statement was made with the caveat that "this is *not* to say that there are no good scientists in psychology or economics." Your generalization is, however, wrong.

First, you express the common assumption that social scientists lack the logical ability to formulate and test hypotheses and that they cannot think mathematically. Most political science departments around the country require a graduate course such as the one for which I was the teaching assistant here at MIT. In our class the professor and I stressed the generation of hypotheses, the formation of operational definitions, and the development of a logical and precise research design. We taught the use of statistical methods, but only with the strictest attention to the underlying assumptions and the interpretation of each test. Our students learned the material quite well, and I would offer their ability as evidence that political scientists are able to employ mathematical methods to express and test their ideas. (As an aside, I also have a bone or two to pick with Jerry Pournelle who seems to think that all social science statistics courses are "cookbook stats" and who seems to share your misperception that social scientists cannot possibly understand the mystical rites of Mathematics.)

Second, I would challenge your assumption that mathematical thinking is necessary to formulate and express complex ideas. Logical and precise writing is a skill lacking in many engineers and scientists, if I may judge from my experience as an adviser for MIT undergraduates and from the results of the recent writing proficiency exam for MIT freshmen. Few indeed are the Norbert Wieners of our day! Most of us mortals must use prose to explain our equations, be they in quantum mechanics or international relations.

Third, your argument implies that if hard science's failed students can suc-

ceed in social science then social science must be simple. True, many colleges offer "Mickey Mouse" courses such as Sociology 101 and Human Sexuality 202, but it does not necessarily follow logically that the subjects, in their more scholarly form, are easy. Certainly no one would argue that astronomy is easy, but my easiest course as an undergraduate was an introductory astronomy course. Classifying radio galaxies (as my fiancé does) is not intrinsically more intellectually challenging or difficult than attempting to unravel and help solve the problem of hunger in America (as I do).

Is this letter just the frustrated ramblings of a failed nuclear physicist? Even though science intrigues me, I never wanted to specialize in it. My first love, since I was in high school, has been the study of politics. The A's that I received in my high school classes in trigonometry and analytical geometry were the equivalent of the A's that I received in advanced composition and American history courses. I did not choose my profession because I failed chemistry. I and most of my colleagues in the field have chosen to study political science because it addresses the important social issues that we, as a community and as a polity, face.

Your comments questioning the ability of social science to overcome the handicap of less than brilliant professionals is an example of scientific chauvanism in the extreme. If the vast majority of social scientists that you have met are dimwitted, I would suspect that (*a*) your sample is highly biased and (*b*) you ought to get out more often.

(MS.) RENÉE E. MARLIN
Cambridge, MA

And I respectfully suggest that you read the editorial at least once more, very slowly. The statement about "people who started out in something else and couldn't make the grade" was not my *comment, but that of a practicing psychologist, on which I explicitly reserved judgment. He says it's true; you say it isn't; I say I don't know but somebody ought to find out. Even if it is true, it does not rule out the existence of some social scientists who have what it takes. Your letter attributes to me several generalizations which I did not make. I certainly did not even remotely imply that "social science must be simple"; I have mentioned repeatedly that it isn't, and it certainly needs highly capable people to go into it for the reasons you give. That was the main point of this editorial, in fact—and if it's true that some not-so-skilled people go into such a demanding area (and I* have *seen evidence that this happens at least sometimes), the combination is that much more alarming.*

Incidentally, you seem to think Jerry Pournelle is looking at the social sciences from "outside." Actually, he has doctorates in both psychology and political science.

Dear Sir,

I enjoyed your editorial in the February, 1984 issue. However, you failed to mention a method of distinguishing a "hard" versus a "soft" science. Simply read the preface and the first two chapters of any textbook on any subject. If these sections of the textbooks try to prove that the subject being presented *is* a science, then (in my opinion) there is some doubt that the subject is a science.

Way back when I was a dumb college freshman, I noticed this unique characteristic of psychology, sociology, and educational philosophy textbooks. So I finally worked on a double major in math and physics and (for job security)

I minored in education, and I sat through my share of the "soft" sciences. And I learned that anyone able to pull a C or D in advanced calculus, higher algebra, optics, mechanics, etc. could always make an A in the "soft" sciences. An easy way to maintain a good grade point average.

Another comment. Did you ever notice that the statistics courses required for sociology, psychology and education majors are a watered-down version of grade school arithmetic? But the statistics courses required for a physics, chemistry, or industrial engineering is usually a much more rigorous course.

Your editorial and Margaret Bishop's article seem to go together. Good job.

MAX M. JAMES

Lebanon, IL

Dear Readers,

I am responding to a letter written by Dr. Robert McCowan on the "Right to Life" issue.

I have two birth defects, Spina Bifida (a malformation of the spinal cord that causes paralysis of the legs) and Hydrocephalus ("water on the brain"). My doctors didn't think I would live more than a few days and even if I did live my life would be of poor quality.

In spite of my handicaps, my life has been good. I am married, and I have a good job at the telephone company (of seven years). If I had been let die because of my doctors' predictions, wouldn't it have been a waste?

My point is this: too many parents of handicapped babies take their doctors' opinions as absolute gospel. I am living proof that they *can be wrong!* By the way, so far I have outlived their predictions of my death . . . I had my 32nd birthday yesterday.

MARK C. WAKEFIELD

Thornton, CO

Brass Tacks

Heirs Unapparent

(continued from page 10)

3. *The general inheritance fund can be used in part to finance some public expenditures—thereby reducing the need for taxes collected from* living *people and leaving them more of their earnings to use as they see fit.* I'm not sure how large such a pool might be, but it could surely take over at least a little of the tax burden. Every little bit helps—and another thing the dead can't do is complain (or even want to) if they *are* finally required to pay taxes. So, better them than us.

4. *One particular use which can be made of part (or all) of the general inheritance is to establish and maintain a "seed corn" fund for* all *children reaching adulthood.* Again, this may not be much—but even if it can, it *shouldn't* be *too* much. The idea is to make sure every new adult has a modicum of resources for the sole and express purpose of helping him get started. Not enough to live on for any appreciable time, but something that he can use to help finance a first year of college or vocational training, invest in stocks, or squander on booze and horses. The choice is his—but at least he will have had a chance that he might not otherwise have had, and the competition won't be quite so heavily armed with unearned advantages.

Again, this would *not*, by itself, make everyone's starting position truly equal. (I'm not sure that would really be a good idea anyway.) People can still make all the gifts they want as long as they're alive, and some may give lavishly on their deathbeds. Family and "good school" prestige will presumably still impress those who are impressed by such things, and some families will still confer upon their offspring such "unfair" advantages as superior genes and home environments more conducive to both academic education and the development of sound judgment and moral standards. Furthermore, turning the basic suggestion into any sort of workable plan for real action would require lots of procedural details and philosophical controversies to be ironed out. But despite all that, this one little gesture—or something derived from it by thinking and arguing—just might do enough good to make it worth considering. ■

● I really . . . want to know why there should be any sympathy or sentiment about a long-legged long-necked bird that lives in swamps and eats tadpoles and fish and crawfish . . . why we should worry ourselves into a frenzy because some lady adorns her hat with one of its feathers, which appears to be the only use it has.

Sen. James Reed, 1913

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a calendar of analog upcoming events

20 - 22 July
OKON 84 (Oklahoma SF conference) at Sheraton Kensington, Tulsa, Okla. Guest of Honor - Stephen R. Donaldson, Artist Guests of Honor - David Cherry & Victoria Wheeler, Fan Guests of Honor - Buck & Juanita Coulson, TM - James P. Hogan. Registration - $10 until 1 July, $13 thereafter. Info: Okon 84, Box 4229, Tulsa OK 74159.

20 - 22 July
RIVERCON IX (Upper South area SF conference) at Galt House Hotel, Louisville, Ky. Guest of Honor - Andrew J. Offutt, Fan Guests of Honor - Jill & Don Eastlake, TM - Charles L. Grant. Advance registration - $12. Info: Rivercon IX, Box 58009, Louisville KY 40258.

3 - 5 August
Atlanta Fantasy Fair at Omni hotel & World Congress Center, Atlanta, Ga. Guests - Larry Niven, Robert Bloch, Mike Jittlov, TM - Forrest J Ackerman. Info: Atlanta Fantasy Fair, Box 566, Marietta GA 30061.

3 - 5 August
PYRAMIDS OF BUFFALO (Dr. Who convention) at Buffalo Hilton, Buffalo, N.Y. Special Guest - John Nathan-Turner (Producer of Doctor Who). Registration - $20 until 1 June, $25 thereafter. Checks payable to Western New York Popular Culture Society. Info: John Zawadzki, 18 Hirschbeck Street, Buffalo NY 14212.

6 - 7 August
Artificial Intelligence Applications Conference at Austin, Texas. Info: R. Haralick, Dept of E.E., V.P.I. & S.U., Blacksburg VA 24061. 703-961-5816.

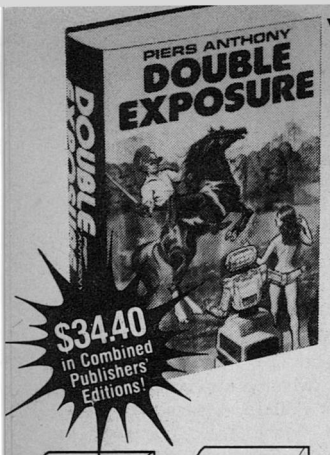
10 - 12 August
PARACON VII (Central Pennsylvania SF conference) at Sheraton Penn State, State College, Penna. Guest of Honor - Marvin Kaye, Fan guest of Honor - Peggy Rae Pavlat. Registration - $11 until 15 July, $14 thereafter. Info: Paracon VII, Box 1156, State College PA 16801.

10 - 13 August
MYTHCON XV (Mythopoeic-oriented conference) at Mills College, Oakland, Calif. Guest of Honor - Jane Yolen, Deceased Guest of Honor - George MacDonald. Theme - "The Wood Between the Worlds." Room and board $120 (Feast not included). Info: Mythcon XV, 6017 Avila Ave., El Cerrito CA 94530.

30 August - 3 September
LA CON II (42nd World Science Fiction Convention) at Anaheim Convention Center, Los Angeles, Calif. Guest of Honor - Gordon R. Dickson, Fan Guest of Honor - Dick Eney, TMs - Robert Bloch & Jerry Pournelle. Registration - $50 until 15 July 1984, $75 at the door. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition, the works. Join now and get to nominate and vote for the Hugo awards and the John W. Campbell Award for Best New Writer. Info: LA Con II, Box 8442, Van Nuys CA 91409.

—Anthony Lewis

Items for the calendar should be sent to the Editorial Offices six months in advance of the event.



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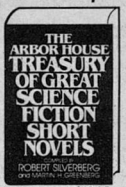

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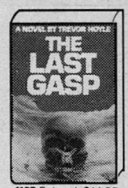

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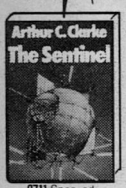

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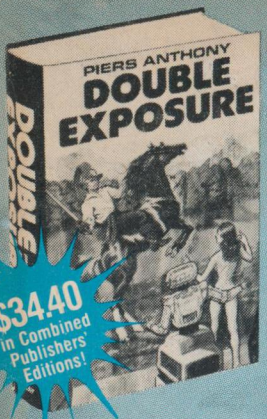

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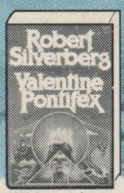

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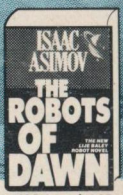

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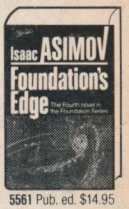

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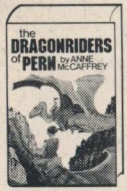

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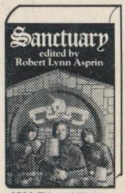

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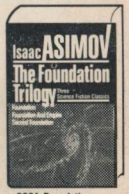

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