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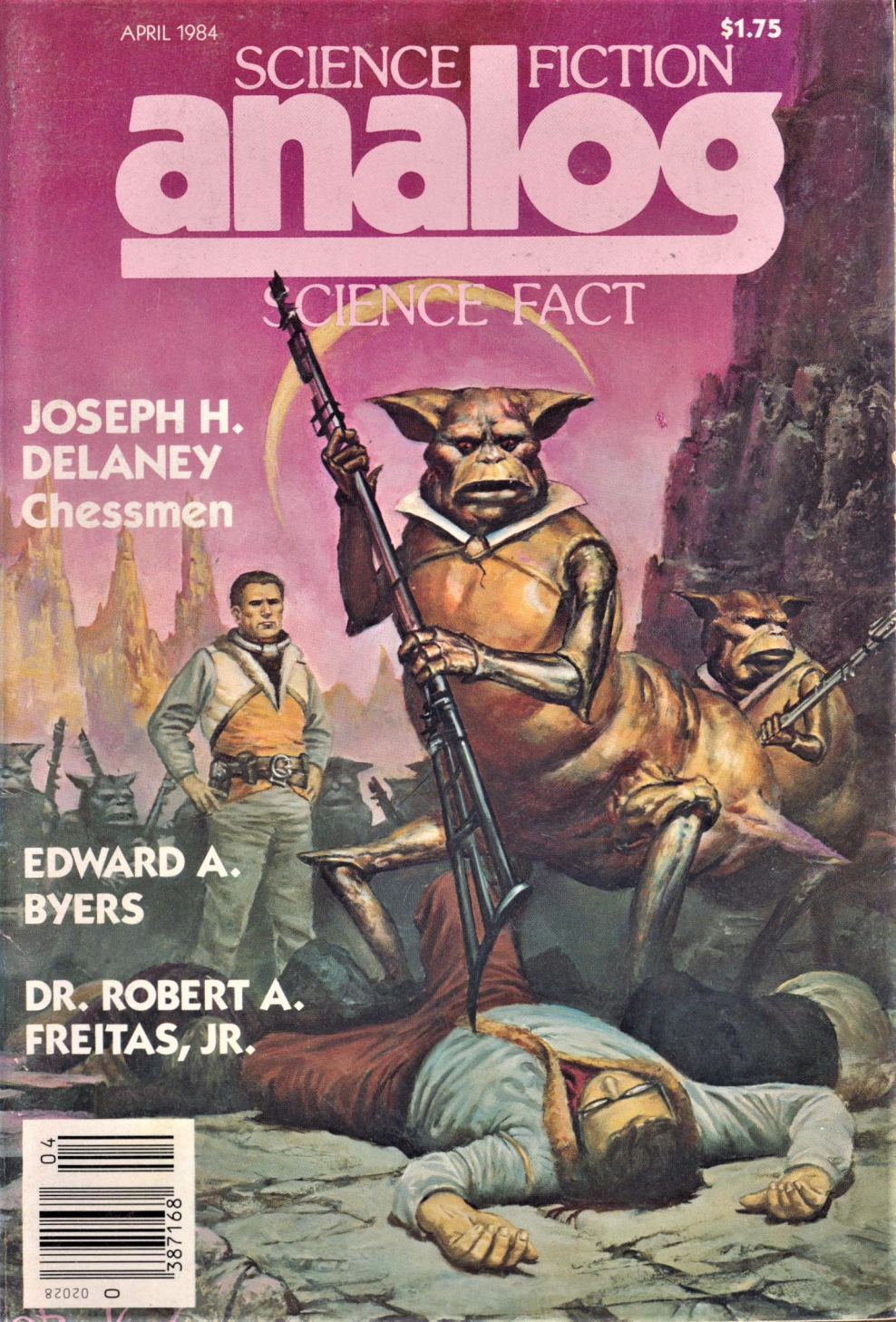

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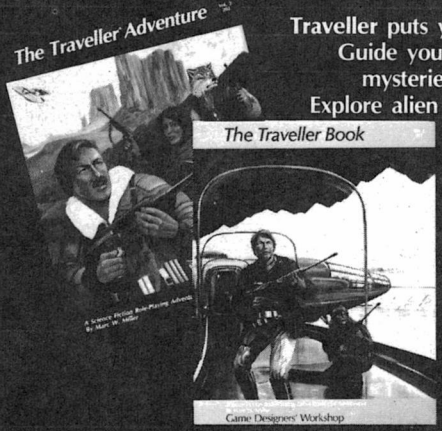

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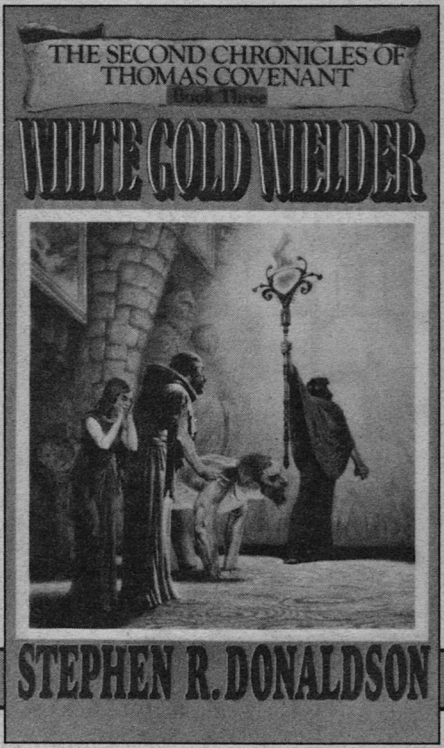

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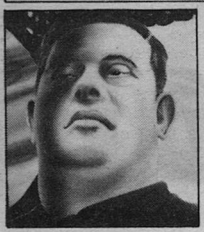

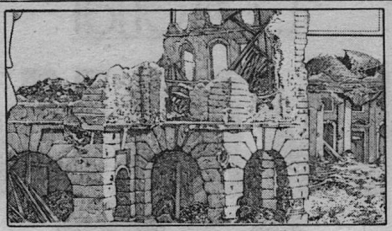

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Editorial

INDIVIDUALS AND STATISTICS

Stanley Schmidt

There is, right here in this country, an entire branch of business which routinely, openly, and unashamedly practices wholesale discrimination against more or less arbitrarily defined groups. Every company in this business, as far as I know, charges its customers different rates for the same services, and makes no bones about the fact that such differences are based largely if not entirely on things like age and sex. This practice is so long established and generally accepted that hardly anybody ever complains about it. Very recently there have been a few complaints and even some changes, but I doubt that they will go very far. The very nature of this business is such that it *has* to discriminate, and if it is forced to eliminate one kind of discrimination, it will inevitably compensate with another.

The business I'm talking about, of course, is insurance. Its discriminatory practices are fully justified, from its point of view—and to some extent from the customers' also. For example, teenage male drivers are an identifiable group which, *as a group,* has a much higher accident rate than the average for the general population. Therefore insurance companies charge higher premiums to insure male teenage drivers. Even good ones—and there *are* plenty who are skillful, careful, and level-headed. The trouble is that an insurance company cannot accurately predict which *individuals* will or will not have acci-

dents, but it *can* predict with high accuracy that this group, as a group, will have more than its fair share. Therefore it charges the group a higher rate, distributed over all its members. Yes, it's unfair to those members who are good drivers, but the only practical alternative seen by the insurance company which wants to stay in business is to charge *everybody* the same rate—which is unfair to many members of the group with the *lower* accident rate (even though some of that group are more accident-prone than some teenage boys).

The situation has important similarities to such physical problems as analyzing and predicting the behavior of a gas. A bottle containing one mole of diatomic oxygen (32 grams, or about an ounce) contains about 6×10^{23} molecules, which is a Whole Bunch. There is no way a chemist or physicist can realistically hope to describe the detailed motions of all of them, but by treating their distribution of positions and velocities as *random* in certain mathematically defined ways, he can predict such macroscopic characteristics of the entire system as pressure and temperature. This type of calculation, called statistical mechanics, is analogous to what an actuary does when he figures out what a company must charge to insure a certain group against a specified risk. In both cases, an aggregate property such as pressure or total cost of claims can be accurately determined by considering averages over large numbers of individuals treated as random. (The "psychohistory" in Isaac Asimov's *Foundation* stories can be thought of as an extension of what insurance companies have always done.) In neither case do those averages have any value whatsoever in predicting the history of any individual molecule or policyholder. If you want to predict the motion of some particular molecule, you must somehow learn the coordinates, velocity, and forces acting on that molecule, and then do ordinary *particle* mechanics. (And since those forces depend on collisions with other molecules, you need detailed information about them, too—and the farther in the future you want to predict, the more other molecules you need to know about.)

The insurer's problem is similar. To predict an individual policyholder's likelihood of an automobile accident, he would have to know a great deal about that individual—and all others with whom he might come into inelastic contact. Since the latter is impractical and there's a limit to what people are willing to tell insurance agents about themselves, he can't do it. So he falls back on statistical analysis—an obviously proper response, in principle; but do insurance companies use the *right variables* to define their statistical groups? "Teenage male" is a serviceable group definition for insuring drivers because it has a statistically well-defined behavior, but might it be possible to define other groups—such as "left-handed second-string male athletes who own cars but no pets"—which showed even better correlation with accident rates?

A less fanciful example comes from actual recent news. A recent Supreme Court decision requires that "all retirement benefits derived from contributions made after the decision . . . must

be calculated without regard to the sex of the beneficiary." There has also been at least some talk about making a similar change in life insurance premiums. Both areas have historically been governed by "sex-distinct mortality tables," reflecting the fact that women, as a statistical group, live longer than men. The recent changes and proposed changes are based on the argument that the old arrangement discriminates against women. Which, of course, is true in at least one sense, though it can be argued with equal validity that the new "unisex" insurance schemes discriminate against men (or that *all* life insurance discriminates against those who live a long time by making them subsidize those who die young). From a strictly statistical standpoint (ignoring such humanitarian considerations as whether a group which has a high life expectancy and is epidemically underpaid should have to pay more for an equivalent post-retirement standard of living), the sex-distinct tables would seem "fairer" in that they reflect an actual statistical difference which "merged-gender" tables conceal.

If gender is really the cause of the difference, and not merely something which has an accidental correlation with something else which is the real cause —and there is evidence that the latter is really the case. At least one recent study concluded that the "gender" difference in life expectancy is attributable almost entirely to a difference in cigarette-smoking habits. Men as a group die younger because they smoke more. If that's true, maybe insurance companies should be using mortality tables which merge gender but separate smokers and nonsmokers.

Statistics is one of the most useful, tricky, and persistently misapplied of all areas of knowledge. In reaction to that, some people resent and reject *any* application of statistics to human problems and make the idealistic but unrealistic demand that all decisions involving people be made strictly on individual merits. Many human problems actually result from confusion over whether individual or statistical methods are more appropriate, or failure to recognize that both have legitimate uses.

Ethnic prejudices present a rich collection of examples. A racial or religious prejudice often consists largely of basing treatment of *individuals* on *statistical* beliefs which may or may not have some validity, but even if they do are irrelevant and meaningless when applied to individuals.

From time to time various individuals have proposed research to determine whether "racial intelligence differences" exist, and such proposals have usually been vehemently denounced. Why? Do such differences exist? And do those two questions have anything to do with each other?

Nobody *knows* whether statistical differences in intelligence exist, because the research has never been done (at least on a sufficiently professional level to win general acceptance). But they *could* exist. (The letters I will get from people who read this far and stop to denounce me as a "racist" are merely further evidence of the widespread and profound confusion about statistics and human beings.) We know of many other

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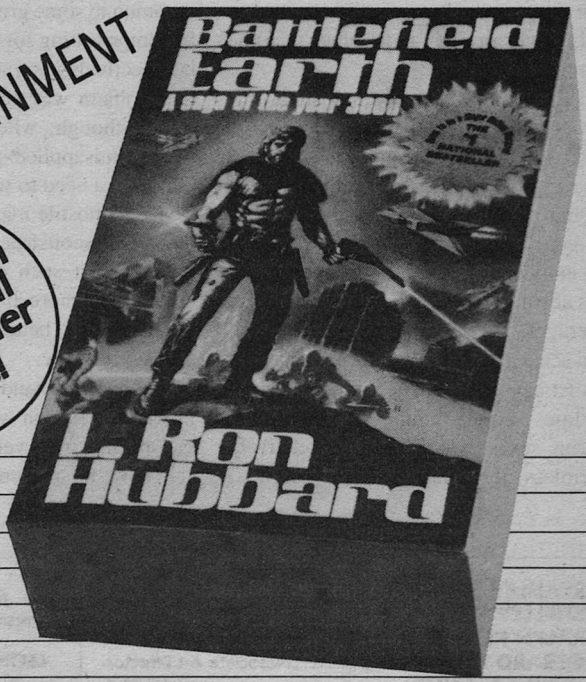

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traits, such as skin color, hair type, and disease susceptibilities, which are undeniably much more prevalent in some gene pools (or ethnic groups) than others. I have never heard a plausible reason suggested why such differences can only occur in body parts other than the brain.

But even if there are statistical differences in brain structure and function from one group to another, so what? The appropriate variable for estimating an individual's performance in a job or an educational program would still be his individually measured ability—which has absolutely nothing to do with ethnic averages. If everybody recognized that and acted accordingly, information about statistical differences in intellectual abilities among ethnic groups or between sexes would seem a relatively harmless, if perhaps relatively useless, addition to the stores of human knowledge. Conceivably it could even find a few beneficial applications—for example, if a particular type of learning disability were found to be especially common in some group, teachers skilled in compensating for that problem might be selectively assigned to schools where the problem was prevalent. In the real world, though, where statistics are so widely misapplied and misunderstood that I see a need to write this (and know I will get hostile mail from people who totally misconstrue it), I can easily imagine that such data might well be used to do more harm than good. So maybe we are better off without them, at least for now.

On the other hand, there can be cases in which a person who genuinely hates racism and tries very hard to avoid it can have no reasonable alternative to

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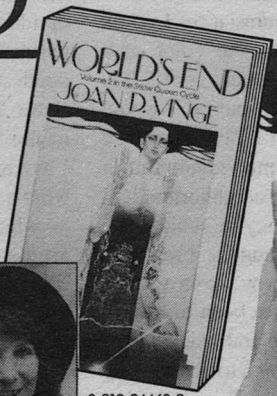

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basing his actions on purely racial data. I experienced such a case on my first days of graduate school, which happened to coincide with the big and overtly racial riots in the Hough section of Cleveland in 1966. My residence was practically on the edge of Hough; there were National Guardsmen with submachine guns stationed literally at my front door, and I could watch buildings burning from the window of my room. Under any normal circumstances I would be quite indifferent to the color of a person I met on the street, and if any interaction between us occurred, I would base my part of it on how I perceived that individual as an individual. But in those days, in that neighborhood, I would go out of my way to avoid close contact with black strangers. I resented having to think that way, even temporarily, but I would have been foolish to do otherwise in a time and place where black people were known to be shooting and knifing white people simply because they were white. (You'll note, though, that my need to act on statistical judgments arose because others were doing so, in response to still others' doing so. . . . Thinking in racial terms tends to beget more and more of the same.)

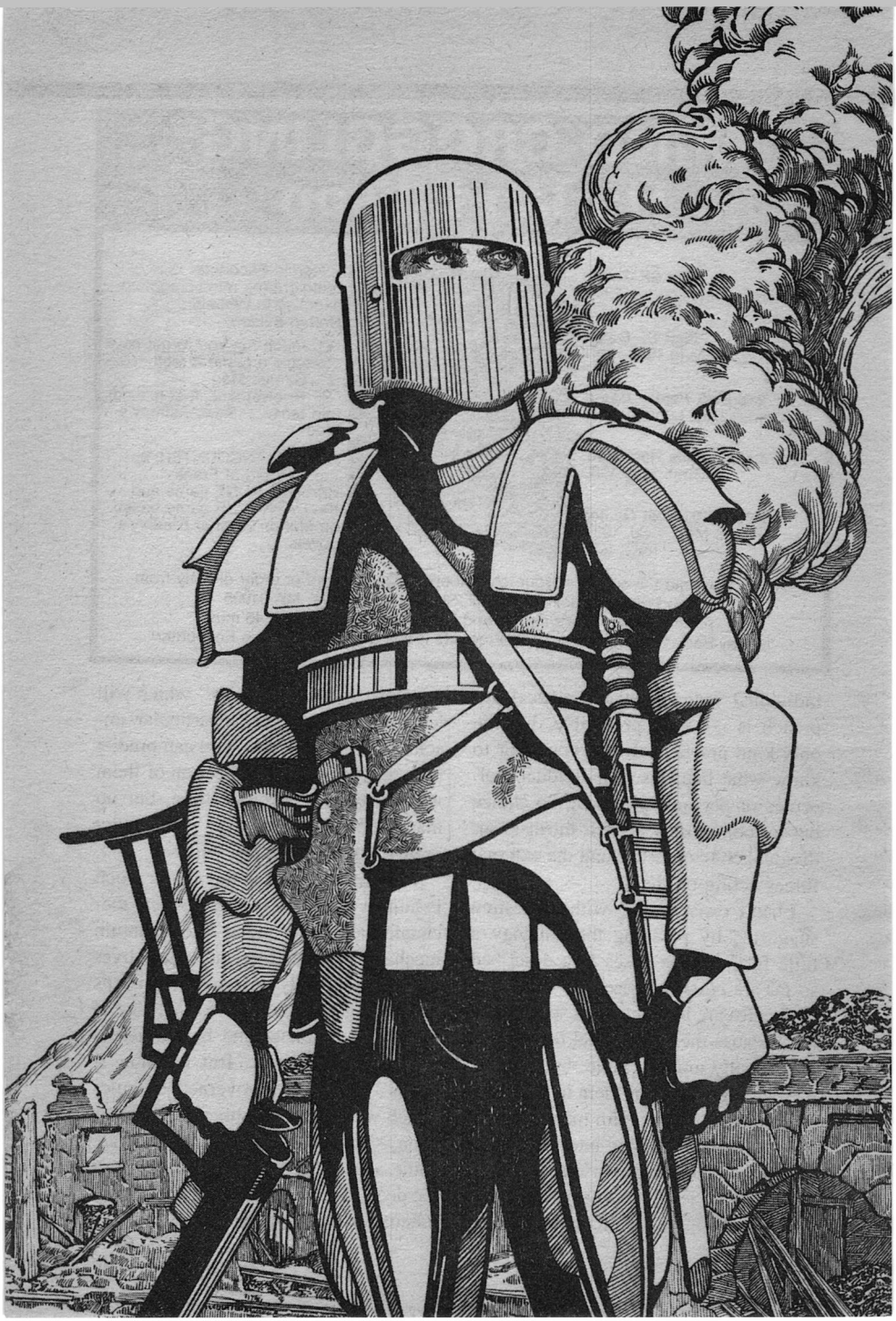
A good example of a case where statistical judgments are *not* appropriate, but are often advocated at least mildly even by professionals who should know better, is the choice of a marriage partner. "Marriage preparation" courses in high schools, articles in popular magazines, and many other sources stress statistics indicating how commonly marriages succeed or fail between various combinations of religions, ages, educational levels, etc. No doubt it's good for anybody to be aware of such trends, if only to make him take an especially critical look at his own situation if he appears to be in a "high-risk" group. But when friends, family, or clergymen tell a couple they *must* not marry because of it, that's going too far. Belonging to any statistical group is not the only significant fact about any individual, and the selection of a marriage partner is a classic case where an in-depth study of individual characteristics *is* (or should be) made. What matters is not what happens to the mythical "average" couple in this situation, but what's going to happen to *this* couple — which depends on their unique characteristics, dynamics, and circumstances. It's more like analyzing the detailed interaction of a couple of gas molecules than the properties of the gas as a whole. What's needed is not glib statistical generalizations, but enough understanding of how individuals function to be able to make a reasonable estimate of how these two will interact with each other and with external influences.

The basic problem is not that human beings can never be dealt with in collective, statistical ways, or that they can never be treated truly as individuals. The basic problem is that too often people dealing with people fail to ask themselves *which* approach is appropriate, or even to recognize that each has its moments. The gas analogy may help. If you want to know about behaviors of whole containers of gases or populations of people, or if you are unable to get enough individual information to make

individual judgments, a statistical approach is not only preferable, but the only kind practical. But if you want to know what happens to individual molecules or persons, you have no choice but to look closely at their intrinsic individual characteristics and the external forces acting on them.

I can't resist ending with a question suggested by pursuing that analogy a little further. The gases I've described so far are *classical* gases, in which the molecules are best analyzed statistically not because their individual behavior is intrinsically unpredictable, but because there are too many of them to deal with individually. In quantum mechanics, at least according to some interpretations, the behavior of matter at a sufficiently microscopic level *is* intrinsically and inherently unpredictable. There *are* no rules or "hidden variables" which will let you predict when a particular unstable atom will decay. You can predict how many of a large collection of them will decay in a specified time, but no matter how hard you try, you *cannot* predict which ones they will be.

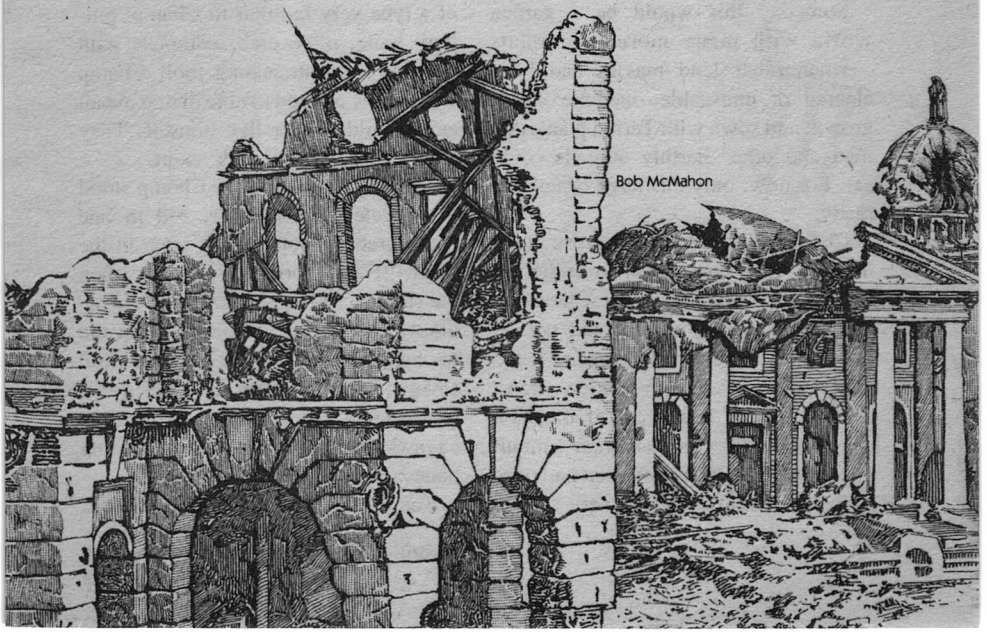
And my question is this: How much is human psychology like classical mechanics and how much like quantum mechanics? Predicting individual lives and making fully informed decisions concerning them requires knowledge of individual character and how it reacts to outside influences. But is "how it reacts" completely governed by rules which we can apply with confidence as soon as we finish learning them? Or are some aspects of human behavior, like the decay of individual atoms, truly and inherently random? ■



CHESSMEN

Joseph H. Delaney

Words like
"heroism" and "treason"
are defined
in terms of
a familiar context.
But with
a truly
alien enemy . . .



Feeling somewhat infirm, as might be expected of a man in his 130th year, Clifford Champ looked up from beneath the broad brim of his hat at the figure on the other side of the pond. From where Champ sat on the near bank, fishing pole dangling in the water, he had to squint into the morning sun; and consequently he could see little more than the silhouette:

Still, details were visible. The man was tall and lanky. He was not young. He moved slowly and deliberately as he bent to drink, as though he too was feeling the burden of years.

Champ had not seen another human being for several months, not since he'd settled into his motor home to lead the life of a vagabond across the length and breadth of Inverness. There were few people on this world, and most of them, like himself, were retirees, who after long lives of toil and frugality had finally found the means to go out to pasture and to do what pleased them.

Someday this would be a garden world with many more inhabitants —when other land masses had been cleared of unusuable, inedible native growth and sown with Terran plants that man and other Earthly animals could eat. For now, only this large island was ready.

Champ watched the man rise, look his way, then turn, ready to trudge off toward the east. Champ knew he could not let this happen. He could not let company escape him; he needed it too badly. He craved conversation almost as if it were a drug—and if that talk could be with a contemporary mind, stuffed with memories of what had once been, he would trade his very soul to get it. He opened the creel which hung at his side to get the count of fish. There were six; six of the fattest, shiniest bass he'd ever caught. That would be enough.

The other man had taken a half-dozen steps by the time Champ acted. He laid his rod down on the bank and rose, cupping his mouth to shout, "Stop! Come back; talk a while. I have fresh fish to eat, and coffee. More than enough."

The figure turned, and for a moment seemed to hesitate, seemingly unsure whether or not to plod on into the rising sun, or to join Champ for breakfast. But after an intense moment of hesitation hunger apparently won out, and he began to take long measured steps around the shore.

As the man approached, Champ could see that he was indeed a contemporary, with weathered face and gnarled hands; that beneath the knit cap he wore, his hair was white as snow. The stranger wore a jumpsuit of some dun-colored synthetic. On his back there was a pack of a type very familiar to Champ: military issue, olive drab, complete with bayonet and entrenching tool. Champ was doubly pleased to note that; it meant another old soldier like himself. They would find things to talk about.

Squinting into the sun, Champ stood and greeted the stranger, rod in one hand, creel hanging by its strap in the other. "Good morning," he said, when the stranger was near enough to use ordinary conversational tones. "Join me for breakfast, won't you? I'm Clifford Champ." He switched the creel to his left hand, holding both it and the rod; an awkward arrangement for his old bones. He held out his right hand.

The other's hand came up to meet it,

and despite its knobby appearance, the grip was firm and powerful. "Al; call me Al. Bass, huh? Nice ones; ought to be right tasty. I'll help you clean them."

Al followed Champ up the gentle slope to his camp. He slid off his pack, and hung it carefully across the back of one of the folding camp chairs.

Champ dropped the creel on the table, opened its lid, and began lifting out the fish. One or two showed tenacious signs of life by flopping across the tabletop.

Al reached for his pack, drawing the long bayonet from its scabbard, though it was not really an efficient tool for cleaning fish. But its edges were razor sharp and he made do, expertly beheading, then gutting one after another and stripping them into fillets. "Will you fry or roast them?" he asked.

"Roast them, I think," Champ replied. "Somehow, they always taste better flavored with smoke. I have a firepit over here. There should still be coals alight."

He added some fresh wood to the fire and fanned it until it flamed, while Al worked the fillets onto a spit. "I have coffee inside, Al. Would you like some now?"

"Please," the stranger replied. "It's been a while since I had any. Traveling afoot as I do has disadvantages. A man can carry so little."

Champ went into the vehicle and in a moment returned with two cups and a pot. He put them on the table and poured, delighted to see the stranger's hand fairly leap up to seize one as soon as he was finished.

"How long have you been on Inverness, Al?" Champ asked, taking a sip of his own coffee.

"Some years. In fact, almost thirty years. I came here before it was even open to settlement, to work on the conversion. I myself helped to stock the pond with the fish you caught." He smiled, then turned to Champ with a question of his own: "And yourself?"

"Seven months. Compared to you, I'm a tenderfoot, but I like it here very much." Champ reflected on what the other had just said. *Thirty years! We were still at war with the Sackers then, and this was on the outer edge of secure territory*. This island, he knew, had been initially reclaimed by using convict labor. He remembered reading that in the travel brochure which had brought him here.

For a while they simply stood there, each with his own thoughts, sipping coffee; and then the stranger turned to the fire, where the fish had started to brown and sizzle in the heat. The stranger turned the spit slowly, cooking the fish evenly, and a delicious aroma began to rise with the smoke.

Champ got plates and forks, set them on the table, and waited for Al to finish the cooking. When at last breakfast was done to perfection, he watched the stranger distribute the plates and lean the spit up against a tree to cool.

"More coffee, Al?"

"Please," the stranger replied, raising his cup.

As he poured, Champ studied that face—that face with no last name. He wondered what the reason was; why Al failed to give it. Champ took his time with the pouring, searching the features as if he expected to find something out of the ordinary, something familiar. They were strong features, prominent

and craggy, framing steel-blue eyes, but in themselves not that noteworthy among the millions Champ had seen in his long lifetime. He felt that vague wisp of recognition which had deceived him so often in the past. With more than a century of memory to search, this was a trick his mind had played on him many times before.

As he watched, the stranger ate; wolfishly, though at the same time delicately, and giving all his attention to the task at hand.

Champ tired of this; took his first bite. "Delicious," he remarked. "Nothing like eating out of doors, especially fresh-caught fish roasted on an open fire. But then I suppose that's nothing new to you. Me, I'm just getting started with this lifestyle, and I'm afraid I'm not much of a woodsman yet."

The stranger looked up at Champ's vehicle; surveyed it in the light of that remark. Thirty feet long, fully self contained and complete with air-conditioning and indoor plumbing, it was—though small—as plush and comfortable as many permanent homes. The luxury model, it traveled on an air cushion, sustained by powerful fans beneath the living quarters, these last fed by solar energy stored in plastic batteries in its outer skin. With this machine, and occasional visits to town to replenish supplies, a man might live in comfort in the wilderness for many years.

Could that be envy I see on his face? Champ asked himself. *Or is it disdain?* "I—uh—I guess you don't think much of my lifestyle, do you, Al?"

"It suits you. And it depends on the man, I guess. I myself couldn't afford that and don't think I'd want it if I could, but I guess it's all right for those who can. I take what life gives me, because that's all there is."

He didn't say it as if he were envious. Champ found he could read no emotion at all into the words.

Al rose, gulped the last of his coffee, and paused to wipe those errant grounds from his tongue: the ones that inevitably find their way into even the most carefully brewed pot. "I'll help you clean up," he said. "Then I've got to be on my way."

He stopped, grabbed the plates and forks, and started for the pond.

"Wait," Champ called to him. "No need for that. I've got a dishwasher. Look; you're going east. So am I. Why don't you ride with me a while? I'm sure you could point out a lot of interesting things I'd like to see. And," he added; "two old soldiers could certainly find plenty to talk about."

The stranger stopped. He turned and faced Champ, striking a pose that jogged Champ's memory that millimeter or so it needed to achieve recognition and confirm that nagging itch that Champ had felt these last few minutes.

The stranger's face gave no sign, though Champ desperately searched for one. He had to know. "It is you, isn't it? It's Al St. Mary. You've changed; you were young then. How long has it been? Thirty years, thirty-five? You're still young. You can't be over sixty. That'd be about right. Only you're supposed to be dead."

The stranger returned to the table, put the dishes down, and reached for his pack. "I'm afraid you're mistaken, Old Man. I don't know you. We never met before. And I travel alone." He slid the

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pack expertly upon rangy shoulders, turned on his heel, and strode out of Champ's camp.

"Sergeant St. Mary! Stop!" Champ's voice echoed around the pond unheeded by the other man, whose long legs carried him swiftly across the grass. "I know it's you. St. Mary—you owe me this. Stop!"

But the stranger didn't stop. He strode into the thick brush beyond the clearing and quickly became lost to sight.

Champ stood there transfixed, immobile. Having briefly rubbed shoulders with a ghost, old memories were suddenly rekindled; they carried him backward in time to another day, across light years to another place.

Champ could never have forgotten, had he lived a thousand years, the solemn appearance of the courts-martial convened in the wardroom of the carrier *Leyte*, the mightiest warship humanity had ever put into space.

He had himself come aboard from a tender at the summons of Admiral Dennis, whose flag the *Leyte* was, knowing only that a General Courts-Martial was being convened and that he—as senior Judge Advocate in the sector—would be defending the accused.

It had taken the admiral some time to get enough rank together to satisfy regulations, but he'd done it, drawing from all the other service branches in addition to the Space Forces.

Being a late arrival, Captain Champ had had no time to meet his client in advance. That had happened at the formal arraignment, a mostly perfunctory occurrance anyhow, designed to give the accused a chance to hear the charges and plead—and incidently to allow the court thereafter to disburse for a time, and get back to their conduct of the war.

Champ had reason to remember the incident. It was the only case he'd ever handled where the death penalty had been requested by the prosecution. He remembered how terrible it sounded when the Charges and Specifications had been read to the court; how helpless he'd felt standing there, at attention with the lanky soldier who was so wooden, so unemotional throughout it all.

"Charges and Specifications," the prosecutor's voice rang out. "That on or about standard date 27 April, 2137, while on active duty status as First Sergeant, Company A, 589th Regimental Combat Team, 82nd Spaceborne Division, which unit was on station, as garrison, of the planet Agamemnon, and at which time a state of war existed by declaration of Congress between the Solar Combine and the Sacker Empire, and while his unit was engaged in combat with the enemy, the accused, Alvin St. Mary, Sergeant First Class, Service Number RSF 512–991–3747–1, contrary to Articles 99, 104, and 105 of the Articles for the Conduct of War, did, knowingly, intentionally and without regard to his oath of enlistment, misbehave before the enemy; as particularized in the following Specifications:

"Specification: That on or about said date, Sgt. St. Mary's unit was under attack by an enemy landing force . . ."

St. Mary had not flinched at hearing the charges. He had stood superbly erect, at attention and motionless, the perfect example of a professional soldier.

Even at the time, while it was hap-

pening, Champ had had an overpowering feeling that it was somehow all wrong. He had himself seen limited action in a colonial unit before joining the regulars as a legal officer. He had seen good soldiers, even exceptional soldiers, before. But he could not at the time recall having seen, nor had he seen since, a chest with so much fruit salad as St. Mary's bore. It was all there: the Space Cross, in gold, with three star clusters; the Comet of Spica; the Holy Ring of Samar, with diamond splash; the commemorative jump medal of Kang-Kao-Tze; and dozens of other citations, both individual and unit, which Champ didn't recognize, much less name. And above them all the wings and rocket of his spaceborne badge gleamed in polished platinum.

Clear as a bell, as though it had happened thirty minutes instead of thirty years ago, the words droned on in Champ's memory. It had seemed that the list of specifications would never end. Dennis was throwing the book at St. Mary; the sergeant faced not one death penalty but three. Besides cowardice, he was charged with aiding the enemy and with misconduct as a prisoner, each of which carried the same punishment as cowardice: death, or such other punishment as a courts-martial might direct.

St. Mary had been a combination statue and sphinx throughout the arraignment and the subsequent trial. Only once, during the entire proceeding, had he spoken, and only then by necessity. To each of the charges and specifications he had uttered the words "not guilty" in a clear and powerful voice.

The trial which followed was a prosecution circus, completely one-sided and, thought Champ, completely unfair; though he had of course realized all along that this was the defendant's fault and not his. St. Mary had sat erect and motionless in his chair throughout it all, observing the process with outward disinterest. He would not take the stand. He refused to say so much as one word in his own defense, to do anything at all to assist Champ in defending him against the charges.

Yet there was an incongruous conflict between his stentorian declaration of "not guilty" and his actions. It was as though he was saying, "I am a faithful soldier of the Solar Combine. I am maligned; I am faultless. My unsupported word is proof enough of that."

If that was his theory it had failed. Witness after witness marched to the stand, called from farflung battlefields by a vigorous and zealous prosecution. Some, like Captain (formerly First Lieutenant) Max Burnette, did so eagerly, thinly disguising their personal contempt. Others, like Corporal Willi Lind, made the prosecution drag the words out of them.

Champ had been able to muster only one reliable witness: the unit records officer, who made the most of St. Mary's splendid past.

It had not been enough. The verdict of the court was immediate and unanimous: guilty on all charges. The sentence: execution, at a time and place to be fixed by the Provost Marshal, should the verdict withstand the automatic appellate procedures.

And it had. Champ himself had started the case up the ladder, and when

that responsibility had passed to others he still kept track. Only when executive clemency was denied did Champ give up, and by that time there was no citizen of the Solar Combine anywhere in the universe who would have hesitated for an instant to serve on the firing squad which would end St. Mary's life.

In the meantime the war had gone on, desperately, but with a sudden turn of fortunes. Champ all but forgot St. Mary, his time consumed by his duties.

Then there was the magnificent victory at Stargate 101, where allied forces had found the enemy deployed for exactly the wrong kind of engagement and slaughtered them to the last shipload.

Exciting days followed. From then on they never lost the initiative. The pitch of battle rose, until on one historic day the Sacker home system was found and slagged. That had, of course, ended the war, except for mopping up far-flung enemy outposts, and that had taken a generation more.

St. Mary, whom Champ had thought long dead, was forgotten—until now.

Champ's mind made the startling transition from then to now, from comparative youth and vigor to fragility and old age. He stood, staring out into the bush, a dirty plate in each slack hand, chasing yesterday's enigma across the pristine plains of Inverness. *Yes, I will pursue him,* he told himself; *I must know.*

Hastily he broke camp, throwing the table and chairs haphazardly into the cargo bay beneath the living quarters, and dumping the remaining coffee into the smouldering ashes of the fire. Without bothering to strap anything down he climbed into the driver's seat, switched on the fans, and pulled up his wheels as soon as the airskirt filled.

All day he cruised the bush, running a zig-zag pattern over the lands that lay to the east of the pond, scanning the bush for signs of St. Mary, and finding none.

He did not wonder at this; the bush was thickly overgrown and abounded with places in which a man on foot could hide, especially if he were a skilled woodsman. And St. Mary, he knew, would be. He was a man of strong will who would make do.

Early in the afternoon of Invernesse's thirty-one-hour day, Champ abandoned the useless quest and found himself a refuge for his thoughts, along a quiet stream. Again he made hasty camp and dropped a line into the water.

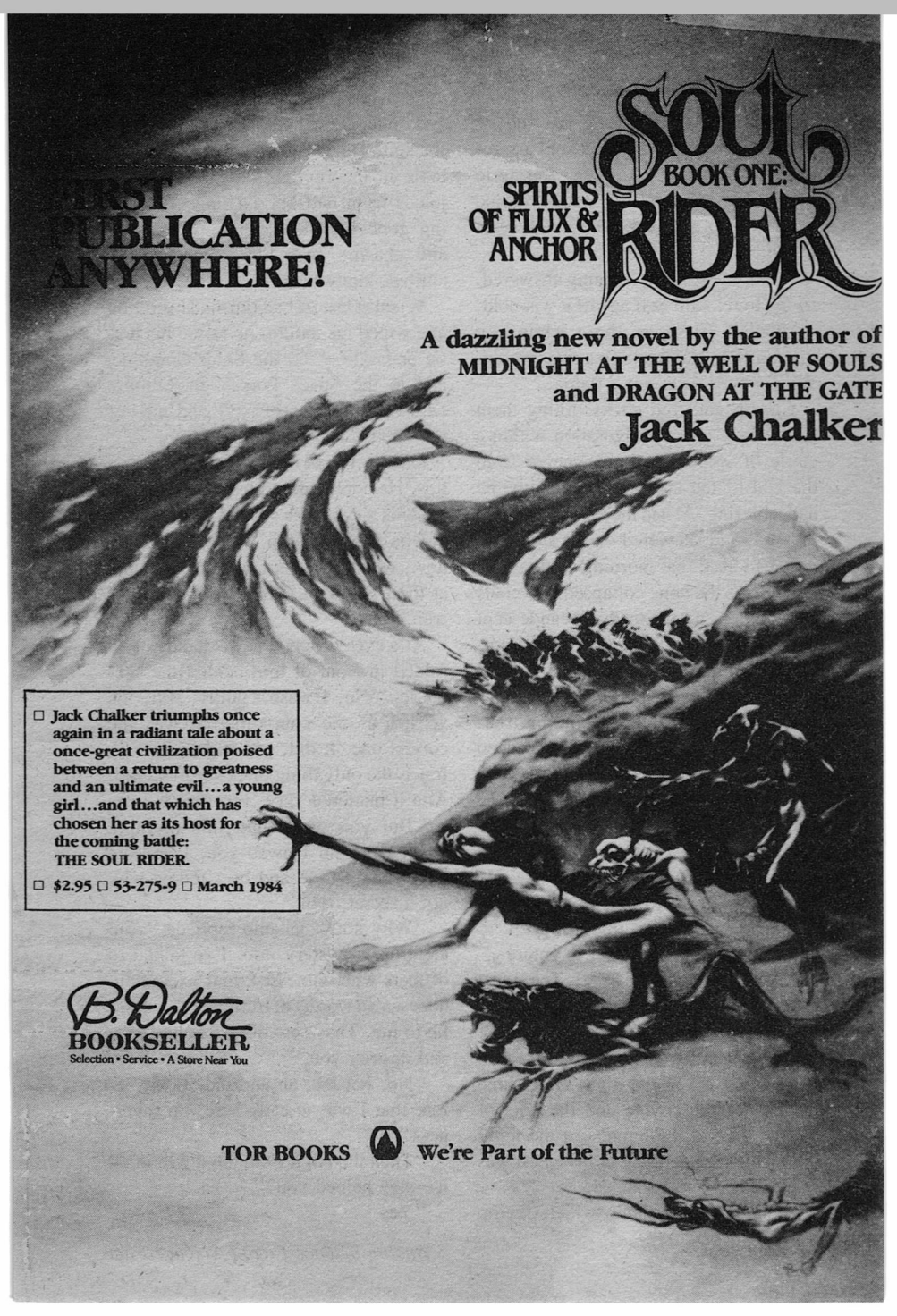
But he caught nothing. He got not so much as a nibble. It seemed as though his mood had run down the line and made the stream as somber as he was.

Darkness rode in on lengthening shadows and brought with it deer, who came to drink before the night's foraging. Champ watched them, trying to make up his mind whether or not fresh venison suited his taste, and half decided to get his rifle and take a shot.

But no, he thought; *it would be a waste; too much for me; I'd be eating nothing else for weeks.*

He went inside and pulled a packaged meal from the freezer, brushing frost from its plastic jacket onto the carpeted floor.

A voice boomed at him through the open door, startling him. He dropped the package and scrambled to look out. "Al?"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Al stood in the doorway, one foot on the sill. In his right hand he held a brace of fat cottontails. "A peace offering to you, Captain Champ. Very good roasted over an open fire, especially with beer. Do you have any beer?"

"Why, yes. I do." Champ answered, trying to remember if any of it was cold.

"Good. I'll dress these while you make a fire. Not too high a fire, please. We want embers, not a flame."

Champ gathered sticks, piling them neatly in a cone configuration within a circle of smooth stones gathered from the bed of the stream. By the time he had it blazing, Al had the rabbits skinned, dressed, and skewered on the same spit they had used that morning for the fish. As soon as the cone collapsed into coals and settled to a steady incandescent glow he mounted the spit on the uprights, turning it slowly to roast the meat evenly. He said nothing. He was as silent as he had been throughout his trial, but this time he appeared to be in deep thought.

Nor did Champ press him to speak. He had already decided that St. Mary was a deep man; that from those depths, in good time, the story would rise. He had to tell it now, to Champ; to the only human being other than himself to whom it seemed to matter anymore.

Champ waited patiently. The meat began to sizzle, dripping melted fat into the fire and causing the coals to erupt in brilliant but transitory blazes. From somewhere off in the night there came the bay of the coyote and the hoot of an owl: two of the hunters of the night with which the ecology of Inverness was finely tuned and balanced.

Al signalled for plates, which Champ had on hand, and slid the crisp meat off the spit. The two men sat at the folding table in the firelight, licking dripping juices from half-burned fingers; chewing gobbets of sweet but stringy meat and chasing each bite with gulps of chilled, tangy beer.

When at last Al had finished his rabbit and wiped his mouth, he raised his bottle and said, "To the Solar Combine; and to the Space Forces; to Admiral Dennis and to the officers and men of the 589th, whom I still serve."

Champ raised his own bottle to his lips. He could add nothing to the toast. He took a symbolic sip and set the bottle down on the tabletop. "Why, Al? Why now, when it doesn't matter? Why not at the trial? You really weren't guilty, were you?"

Al's eyes dropped to his hands, now folded in front of him behind the beer bottle. "No, I wasn't guilty; still, the verdict of the courts-martial was the correct one. It did, and it does matter. It was the only thing that ever mattered. And it mattered very, very much.

"But you were right this morning when you said I owed you. I do. We have shared food and beer today; why not a secret, too?"

"Why not?" Champ replied. "And clear up a mystery, too. I've talked to officers who witnessed your execution; honest men worthy of trust, who wouldn't lie to me. They saw blaster bolts strike and destroy you."

"No, not me; an android. Long before that I was already here, on Inverness."

"Then the High Command was in on it—they helped you?"

"Yes."

"Someone might have told me."

"No. That was part of the bargain. No one was to know. Even today, after all these years have passed, I break an oath by telling you, but it is better than killing you. Those are my orders, should I ever be recognized."

Champ stared back at the man. He knew he had been fortunate. Sergeant St. Mary could not have endured what he had, had he been prone to break such oaths lightly. "I appreciate how difficult the choice must have been; but please go on."

"I hardly know where to begin, Captain Champ," Al said, sounding strangely formal. It was almost as though he were beginning an official report. "Perhaps I should start by asking a question. How much do you know about the Sacker Empire?"

"As much as any man who fought against it, I guess. They were the only alien race we ever met which approached our technological level. They were called Sackers because they came from the direction of the Coal Sack, and they don't exist anymore because we exterminated them. We exterminated them because we couldn't find any way to make peace with them."

"It, Captain."

"What?"

"I'll explain later. Please go on." Champ finished off his beer, swallowing slowly, pursing his lips in an effort to taste the last drop. St. Mary's strange remark intrigued him, though the implications were anything but clear, but having waited so long to break his silence, the sergeant was entitled to indulgence. "Well, let's see," Champ began. "First contacts: about 2115 out in the near clockwise arm. It was the Uleatha sector, I think."

"Kang-Kao-Tze, Captain."

"Yes—the scorched world. The first we knew of them, and no one believed it."

"That was a substantial handicap to us in that war, Captain. It happened so far away that it wasn't real to our population, except the ones in the combat zones. But, I interrupted you; I'm sorry."

"The Sackers were observed attacking Kang-Kao-Tze by the cutter *Orpheus*, and *Orpheus* herself was pursued. She escaped though, all the way to Faraway, and played her logtapes for authorities there. They sent her out again to warn Sol, and right after she left the Sackers smashed Faraway too. We had no forces nearer than Wolfingham; light forces, at that. But when these forces fought back the Sackers turned."

"Do you see any clues in that, Captain?"

"No. I assume the Sackers found themselves out-gunned and retreated rather than face destruction."

"That wasn't it, Captain." St. Mary's gaze was confident, and the look on his face was wise.

"Why, then?"

"Because what we did was not rational."

"I don't understand."

"Few did. It was a common failing and it cost us many lives."

"You promised me an explanation, Al, but you speak in riddles."

"Ah, yes, you are right; I do. But this is not an easy thing to understand. Perhaps we can get back to that part a little later."

"Agamemnon might be a good place to begin."

"Agamemnon was the end, Captain. Even though the war went on for years afterward, the Sackers lost it there."

"They lost it to you, didn't they, Al? And that's why you weren't executed. They don't execute heroes, do they?"

Al ignored the last remark and responded to the first. "Yes, in a manner of speaking, I guess they did."

"An insignificant place to lose a war."

"Only if you are impressed by the physical. Agamemnon was not a pleasant world. It had minerals we needed. That's why the miners were there. And the miners naturally took their families with them. The High Command didn't have enough muscle to go around, so there was only token protection: a parts depot and fuel dump, and us. Agamemnon wasn't considered a target risk; nobody expected a Sacker raid on it, and most of us considered it to be a punishment station. Nobody liked it."

"They said at the trial that 'A' Company had been pulled out of the line for R & R."

"Only half right, Captain; 'A' Company was an eightball outfit. It had all the goldbricks and goof-offs nobody else wanted. They pulled them out of other units and stuck them in 'A' Company, then sent it there, where it would be out of their way."

"What was a man like you doing in it then, Al?"

"I was part of its original cadre, along with Lieutenant Burnette and Sergeants Grow and Mineau. We didn't have much choice. But Burnette belonged there. He was dangerous."

"You didn't like each other, did you, Al? That showed up clearly in his testimony."

"No. We didn't."

"Yet because of what happened to you Burnette's career got a boost, and he retired as a brigadier."

"I heard about that. But you'll note he did it from a desk, in a staff position where he couldn't get anybody hurt. He never held another combat command. Burnette was incompetent for command; what's worse, he was temperamentally unfit for it. He couldn't handle power, though he craved it. He wanted to be God."

"Those are strong words, Al. You sound bitter."

"I suppose I am, Captain. After all, had I not done what I did, Burnette would have died; so would the rest of the garrison, and the miners, and the rest of the civilians. I saved Burnette's career for him, in spite of myself."

"I never heard your side of it, you know. I never expected I ever would."

"It was a long time ago, Captain."

He was right, thought Champ. *It is an impossible burden to place on the memory. How is it, then, that I recall it so clearly? It might have been yesterday.*

Al seemed to agree. He started his narrative the way he would have begun an official report.

" 'A' Company was a reinforced company: two blaster platoons and a heavy weapons platoon, plus headquarters squad. We were heavy on NCOs and short on officers, which is why Burnette was doubled up in the field command. He had personal charge of

the second platoon, to which I was also attached.

"When the Sackers landed we were conducting a company exercise in the foothills about fifty kilometers north-northwest of the mines. They were down before we knew it. They took the Space Port without a fight, and from there they moved on to the depot, where the depot commander, Colonel Merthens, had organized his people into blaster squads at the sight of the enemy ship, and was putting up stiff resistance. That was the first knowledge we had that we were under enemy attack.

"Merthens beat off a couple of infantry charges, but then the enemy laid in half a dozen missiles and destroyed the depot. In the meantime, Burnette . . ."

It was coming back to Champ. Thirty-five years of yesterdays were swept away. It was today, and he sat at the trial table watching the prosecution tear his client to pieces. The prosecutor was Thomas Vincent, a young Space Force captain who, though he stuttered, had managed to control his handicap to the point where he was very, very effective. Burnette was on the stand.

"Now, Lieutenant Burnette: you say at the time you received the call from Colonel Merthens the enemy was unaware of your presence?"

"Yes sir. The Sackers definitely did not know we were there."

"Were your forces in a position to offer resistance?"

"Absolutely; we were training with live ammunition. We had substantially all our transport with us. We had four days' rations; we knew the terrain; we had an opportunity to occupy positions between the enemy ground force and the Sacker ship; and the size of my force was substantially equal to the enemy's."

"How long would it have taken you to mount your attack?"

"We could have been in position in a matter of hours. Four hours, five at the most, to get our heavy weapons within range of the Sacker ship."

"Was the ship your primary target?"

"Yes sir. Without the ship, the enemy would have been deprived of any means of retreat. He would have lost a substantial portion of his communications capability and heavy weapons, and his landing force could not have been resupplied."

"How many ships did the Sackers have on Agamemnon?"

"Just one; the one that landed. We scanned near space. There wasn't anything in orbit."

"So, in your judgment, was an attack on the landing force indicated?"

"Definitely. And, in my judgment, such an attack would have been successful. We had the advantage of surprise; we could match them in firepower; we could even have chosen the battleground, since at that point the enemy had not yet occupied the town."

"You were prevented from attacking, were you not, Lieutenant Burnette?"

"Yes sir."

"How."

"By treachery. Sergeant . . ."

Champ had objected violently at the prosecution's use of that adjective, and his objection had been sustained. The prosecution warned against repetition of inflammatory tactics, and the slaughter had continued. After all, the members

of the court were military men too, and Champ knew that they would have thought the word into Burnette's testimony even if he had never uttered it.

The prosecutor repeated the question. "What prevented you from carrying out your attack?"

This time, Burnette was more careful with his answer. "My senior NCO deserted; defected to the enemy. His defection so changed the tactical situation that an attack no longer had any chance of success."

"What was the tactical situation at the time this defection was discovered?"

"Very bad. I had ordered Lieutenant Caesario's heavy weapons platoon mounted on its transport. They moved out, screened by two squads of infantry, in advance of the main force, to take up positions behind the Sacker ship. Since the range of their weapons was substantially less than that of the enemy ship's guns, it was necessary that they advance to within thirty kilometers and dig in deeply. They didn't make it; they were caught in the open when the Sackers attacked prematurely.

"In the meantime, I started the remainder of my forces, consisting of my first platoon, commanded by Lieutenant Hanson, and two blaster squads from the second platoon, to interdict the enemy forces which I believed intended to occupy the town. In the meantime it was my intention to deploy my headquarters squad on hill 139, from which I could coordinate the attack."

"Did you reach your objective?"

"Yes sir; I set up my command post immediately, finishing shortly after dark, and established micro-wave contact with my other units. This was my first opportunity to coordinate the movement, since we had been maintaining radio silence."

"What duties were assigned to Sergeant St. Mary?"

"Well, at first I was tempted to keep him with me at headquarters, where he'd ordinarily be stationed. I wish I had. Instead, I placed him in command of my short platoon, the one I ordinarily commanded. I felt that the presence of an experienced NCO would benefit the unit's morale, and I could then keep my experienced platoon sergeants with their own units."

"When did you first learn that Sergeant St. Mary was gone?"

"When I contacted his unit to get his report. Corporal Lind answered, and he told me that St. Mary had left him in charge."

"He was gone then?"

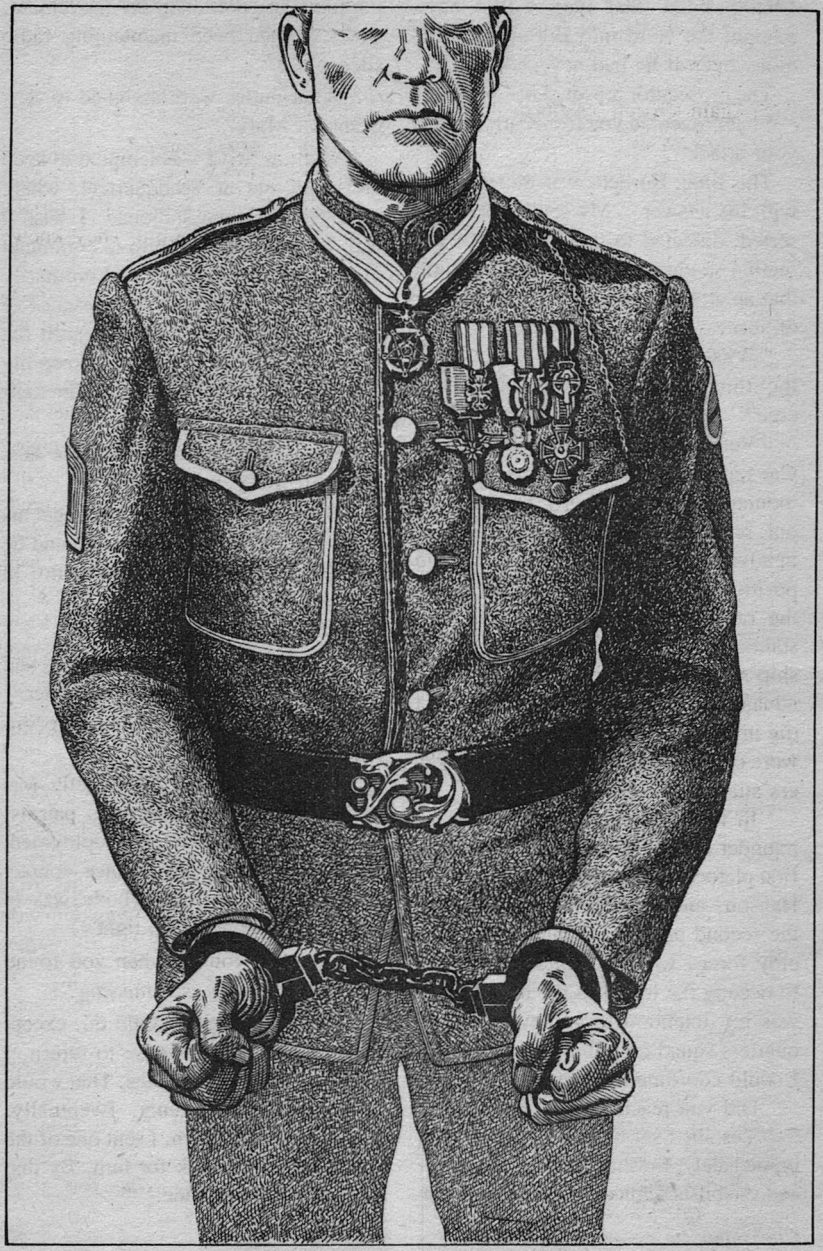
"Yes. Lind told me that St. Mary had taken a jeep and gone out to reconnoiter."

"Had you ordered any such reconnaissance?"

"No sir. In fact, I had strictly forbidden anything beyond point patrols. I already knew the enemy's deployment and I didn't want any chance contact upsetting the plan. Everybody was to get to his station and sit tight."

"What did you do when you found Sergeant St. Mary was missing?"

"There was little I could do, except hope he had enough sense to return. I couldn't break radio silence. That would have alerted the enemy. Eventually, when he did not return, I sent one of the squad leaders to look for him. By that time he was long gone."



"Did you later learn where he had gone?"

"Yes sir. He had gone into the town for the purpose of contacting the enemy."

Again Champ had made violent objection, based on the impossibility of Burnette's knowing what St. Mary's intention had been in going to the town. Again the objection had been sustained, but it was a useless triumph. Champ had known all along that other witnesses would testify that, once in town, St. Mary committed his acts of treason.

"What happened next, Lieutenant?"

"I ordered both my columns to continue their advance toward their objectives, since I was at that time ignorant of what the accused was doing. Second platoon had approached within about fifteen kilometers of Daileyville—the town—and the weapons platoon, which had much farther to go, was nearing its fire station. The ship was just beyond range of their guns when the enemy opened fire on them."

"Please go on, Lieutenant."

"We observed the fire at headquarters, and I immediately signalled my other units that contact had been made. I ordered them to halt."

"Why?"

"Because the operation's success depended on destruction of the Sacker ship. Until that part of the mission had been completed I couldn't risk my infantry."

"What orders did you give Lieutenant Caesario?"

"He was to disperse his guns. Dig them in, if necessary, and wait until such time as he could move them up. In the meantime, he was to equip his infantry squads with satchel charges, advance on the enemy ship, and try to disable it that way."

"Did he attempt to carry out these orders?"

"Yes sir."

"With what result?"

"His force was wiped out by Sacker infantry deployed around the ship. They were waiting for him. They knew he was coming."

Champ had objected to that last remark, and the court had ordered it stricken from the record.

"Did you subsequently order your remaining forces to retire, Lieutenant?"

"I did. First and second platoons were ordered to take up positions in the hills north of the town. I made rendezvous with them there later that evening, and Lieutenant Caesario's unit reached our station just after dawn the next day. But he had had to abandon his guns, which left us with nothing but company mortars. Our effectiveness against the enemy was ended."

"I can see why Burnette would have been bitter, Al. He'd been in a position to slaughter the Sackers and you aced him out of it."

"No, Captain. That's just it; he wasn't. A successful campaign would have meant the destruction of Agamemnon."

"You were already in the Sacker camp at that time?"

"Yes. And I'd already established communication with it."

"You keep saying 'it,' Al. Don't you mean 'them'?"

"No. But I'll get to that part. It'll be

easier if you just bear with me. Remember the woman—what was her name?''

Again, Champ did. He remembered her testimony as vividly as he had Burnette's. He considered it especially destructive, since she was a civilian and presumably had no personal axe to grind.

''State your name, for the record.''

''Clara Kropinski.''

''Is it 'Miss' or 'Mrs.'?''

''Mrs. Uh—I'm widowed.''

''What was your husband's name, and when did he die?''

''His name was Alexander Kropinski. He was killed on April 27, 2137.''

''Did that happen on the planet Agamemnon?''

''Yes, sir. Alex was a miner.''

''Was Agamemnon your home too?''

''I lived there. I went where Alex went.''

''Now: on that date, April 27, 2137, the town where you lived came under attack by Sacker forces; is that correct?''

''Yes, sir. They just came out of nowhere.''

''Was your husband, Alex, also a municipal official, Mrs. Kropinski?''

''He was the town mayor.''

''What did he do when he learned of the invasion?''

''He went to his office down the street from our house to organize the civil defense system.''

''Did you go with him?''

''Yes. I wanted to help.''

''What was happening when you arrived there?''

''Well, when I got there we had just learned the depot had been destroyed. Some of the people who'd managed to get away were straggling in. Some of them were soldiers. They were all wounded; walking wounded, they called them. Colonel Merthens sent them out when the Sackers started shooting the missiles. Most of the civilians were already in town.''

''Was the town itself under attack at that time?''

''No. Not while I was there.''

''You left?''

''Yes. Our civil defense plan called for evacuation into the mines. We had stores of food and water there. I went with the last group, just after they took my husband away.''

''Who took him away?''

''Some Sackers, and that—that man over there.''

''If it please the court,'' said the prosecutor, ''let the record reflect that the witness is pointing to the accused, Sergeant St. Mary.''

The court had so ordered.

''Did you ever see Alexander Kropinski alive after that?''

''No.''

''Did you have an opportunity to observe Sergeant St. Mary's behavior in the presence of the Sackers?''

''Yes sir. He was helping them; like he was one of them.''

That remark had met with violent objection and it had been overruled.

''Go on, Mrs. Kropinski.''

''Well, he went through the crowd there at the City Hall, and he helped them pick people out, and all the while those things had guns pointed at us. One of them shot a wounded soldier who tried to help Alex. Then, right after that, they left.''

"They didn't try to stop the rest of you from going to the mines?"

"No. They just left. After they left, we left. There were only about a dozen of us still in town then. A couple of days later *he* sent for me, and told me Alex had died. I went with him to claim the body, and it was all cut up." She started crying at that point. "They'd cut him open and taken him apart, and then stuffed everything back in and sewed him shut. . . ."

That had ended Mrs. Kropinski's testimony, but others with equally damning stories had later mounted the stand, and driven nail after nail into St. Mary's coffin.

Champ had cross-examined very sparingly, knowing that Al would not utter a word in his own defense. He did not wish to amplify anything the court heard from the witness stand. This strategy was theoretically the correct one, but it certainly didn't make the job any easier.

"They said 400 people died that day, Al, and that you were responsible for killing every one of them." Even now, Champ found that hard to justify. He hoped Al would be able to do it, though to himself he confessed that that would take some work. Laywers are used to representing the guilty. A good one can divorce his own emotions and prejudices from the situation and concentrate on insuring that his client get effective representation of counsel. Champ had been a good one; hoped he still was. *But there is something immeasurably difficult about keeping faith at times,* he thought, *even though I know the High Command believed Al was innocent.*

"I was. I never claimed to be innocent of all crime, Captain. Only that I was not guilty of the crimes charged. I did take life that day, many, many times; and in the days that followed I took still more. But the alternatives were much worse. I could have lost all of them if I'd gone by the book. As it was, the fact that I had to choose who would live and who would die took me close to the breaking point. I sacrificed companions in arms, with whom I'd lived and fought. Some of them, like Mineau and Grow and Caeserio, I chose for that very reason, and because they were the strongest. Burnette survived principally because he was weak."

"I still don't understand, Al. The surrender; I can see how you might have gained a greater insight into the circumstances than Burnette had, because you'd reconnoitered. If surrender to a superior force saved the bulk of the company, and insured the safety of the civil population . . ."

"It wasn't a superior force, Captain. Remember Corporal Lind's testimony?"

Champ did. Lind was the only one who hadn't screamed for Al's blood. He didn't like the business of this court. He had spoken only because it was his duty to obey the court; because he was a good soldier.

"I ask you," the prosecutor had demanded, "if on Standard Date 5 May 2137 you had occasion to have a conversation with Sergeant St. Mary?"

"Yes sir."

"Where did this conversation take place?"

"In the woods north of Daileyville,

when the patrol I was leading was captured.''

''Do you mean captured by the Sackers?''

''No sir. I was captured by Sackers *and* Sergeant St. Mary.''

''Do you mean to say Sergeant St. Mary was operating with the enemy forces?''

''Yes sir.''

''And, as a matter of fact, did he not appear to be in command of the Sacker patrol?''

''Yes sir.''

''How many men did you have?''

''Four.''

''What happened to them?''

''They were all killed. I was the only survivor.''

''How were they killed?''

''Two were killed by a grenade triggered by a trip wire. The third was shot by a Sacker soldier.''

''Were you also wounded?''

''Yes sir.''

''Were you also knocked unconscious?''

''Yes sir.''

''And is this how you came to be taken captive?''

''Yes sir.''

''And disarmed while unconscious?''

''Yes sir.''

''Now then, after you regained consciousness, you had a conversation with Sergeant St. Mary?''

''Yes sir.''

''After which you were released, with instructions to report the substance of that conversation to Lieutenant Burnette?''

''Yes sir.''

And he had. Champ recalled the words very clearly. He repeated them from memory even now, almost verbatim, over thirty years later.

''Corporal Lind, repeat the report of this conversation which you gave to Lieutenant Burnette.''

''Yes sir. I told Lieutenant Burnette what had happened to my patrol, and how it was that I survived. And then I told him that Sergeant St. Mary had said that further resistance was useless, that we would be overwhelmed if we attacked the Sackers, and that the Sackers would then kill all the civilians unless we surrendered immediately.''

''To your knowledge, were any civilians in fact killed?''

''Yes sir.''

''How many were killed, and when were they killed?''

''Later that day we received a call on the radio from Sergeant St. Mary. He directed our attention to a field within view of our bivouac. We could see ten civilians lined up in a row. A few minutes later these ten were killed by a Sacker firing squad.''

''What did Lieutenant Burnette do after that?''

''He surrendered the garrison to Sergeant St. Mary.''

''Don't you mean to the Sackers?''

''No sir. I mean to Sergeant St. Mary.''

''You had a really loyal friend there, Al. Even after what he saw he didn't want to tell on you.''

''I know. I was sorry to hear he'd killed himself after my trial. Willi deserved a medal.''

''Just how large was the Sacker force, Al?''

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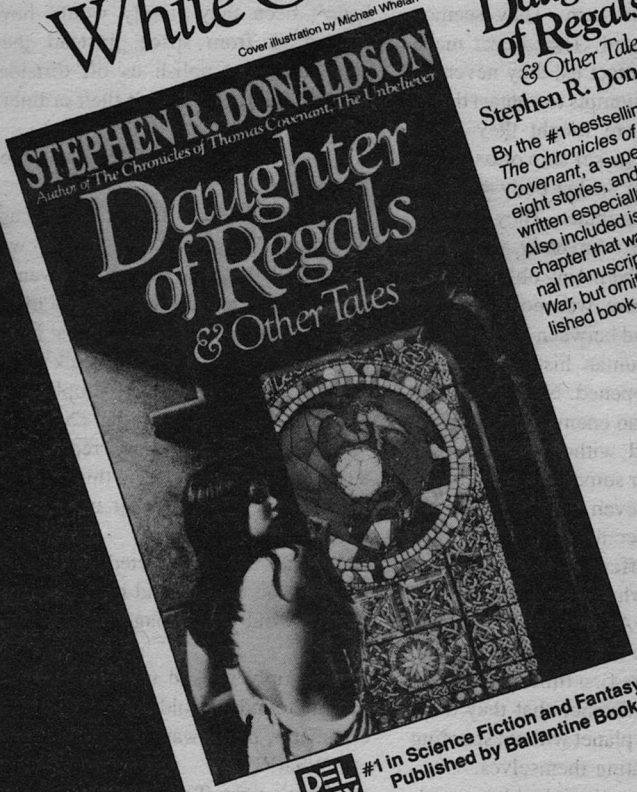

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"One hundred two Units, Captain."

"Units?"

"Units. It has to do with something you asked me about before. I'll get back to that a little later.

"What I'm about to tell you would make no sense whatever to the general populace, Captain. There isn't one in ten thousand who'd swallow the story. This is the main reason for this elaborate cover-up; this is why I am regarded as the greatest traitor of all time.

"You see, there was a strangeness in the Sackers from the very beginning of our contact with them. They seemed absolutely paranoid. They never made an attempt to contact us; they never responded to our attempts to contact them. When battles were fought they never surrendered; no Sacker ship or base was ever captured; no Sacker body survived disabling wounds intact. They took no human prisoners. Anybody who tried to surrender to them was obliterated.

"In short, there was no communication of any kind between belligerents, and in all of human history that had never before happened. Not once in any human war had an enemy charged forth to kill or be killed, without making some kind of excuse or some kind of demand. Always before, even with our enemies, we had some common ground. The Sackers were different.

"And that's why, Captain, when that ship landed on Agamemnon, it represented one of the turning points in racial history. It was the first time since they'd known of our existence that they'd set foot on the same planet without shooting at us or incinerating themselves.

"I didn't know why it had happened, but I realized that it represented an opportunity we'd never hoped to get, and I couldn't let Burnette screw it up. I knew he would, too. Burnette was that kind of a guy."

"Most of what you've said so far I already knew, Al. It was common knowledge. But I'll concede that the landing was unusual. Tell me, weren't you taking a pretty big risk in walking in on them?"

"No more so than if I'd let Burnette shoot it out with them. At the time I didn't know the Sacker ship's planet-buster weapons were on the fritz. If they hadn't been they simply would have zapped us from space. Instead they came down to polish us off dirtside, which is a little bit outside their ordinary routine."

"Land engagements had taken place before, Al."

"Yes, I know. But in every case where that happened the system was strategically located. The Sackers wanted it, and they wanted it intact. And every time they wanted something that badly they got it, because they'd pack in reinforcements until we were simply overwhelmed. That wasn't the case with Agamemnon. Agamemnon represented a rare and possibly unique thing: an undetected, defective Sacker unit; a mutation, so to speak.

"It had to be protected; preserved. It had to be used to end the war."

"How did you manage to make contact?"

"I simply walked up to the nearest bunch I found and told them I was taking command, that I was their ally."

"What!"

"That's right. Talk about shock value; bold action seems to do it every time."

"They understood you?"

"Certainly. Every Sacker on Agamemnon spoke and understood English."

Champ could not believe his own ears. "You mean, the Sacker landing force learned the language before the attack, planned it that closely?"

"No, nothing of the sort. They were born with the knowledge, so to speak, though the term 'born' is entirely inappropriate. The Sacker troopers behaved with absolute logic, like a computer would.

"That's why they fought with such suicidal determination; why they didn't ordinarily bother to take prisoners, though they must have done that on at least one occasion so they could learn the language. It also accounts for certain other tactics they employed against us. I fought them for a long time, Captain; I noticed things. So did many others. And one of the really strange things we observed was that it was impossible to interrupt the continuity of their command. In a human fleet, for instance, command usually reposes in the biggest, strongest, most well protected vessel in the force, because if anything happens to the commander it's devastating to combat efficiency.

"Also, Sacker forces never attacked a superior human force; they always waited until they had numerical superiority, even if this also meant passing up a strategic opportunity. They were playing a long game. I mean that literally."

"A game?"

"Exactly. That was what this war represented to the Sacker, Captain; a kind of cosmic chess. It was playing a game it had learned uncounted millennia ago when its kind were alive."

"Were alive!" Champ's face was twisted into a grimace as he responded. "We were fighting some kind of ghosts?"

"In a way, that's exactly what they were: ghosts. The race hadn't had any real existence for millennia. In fact, we believe there was only one individual specimen surviving at the time all this was happening, and it was clearly mad; one deranged being, Captain, sole heir to a gigantic automated technology. The Sacker troopers were its creation. They were androids."

Champ was wide-eyed. He half believed that Al had made it up; that he too was mad. But no; there had to be some sense to it. The High Command had believed him, and they had not been fools.

"I'm trying very hard to understand you, Al, and I'm having trouble. The thing I'm having the most trouble with is why it was necessary to kill so many people and why, in the end, you let the ship escape. But even that might have been justified if you'd only come out with it at your trial."

"I had good reasons, Captain, not the least of which was that the Sacker conceived us not as individuals but as another player. No doubt it pictured some human equivalent of itself sitting on its home planet manipulating its own forces across the board.

"That may have been how all this started. Perhaps long ago there were other players; perhaps the Sacker eliminated the others. I talked to many knowledgeable people after it happened. A large part of my first year of

'imprisonment' was devoted to debriefing. I endured weeks of hypnotic probing, during which every detail of my experience was explored. I met with not one note of dissent. All agreed that what I had done was correct under the circumstances, that the Sacker had made a tactical error which humanity could exploit—*must* exploit, if it was to win."

"Why did we have to win, Al? If we then had the means to contact the Sacker and explain, why could we not have made peace with it?"

"Because the concept of peace has no function in a game, Captain. The game contemplates one of three results: victory, defeat, or stalemate. Defeat, of course, meant the end of humanity. Stalemate was no better; it meant only the renewal of the contest. It had to be victory."

"I see."

"No, Captain, I don't think you do. Like most of us, your picture of life is composed of relationships between individuals. This obscures life's realities to some extent. That level of thinking was far too lofty to be contemplated by the Sacker. It understood concrete terms; its thinking was largely positional. It operated on the supposition that sooner or later, if it was persistent, its pieces could overcome and replace its opponent's pieces. That, after all, was the principal rule of the game.

"What I did was to alter the rules slightly. By doing what I did I confused the Sacker; demonstrated to it that variations could occur, variations which could shortcut its regular strategy. These variations had to be explained; otherwise the Sacker's units would not have accepted them. The method used was to reveal the differences in 'construction' between our 'pieces' and theirs; to suggest that 'construction' differences meant behavioral differences too.

"My appearance, for instance, was so irrational that the Sacker units couldn't handle it. Hostile pieces didn't behave in that way, therefore I was not a hostile piece. If I was not a hostile piece I was friendly, I had the same objective; therefore my directives were worth following.

"Again I demonstrated this—by subduing the opposing pieces. They did not understand the methods I used, but they understood that the result was the occupation of the position which they had come there to take.

"Again, logically, if these methods worked, they should be incorporated into the strategy of the game. To do that, these units had to restore communication with the rest of the Sacker units, therefore I had to allow the ship to leave.

"By the time they left they had, of course, been completely reprogrammed. I spent days drilling them in all the classical tactical mistakes committed by commanders in humanity's past conflicts. They took it as gospel; they expected nothing less than winning strategy from a unit which had demonstrated so clearly that such strategy existed, and that it worked on humans.

"Nor did they hesitate to leave Agamemnon in my charge. I had conquered it for them; I was a friendly piece; therefore Agamemnon's position on the Sacker's board was secure. It did not matter that at that time I was also in possession of navigational data which

eventually led to our discovery of the Sacker's home world.

"The rest you know. The Sacker began to utilize the tactics I had taught it, faithfully repeating all our past mistakes—mistakes we could easily recognize and exploit, and *did* exploit, successfully, until at last we occupied the positions we needed to end the game."

Champ went to the refrigerator and got two more beers. He handed one to Al, who grimaced while he popped the top open. "So you see, Captain, I was not guilty, after all. I was not a coward nor, technically, was I a murderer. The people who died died as soldiers; they were casualties in the same sense that Colonel Merthen's command was."

Champ took a pull on his beer. He did understand, he decided. And he could see at last why St. Mary had acted as he did. But he did not understand the behavior of Al's superiors. That explanation eluded him, and he wondered if even Al knew. "Why," he asked, "weren't the people told?"

"Because, being human, they would have insisted on deliberating our course of action. There was some of that tendency even within the High Command. Fortunately these people were soldiers, and in the end they yielded to the wisdom of the arguments in favor of secrecy.

"No one knew for sure how the people would have felt if they'd known the truth. There was already enough resistance to the war, because it was all happening so far away it wasn't real to the people. How would they have reacted had they known so much blood and treasure was being expended to smash *machines*, just to win a game?"

"But it was only a game to the Sacker. Our people really died."

"That is an important observation, Captain. It was another use the High Command had for me. My exploits were much publicized. I became the villain, instead of the Sackers. People could tolerate atrocities from the enemy, because the enemy was expected to behave that way. In his ignorance they could forgive him. But they could not forgive one of their own kind. And if I defected, would not others also do the same?

"So the High Command used this to fan up emotion in favor of its policy of unrelentingly pressing the offensive. Thousands of copies of the tapes of my trial were made, and shown to audiences all over the Combine. They took the survivors of the Agamemnon incident on tour; real people who had not only seen with their own eyes what the Sackers and I had done, but who had surreptitiously photographed the results. For the first time humanity looked on the face of his enemy, and the enemy was me."

"But the war is over, Al. Is there any reason now why you should still be so reviled? Haven't you ever yearned to clear your name, straighten out the record?"

Al's eyes turned somberly downward to his hands, which tightly gripped the beer can, looking as though at any moment their muscles would tighten in frustration and crush it. "Many times, Captain. But I can't. It would undo all the good that came of it. The sacrifice would be too great."

"Again, Al, I don't understand. How can it make any difference now?"

"Ever hear the story about the little boy who cried 'wolf'?"

"Of course."

"No one ever believed him after that, did they?"

"It's only a story, Al."

"No, Captain. It's more than a story; it's an emotion, and it lies at the heart of the human psyche. Emotion is at once man's greatest strength and his most grievous weakness. To man, what is real does not matter nearly so much as what he thinks is real. We have occupied a substantial portion of this spiral arm, Captain. The size of the Solar Combine increases by the day. In all of this expansion we have never met our equal, but the people think we met one who came close.

"Our luck cannot hold forever. Sooner or later we *will* encounter that equal. It may well be that we will not get along with them. If we were to reveal the truth—that the Sacker War was nothing more than a game—can we ever again expect them to fight a real war?"

Champ nodded. He found himself in agreement. Al was right in his assessment of man's makeup. He himself was torn between the joy of vindication and the logic of the lie. Al had suffered and would suffer, because it was necessary to the welfare of his kind.

Al buried Champ on the knoll that overlooked the stream, taking special pains to conceal the grave behind a stand of bushes. It might be a long time before anyone else passed this way; perhaps as much as a century. If so, that would be so much the better, because it would mean the memory would be dimmer yet.

As he threw that last shovelful of dirt onto the mound he thought perhaps he might yet carve a marker, one that would at least identify this old man as the last casualty of the Sacker War.

He did not do this. It would have been contrary to his orders, and the order had been specific: "You will take all measures required, however drastic, to preserve the secret of your continued existence."

Al had. He had not in truth broken his oath, though the price of obedience had been almost too much for him. He would remember that. Never again, he resolved, would such tragedy recur.

An hour later, in another part of the valley where the quiet pools of the little stream became first rapids and then a torrent, where they coursed through a deep gorge and finally fell a hundred meters over a cataract, there was a rumble, followed closely by a ball of fire. A puff of oily smoke rose from the gorge.

It signalled more than the destruction of the old man's camper. It was a monument to both of them: two chess pieces, swept from the board. But the race lived on, perhaps prepared a little better to meet its destiny, whatever that destiny might be. It was all part of the game. ■

● Do not do unto others as you would they should do unto you. Their tastes may not be the same.

George Bernard Shaw

Dr. Robert A. Freitas, Jr.

XENOPSYCHOLOGY

So far we have very little direct knowledge of alien minds—but we have some fascinating bases for speculation.

"There's a story about a psychologist," science fiction writer Murray Leinster once wrote, "who was studying the intelligence of a chimpanzee. He led the chimp into a room full of toys, went out, closed the door and put his eye to the keyhole to see what the chimp was doing. He found himself gazing into a glittering interested brown eye only inches from his own. The chimp was looking through the keyhole to see what the psychologist was doing."

What the psychologist was doing was proceeding on a false assumption: that the subject would behave as expected! Obviously even a creature that looks vaguely human may or may not act human. How vastly more difficult must it be for us to understand extraterrestrial beings who may look like nothing we've ever seen before? Certainly we shall be at least as surprised by alien behavior as we are by earthly minds. But evolution is even more important than physical appearance, especially where alien psychology—xenopsychology—is concerned. All living creatures, whether of this world or another, are survivors in an endless chain of "winners," organisms whose behavior and sentience allowed them to succeed and increase their numbers.

Intelligence on Earth

On Earth, evolution favored the appearance of intelligence in two major classes of animal nervous systems, called ganglionic and chordate. Each has its own peculiar psychology.

The invertebrates, representing perhaps 97% of all animal species alive today, took the ganglionic intelligence option. The earthworm is typical. Each of its many segments is almost an individual organism unto itself, having its own set of kidneys, muscles, sensors, and so forth. Coordination is achieved by a thin latticework of nerve fibers crisscrossing the animal from side to side and lengthwise. The ganglionic system resembles a ladder with bulbous neural tissues at the joints. Invertebrate organisms thus are comprised of a collection of sub-brains, each of which

controls a separate part of the animal with fairly complete autonomy and no real centralized control. Sensors and their ganglia tend to cluster nearer the head, making not a true brain as we understand the term but rather a large bundle of distinct fibers. Such a nervous system is highly efficient for responding quickly to stimuli. Each clump of nerve cells becomes expert at some particular function—detecting and passing along sensory information, sweeping a leg or wing in wide uniform arcs, opening and closing the jaws in slow munching motions during feeding, and so on.

Might extraterrestrials develop a high ganglionic intelligence that has never developed on Earth despite hundreds of millions of years of opportunity? Many evolutionary biologists believe the system is too complicated to scale up in size—invertebrates are much less intelligent than vertebrates, kilogram for kilogram. Also, ganglionic intelligence may be physically self-limiting. Typical invertebrate nervous systems just have room to accommodate mostly preprogrammed behaviors. Little space is left for growth of surplus neural matter that might eventually evolve into higher intellect. Finally, the endless cross-connections within the body can become so entangled that they actually begin to strangle other body organs. For example, massive head ganglia ringing the spider's gullet squeeze the throat so tightly that the animal must swallow its food in a thin trickle.

It is hard for us to imagine the mentality of beings with advanced ganglionic intelligence. Dr. H. Chandler Elliot, a neurologist at the University of Nebraska College of Medicine, notes that humans normally disregard their internal organs. We respond to an empty stomach or a feeling of indigestion, but normally we ignore its activities. Says Elliot: "The head of an insect apparently regards not only its viscera but also its legs, wings, and so on, with similar detachment. If one deftly clips off the abdomen of a feeding wasp, the head may go on sucking, obviously not distressed. The mind of such a creature must be alien to us almost beyond comprehension."

The second option for advanced intelligence on Earth, spinal-cord or chordate intelligence, was tried by just a few tens of thousands of species—mostly the vertebrates such as amphibians, birds, and mammals. Neural centralization is the key idea, with any number of modular sensory, analytical, or other information-processing units plugged into a coordinating "data bus." With this simple invention organisms could evolve to any size, yet continue to increase their intelligence by hooking up more "peripherals." Because of centralization, spinal cords could grow far more massive than invertebrate ganglia, yet never entangle other organs of the body. The simple brain was more compact and had plenty of room to grow, perched on the tip of the notochord.

Dr. Paul MacLean, chief of the Laboratory of Brain Evolution and Behavior at the National Institute of Mental Health, believes that the evolution of the human brain involved the slow accretion of three successive neural strata. This "triune" brain, explains MacLean, "amounts to three interconnected bio-

logical computers, each with its own special intelligence, its own subjectivity, its own sense of time and space, its own memory, motor, and other functions. Thus we are obligated to look at ourselves and the world through the eyes of three quite different mentalities." These three mentalities include the reptilian brain (evolved during the Age of Reptiles) which dominates in aggressive behavior, territoriality, ritualism, and the establishment of social hierarchies; the limbic brain (evolved later) which generates hormonal responses and appears to be the seat of emotion as well as short-term memory, sensitivity to pain, and sexual interest; and the neocortex (developed mostly in the last 30 million years), largely responsible for deliberation, initiative and caution, anticipation and planning, spatial perception, audio and visual processing, and abstract thinking.

What if alien chordate intelligences evolve with a slightly different emphasis? One likely prerequisite for rapid neocortical development is stable internal body temperature. On another planet where warm-bloodedness had not yet been invented, the reptilian brain might predominate instead of the neocortex as in humans. Some scientists have proposed just such an intelligence among the dinosaurs, whose evolution was perhaps short-circuited by a meteorite impact 65 million years ago, causing the Great Extinction. ETs with advanced reptilian brains might display dogged aggressiveness and unyielding single-mindedness of purpose, and create societies having massive, impenetrable hierarchical bureaucracies with individ-

ual actions heavily dictated by ritual gestures, elaborate ceremonies and dances, "turf" rules, and highly stereotyped, emotionally cold behaviors.

A predominantly limbic intellect possibly could arise in an environment favoring the rapid development of the olfactory cortex, the oldest and one of the most important components of the limbic brain in mammals. A small, hot, windy, perpetually foggy world located close to a dim red star would have little energy available for vision and any images would be wavering and distorted. Strong winds and faint air would make hearing useless, but molecules travel farther faster in a hot, thin, moving gas, thus favoring the evolution of olfaction over the other senses. A predominantly limbic-brain extraterrestrial intelligence would be heavily emotional, oriented toward pain avoidance and pleasure-seeking, conciliation and altruism, and familial and sexual concerns. Their minds might be easily distractible due to a relatively short attention span.

Of course, each of MacLean's neural strata represents an earthly evolutionary experiment. Fundamentally different ones might be tried, singly or in sequence, elsewhere. An example is a bipolar mentality in which "aggressive" (fight, carnivorous, solitude, competitive, genocidal) and "nurturant" (flight, herbivorous, sociability, cooperative, parental) brains vie for control according to prevailing environmental or social conditions.

Yet another possibility is alien minds incorporating the advantages of both ganglionic and chordate architectures. For instance, each invertebrate sub-brain might evolve and enlarge to avoid the multiplication of internal interconnections. This development is most likely in a radially symmetrical sea creature, wherein each brain has roughly equal access to sensory input and motor controls. Such creatures would have "collegial" mentalities, something akin to the many voting computers aboard the Space Shuttle, with multiple personalities within each organism and the ability to maintain consciousness under extreme physical trauma so long as any one brain remained functional.

Extraterrestrial Sociobiology

The father of modern sociobiology, Harvard professor Edward O. Wilson, caused quite a stir several years ago with his suggestion that human social patterns are shaped by evolutionary processes acting through our genes. He did not say that our genes drive us to a series of irresistible behavioral compulsions like ants or bees, but rather that our more malleable psychology can be influenced by our genetic makeup—human behavior can be the subject of natural selection and evolve just as our physical makeup does. Some sociobiologists believe that all behavior, as well as biology, undergoes natural selection. But where genes directly control body shape, their influence on behavior is far more subtle and plastic. Each species, say the sociobiologists, is predisposed to exhibit certain behaviors such as emotionality, aggressiveness, or sociability because these are useful survival tactics in its particular environment.

The sociobiology of competition provides one simple example. Two com-

mon forms of aggressive competition are territoriality and dominance. Territoriality is the defense of a resource-containing area, by an individual or group, against intruders. Dominance is the establishment of a scarce resource distribution hierarchy within a single social group based on "power" (physical strength, cunning, wealth, etc.). Under what conditions might each behavior be favored by evolution on other worlds? Sociobiologists have learned that when important resources are distributed uniformly in space and time there is little opportunity for monopolization, and territoriality tends to occur. When important resources are highly clumped, a small proportion of the population can monopolize most of the available rewards, giving rise to dominance chains or "pecking orders."

Similarly, it appears that herding, flocking, and schooling are genetically preprogrammed tendencies in certain animals, mostly prey herbivores. The group avoids predation by using marginal individuals as a living shield against danger. Predators seize the first animal they encounter, so there is a great selective advantage for each individual to press toward the center of the group. "The result in evolution," explains Wilson, "would be a herd instinct that centripetally collapses populations into local aggregations."

Countless other examples of "evolved behaviors" have been examined by sociobiologists. Each behavioral predisposition appears because it allows individuals displaying it to pass more of their genes (containing, of course, the predisposition) to the next generation of offspring. In similar fashion, different alien psychologies might evolve in response to different challenges to survival elsewhere in the universe.

Wilson believes that human social behavior is best evaluated by comparison with that of other major categories of earthly species. Human beings are proud of their intelligence and many cultural achievements, but seldom pause to consider how much of their psychology can be traced back to their primate (and mammalian) ancestry. "The general traits of human nature," explains Wilson, "appear limited and idiosyncratic when placed against the backdrop of all other living species." To illustrate his point, he first refers to an inventory of the elements of human nature compiled by the American anthropologist George P. Murdock during a study of cultural universals:

> Age-grading, athletic sports, bodily adornment, calendar, cleanliness training, community organizations, cooking, cooperative labor, cosmology, courtship, dancing, decorative art, divination, division of labor, dream interpretation, education, eschatology, ethics, ethnobotany, etiquette, faith healing, family feasting, firemaking, folklore, food taboos, funeral rites, games, gestures, gift-giving, government, greetings, hairstyles, hospitality, housing, hygiene, incest taboos, inheritance rules, joking, kin groups, kinship nomenclature, language, law, luck superstitions, magic, marriage, mealtimes, medicine, obstetrics, penal sanctions, personal names, population policy,

postnatal care, pregnancy usages, property rights, propitiation of supernatural beings, puberty customs, religious rituals, residence rules, sexual restrictions, soul concepts, status differentiation, surgery, toolmaking, trade, visiting, weaving, and weather control.

Wilson insists that few if any of these elements are inevitable outcomes of either high intelligence or advanced social life; rather, that "human nature is just one hodgepodge out of many conceivable." An entomologist by training, he has no trouble imagining an alien insectlike society whose members are even more intelligent and complexly organized than people, yet which lacks many of the qualities listed in Murdock's inventory. The alien inventory:

> Age-grading, antennal rites, body licking, calendar, cannibalism, caste determination, caste laws, colony-foundation rules, colony organization, cleanliness training, communal nurseries, cooperative labor, cosmology, courtship, division of labor, drone control, education, eschatology, ethics, etiquette, euthanasia, firemaking, food taboos, gift-giving, government, greetings, grooming rituals, hospitality, housing, hygiene, incest taboos, language, larval care, law, medicine, metamorphosis rites, mutual regurgitation, nursing castes, nuptual flights, nutrient eggs, population policy, queen obeisance, residence rules, sex determination, soldier castes, sisterhoods, status differentiation, sterile workers, surgery, symbiont care, toolmaking, trade, visiting, weather control . . . and still other activities so alien as to make mere description by our language difficult.

So intelligence and civilization are not intrinsically limited to hominoids. Only by an accident of evolution on Earth were our social characteristics linked to the anatomy of bare-skinned, bipedal mammals and the peculiar qualities of human nature. What other strange psychological "accidents" may await us on distant planets we can hardly guess.

Universal Emotions?

Emotions are extremely important in human psychology, activating our aggressiveness, sexual activity, learning and perception, and a wide variety of other behaviors. Will ETs be more or less emotionally motivated than humans? Will they have emotions foreign to us, or are there any universal emotions?

First of all, what exactly do we mean by "emotion"? There is much disagreement on this, but one of the most useful definitions, by psychologist Magda Arnold, draws a careful distinction between states and behaviors. In Arnold's theory emotional experience proceeds in three steps: (1) Perception and appraisal (external stimulus is perceived and judged good, bad, useful, harmful, etc., mostly based on learned associations); (2) Emotion (internal state of arousal or "feeling" arises, involving physiological effects); then (3) Action (specific behavior such as approach, avoidance, attack, or feeding, depend-

ing on emotional intensity, learned behavioral patterns, and other motivations simultaneously present). In this view emotion is an internal state, *not* a behavior or a perception of external reality.

In the sociobiological view, both emotionality and behavior evolve as strategies to maximize the spread of genes. Thus the mammalian limbic brain system has been programmed to perform as if it knows that its underlying genes will be proliferated maximally only if it orchestrates behavioral responses that bring into play an efficient mixture of personal survival, reproduction, and altruism.

Consider parental love. Sociobiologists believe that love is a behavioral predisposition with selective advantages for organisms which (1) are warm-blooded (love induces close physical contact permitting shared body warmth for small, high-heat-loss young), (2) produce relatively small numbers of offspring (love encourages parents to make a larger investment in time and resources per child), (3) produce offspring that are helpless at birth (love ensures parental material support essential for infant survival), and (4) have highly plastic intelligence (love drives the parent to teach offspring very complex behaviors). Love is rare in the animal kingdom—only birds and mammals fulfill these requirements on Earth, and only these species experience the emotion. So parental love likely won't be a part of the psychology of intelligent ETs unless they satisfy at least some of the above criteria.

Of course, extraterrestrial sentients may possess physiological states corresponding to limbic-like emotions that have no direct analog in human experience. Alien species, having evolved under a different set of environmental constraints than we, also could have a different but equally adaptive emotional repertoire. For example, assume that human observers land on another world and discover an intelligent animal with an acute sense of absolute humidity and absolute air pressure. For this creature, there may exist an emotional state corresponding to an unfavorable change in the weather. Physiologically, the emotion could be mediated by the ET equivalent of the human limbic system; it might arise following the secretion of certain strength-enhancing and libido-arousing hormones into the alien's bloodstream in response to the perceived change in weather. Immediately our creature begins to engage in a variety of learned and socially-approved behaviors, including furious burrowing and building, smearing tree sap over its pelt, several different territorial defense ceremonies, and vigorous polygamous copulations with nearby females, apparently (to humans) for no reason at all. Would our astronauts interpret this as madness? Or love? Lust? Fear? Anger? None of these is correct, of course —the alien is feeling *badweather*.

While xenopsychologists suspect that even emotional intelligences may not share all our feelings, they are far more certain that there exist no universal emotions among all extraterrestrial sentients. Survival and intelligence simply do not require it. Very smart aliens, in other words, may be emotionless. Prob-

ably the cleverest nonemotional creature on Earth today is the octopus. This eight-tentacled, highly educable animal is an invertebrate mollusc with a ganglionic nervous system having 5% as many nerve cells as the human brain. The octopus has a few minor endocrine systems which influence the maturation of its sexual organs, the onset of sexual behavior, body fluids, and maternal behavior, and which react to the changing length of day with the seasons—but compulsory hormonal responses appear to be absent. The animal is, from the strict mammalian viewpoint, virtually without emotion.

Octopuses are fiercely independent solitary carnivores with no social inclinations whatsoever; crowded into a small tank, they will fight and establish a dominance hierarchy. They have no fear of fire and are insensitive to burns. The animal knows sex, but doesn't get very excited about it. The heartbeat of a male octopus in the midst of copulation is as steady as in a resting animal. The sexual displays of males during courtship appear to serve only for identification, never for stimulation, of the female. Broods are enormous impersonal affairs—up to 250,000 eggs per batch. No maternal love is lavished on offspring after birth, so the young must fight for their own lives. Yet females often fast themselves to death guarding their own *un*hatched eggs.

The creature may not even know what it means to feel hungry. Mammals long deprived of food become excited and venture out in an agitated search for dinner. The response of the octopus to food deprivation is totally different and utterly alien. When crabs become scarce, octopuses resign themselves to long watchful inactivity until the day the supply improves. They become less likely to emerge from their caves and houses to attack possible prey passing by. Motivation is not as adjustable as in mammals, yet octopus behavior under stress is considerably more cool and calculating. After hundreds of hours of direct observation, undersea explorer Jacques Cousteau admitted that while the octopus is a timid animal (its first reaction to a diver is to flee or hide), "its timidity is a reasoned reaction, one that is based primarily on prudence and caution. It is not an instinctive and groundless fear that persists regardless of circumstances."

Octopus mentality seems to be more oriented toward calculated prudence, more plastic than reptiles and more aloof than mammals. Is this, perhaps, a clue to the possible psychology of intelligent emotionless extraterrestrials?

Alien Logic, Time, and Space

Logic is the way we know whether something is true. Denoting rationality and reason, logic lies at the very foundation of all intellectual pursuits. Aristotle is largely responsible for the classical development of the so-called "laws of thought." Perhaps the best-known tenet is the Law of the Excluded Middle, which holds that if a statement is true, then its negation cannot also be true. For example, if the statement "the sky is blue" is true, then its negation "the sky is not blue" *must* be false. This sort of reasoning seems intuitively obvious to most people. Aristotelian

logic is just common sense.

Thus not a few writers have suggested that intelligent extraterrestrials, no matter how physically strange they may appear, probably will think much like human beings. ETs, in other words, will be good Aristotelians. This is an unfounded and potentially dangerous assumption even if alien sociobiology proves remarkably similar to our own. Aristotelian logic is just one of many different formal systems of logic, all of which are equally valid in mathematics and philosophy.

The danger inherent is relying on any single logic system is that it tends to limit the diversity of problems that can be addressed. One good example of this may be found in modern quantum mechanics. Imagine the following physics experiment: A solid plate with two small parallel slits is placed in front of a beam of electrons. Behind the slits on the other side is a photographic screen to record the arrival of electrons. During the experiment, electrons are sent toward the slits one by one, some bouncing off the blocking plate and others passing through the slits to be recorded as they hit the screen. The Law of the Excluded Middle demands that any recorded electron must pass either "through the left slit" or "not through the left slit" (i.e., through the right slit). These two choices define *all* logical outcomes, but unfortunately nature does not cooperate. When physicists perform the experiment the "impossible" happens: The pattern recorded on the photographic screen could only have been generated if each electron passed through *both slits simultaneously!*

Perhaps the most exciting development for xenologicians in this century is Gödel's Incompleteness Theorem. In 1931 an American mathematician named Kurt Gödel devised a brilliant proof that any system of logic must necessarily either be internally inconsistent or incomplete. Gödel's proof demonstrated for the first time that there exist statements that are unprovable in any logic system (even the Aristotelian system) and that all arithmetic as we know it is at best incomplete, at worst inconsistent. Further, it is logically impossible to construct a single grand "metalogic" capable of subsuming all other modes of logic while remaining consistent itself. So human mathematics—the language of the physical sciences—is incomplete.

The implications in xenology are far-reaching indeed. We now know, for instance, that no single system of thinking can hold, even in principle, all answers to all questions while remaining internally consistent. All logics must harbor unresolvable paradoxes. Therefore each new logic system we discover most likely will teach us something new, some novel way of looking at the universe and understanding it in a consistent fashion which may be imperceptible —even impossible—from within previous systems of logic. To this extent, all human thinking necessarily must be incomplete. Contact with alien minds will almost certainly open new vistas of knowledge and beauty to us. Extraterrestrial logicians may find many of our most enduring paradoxes to be trivially solvable, just as we may be able to resolve some of theirs equally effortlessly.

Most living organisms possess natural cycles and rhythms, so sentient aliens should have some finite sense of duration. Dr. Bernard Aaronson at the Bureau of Research in Neurology and Psychiatry in Princeton, New Jersey, conducted some fascinating experiments in regard to subjective time that may be highly instructive for xenopsychologists. Dr. Aaronson gave posthypnotic suggestions to human subjects to test their reactions to expanded or contracted time frames, such as: "Do you know how we divide time into the three categories of past, present, and future? When I wake you, the future will be gone. There will be no future." Subjects with no future experienced a loss of identity and a profound euphoric mystical sensation—one person reported that he "found himself in a boundless, immanent present." Expanded futures cancelled all fear of death, inducing serene calmness and happiness. Elimination of the present was found to be most disturbing (subjects were inordinately depressed and behaved almost schizophrenically), whereas deprivation of the subjective past produced drowsiness, memory loss, speech difficulty, and a vague sense of meaninglessness. These kinds of experiments may someday help us understand apparently incomprehensible alien psyches.

Alien languages might incorporate concepts wholly unfamiliar to any human culture. For instance, astronomer Carl Sagan has written that if dolphins are clever enough to have language they may not have words which are arbitrary representations of concrete objects, as do humans. Rather, because of their fine sonar sense, their words may consist of sonic pictures of the object in question. Instead of an arbitrary sound for "shark," they may instead transmit a set of clicks corresponding to the audio reflection spectrum the animal would obtain upon irradiating a shark with sound waves. Another interesting proposal by psychologists David and Doris Jonas is that sentient ETs who could see polarized light (as bees can) would create a language whose vocabulary—and thinking—incorporates a running sense of time. To such eyes, objects and colors must appear different at various times of the day because of the changing angle of polarized light due to the motion of the Sun. The aliens might use a dozen words for what appears to us to be a single object.

Xenopsychologists also recognize the close association between human language and human body form. Extraterrestrials will speak, think, act, and feel differently simply because they have some other body shape and thus experience a markedly different awareness of space, position, and movement. The human body is basically bilaterally symmetric, with the upright posture universally regarded as typical. According to psychologist Donald G. MacRae, our categories for classifying, organizing, and manipulating space, and our emotions about space and the values we attach to direction in space, derive directly from our body form. Explains MacRae: "What is superior is up or high and what is inferior is down or low. Low is often dirty, but high is not necessarily clean. Right is law, morals, the holy and the strong; left is sinister, profane, weak

and (often) feminine. Backward and behind are slow, hence stupid. Forward and in front are active, oriented and intelligent. Beside is confederate or paranoid: It is an ambiguous category of place. What is clear is that these aspects of space derive from our conception of the body and would not hold for an intelligent bilateral but horizontal animal, far less for a radially symmetrical one like a clever starfish, or for spherically symmetrical beings like those of the fable in Plato's *Symposium*."

Sentience Quotient (SQ)

"Of all the things that have been tried by the creatures of Earth to aid survival," Cornell astronomer Frank Drake once wrote, "be it camouflage, many legs, large size as in the dinosaurs, and so forth, only one characteristic has continuously been retained and improved throughout the entire succession of species—intelligence." Perhaps the most interesting aspect of intelligence from the human point of view is that we, possibly alone among all creatures on this planet, have an awareness of self. Consciousness may be an emergent property of intelligence, a fortuitous feature of a terrestrial animal brain architecture originally designed for other jobs. Is it possible that there could exist yet higher-order emergents beyond consciousness?

Science fiction writers are fond of suggesting levels of awareness in the universe which lie utterly beyond man's comprehension. In Fred Hoyle's *The Black Cloud* the human protagonist is killed by data overload during interaction with a vastly superior alien intellect. We may not even recognize the activities of very advanced extraterrestrial civilizations, Carl Sagan once said, "any more than an ant performing his anty labors by the side of a suburban swimming pool has a profound sense of the presence of a superior technical civilization all around him."

It is possible to devise a sliding scale of cosmic sentience universally applicable to any intelligent entity in the cosmos, based on a "figure of merit" which I call the Sentience Quotient. The essential characteristic of all intelligent systems is that they process information using a processor or "brain" made of matter-energy. Generally the more information a brain can process in a shorter length of time, the more intelligent it can be. (Information rate is measured in bits/second, where one bit is the amount of information needed to choose correctly between two equally likely answers to a simple yes/no question.) Also, the lower the brain's mass the less it will be influenced by fundamental limits such as speed of light restrictions on internal signal propagation, heat dissipation, and the Square-Cube Law.

The most efficient brain will have the highest information-processing rate I, and the lowest mass M, hence the highest ratio I/M. Since very large exponents are involved, for convenience we define the Sentience Quotient or SQ as the logarithm of I/M, that is, its order of magnitude. Of course, SQ delimits only maximum *potential* intellect—a poorly programmed or poorly designed (or very small) high-SQ brain could still be very stupid. But all else remaining equal, larger-SQ entities should be higher-

quality thinkers.

The lower end of our cosmic scale is easy to pin down. The very dumbest brain we can imagine would have one neuron with the mass of the universe (10^{52} kg) and require a time equal to the age of the universe (10^{18} seconds) to process just one bit, giving a minimum SQ of -70.

What is the smartest possible brain? Dr. H.J. Bremermann at the University of California at Berkeley claims there is a fundamental limit to intelligence imposed by the laws of quantum mechanics. The argument is simple but subtle. All information, to be acted upon, must be represented physically and be carried by matter-energy "markers." According to Heisenberg's Uncertainty Principle in quantum mechanics, the lower limit for the accuracy with which energy can be measured—the minimum measurable energy level for a marker carrying one bit—is given by Planck's constant h divided by T, the duration of the measurement. If one energy level is used to represent one bit, then the maximum bit rate of a brain is equal to the total energy available E ($= mc^2$) for representing information, divided by the minimum measurable energy per bit (h/T), divided by the minimum time required for readout (T), or $mc^2/h = 10^{50}$ bits/sec/kg. Hence the smartest possible brain has an SQ of $+50$.

Where do people fit in? A human neuron has an average mass of about 10^{-10} kg and one neuron can process 1000-3000 bits/sec, earning us an SQ rating of $+13$. What is most interesting here is not the obvious fact that there's a great deal of room for improvement (there is!), but rather that all "neuronal sentience" SQs, from insects to mammals, cluster within several points of the human value. From the cosmic point of view, rotifers, honeybees, and humans all have brainpower with roughly equivalent efficiencies. Note that we are still way ahead of the computers, with an Apple II at SQ $+5$ and even the mighty Cray I only about $+9$.

Another kind of sentience, which we may call "hormonal sentience," is exhibited by plants. Time-lapse photography shows the vicious struggles among vines in the tropical rain forests, and vegetative phototaxis (turning toward light) is a well-known phenomenon. All these behaviors are mediated, it is believed, by biochemical plant hormones transmitted through the vascular system. As in the animal kingdom, most of the geniuses are hunters—the carnivorous plants. The Venus flytrap, during a 1- to 20-second sensitivity interval, counts two stimuli before snapping shut on its insect prey, a processing peak of 1 bit/sec. Mass is 10-100 grams, so flytrap SQ is about $+1$. Plants generally take hours to respond to stimuli, though, so vegetative SQs tend to cluster around -2.

How about intelligences greater than human? Astronomer Robert Jastrow and others have speculated that silicon-based computer brains may represent the next and ultimate stage in our evolution. This is valid, but only in a very limited sense. Superconducting Josephson junction electronic gates weigh 10^{-12} kg and can process 10^{11} bits/sec, so "electronic sentiences" made of these components

could have an SQ of +23—ten orders beyond man. But even such fantastically advanced systems fall far short of the maximum of +50. Somewhere in the universe may lurk beings almost incomprehensible to us, who think by manipulating atomic energy levels and are mentally as far beyond our best future computers as those computers will surpass the Venus flytrap.

Just as consciousness is an emergent of neuronal sentience, perhaps some broader mode of thinking—call it communalness—is an emergent of electronic sentience. If this is true, it might help to explain why (noncommunal) human beings have such great difficulty comprehending the intricate workings of the societies, governments, and economies they create, and require the continual and increasing assistance of computers to juggle the thousands of variables needed for successful management and planning. Perhaps future computers with communalness may develop the same intimate awareness of complex organizations as people have consciousness of their own bodies. And how many additional levels of emergent higher awareness might a creature with SQ +50 display?

The possible existence of ultrahuman SQ levels may affect our ability, and the desirability, of communicating with extraterrestrial beings. Sometimes it is rhetorically asked what we could possibly have to say to a dog or to an insect, if such could speak, that would be of interest to both parties? From our perspective of Sentience Quotients, we can see that the problem is actually far, far worse than this, more akin to asking people to discuss Shakespeare with trees or rocks. It may be that there is a minimum SQ "communications gap," an intellectual distance beyond which no two entities can meaningfully converse.

At present, human scientists are attempting to communicate outside our species to primates and cetaceans, and in a limited way to a few other vertebrates. This is inordinately difficult, and yet it represents a gap of at most a few SQ points. The farthest we can reach is our "communication" with vegetation when we plant, water, or fertilize it, but it is evident that messages transmitted across an SQ gap of 10 points or more cannot be very meaningful.

What, then, could an SQ +50 Superbeing possibly have to say to *us?* ■

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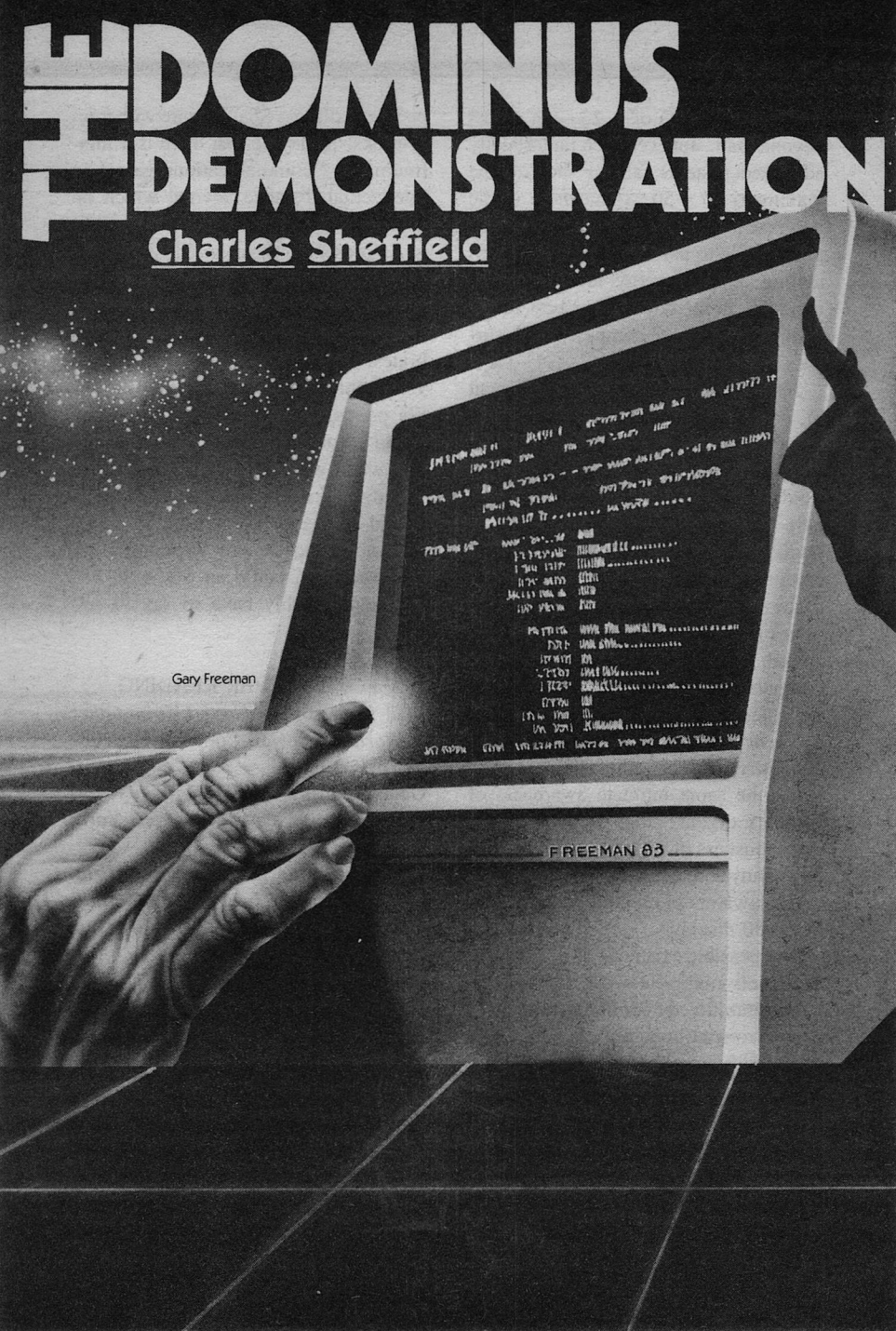
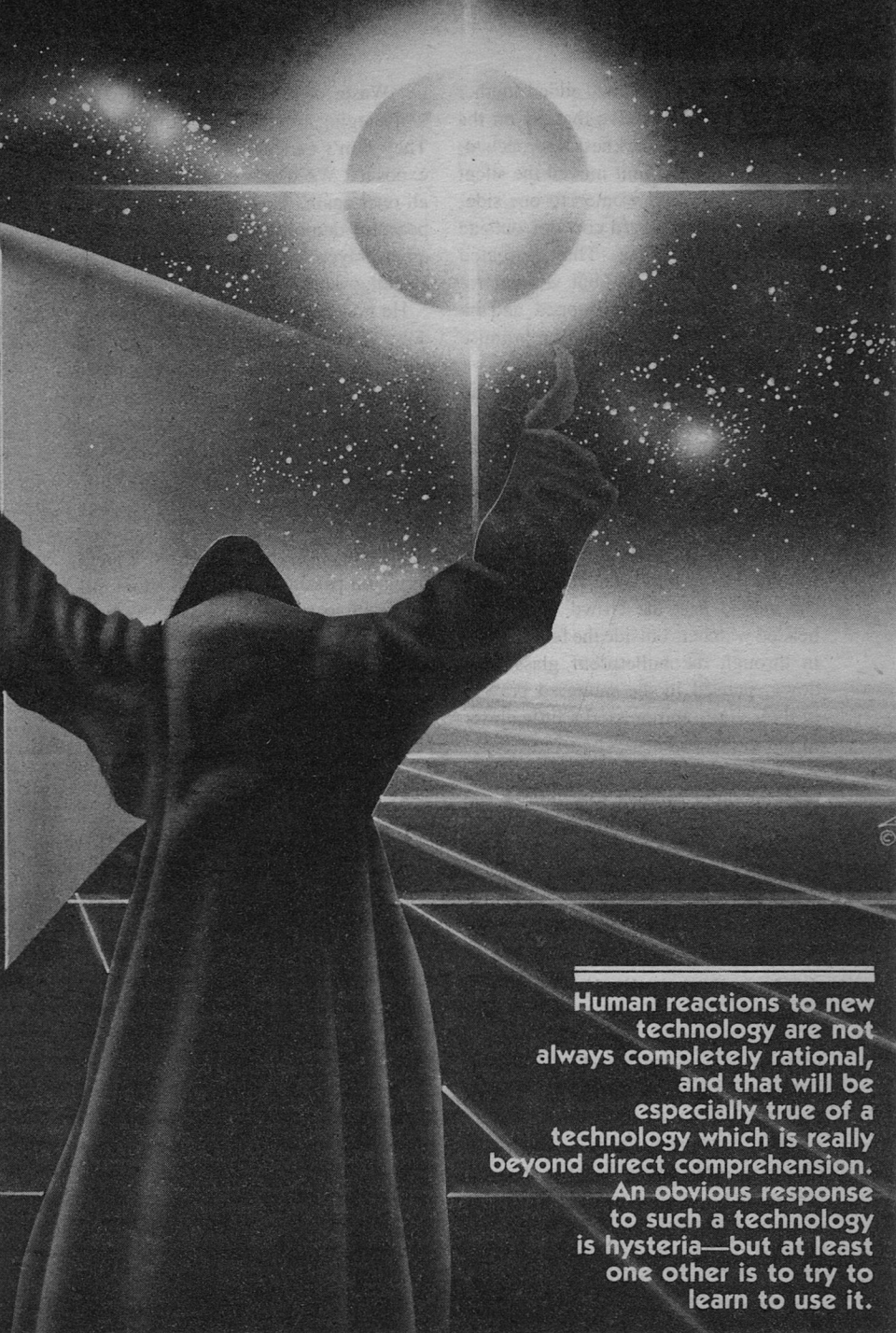
THE DOMINUS DEMONSTRATION

Charles Sheffield




Human reactions to new technology are not always completely rational, and that will be especially true of a technology which is really beyond direct comprehension. An obvious response to such a technology is hysteria—but at least one other is to try to learn to use it.

A day of steady snow had added another six inches to the twelve that lay on the ground. Now, as darkness approached, a National Guard unit moved the silent group of men and women to one side, to leave a twenty-yard corridor outside the chain-link fence. They retreated from the road slowly, but without resistance. The wind had dropped, and the sky was a dull overcast with a promise of more snow.

An Army vehicle approached over the partly cleared road from the airport, scrabbling and slewing its way towards the isolated building complex. Its wheels had poor traction despite the chains and four-wheel drive. The driver, conscious of his cargo, drove with great concentration. He slowed even further as the car moved past the crowd. The bareheaded watchers outside the fence stared in through the bulletproof glass windows, paused in the muttered prayers of their vigil, and pressed a little closer to the guard pickets.

To the two men who looked down from the main building's sixth floor, the hump-backed car was dwarfed to a mottled gray and brown crab, creeping its carapace up to the guard box at the front gate. The taller of the two rubbed his hands together and shivered.

"Cold, Jim?" said his companion.

"Nah. Not really." Jim Bevin shrugged. "Just watching them gives me the shivers. It's still getting colder. If they stay outside tonight we'll have a dozen more cases of hypothermia to deal with."

"If we're lucky. There's a lot more people than last night. Must be close to a thousand out there right now. Want to try to have them moved inside?"

"Waste of time. Their lawyers are still hanging around. Bunch of vultures. They don't care if their clients die of exposure. We'd hear the same argument all over again. They quote the 'right of peaceful demonstration,' and 'right to quiet prayer'—but you don't see *them* standing outside."

He nodded his head toward the window. The advancing car had moved closer to the building and was hidden by an overhang of masonry. The watchers outside the fence had turned their attention again to the tall building.

"Thank heaven he's finally arriving. Maybe we can settle this thing one way or the other."

"Yeah. Maybe." Rafael Chang shrugged pessimistically and shook his head with its tangle of dark, bushy hair. "I won't hold my breath. Want to go down and meet him?"

"No. But we'd better do it. No point in losing his sympathies before he starts. He was our first choice, and we got him. Let's make the most of it."

By the time they reached the lobby the car's single passenger was inside, signing the guard book, then straightening, blowing on his hands, and stamping his feet on the tiled floor. As the elevator doors whined open he turned slowly and nodded a greeting.

"Rafael Chang. How are you? You've put on a little weight."

"Long time no see. It's been nearly ten years."

"That long? Seems like yesterday." He turned. "And you must be Doctor Bevin. Did we ever meet back there? I know your name, but I don't recall your face. My memory's not what it should be."

The newcomer stood perfectly still, as though inviting their appraisal. He was tall, with thinning white hair and eyes of faded blue. His clothing was an expensive tweed, well tailored to his long, rangy body. The hand that he at last held out to Jim Bevin was thin, blue-veined, and marked with liver spots.

"We met only once, sir." The honorific came without thinking, surprising Bevin. He coughed self-consciously, suddenly aware of his grubby cardigan and battered leather shoes. "I'd be amazed if you did remember me. I was working for Control Data, and you ran a procurement review that I attended. But I was just the go-fer, carrying in flip charts and hoping nobody would ask me anything."

The visitor smiled. "I'd be lying if I said I remembered it. We had two of those every week. Most of them I'd rather not think about. You two aren't the go-fers now, eh?"

"Sometimes wish we were, sir." Rafael Chang took the outstretched hand, noticing the lack of strength in the other's grip. "I remember the last review you did with me, after my promotion. It was on the Randall Mark One, and the schedule had slipped. You roasted me—I was nervous for weeks." *But how you've aged,* the thought ran on. *It's terrifying to see what ten years can do to even a healthy man.*

"But you finished ahead of schedule. I remember that one. Happy days, eh?" The pale blue eyes beamed. "Why don't we get out of this lobby. The car was freezing, and this place isn't much better. I'm not used to the cold these days."

"There's hot coffee upstairs." Rafael Chang led the way to the elevator. "If you'll excuse me, I'll make sure everything is ready for you in the visitor's suite. Jim will show you the lab. It has a small kitchen, General, if you're interested in food."

"Not in the slightest. They stuffed me on the flight up. And please, cut out the 'General' bit. I dropped that when I retired. Can't stand people who treat their old titles as a lifeline. These days it's plain Tom Armstrong."

"Yes, sir." Rafael caught the sideways look from Jim Bevin. That adjustment wasn't going to be an easy one. "Did you have a good journey?"

"What do you think? Twelve hours from Boca Raton, Florida—seventy-two degrees when I left this morning—to Chippewa Falls, Wisconsin. What's the temperature outside now? Can't be more than twenty, and the forecasts say it's going to be colder tomorrow."

They ascended in the elevator, leaving Rafael Chang at the fourth floor. As Armstrong and Bevin entered the lab the old man looked alertly around him, from benches to monitors and consoles. There was little sign of the wires and breadboard assemblies found in a traditional electronics shop. Everything was small and neat, the compact units connected by massive fiber optic bundles. They paused before a dull grey cabinet, on which an English visitor had written in black magic marker "DOMINUS RULES O.K."

Tom Armstrong stared at it, his pale blue eyes thoughtful.

"I hope that's as much a joke as it was intended to be. When I was running things at Fort Meade I discouraged the idea of giving names to computers—any

computers. But everybody did it anyway. Why in God's name did you move the project here, instead of leaving it near Washington? I don't like the climate there, but it's at least half-civilized."

Jim Bevin poured coffee and handed a mug to the other man before he answered. "Blame Seymour Cray. He grew up in these parts, so when he had a chance to start a research center for Control Data, back in the '60s, he put it here. As soon as it seemed that Dominus was a theoretical possibility, I looked for experts on high-associative memories. They were all living out here, and they were damned if they'd fight traffic in suburban Maryland. So if Mohammet wouldn't go to the mountain . . ."

"It's certainly quiet." Armstrong moved forward to look out of the window, at the undulating plain, snow-covered and treeless, that stretched away from the buildings. He was clutching the mug of coffee tightly, warming his hands on it instead of drinking. "But it's a cold site for a demonstration. Look at them. They're not even wearing hats down there. And I can see a couple of TV cameras. You know, there's a lot of national attention focussed on this place. It was bad enough before the snow came along."

"They insist that their ceremonies must be conducted bare-headed. Six of them are in the hospital already—frostbite and exposure." Jim Bevin hesitated, and finally decided that he had nothing to lose by frankness. "Rafael Chang and I are very aware of the fuss over this, sir. We were the ones who started to agitate for an impartial and respected arbitrator to come here and analyze the situation. We feel a lot of responsibility. We are hoping for a quick decision."

"You mean I've got you to thank for being dragged out of retirement? Well, damn your eyes." Armstrong grinned, taking the edge off the words. "I can promise you a quick decision, as soon as I have a full understanding of the problem. I don't want to spend winter in Wisconsin. But I can't promise you the answer you want to hear. And first I need more information. Can all the consoles here tap into the data banks?"

"Every one. Want me to log on?"

"Not now. I assume there's a terminal in my room? Good." Armstrong yawned, then shivered. "I'd like something from the two of you as well. A fair chunk of written material was waiting for me on the flight here, so I'm coming up to speed. But I would like *recent* written summaries on the attosecond module and the high-associative memory."

"We'll get you something. Rafael and I may have to write it tonight."

"Keep it short. I know the work goes back over five years to the time that the prototype was patched in to Magsman Three, but I don't want old history. And I need more general background on the Church of Christ Ascending. There was nothing about them in the briefing files. All I know is from the media coverage. How old are they?"

"About five years. They started in '94, as a group preaching that the Second Coming would occur at the end of the Second Millennium. But they only began to proclaim Dominus as the agent for its arrival about two years ago. They've grown fast."

"I know. I've seen their placards. 'Supercarnata inorganica,' the inorganic made spirit. You fellows have only yourselves to blame. Why choose Dominus as a name, for heaven's sake? You were asking for trouble."

Jim Bevin shrugged. Armstrong had a way of speaking that sounded polite and easy-going, but it left the listener in no doubt of his own follies. "It was just another dumb acronym—everything gets one, and we thought it was neat at the time. Deuterium Oxide Matrix In NUcleated Suspension: DOMINUS. It describes the new technology we're using, with deuteron spin-flip gating. And the fact that the word means 'Lord' or 'Master' just seemed like a good joke. It backfired on us, but we certainly didn't expect anything like this."

"Don't feel too bad about it. You're not the first. I became sensitive to acronyms the hard way. When I was still down in the woodwork at NSA, my team was developing silicon-lithium circuits around a frozen heavy water lattice."

Armstrong shook his head slowly and picked up a pad. "I had to make the presentation. I showed old Blimp Wallace the first flip chart, the title of the project. Silicon-Lithium Suspension Of Deuterium. He stood up from the table, walked to the easel, and picked up a marker. 'You realize,' he said, 'that everyone is going to want an acronym? And if you're not careful, it will be this.' And he changed the chart to read: SIlicon-LIthium Suspension Of Deuterium: SILI SOD. 'I think before our next meeting you should try again on the name,' he said. 'Unless you want that designation.' Ever since then, I've been more careful."

"Yes, sir. The point's well taken. If you're ready, we can go ahead to the visitor's suite. By the way, there is a press conference scheduled for noon tomorrow. All right?"

"No. Too soon. Hell, I'm nearly seventy years old. I can't mop up information like a sponge and dispense instant wisdom. Change it to four." Drawn to the window again, Armstrong had walked forward and was staring at the landscape, bright with television spotlights. "No, better make that earlier. Fifteen hundred hours. We can't let them wait here forever. But I'd like to go at it hard in the morning. Can you and Rafael Chang have breakfast with me tomorrow at half-past six?" He caught the other's look of distaste. "All right, half-past seven."

"Very good, General. I'll tell Rafael."

"Remember, you fellows have to educate me *fast*. I don't know shit about what's been going on in this business for the past ten years. I went out with picosecond memories. And cut out the 'General' bit, for Chrissakes. It won't be easy to educate me if we stay too formal. I have to feel free to show my ignorance."

"Yes, sir. Yes . . . Tom." The name came out flat, like a dead weight. Bevin moved forward to Armstrong's side, and together they peered out into the night. A new unit of the National Guard was coming on duty. The crowd on the eastern fence was still growing.

"They'll be there all night?" said Armstrong at last.

"All night, all day. I don't know

where they get their information, but the big crowd will be here the day after tomorrow. Somehow they've heard that Dominus is supposed to go on line with all units at seven P.M. on December 16. That's their time for the revelation of Christ Ascending."

"Then we'd better not switch on at seven, had we? Surprising, don't you think, that they didn't choose Christmas Day." Armstrong sighed and yawned hugely. "Come on. Let's get out of here before I fall asleep on you. I've been up since 4:30. This is the time of Tom Descending. What are they *doing* down there?"

The crowd on the snowy plain was in gentle motion, each person rocking from left to right. Bevin opened the window a fraction. Faint sounds came up to them, like a slow, mournful plainsong.

"They do that every night, sir. Actually, you find you enjoy the sound when you get used to it."

"It beats lots of music. But it's creepy. 'Chanting faint hymns to the cold fruitless moon,' eh? Except we'll not see a moon tonight, those clouds are here to stay for a while. That's worth something. At least the poor devils won't freeze too hard. And not a damned hat in sight."

Tom Armstrong turned and headed slowly towards the lab door.

"He's a harsh master, the God in the Machine."

"All right, ladies and gentlemen. I'll tackle any questions that I can answer. Sometimes I'll call on Dr. Bevin and Dr. Chang here to help out, but when I do you can be assured that it's my ignorance, and not buck-passing. Try to remember that I only arrived here yesterday."

Armstrong's age and Florida tan set him apart from the others on the platform. The three of them were on a low, raised dais, at a table with built-in microphones and desk-top computer consoles. The backcloth behind them was plain dark blue, and four television cameras were already recording everything, questions and answers.

Jim Bevin did a quick head count of the reporters. About thirty—at least twice what he had expected. Thanks to the demonstrators outside the fence, public interest was growing steadily.

"I think we're ready to begin." Tom Armstrong pointed a bronzed index finger. "The gentleman in the red tie."

"General Armstrong, when you retired as head of the National Security Agency, you said—and I'm quoting—'From now on, don't ask me anything about computers, cryptanalysis, artificial intelligence, or triple-locked software. If you do, I won't answer. Ask me about fly-fishing, water-skiing, orange groves, pretty girls, and sunshine.' Are you proposing to hold us to that this afternoon?"

The laughter eased the tense atmosphere in the low-ceilinged room. Jim Bevin felt his own uneasiness subside. Only Rafael Chang, more devious in his outlook and familiar with Armstrong's old subtlety of operation, had a different thought: Was it a planted question, to achieve that precise relaxing result? The General would have done it just that way in the old days.

Armstrong spread his hands wide on the table. "I don't have to tell you where

my personal preferences lie. But I'll stand by my statement of a couple of minutes ago. I'll answer anything I can, and I'm not restricted the way I used to be by worries about national security issues. So let's go." He pointed again. "The lady at the back in the beautiful green blouse."

"Thank you, General. We have a problem covering this story, because we keep talking about Dominus, but we've never had a chance to *show* viewers the computer. Will it be possible for us to do that?"

"I'm afraid not. It's not that we're trying to keep something from you. There's nothing to see, not all in one place. Dominus is what we call a 'distributed system,' which means that there are bits all over this building. Some central processing units on this floor, some peripherals and bulk storage devices upstairs. All over. And seeing the bits doesn't help too much. Here—"

He picked up a small assembly, roughly spherical in shape and small enough to fit comfortably in his spread hands. "This is a prototype of the attosecond memory, one of the most important parts of the machine. As you can see, it's not much to look at. And if I broke it open for you, there'd be even less to admire. It's like an intersecting set of thin sheets inside, with a sort of cotton candy of glass material between them. All the signals are carried using laser optics, and before it's used the assembly is cooled to about three degrees Kelvin. We'll show you any bits you want to see, but they'll all be as unimpressive to look at as this one. Next? I think the gentleman from NBC was first in line."

"Yes, sir. We've heard many stories about the significance of the system that may be brought on-line tomorrow, everything from divine power to just another dumb ol' big abacus. Would you please tell us how Dominus is different from any other computer in the world?"

"I'll give you my simple-minded answer, then hand over to Dr. Bevin to correct me and provide the details. In two words: speed, and complexity. Dominus sets new standards for both. Now, I could make an argument that says making a machine faster doesn't produce any real difference. But when you have a speed increase of many orders of magnitude, patterns of adaptive logic can be employed that would be impractical at lesser speeds. What looks like a quantitative improvement eventually becomes a *qualitative* difference. Dominus has huge speed, and that adaptive logic. As for complexity, no human can track the detailed structure of Dominus. Its general design was provided mostly by Magsman Three."

"Mag's whosit?"

"Magsman Three is the immediate predecessor to Dominus. It pointed the way to the machine that followed it."

"I see. Sort of like John the Baptist?"

Armstrong grinned. He had not lost the knack of steering a meeting his way. "Your words, not mine. I don't think of it that way. Jim Bevin, would you like to amplify what I said?"

"A little. One of the points that I've been stressing for the past couple of years is that Dominus isn't really a completely separate machine from Magsman. As General Armstrong said, much of Dominus was designed by Mags-

man's programs. But more than that, we'll be using eighty percent of the same cpu circuitry, and almost all the same I/O and storage peripherals. Dominus is Magsman Three, greatly augmented by two new elements."

He leaned over and took the grey spheroid from Armstrong.

"Here's the prototype for the first of them. A gigabyte attosecond memory. To give you an idea what that means, with this unit on-line Dominus will be able to perform ten to the eighteenth logical or arithmetic operations a second—that's a million, million, million. What took Magsman Three, the fastest and most complex machine now in existence, one full year to compute, will take Dominus about half a minute. So not only is there no human or group of humans capable of checking the results that Dominus will produce—there is no computer or group of computers able to do it, either, for anything more than trivial test cases.

"The second new element in Dominus is a high-associative memory. A trillion bits of it. We've had this available for nearly five years, but we've never used it before in a system with complex architecture."

Tom Armstrong had been carefully watching the faces in front of him. "I think a few more words of explanation would be appreciated, Jim," he said. "For me if for nobody else."

"Sure." Bevin looked down at the table for a few seconds, organizing his thoughts before continuing. "I don't think it helps to go into hardware details, but let's talk function. I guess you know that computer memories don't operate the way that human memories seem to. If we want a piece of information—say, somebody's phone number, or maybe the way their house looks—the association inside our heads goes very fast. We feel as though it takes no time at all, even though human nerve impulses are snail-pace compared with electronics, and we have billions and billions of pieces of stored information in our brains. Somehow we can associate things, one with another, without going through a systematic search process. Fundamental point: *humans have associative memories*. Existing computers can't operate like that. They have to search and match data systematically, either serially or in some modified version of a serial search, like a binary sort. So it may take a long time to find a phone number for a given name, especially in very large files. Clear?"

He looked around at the audience.

"I can never remember anybody's damned phone number," said a voice from the middle of the room.

"Me neither," said Armstrong cheerfully. "Go on, Jim."

"People have been trying to build a computer memory that operates more like a human memory for forty years, ever since the Perceptron. We weren't very successful. We finally presented all the data we had on the problem to Magsman Two, and then later to Magsman Three, and let it grind away on it. Six years ago we had the elements for a new design. Terrific, eh?" He smiled. "Just one problem: nobody could understand how it was supposed to work. The machine had been through an enumeration process that we couldn't hope to duplicate. We built it anyway. It seemed to do its job, but it did a few

other things too—I don't know if I should get into this—so we've only included it as an available unit in our sysgens for short spells."

There was a stirring of stronger interest among the reporters. Bevin looked questioningly at Armstrong. The other man nodded his encouragement.

"Go ahead, Jim. I promised we'd not hold anything back. The performance of the high-associative memory may be a mystery, but it's not a secret."

"Very well. Let me start, then hand you over to Dr. Chang. Most of this involves software questions, and where the software starts, I stop. But I'll tell you one of the hardware mysteries. The circuits for the final memory included aleatoric components. That's just a fancy name for pieces that introduce random elements into the system. In the case of the high-associative memory, those are produced from quantum level fluctuations—completely unpredictable. It means that the outcome of the calculations, and the logical circuits employed to make them, can never be known in advance." He grinned at the expressions of the faces in the audience. "I know. We didn't like it too well, either, when we realized what was going on. Now I'll let Dr. Chang make it worse."

He paused, as a hand was raised in the audience. "Yes, ma'am?"

"Can you show us this 'high-associative memory'? People will want to know what it looks like."

"Rafael?"

Chang nodded, reached beneath the table, and picked up a glittering object the size and shape of a shoebox. He placed it gently on the smooth wooden surface. "This is a prototype. The one that will be used in Dominus is a little smaller, but not much." He raised his eyebrows. "I don't know how interested you are in cost figures, but this one cost us sixty million dollars to develop, and almost nothing to fabricate. The assembly was done completely under computer control. I should also mention that the programs I'm going to describe were also developed largely by Magsman Three and its predecessors.

"Let me get to questions of software performance. We found two things happened when we began to use the high-associative memory on real problems. I'll call the first one the 'realism' problem. In human terms, you might say that the system doesn't have too good a grasp on reality. Sometimes we receive logically possible—but practically outlandish—solutions to the problems we enter."

"Let's have an example, Rafael," said Armstrong. "I don't operate too well with abstractions, and maybe some others here are the same."

"Here's a simple one. We defined a problem in microcircuit design, trying to lay out a mini-microchip in an optimal way. Very standard, very important practically." He drew in a deep breath. "All right. First few cases, the output was conventional solutions. So then we threw in a much harder case, where we weren't at all sure that a feasible design solution existed. After a few minutes' computation—which is a huge amount, for these machines—we had an answer. But it wasn't a useful one. The connections were to be made in a space of more than three dimensions. Theoretically interesting, but off the wall. Again, if you

want to describe it in human terms, you might say that the high-associative memory made the machine smarter, but maybe it did so at the expense of common sense."

He paused. Another hand had been raised in the audience.

"Dr. Chang, you've used words like 'smart' and 'remember.' Those are terms I'd reserve for people. I want to know, will Dominus be able to *think?* I mean, the way that we think. Wasn't there some test done to see if that was true?"

"Let me handle this," said Armstrong quietly. He looked up, blinking in the bright lights. "I'm sure that what you are referring to is the Turing test. It's a classical test, proposed by Alan Turing in the 1940s, to see if a machine is 'intelligent.' But it has problems. The idea is that you communicate with something—a machine or a human—over a remote connection, so you can't see, hear, smell, touch, or taste what's at the other end. Then you are allowed to ask any questions you want. If you can't tell from the replies whether you're in touch with a man or a machine, then the machine is said to be intelligent. Sounds good, right? The initial partial tests of Dominus included a test of the Turing type. And Dominus *failed*—the first time. The machine had inhuman powers of memory, superhuman computation speed, and never made an error. The testers knew damned well it wasn't a human. On that test, Dominus was too intelligent to be human. On the second test, the machine passed. A heuristic analysis of the desired objective, based on the record of the first test, allowed it to simulate lapses of memory, slowness of thought, and all the thousand failings that flesh is heir to."

He smiled at the perplexed expressions on the faces of the audience. "Can Dominus think, ladies and gentlemen? I don't know. I suspect that it can do at least as well as any of us. I don't think that was the answer you perhaps wanted, but it's the best one I can offer. Rafael, would you like to finish what you were saying about your worries over the high-associative memory? Then we ought to call it a day. Our audience has deadlines to meet."

Chang nodded. "It won't take a minute. The second anomaly we've noted I call the 'sense of humor' problem. It's not easy to put in concrete terms, but when there are several solutions permitted to a problem, the one rated highest by the machine is often the *least* likely. There appears to be a preference for the most surprising answer. Surprise is central to most humor. Having said that, I should point out that I'm stating this in very anthropocentric terms. I shouldn't do so. These are purely technical issues. The groups that are opposed to activating Dominus do not seem to distinguish human emotion from computer operations."

"How are you responding to the civil suits that those groups have prepared?" The question was interjected by a reporter in the back row.

"Mine again, I think," said Armstrong. He stood up. "I don't have a good answer for you. I wish I did, and I wonder what I'm doing here at all, in all this snow and lousy weather. It's snowing again outside now. That's the bad news. The good news is that we won't have to worry about the civil suits

to reach our decision on activation of Dominus. As you know, there are two suits involved. The Church of Christ Ascending wish to force the program to proceed. The Citizens for Appropriate Technology seek an injunction to prevent it. Shortly before we began this meeting, the judge called the lawyers for both groups. He will neither halt the final assembly of Dominus nor will he require that the final hook-up take place. He will leave the responsibility here."

Armstrong shielded his eyes against the lights and scanned the roomful of attentive reporters. "I will offer you one guarantee. Some of you have been here for a long time. I think I see shirts that have been worn for more than one or two days. None of us wants to spend the winter here. I promise you a decision within twenty-four hours. One more day, ladies and gentlemen."

"Have you already made your decision, but don't want to announce it?"

"We have not. We need more time to think, and with your permission we will go and do it."

"One last question, General. Did you know that the members of the Church of Christ Ascending are still rolling in here? Our estimate is that there will be more than twenty thousand of them tomorrow. They plan a mass demonstration."

"I know." Armstrong shrugged. "The judge refuses to block that demonstration. We will go along with that. But let me assure you the decision will not be forced by pressure from any groups."

"All right, gentlemen. We're down to the last lap. Speak now, or not at all."

Armstrong leaned back in the center seat and waited. The three men were sitting in line in comfortable chairs in the visitor's suite, staring out of a deep window of one-way glass. The lights in the room were turned low, so that they could observe the clearing afternoon sky. The forecast had definitely called for more snow, but the clouds of the past week were dispersing. They had drawn out to long, fragile wisps. The sky directly overhead was taking on a deep, clear blue, and the temperature was dropping rapidly.

Four stories below, the flat area beyond the complex was covered with thousands of people, standing, talking quietly together, or kneeling in small groups. As far as the horizon, moving figures could be seen. More people were arriving, steadily converging on the crowded area. TV cameramen, readily distinguished by their warm headgear, weaved through the assembly.

"If you have nothing to say," went on Armstrong after a long silence from the other two, "then let me tell you my main worry. It's not the machine and the things I've heard about it. It's the two of you. Here I am with the principal designers of Dominus. Hardware and software, you've nursed this along from the beginning. True?"

Jim Bevin looked across at Rafael Chang, and both men gave slight nods.

"So it's nearly nine years of your lives," said Armstrong. "That's what you each have invested in this project. Now we're approaching the final step, the fruition of all that work. And suddenly I receive a request from Washington. The project has been receiving pressure from two different directions

—one to delay it, the other to force it to proceed on schedule. Would I provide an independent review, and make a final decision? Very well. I agreed, I came here, and I've listened and learned a lot. But through all of the listening and learning, one thing has been missing—conspicuous by its absence. Know what I'm talking about?''

The other two looked perplexed. After a few seconds Chang silently shook his head.

''All right, I'll tell you.'' Armstrong's eyes were old, thoughtful beneath the wrinkled brow. ''I was waiting for the big pitch from both of you—to go ahead and put Dominus on-line. Even if that would have been the wrong decision, it was natural for you to try to persuade me. The project is your baby, many years of work. But you haven't said one damned word to influence my opinion. I want to know why you haven't. Rafael?''

Chang hesitated, rubbing at the dark bristles on his chin. By late afternoon he always looked unshaven. ''Yeah. You're right.'' He sighed. ''We've not been pushing. A year ago Jim and I would have said, get moving, turn Dominus on as soon as possible, and to hell with more delays. But we've had some strange experiences over the past few months. They might not make an impression on you, or anybody who hasn't lived with this project, but they've affected us.''

''We didn't want to talk about them,'' added Bevin. ''It took months before we could bring ourselves to mention them to each other. We felt sure nobody else would understand.''

''Try me.''

''I can give you a good example,'' said Chang. ''Even with only a fraction of the system hooked up, Dominus is still far and away the most powerful computer ever built. So I wanted to take advantage of that by analyzing socio-political problems, where nobody has good models because the input variables are so fuzzy.''

''What sort of problems? Do you mean political systems?''

''No, I'm talking mainly of resource allocation—how should we distribute food and materials? We stated the problem as well as we knew how and let Dominus go to work. Most of the answers we got looked very good, plausible and novel. But one output advised a population reduction of certain countries to zero. If we wiped out the people there, Dominus said, the overall world resource problem looked a lot cleaner. At first that output was funny. Then it was scary. Dominus stated it as the *best* solution. Gruesome. That's when I started to think of the machine as crazy, or at best having its own sense of humor—and a pretty black one, by any standards.''

''Did you evaluate your assumptions and your inputs? Garbage in, garbage out, even for something as advanced as Dominus.''

''That's not the way Dominus operates. It has access to all the data banks on this site, and it draws from them whatever it needs. After I got that answer I began to worry, but then Jim told me the trouble probably came from working with an incompletely assembled system. When we had all of Dominus running together the problems I was having would go away.''

"Sounds reasonable to me, Rafael."

"It did to me, too," added Bevin. "Then I got worries of my own. As you know, I don't care much about the software. There are quite enough hardware worries to keep me busy. The design for the attosecond memory came out of Magsman Three, with the associative memory added. It works fine, and it's wonderful as long as you don't look at the implications. I got worried when I did a little simple arithmetic. Dominus can do a multiplication in ten to the minus-eighteenth seconds. That's so little, light travels only a couple of times the diameter of a hydrogen atom. The logical circuit units in the attosecond memory are thousands of times bigger than that—so how are the signals getting between the components?"

"Parallel logic? That's the obvious way you'd increase overall processing speed."

"It is, General, but it's not the answer. The attosecond memory has a *serial* design logic—in fact, a faster unit is under consideration now that will operate with parallel components and should be a thousand times as fast. So the attosecond memory looked like an impossibility. Only it worked."

"I see." Armstrong sat silent for half a minute, staring out into the gathering dusk. "So what's your explanation?"

"I don't have an explanation, except through a bigger mystery. I finally asked for a listing of all the theorems and papers employed in the Magsman design for the fast memory. They were exactly the sort of things I expected—papers on solid state phenomena, superconductivity, and information theory. But there was one exception. I found twenty-one citations of papers relating to Bell's Theorem."

"Never heard of it."

"Not too surprising. It's a result from quantum theory. One interpretation of the theorem is that non-local phenomena are possible; actions in one place can be coupled to actions at another without being limited by the speed of light. If I let my imagination roam free, I'd decide that signal transmission within the attosecond memory is not lightspeed limited."

"Have you looked for confirmation elsewhere?"

Bevin grimaced gloomily. "I sent the output and the suggestion to CalTech. So far, no answers. See why we've been worrying, General?"

"I do. Anything else?"

"Rafael has one. But it's still too wild for me."

"I don't like it any better than you do," said Chang. He turned to Armstrong. "We tackled some geophysics. We've never had a full computer solution for the rotational motion of the Earth—too messy, with core convection, tidal forces from the other bodies of the Solar System, and the inhomogeneous heat balance calculations. So a few months ago I decided to let Dominus have a go at it. We switched the full system on only for short test spells, a few minutes at a time, but with its speed that's an incredible volume of computation. We produced a nice result, with detailed predictions of polar motion for the next year. Everybody was very happy, and we were even more pleased when we checked the predictions against the new observations, and they were spot on. We sent the results

along to the Naval Observatory, and were all set to write up the results."

He paused.

"Until?"

"You've got it. Until the Naval Observatory people called back here, to point out that there had been errors in the previous *observed* values they had sent us for polar wander. Those erroneous values had gone into the inputs that Dominus used in its calculations. The correct historical values would have led to different predictions. Dominus has been making the wrong predictions—*and the Earth has been following them.*"

"Rafael, that's impossible."

"I know it. It's also what happened. These last few weeks I've been thinking. If you build a machine that performs as many logical operations in one second as the whole human race performs in a year, what will its state be at the end of a few hours of operation? What capabilities might it have that we can only begin to guess at?"

Before Armstrong could respond there was a sudden increase in the noises of the crowd outside. He looked at his watch.

"I see. Three minutes past six. Jesus, just look at them."

The crowd below was so densely packed that the snow cover was hidden. Beyond the main group, smaller clusters were dotted over the frozen surface, out past the point where the yellow floodlights ended. There was no movement except for a steady rocking back and forward of each person. The sound level was growing, a sibilant continuous hissing over lower muttered consonants. It was a single word, repeated over and over by forty thousand voices.

DOMINUS . . . DOMINUS . . . DOMINUS . . .

Rafael Chang leaned forward, staring down to the area closest to the building. "I hope the guards down there don't over-react. The demonstration is timed to a seven o'clock peak, when Dominus was scheduled to be fully integrated."

"The crowd doesn't look violent. They seem to be in a trance, almost," said Bevin. "What are you going to do, General?"

After one long look at the crowd below, Armstrong had leaned far back in his chair and closed his eyes. He seemed oblivious to the other two, and to the sounds and sights outside the building.

"Tell me, Jim," he said at last. "You've been testing the subunits of Dominus for over eight years. Correct?"

"We started in May of '91, didn't we, Rafael? So it's been eight years and eight months."

"And for all that time, you've been building and testing pieces of the final system. Now tell me, is there any part of Dominus, even the smallest circuit, that hasn't already been used, many times over?"

"Not a chip. We've never had all the system integrated, but we've done module testing a hundred times."

"That's what I thought. I've another question for you. Rafael, what data bases do you keep online at this installation?"

"The complete list? I can't quote you that off the top of my head, but we can read it out through a terminal easily enough. I know for a fact that we've got

complete physics and math for all the major journals, and there's chemical abstracts, and all the important electronics references, plus a lot of geology and astronomy. Plus a smattering of other stuff. Do you want everything?''

''No. That will do. Jim, can you perform final system integration from here?''

''Right at that console.'' Bevin pointed a finger over his shoulder. ''If we decided to go ahead, it would be a two-second job.''

''Good.'' Armstrong stood up. ''I've made my decision. Go ahead, bring the system online. Do it now and let's disperse those demonstrators before they all freeze. But we have to do one other thing as well. I want you to call Washington on a Domsat link and start transferring other data files into your banks here. Bring Dominus up, then I'll give you the access codes.''

After a moment's hesitation, Bevin stood up and went across to the control console. He stood there without moving.

''Are you sure about this, General?''

''Quite sure. I've got questions, and I'd be a fool to pretend I know everything about what we should do. I'm as worried as you are. But I'm absolutely sure of one thing. We'll solve nothing by delaying the completion of Dominus. I can't think of a case in human history where it helped to slow technological progress. At best it defers the problem, and in the long run it makes things worse. We're not the only people working on advanced designs. If Dominus is stopped here, a machine like it will be built somewhere else. Go ahead. But make sure you get that communication link through Domsat into the system from the beginning.''

While the brief command string was being entered through the console, Tom Armstrong took a brown wallet from his pocket. He removed a sheet of paper and handed it to Jim Bevin.

''Do this in a particular order. I want the Library of Congress files transferred first: history, art, literature, music, philosophy, and anthropology. Then we'll take Medline for all the biological data, plus all the psychology. Then all the politics and social science references. Any problem with any of those?''

''Not if these access codes are correct.'' Bevin was silent for a few seconds as he entered the call codes. ''I'm glad you've made the decision, General, but would you mind telling me why we're doing this?''

''I'll be glad to. I'm not out to create a mystery. What Rafael observed in the behavior pattern of Dominus shouldn't be surprising—not if you will first accept that this is an intelligent machine. Even with only parts of the system online, Dominus already possessed the capacity and billions of times the speed of the human brain. Normally we try to avoid thinking of machines in human terms. This time, let's do the opposite. If Dominus were human, what would its present characteristics be?''

Rafael Chang had moved forward to stare at the console, where Bevin had typed in a final character string. ''That's a complex question.''

''Give me a simple-minded answer.''

''Well, if Dominus were a man, he'd be super-smart. And he'd have total recall.''

''Correct. But of what? Only what

you kept in the local data banks. Only the hard sciences. But you were setting problems for the machine that required more than intelligence and memory—you were calling for judgment, even wisdom. Dominus is no more than a very bright baby, an *idiot savant* with fantastic logic and computation power, but shielded from knowledge of most of the real world. In human terms, you have a data-starved supergenius. Do you wonder that sometimes Dominus seems unbalanced and insane, and comes back with completely outlandish solutions?"

"The communication link is up," broke in Bevin. "See, that's the Library of Congress access code. Information transfer has begun to Dominus's data banks. It's going to take a long time, though. The satellite link has a gigabaud transmission rate, but we're tapping into some colossal files back there."

On the screen, a steadily increasing numerical index recorded the receipt of the incoming files. As the final sysgen for all components of Dominus was completed, the index became a continuous blur of green.

"Good," said Armstrong. "Do you think we can hold this rate? Won't Dominus have to slow down for sort and store activities?"

"Not for a gigabaud line." Bevin looked pleased for the first time in several hours. "A billion bits a second is nothing for this machine. Receiving at this rate exercises less than a millionth of Dominus's capacity. It won't be wasted, though. The rest of the time, the associative memory will be examining data redundancy and cross-correlations. It will—"

He paused and turned his head. "What's that noise? They can't possibly know we've turned Dominus on ahead of schedule."

There had been an abrupt change in the sounds reaching them from the crowd outside. The steady chant had become an outburst of hysterical screams and shouting. The three men left the console with its flickering display of data receipt and hurried over to look out of the window.

The people below were no longer looking towards the building. Every head had turned to the horizon. After the initial cries of surprise, the members of the Church of Christ Ascending had fallen silent. The wind had dropped and the evening air was totally still and clear. Orion hung in the eastern sky, in the familiar outline of the celestial hunter. Below and to the left of the constellation was a fiery point of unbelievable blue. It grew in intensity second by second.

"Sirius," said Armstrong, almost under his breath. "That has to be Sirius."

"Yeah." Bevin squinted at the dazzling point of light. "But it's too bright. Way too bright—see, it's throwing shadows down there. It's a nova. But it's the wrong stellar type for a nova."

"They don't care," said Chang. "Look at them."

The people below were falling to their knees on the snowy ground. The star, still increasing in brightness, was turning the outside floodlights to pale yellow ghosts.

"Of course they don't," said Armstrong. "It's what they've been praying for. The sign, the star in the east. The coming of Dominus."

"That's absurd." Chang gave a snort of uneasy laughter. "Sirius is lightyears away. The nova must have happened a long time ago, for the explosion to be reaching us now."

"Eight point seven lightyears, I think," said Bevin quietly. "So it happened about May of '91. That was when we had our conceptual design and began to assemble the first components of Dominus."

He drew a deep breath. The waxing star was brighter moment by moment, returning a blue-edged day to the sleeping, snow-covered earth.

"But that doesn't explain anything really," Bevin went on at last. "How could a signal get out to Sirius instantaneously? Why didn't *that* take eight years?"

"I think only Dominus can give you an answer," said Armstrong. He shielded his eyes from the light outside. "The star in the east. You said the machine had a sense of humor, but no sense of proportion. I believe that point has been proved. Let's hope you're as accurate about something else, too."

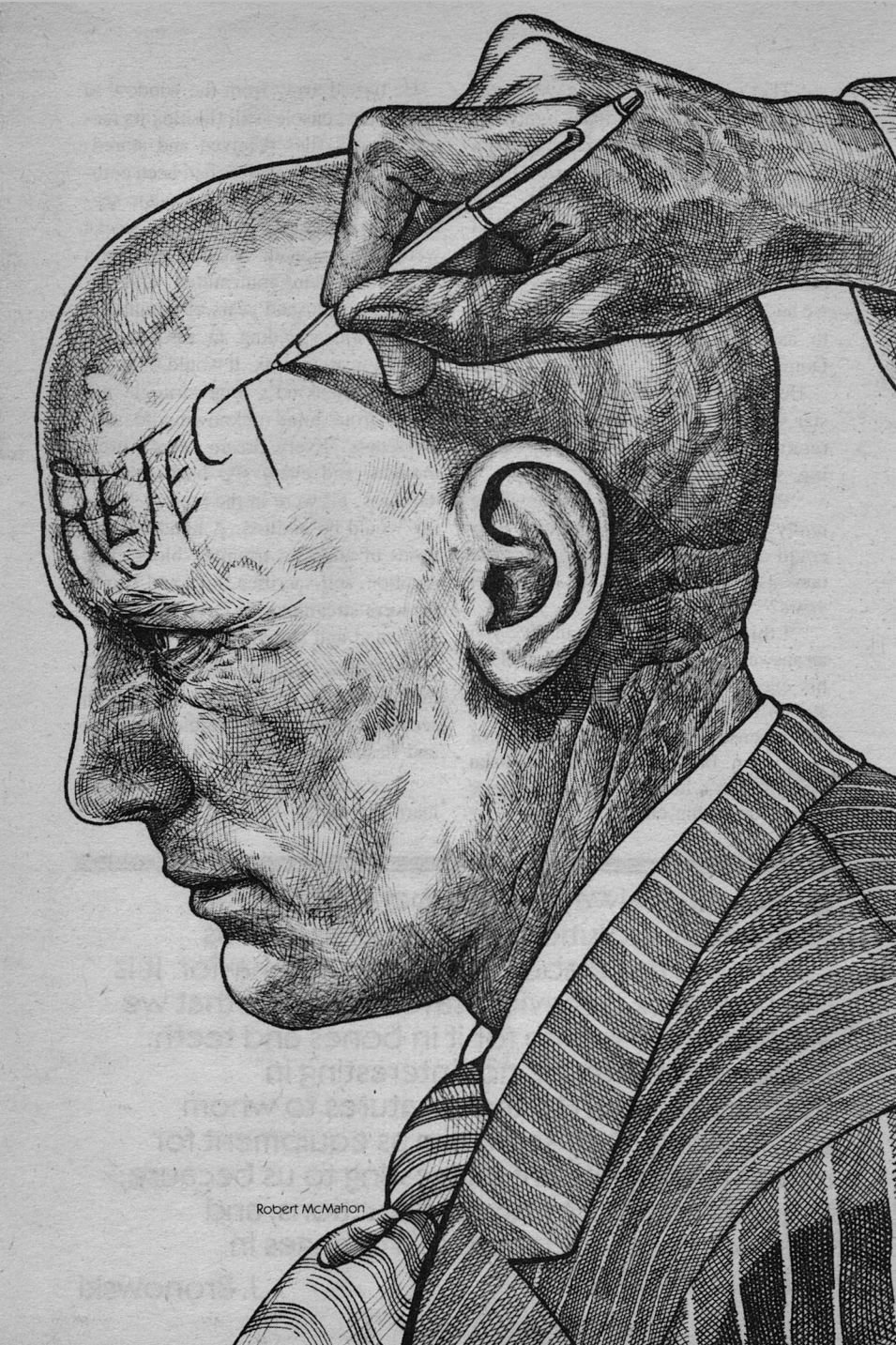
He turned away from the window to look at the console, still flashing its record of new files received and stored. The history file transfers had been completed, and now the art and music sections of the Library of Congress stacks were being tapped. Another mountain of data was being transmitted. The record of ten thousand years of human activities was speeding in through the communications link. It would show the steps of mankind's long struggle upward, from blind unknowing to self-awareness. Every dream, every great thought, and every slip back towards darkness, all were in the record. Nothing would be omitted. A hundred centuries of anguish, triumph, bloodshed, emotion, self-sacrifice, love and laughter were streaming in, to be examined, evaluated and stored by the computer.

Armstrong reached out and touched the screen with his fingertips, as though seeking the electronic life that flickered and flashed behind the cool glass.

"Let's hope that Dominus is a fast learner." ■

● We must always remember that the real content of evolution (biological as well as cultural) is the elaboration of new behavior. It is only because behavior leaves no fossils that we are forced to search for it in bones and teeth. Bones and teeth are not interesting in themselves, even to the creatures to whom they belong; they serve him as equipment for action—and they are interesting to us because, as equipment, they reveal his actions, and changes in equipment reveal changes in behavior and skill.

J. Bronowski



Robert McMahon

Rob Chilson

SLOWLY, SLOWLY, IN THE WIND

Knowledge is a valuable tool—but the most important thing about some facts is that they are not immutable.

The concession speech had been ready for weeks. Richardson was not a man to leave anything to the inspiration of the moment. But he did not tape it till the last week. He knew he would be worn down, strained, and he did not want the speech to seem to have been made in advance. The same for the victory speech, which now nobody would ever see.

Just before his concession speech was aired by the jubilant networks, Richardson stepped into the hotel suite's bathroom for a quick glance at himself in the mirror. He was shocked at the cadaverous face that looked back. Though the speech had been taped a week ago and he had definitely been feeling the strain of Groteckie's building landslide then, the taped image was hearty, confident, and well-fed by contrast with *this* face.

It had been a shocking defeat.

Marty Aaron sighed from deep down in his big belly when the speech was over, and cut off the happy announcer. "Well, Jim, congratulations on playing a losing hand out to the end, without any recriminations. That concession speech was almost statesmanlike."

Richardson looked at him in some surprise. *Et tu?* Did Marty of all people believe all that crap about him? The man'd been with him all this year. But all he said was, "Not quite yet. I've got to make an appearance before the troops. And be 'almost statesmanlike.' "

Marty glanced at him quickly, but heaved himself out of his chair. One of the aides called down to the Gold Room, and they were expecting him when he entered. There was a sigh rather than a roar, and little other sign of animation. From reports Richardson gathered there'd been some false gaiety earlier, but all this past month the tide had set strongly against them and there could have been no doubt that they would lose.

He gave them his patented grin: subdued now, but the grin of an undefeated man. "Well, troops, I understand that the squabbles over who gets what office have been dying down among you this past couple of weeks. I like that; it shows a good spirit."

There was a weak laugh. Glancing over them as he spoke on confidently, Richardson was struck by a thought: Where were the kids?

These were mostly of the older generation, and a lot of them were either paid professionals or paid volunteers. The unpaid amateurs, the college kids and youthful professionals who were the backbone of any campaign—well, he had never drawn many of them, but there had been some. But they all must have deserted a couple of months ago.

They all believed that psychometrics guff.

Richardson's "second concession speech," as he thought of it, was short, manly, and gracious, taking all the blame, giving his troops all the credit. They gave him the heartiest cheer that was in them, but it was obvious they cared very little. Mercenaries! As long as they got paid—

Back in the suite Richardson's first weary thought was that now he could get some sleep. But then he knew that he couldn't. He had to make plans: partly for the same reason that a person who's taken a fall must immediately get back up on that horse, and partly because it would look good if it was seen

that immediately defeat was assured, he was planning for the next battle.

"Well, Marty, how soon can we start the legal mechanisms for a run at Cy Thompson's Senate seat?"

Again Marty Aaron looked quickly at him. "What? Jim, that's crazy."

"Crazy?" Richardson was startled. "In what way? Cy is definitely retiring at the end of his term. That gives us a year to run for it—though he won't announce his retirement till after the fall session. It means a postponement, but it isn't the first time my career has been derailed."

He had had it all mapped out in his early twenties: minor state office, less minor state office, then the House of Representatives for one term minimum, then at least one Senate term, then governorship of a major state—probably for two terms: then the presidency, and still comparatively young. He'd been compelled to serve two terms as a representative, and the fight had been progressively bitter ever since. He had a reputation as a conniver, a schemer, a shifty politician who always took the side of a question that had the most votes. Well, that was politics; you have to compromise.

And now his defeat for the governorship derailed him again. Okay; he could take another term as Senator and run for president from that office; there was precedent for that.

"Jim, you are out of politics. Don't you know what this defeat means?" Marty was staring at him.

Richardson stared back. "Defeat? Did you think the loss of an election is a *defeat?* It's just a setback. I handled it well; 'almost statesmanlike,' you said. Nothing there to haunt me. How many politicians have come back from worse defeats than that?"

"More haven't. Look, Jim, the public knows you too well and doesn't trust you."

Scornfully, "Psychometrics?"

"That's right. Psychometrics."

The mathematical expression of psychology, that enabled psychometricians to draw up a mathematical description of a person's personality—almost of one's mind. It was not "prescriptive" —there were too many variables to allow them to say that in *this* situation this person will do *that*. But it could quantify such formerly immeasurable terms as "trustworthy," "honest," etc. If one's honesty factor, or whatever the hell they called it, was high, one could be trusted in very tempting circumstances. If it was weaker, one could be trusted only in less tempting circumstances. If it was very weak, one could scarcely be trusted at all. And some people could only be trusted in certain areas; a person might have a high loyalty to a group—the Mafia, or the Republican Party, or Students for Radical Change—and be untrustworthy in all other areas.

Or so they claimed to know.

It would be better not to call it bunk even in private—and this suite was not private. "Look, Marty, the psychometricians themselves say their work is *de*scriptive, not *pre*scriptive—nor can they estimate how much *strain* a man can stand. In public life that's an important factor. In short, their science is by no means complete or very accurate. To draw conclusions based on it is to ask for trouble—you're apt to get a lot of nonentities without much personality—"

"Jim, it isn't me you have to convince. You have to convince the public. And the public believes in psychometrics."

That silenced him, for it was true.

That had been the big bugaboo of this campaign. Psychometricians had been shaking their heads over James Rutledge Richardson for the past five years now. Before that too little was known about the new science; too few people knew what little was known. But in the last five years the science, and the public's perception of it, had grown astronomically.

They deemed him callow, egocentric, self-seeking, a man who would do anything to win. But honest as regards money—at least they gave him that.

Well, there was some truth to such charges. Without such qualities a person wouldn't be in public life at all—without a lot of them, no one would make it to the top. Was Groteckie that much better? He had fooled the psychometricians, but Richardson did not trust him.

"It won't be easy to turn the public's mind around," he began slowly.

"It won't be possible. You've put on too many faces in the past; how many 'new Richardson's have there been? Even before psychometrics. And when they can show, mathematically, that all these new faces have been hiding the same old Richardson, how likely are they to believe any change of personality now?"

"A good public relations man—"

"Not me." Marty was shaking his head. "Look, Jim, I personally have nothing to complain about. I even rather like you—and that's rare among your staff—"

That hurt, but Richardson did not let it show.

"—but I'm a professional, and it is not good for my career to be tied up with a loser. I can't—don't dare—help you in the future. My little company might be wiped out."

"Just by one defeat?"

"Two defeats in a row, I could take; two years of association with someone as distrusted as you, I could not. A political PR man must be as pure as Caesar's wife these days. I'm sorry, Jim, believe me. But I doubt you can raise the money to run again, anyway."

Richardson had to nod, wincing, at that.

"So you're saying goodbye, Marty?" He smiled palely and held out his hand. "Well . . . good luck. And better clients."

Marty took his hand without hesitation. "Good luck to you, Jim. If I can do anything for you—except helping you run for office—call on me. I feel bad—as if I had stabbed you in the back—but this is how it must be."

"No hard feelings, Marty." His face felt like wood; he had to force it to smile. There was a vast cold weight over his mind. The room was a long way away; he could barely see it. His whole body was wooden, or frozen. He had to keep forcing it to move through the gracious movements, the goodly rituals, as he spoke to his staff and aides, knowing that he'd see few or maybe even none of them after tonight or tomorrow.

For they were all leaving him.

It wasn't something they had talked over and decided. They had concluded separately that James Rutledge Richardson was finished in politics, and had

stayed on only out of professional pride, to see it through. Well, it was through. He hoped they were satisfied!

Finally they were gone and he could go to bed. But he did not sleep.

The next morning there were a couple of reporters—no TV cameras—waiting to get the last word on James Rutledge Richardson's political life. Richardson made an enormous effort and spoke not unnaturally. Tendencies toward rage and tears both firmly suppressed—he had this weakening feeling: *Why me?*—he spoke respectfully of John Groteckie, smilingly sidestepped any questions about his future, and begged off; he needed his breakfast.

Why me, indeed? Nobody in the hotel restaurant spoke to him, though more than several recognized him. The waitress was studiously polite, but not especially respectful. There had been a time when people tended to be awed by him.

Wiped out by psychometrics!

But they counted too soon who counted JRR out.

Having eaten all he could manage and overtipped the waitress, he found a phone booth and again tried to call Thelma. Still no answer.

His first step obviously had to be a reconciliation with Thelma. Her leaving him two months before the election was the severest blow he had received; he was still convinced it had cost him the election. She *said* it wasn't personal, that she just couldn't handle being a politician's wife. Everybody had interpreted it as a confirmation of his own callow self-centeredness. They said his wife had had her consciousness raised by study of psychometrics (applied to him!) and found him out for the monster they said he was. And so had left him.

No answer. What to do?

At least she had never publicly admitted those charges. She knew him best; psychometrics couldn't be applied in ignorance, and people who had tried to apply it to him from a distance—by a study of his political deeds, for instance—couldn't claim any kind of accuracy. Not that Thelma could; she had no expertise in it. Just some old questionnaires from popular magazines and a six-week night course.

He called her mother.

"Mrs. Julien? This is James. Could you get a message to Thelma for me? I can't get her on the phone. . . .

"No, just ask her to get in touch with me. Or at least urge her to answer my letters. I get no answer of any kind, but if she doesn't want to talk to me, at least have her write. . . .

"Yes, that would be satisfactory. Thank you, Mrs. Julien."

Well, one small step. Richardson had the feeling that he was going to have to rebuild his career literally from the ground up. Maybe he really had been defeated by Groteckie. *Everybody* thought he was out of politics for good and all. . . .

The law firm was known as Barton, Carstairs, and Richardson, and they had prospered with their junior partner in Washington for ten years. He and they had been careful to do nothing in any way questionable; it would have been disastrous for both in the modern climate if there'd been any question. Richardson in particular wanted no skeletons

in his closet. He was a profound student of politics, and knew that a politician who sold out ceased to have value for anybody.

But people, even knowing that, would choose a law firm with juice in Washington.

His senior partners, however, seemed uncomfortable with him. They avoided meeting his eye. For once Richardson did not have to hold himself in, and after a month and more of being "almost statesmanlike," it was a relief to let go:

"What the hell is wrong with you?" he said icily. "It's almost enough to make me ask you who you voted for."

"For you, of course," said Randolph Carstairs testily. "Damn near the only ones who did, too."

"Then why are you so unhappy to see me? Have I suddenly become a pariah?"

"By God that's not far from the truth," said Barton, his high-pitched voice almost a squeak. "The tenor the press is taking is enough to make us wonder if we're safe having you around. People don't trust you, Richardson. And they may well not trust us, if you're one of us."

Richardson. Not James. But few people called him James or Jim. So now it was out in the open. He knew that his partners did not like him. Few people did; he was not a very likable man. But then, he was driven; had to work hard. But distrust? Him?

"Randy, Hank, that's nonsense. You're my lawyers; you *know* I've never done anything illegal. I didn't even try to beat that speeding ticket. Showed up in court, pled guilty, paid the fine with a smile, and praised the judge."

Barton snorted. "A political ploy!"

"Of course it was; I could've beaten it handily. I've been around. Hell, either of you would have. I didn't dare; I wanted no replays in the future, like young Kennedy and his cheating rap. So I went public with it."

"Trouble is that everybody saw through it," said Carstairs heavily. "They all knew it was a political ploy. They see through everything you do; everything is a political ploy with you. They know you're not sincere."

"That's a crock. Henderson pays his drunk-driving fine and he's a statesman; I pay my speeding ticket and I'm a scheming politician. I help engineer a few political compromises and I'm a crooked politician who can't be trusted; De Wolf and Hernandez do the same, and Kamil changes parties, and *they're* a bunch of be-blessed statesmen! It's not only not fair, it by God isn't true!"

"There's a difference: their psychometric profiles indicate they really meant what they said. Yours doesn't."

"Don't come holier-than-thou on me—"

"We're not; certainly *my* profile is nothing I'd want the public to see," said Barton, his voice again approaching a squeak. "But I'm not in the public eye the way you were."

"Right. A politician must either be straight, or be able to fool the public."

"But I was—I *am* straight, dammit! There's never been the slightest question— All I ever did to make anybody distrust me was cut political corners—violate a few confidences, break a few promises, vote in favor of

political action committees that supported me. So I'm insincere! Who isn't, in Washington?''

''Fewer than last year,'' said Carstairs darkly. ''You weren't the only politician who got upset by psychometrics. And you won't be the last. The public's educated now in psychometrics—and getting more education fast. They're getting damn hard to fool! It's a new age dawning. It's going to be rough on lobbyists, PACs, and lawyers who depend on contacts, even perfectly honest ones.''

''Like Barton, Carstairs, and Richardson.''

''Exactly.''

''So you want me out.''

''We think it very likely we'll all go under with you aboard.''

''This isn't the little three-man partnership with two associates you left behind ten years ago, Richardson,'' Carstairs added. ''Seventeen lawyers work here now. It means a lot to them; it means a lot to us.''

''We'll be generous; it's been good for us, having you in Washington. You'll get your full twenty-five percent of all past business, and we can make you a good price, especially if you let us buy you out in quarterly installments. . . .''

But all Richardson was seeing was the public's response to the news that he had been ousted from his own law firm. Another blow; and when he taped that concession speech he had thought he had charted the defeat and absorbed it; begun to plan for the future. It seemed that the defeat only began with the election.

He looked at them and opened his mouth to protest; saw their expressions. No. Well, they had never liked him; he was not a likable man. Sacrifice for him? Never. Never. All he said was, ''Let me handle the public announcement.''

It was plain they hadn't thought of that.

It was three days before Thelma called, and he hadn't dared get drunk any evening for fear she would call. But the temptation had been great. They had been three empty days. Denied any kind of work at his old law firm, with no campaigning to do, he was starting to go to pieces. Not that he had been entirely idle. He'd cleaned out his offices; he'd gone to see the state party chairman, and the heads of three local PACs that had supported him in the past. All cold to him now. He was a horse that had lost the race; nobody was going to bet on him now.

When he saw Thelma in the screen he felt a faint revival of hope. If she would come back to him, a discreet announcement of the fact, plus a modest disclaimer of any political ambition, might get him back on track . . . if nobody called it a political ploy.

But her expression was cold.

''Thelma? Good to see you. How have you been?''

''Quite well, and since you probably won't ask about the children, they're quite well too.''

He flushed. ''I *was* going to ask. I'm glad to hear they are.''

''No doubt you were, and no doubt you are. It's the right thing to do, and the right thing to feel, and would look good in your political record.''

He winced but tried not to let himself be drawn. "What political record? Haven't you heard what everybody is thinking? I'm out of politics."

"You sure are. But you don't believe it yet. I'd be willing to bet you're still scheming for a comeback. I read your announcement about separating from Barton, Carstairs, and Richardson; you didn't fool me. Going into retreat; studying, my ass!"

Choking down his rage, he said steadily, "I sometimes wonder how you would feel about me if I had mistreated you. I was a good husband, Thelma, as good as a working politician can be. I had little time to spare for you and the kids, but it was well spent—"

"I always had the feeling when you were making love to me that it was a political ploy, done to make you look good to the voters. You always thought of them first. *That's* insincerity."

Furious, he almost slapped the screen off. "And when were *you* a model of sincerity? That time at the brewery when you asked for wine? Or the time you poisoned Bobby's mind against me on account of the school I wanted him to go to? Or—"

"Okay, so I haven't been the best woman I can be." Her expression had changed. "Look, I'm sorry for how I came at you just now; that wasn't right, and more important, it wasn't effective." That was a tagline from psychometrics jargon. "I'm learning better; in a year or so I'll be a much better woman. Maybe even a wife. Yours—but only if you can grow and change along with me. You know, Jim, you haven't changed emotionally since you were seventeen or eighteen? Study psychometrics for a year and we'll talk—"

This time he did slap the set off.

Richardson would have been better off if he had had to go out and get a job. His income from the firm, plus the purchase of his quarter-interest in it, was enough to keep him going for several years. The more so as his expenses were sharply cut. He sold the house, scrupulously sending Thelma half, and bought a small condominium apartment. All his employees were gone. He no longer needed the big car, and traded it in on a small one.

The only thing to occupy him was moving. He crammed boxes of papers into the spare bedroom, moved a few items of furniture, and bought others. But in less than a week, except for those boxes of papers, he was moved and had nothing to occupy him.

He got drunk twice a week for three weeks; it was the only way he could let off steam. But after the first time, when he had gone to a tavern in the vague hope of company—not necessarily even female company—he had drunk at home, alone. They had recognized him there; and while they were not hostile, neither were they friendly.

It shocked him profoundly. Maybe he *was* out of politics.

He considered shaving off his mustache, but instead added a small neat beard. To his disgust it came in with a number of gray hairs. At his age! It was a sign of defeat.

During those three weeks he had tried all the quiet tricks he knew to get back in the swim. Fortunately the big machine he had built up as a senator had

rolled in enough money to pay for the last campaign, so he wasn't starting out in debt. But all the people for whom he'd done favors seemed strangely forgetful. He was out of it; he was one of the little people now. As for running, anywhere in the state—forget it. Some told him kindly, some bluntly, some even hostilely. That too shocked him. He wasn't used to hostility; the big boys didn't often display it; it might have repercussions.

But he had no comeback.

It all ended with him sitting alone in an otherwise empty apartment, staring at an empty future. James Rutledge Richardson: whatever became of . . .

A week later an idea came to him.

It wasn't the first. He had considered writing his memoirs. But that was for retired presidents, not failed governors; and besides, it was a political ploy. . . .

No. He wasn't the only one deprived of career because of psychometrics. People had been fired because of their profiles. Not always officially: "inability to get along" or "mutual consent" or some such face-saving nonsense was the official reason. But it was increasingly frequent for personnel offices to use psychometric profiles as a guide to their hiring and firing policies.

Well, that might well be in violation of their civil rights. Besides, there was a large pool of people out there affected by psychometrics, or simply ignorant and suspicious of it. A shrewd operator might just appeal to them. Once in Congress he might bring laws to bear, forbidding this kind of discrimination.

Admittedly that was a long way off. Nor could a politician kick if voters voted against him because of what was publicly perceived as his profile. And for Richardson to champion such a thing was obviously a political ploy. But those at whom he was aiming wouldn't care so much about that. Besides, in this case he *was* sincere. There was nothing to psychometrics and he'd damn well prove it!

Or, at least, that it was vastly overrated.

What was the name of that kid?

About three years ago he'd gotten some kid's college scholarship straightened out. Hornsby, that was it, Judy Hornsby. Richardson called the university and asked if she was there. Registration checked and said she was, and gratuitously gave him her number. He took the chance she was in tonight and called.

She was. "Oh! Senator Richardson! This is a surprise."

"Just Mister Richardson—or even Jim. Look—may I call you Judy?—I need to know a few things about psychometrics, and I understood that you were studying it?"

"That's right, it's my minor. If I can be of help . . ." She wasn't hostile; she seemed a little embarrassed, but she wasn't hostile. Perhaps there was gratitude in the world after all. Richardson changed his plans.

"I wonder if you'd care to eat lunch, or maybe dinner tomorrow with me. You could answer a few questions then—nothing deep, you understand. Just a good overview."

"Why, sure. Lunch or dinner is fine with me."

"Fine." An unaccustomed sensation came to him. She hadn't been well off, he knew; she'd needed that scholarship.

"Make it dinner, then, and how about seven? And at a good restaurant; I've got money and it occurs to me you've probably been living on beans and rice—"

She laughed—though belatedly he'd realized she could have taken that badly—he'd always been a little clumsy with feelings. "It sounds as if you mean to pay me for my knowledge. I won't turn you down, Mr. Richardson, but I already owe you any answers I can give you."

Next day he drove down to University City. Judy Hornsby had dressed up and seemed quite fresh and young. Richardson felt a pang, thinking: If I hadn't lost Thelma, I might have watched Renee grow up to be something like this. I made more mistakes than I knew, when I plotted my career. . . .

Over salads, while they waited for their steaks, he opened the questioning. "I understand that psychometrics met the usual resistance from academics before being accepted, and was subjected to the usual rigorous scientific proofs."

"More than usually rigorous proofs, and some academics never did accept it. You see, psychology and sociology were both very hide-bound fields, and psychometrics came in largely from the Artificial Intelligence people, who were trying to design intelligent computers. So it took a lot to convince the academic community."

"Which is all to the good, in one way; it really has been proven out?"

"Oh yes. Within limits. The popular conception of it is false, of course. It truly cannot predict people's actions, even assuming all variables were known. That's an impossible assumption in itself. It's possible that some day psychometrics can be extended to the point where a person's actions in a rigidly limited setting—as limited a universe as a chessboard, for instance—could be predicted. But not likely."

"Why not?"

"Well, the classic case is a man on a mountainside in the path of an avalanche. What can he do? He can run along the mountainside, trying to get out of the line of the avalanche; run down the mountain, up the mountain, or slantwise up or down; or he can fall in a faint, or to his knees and pray, or go mad and start dancing around in a frenzy of fear, or a number—but not a large number—of other things."

"I see. There is only a small number of things he *can* do, and many of these he's very unlikely to do."

"Quite. But to predict just which one he *will* do requires knowledge of his mind so complete that—well, the equations would fill a big book. You'd have to study him in detail back to when he was being toilet-trained, most likely. You understand, psychometrics is not nearly as advanced as that, so we can't be sure just what *would* be required; but we can be sure that it would require us to integrate a *lot* of information about the subject. And that's a really simple case of a man in immediate physical peril."

"And I gather that his profile is not that helpful in describing his emotions under stress."

"Right. Catastrophe theory—there's a sharp break. Brave men have panicked; cowards have suddenly found themselves without fear—many instances are known of this sort of thing."

"So the public's view of psychometrics as being able to predict is false. But it can describe."

"That's it. That's all it can do, really. It enables us to describe a person's mind—I like that better than *psychoprofile*, which has mathematical connotations that are very inaccurate—a person's mind very precisely. From that, a layman's guess as to what a person might do is as good as anyone's. Just because psychometrics is accurate does not mean that accurate estimates of personalities have never been made before. Our exercises include charting the personalities of Shakespeare's characters and historical people like George Washington and Abe Lincoln."

"Some of my senatorial colleagues had an almost uncanny ability to size people up. I was never very good at it."

She nodded and crunched lettuce in a trifle of embarrassment.

Richardson had thought out his questions during the drive down to the University and mentally rehearsed the conversation, quite as if it were another meeting with the press. So he remained in character, "almost statesmanlike," and allowed no bitterness to show. His image was earnest inquirer after Truth.

"Now, really accurate charts of a person's mind cannot be made without the full battery of tests—word association, Voigt-Kampf pupilometry, electro-encephalographic scans, and so on. But a crude picture of a mind can be drawn up by a person's actions, reactions to daily crises, and so on.

"And a comparison between a person's words and his actions," Judy added, eyes on her plate.

So she'd studied her benefactor. He wondered what she'd learned.

"That too. And then there are all these magazine things, little 'rate-yourself' tests, which I suppose are very inaccurate."

"*Extremely* inaccurate, though a skilled student of humanity could use them as a general guide. Or a sufficiently objective person could use them as a guide to his own personality."

"You ever used them?"

"Oh yes. You see, all students who study psychometrics must have their profiles taken." She grimaced. "Quite a painful process: not physically, but it hurts to see the truth about yourself, even if you're a pretty decent person."

Probably it was a rueful expression, the grimace, but Richardson chuckled. "That explains why so few politicians have ever been profiled."

She was startled into laughing with him. "Anyway, you take the rate-yourselfs and make the best estimate you can of your personality; then you compare it to the big test. Usually you're far less biased than you expect."

"So even these little things are not worthless?"

"Only if you are reasonably objective about yourself. Not many people are. Or you can use them to rate other people, but either you don't know enough about them to be in any way accurate, or you are likely to be biased. So they're usually worthless for that purpose. No psychometrician would dream of using them for that."

"They'd have to see the full battery: brain-waves, pupilometry, and so on."

"Right."

He questioned her closely for most

of another hour, filling in details, but learning nothing startling. When it was over he took her home, then sat in the car and thought.

I'm not going to break all this down just by shouting at it. Even McCarthy probably couldn't have gotten anywhere with his tactics. The public had taken to psychometrics in a big way. They used it very inaccurately—naturally, being totally ignorant of it. But there was still a core of truth in there, and the public was quite right to trust those who *did* understand it.

Which did not mean that people fired because of supposed failings in their psychoprofiles had not been treated unjustly.

He had mentioned the faddish aspects of the subject to Judy gingerly, fearing she would realize he projected an attack on psychometrics. She didn't; she merely nodded and said that it was a cause of concern to knowledgable people.

"It was the same with health, when you were young," she went on. "People were sure that food magic would cure all their ills. Eat the proper foods and you won't catch cold, get cancer, or beat your spouse. Vitamins, especially, and minerals. People who were afraid to have sodium fluoride put in their water or any kind of 'chemical' used on the food they ate would swallow all kinds of vitamins and minerals. Self-educated experts went on the air to proclaim that hypertension was caused by an excess of salt, and migraines by a deficiency of—I forget what—and so on."

"And atherosclerosis by an overdose of cholesterol. But many doctors believed that."

"They had evidence that there was a connection, but it could have been interpreted two ways. Unfortunately they took the wrong interpretation."

"Some never did accept that inability to properly metabolize low density lipoproteins is the true cause of atherosclerosis, and that it is an inherited defect. If you've got the defect, a low-cholesterol diet will be good for you; if not, it won't hurt you, but neither will it help. Judy, have you been in a supermarket lately? Know how many low-cholesterol products are still being touted as good for *everyone's* health?"

"Oh yes. It takes a long time for superstition to fade."

"Superstition! But it was science—the best science they had in their day."

"To the doctors, maybe, despite the wrong interpretation. Anybody can make a mistake. But to anyone who didn't understand it—I don't mean understand the *explanation;* to anybody who didn't understand the *science*—it was superstition. Anything you don't understand, that you take on faith, is superstition."

"Belief in Science is a superstition. Let me make a note of that—that's a damn good point. It's just magic if you don't understand. So, Judy, what superstitions about psychometrics are being propagated now?"

"Belief in its ability to predict an individual's actions. Also, belief that it is a completed science with a high degree of accuracy. The last is common about any science."

Sitting in the car, he tapped the wheel and considered that. That was it; the public was basically superstitious, and it had a badly wrong idea about psychometrics. It was a matter of educa-

tion. Why, that went even farther than his projected attack had done.

It was going to be a difficult job. But he could see that it needed to be done.

After some more thought he went to the university book store and found it closed. But in the entryway was a sales kiosk. He keyed up the index and cut to "Psychometrics." The index conveniently told which courses they were intended for, so he paid for three elementary texts. After a moment three 7.5 x 15-centimeter cards slid out; he scooped them up and his credit card, and started the long drive back to the city and his apartment.

Richardson did not stop with three texts on psychometrics. He dialed a bookstore, called up *The Reader's Guide to Periodical Literature*, got the indexes of a dozen popular articles on the subject, and bought them; they filled one book card. He also bought a good popularization introduced by Hofstader himself. He read all of these first and got a good feel for a subject that could only be understood as math.

He thought over what he'd learned for a couple of days before beginning the textbooks. It took quite a while to steel himself for what might well be necessary. After all, Judy'd said every student had to have a profile taken.

"Psychometrician's office." The receptionist was calm and somehow pristine. She didn't recognize him.

"Yes. How much would it cost to have a complete psychoprofile taken, and how long?"

"A *complete* profile?" She glanced aside, turned a page, told him the price, and added, "That would take about three hours. But few industries require complete profiles; there are special ones that cost much less, and take less time."

"I want a complete one, and I have the time."

"Very well, sir; the doctor could see you day after tomorrow at eleven. You'd have to break for lunch, but that is no problem."

"No problem here either. Make the appointment, please."

"Yes sir. The name?"

"James—Rutledge. By the way, do you accept cash?"

"Why—I don't know."

"You *must*. Money is legal tender; to refuse it is to cancel the debt. Ask any lawyer."

"We're not equipped to handle cash at the office—"

Richardson hadn't handled cash himself, except coins for the increasingly rare coin machines, for years. "I could bring you a money order, but that is not legal tender, and I don't want it refused."

She was thoroughly confused now, but said, "Well—bring the cash and I'll take it down the block to the bank."

"Good."

Richardson stuck to his alias; it was obvious that the psychometrician did not recognize him. When the electrodes were taken off his head—his EEG had been taken while he was subjected to varying stimuli, from words to animal sounds to light electric shocks, nothing painful or very stressful—the test was over.

The doctor looked at him benignly. "Now, Mr. Rutlege, it will take a day or so to integrate your profile; and even

then, should you read it yourself, it may mean little to you unless you have had training in psychometry. We will send it to you—or you can come by and pick it up—in a sealed capsule, suitable for submission to the personnel office. You understand, all we have done is take your profile. We give the results; we make no attempt to interpret them. You will also receive a separate copy, just so you know what we are telling Personnel. Is that satisfactory?''

''Very much so.''

''Some people suspect there may be some kind of collusion between their psychometricians and the personnel officials. So most corporations rule that employees may see their file after Personnel has examined it. You should apply to them to see it, take a copy, and compare it with the copy we give you.''

''Seems like you take very elaborate precautions, Doctor.''

A shrug. ''Nobody distrusts psychometricians yet—not loudly. We want to keep it that way. We know of no reason why you should trust us; or Personnel of whatever corporation you work for; or why they should trust you, hence the sealed capsule. We try to compromise; it's a poor best.''

Nevertheless, Richardson was impressed.

He did not read either copy of his profile, but after a day or so plunged into the first text. It was tough going, and he was reminded ruefully that in college he had been better at running for office in the student organization than studying. But during the blustery winter months he forged steadily if slowly ahead, and in due course was making simple integrations with a hand-held computer.

All this dry study of dessicated personalities—spread out to the sun as it were—helped greatly in promoting objectivity. Richardson pushed through the three texts and had a celebratory drink. He actually went out to the tavern this time, and quite enjoyed himself. Nobody recognized him.

Recovered from the drink and feeling nothing but a mild anxiety and a gentle melancholy—it had been a quiet and lonely winter—he sat down to a simple experiment.

He had various newspaper and magazine printouts giving what purported to be ''external'' psychoprofiles of himself. These had contributed heavily to his defeat in the last election. In each case, in the cautious modern tradition of journalism, they had given the sources: speeches he had made, and votes. Re-reading those speeches, re-examining those votes and other actions, he assigned the most objective values he could to them, trying to suppress all memory of his feelings and reasons at that time.

He did not integrate the scores just yet.

Instead he took three of the best of the ''rate-yourself'' tests that had appeared in national magazines, some grudgingly and with reservations recommended by top psychometricians. Again he did not integrate the simple scores.

Finally, he opened the sealed capsule and spent an hour comparing it with the thick printout the doctor had given him. They were identical in all respects.

Good; the psychometricians *must* be honest or it all fell to the ground.

Then he integrated the scores he had already derived, and compared them all to the complete psychoprofile.

This time he stayed home and got drunk.

Three days later, recovered first from the hangover and then from the depression, he went into his den and again looked at the answers. Translated crudely into English, they seemed to say: James Rutledge Richardson, you are a third-rate son of a bitch.

There it all was. Callow; without much feeling for other people. Shallow; no very profound feelings of his own. Self-serving; egocentric. Would do anything, tell any shifty lie (and believe it himself, which was worse) to get ahead. Untrustworthy. Loyal only to himself. A bad leader and a worse follower.

Oh, there were good sides to him. He was brilliant (that surprised him). He had an enormous capacity for hard work. He could be charming.

But emotionally he was still in his teens, at best. Self-centered, tending toward low self-control—though that was suppressed by an iron discipline imposed in deference to what the public expected. It tended to break in private into rages, or cutting, biting sarcasm.

He really was honest. But this honesty extended only to actual lawbreaking: theft, violation of the election laws, etc. In any gray area his action would be guided by expediency. If he thought the public might learn, he would be very righteous; if he was sure it never would—Such cases, of course, didn't involve anything as crude as money changing hands. Influence-peddling was his weakness.

No wonder he'd never had friends. Even before psychometrics, people could tell he was a bastard.

"One thing's for sure," he muttered, staring with horrified fascination at the profile. "James Rutledge Richardson is finished in politics. If this profile were to be published, it wouldn't matter. He's already dead."

He couldn't stay in the same room with it any longer; went to the kitchen and, to keep his hands busy, made coffee. He drew a cup and wandered to the door giving on the balcony and stood looking gloomily off through the rain at the neighborhood park, two stories down.

Psychometrics, he brooded, involved training in objectivity, and let us therefore be objective. In its feeble youth psychometrics had eliminated a whole slew of real bastards from public life—among them JRR.

O brave new world, that has no such people in't.

He contemplated a world in which politicians, as a class, were even reasonably honest. Eliminate the most flagrantly dishonest, and you have an immediate effect. Meanwhile psychometrics is refining its tools and people are learning more about it. People trained in it are doubling and tripling. So then you remove the next most dishonest contingent.

Richardson questioned whether politics ever would cease to be pretty dirty, or politicians ever be wholly honest. The pressures were too great; the people demanded too much; and the rewards were too large.

But as politicians became more honest it would be less and less the case that a shrewd vote-getter would drown a serious discussion of the issues with a screech of emotion or a slinging of mud. And as people came more and more to trust their elected representatives, it would become politically safer and safer to speak truthfully of the issues.

Finally it would become political suicide *not* to speak honestly to the public.

Of course that presupposed that the public *wanted* to hear the truth—a big if. Too often they merely wanted to be told that bread and circuses ("The American Way"—JRR knew all the button-push phrases) was really the very best thing for them. But the time would come when every aspirant to public office would have to publish his psychoprofile. If such truly trusted and respected officials stood up and publicly told the public it was behaving childishly, could it fail to have an effect?

"Statesmanship, they call it," he muttered. Yes, it would have an effect. If only he—

O brave new world, that has no place for me in't.

Spring was here. Over there in the park, forsythia was defiantly yellow in a gray day. Despite the drizzle, Richardson went for a walk, thinking, thinking. His problem wasn't in his profile; it was in his personality.

Why hadn't he grown up? How did people grow up? When he was young there had been things like assertiveness training, "est," and so on, various unscientific regimens designed to change personalities. That was what he needed: maturity training, you might call it.

How and why did people grow up? Must be something to do with the experiences they had. He spent many hours in the rain, thinking about it.

Afterward he did not want to go home to the apartment, empty but for his profile. He stopped in a different tavern, and for once retreated to a corner table, drinking beer sparsely and looking interested in the people around him. Anything as a relief from his thoughts.

And for the first time attracted the interest of a woman. She spoke to him from the next table and he answered gratefully. Presently she joined him, they talked a little—his answers tended to be short—and she studied him, head cocked.

"Lose a loved one?"

Despite himself, Richardson laughed. "You might well say so. Not that it's something I want to talk about. How about you? You don't look like the kind of woman who often drinks her dinner."

"Not and keep this kind of figure, but hard stuff puts me at a disadvantage, so I stay with beer." He lured her on to talk, and wondered vaguely why she didn't lose interest and drift away as women usually did.

Not till the next day did it occur to him that he had not been talking about himself. How could he? All he could think of was that bastardly profile, and how he was going to discuss *it?* So he was unexpectedly successful—depending on how one counts success. The woman, Debra, let him know when she could be found there and that she'd be pleased to see him again. That was success, and Richardson was gravely pleased with it.

As for seeing her again, he thought next day, what had he to offer her?

* * *

But somewhere during that long walk, or the evening that followed, he had crossed a boundary and could not look back. A small decision had been made. And today he cruised down to the shopping mall and hesitantly entered a pet store. One small step. "Maturity training," he'd called it.

"May I help you, sir?"

A teen-age girl. "I'm looking for a pet. I want—I want some animal that's very loving and responsive, and needs a lot of care. Uh, it's for an emotionally deprived child."

For a moment she looked at him in surprise and he cursed himself, but she pulled herself together. "Well, uh, how about a dog? A puppy. They take a lot of care, and they're real loving. We've got some nice pups—over here in the cages. We've got purebred of various kinds, and plain old pooches. Uh, I'd probably recommend a mongrel, sir. How big a dog do you want?"

"Small. Apartment-sized."

"Well, these are part Sheltie and part cocker, and part God-knows-what. Both parents were small. We think this one will look a lot like a Sheltie when it grows up. That one might look like a spaniel, a little. Both sides of their family are real friendly and warm-hearted, sir."

Richardson stared into the wire at the squirming masses of silken fur and something stirred in his heart. "May I touch?"

When he lowered his hand onto them, four little heads shot up. Two of the pups struggled away, one rolled over, and one took hold of his thumb and looked at him impishly.

"I'll take this one," he said hoarsely. ■

Jay Kay Klein's biolog

It's not every writer who realizes he needs more education before being able to write convincingly and authoritatively. Rob Chilson realized at the age of six or seven that his original tales about Donald Duck and Roy Rogers lacked something that only greater learning and more maturity would bring. Accordingly, having mastered improper fractions at age eleven, he felt himself well enough equipped to try again.

Born in Oklahoma of a farming family, he started reading science fiction in high school. He grew up mostly in Missouri, attending small country schools — including one with just two rooms—where he was the only person interested in science fiction and where the other young people were interested in farming and sports but certainly not in reading. With this magazine his favorite by far, he fell under the educational influence of its iconoclast editor, John W. Campbell, who instilled in Rob a skepticism which led him to question everything until it could be resolved by first-person thinking. He considers that he was in the "last generation" of writers trained by Campbell, who generously spent three years sending long letters of criticism along with rejection slips before purchasing Rob's first published story for the June, 1968 issue. At first he used "Robert" in his byline, but switched to "Rob" when he found himself automatically called "Bob" by strangers (a detestation he shares with Robert Heinlein).

Since then thirty stories have borne the Chilson byline, including short stories and three novels. He writes slowly, and then only on weekends since he works full time with the IRS in Kansas City—where a knowledge of improper fractions would have come in handly if he weren't in personnel. In his own writing he likes to deal with "real" people, not cardboard figures, and provide "realistic" problems for them, not single-dimension setups. As a continuing reader, his bane are the stories that merely repeat old themes and ideas. What he appreciates are fresh insights into human motivation and the physical constraints of the universe. He deplores the use of literary devices and techniques without any real substantive story behind them.

As a science fiction fan, Rob can be met at Worldcons and many of the smaller midwest conventions. In fact, last year he was guest of honor at two of them. Talking with Rob, like reading his stories, is an adventure into humor and depth of thought. ■

Rob Chilson

The Alternate View

WHAT PRICE THE HUMAN LIFE?

G. Harry Stine

Although all of the data isn't in hand at the time of this writing, it appears that the loss of 269 lives and a Boeing 747-200B airliner as well as the creation of an international incident could have been prevented by four satellites in geosynchronous orbit.

Available information indicates that Korean Air Lines Flight 007 *(a)* was out of radar contact with both Alaska and Japan for more than 2000 miles, *(b)* was being radar-tracked by the Soviets from Kamchatka and Sakhalin, *(c)* had experienced avionics trouble en route from New York to Anchorage and had supposedly had these squawks repaired before Anchorage departure, *(d)* believed it was following west polar track R20, the westernmost airway on the Anchorage-Seoul route, *(e)* was equipped with a Sperry LTN-27R inertial navigation system (INS) which was telling the autopilot where to fly, *(f)* was 300 miles west of its intended course, and *(g)* was shot down by a Soviet Su-15 interceptor.

Nobody yet knows what caused KAL 007 to be off course. Conjecture: The INS could have been out of alignment, causing the pilots to believe they were on course because everything looked copasetic on the panel.

Did the KAL 007 pilots see the Soviet Su-15 interceptors or the cannon fire from them? Did they hear them on the radio if indeed the Soviet pilots did call as required by international law on the international frequency of 121.5 mHz (which is doubtful because that frequency was monitored along with the air-ground transmissions of the Soviets)? Conjecture: They were cruising along at 10,000 meters with the autopilot in control because it does a better job of flying a 747 than humans. On the flight deck, it was 5 AM local time. The pilots were probably dozing in half-sleep, occasionally checking to see that they were on course according to the INS. They heard nothing on the VHF air traffic control frequency they were monitoring. They weren't looking out the windows because there wasn't anything out there to see, and they certainly weren't expecting a Soviet Su-15 interceptor because they believed they were on course.

They lost their lives along with more than two hundred other people because a cardinal rule of aviation wasn't observed: Always have a back-up. Always utilize redundancy to overcome unreliability.

In the north Pacific area, there's no radar coverage, no Loran-C, and no Omega capability. There's no back-up for an INS except dead reckoning, and few airline pilots use DR these days.

A back-up was available but couldn't be used: the US Department of Defense Global Positioning System (GPS), a satellite navigational system which is emplaced to the extent that a Rockwell

Sabreliner used it to navigate across the North Atlantic to Paris in May 1983 and which guided it to a stop on the ramp at Le Bourget within 10 meters of its pre-programmed parking spot. GPS is a DOD system, and civilian airliners can't normally use it.

And GPS with its Navstar satellites is going to cost $30 billion.

In 1980, a private pilot named Gerard K. O'Neill came to the conclusion that it would be possible with off-the-shelf hardware and existing technology to build an inexpensive satellite system that would either totally replace the existing aviation radio navigation system or serve as an excellent backup for the existing ground-based collection of VHF Omnirange (VOR) stations, combination VOR-TACAN (Vortac) stations, Loran-C, Omega, non-directional radio beacons (NDB), and instrument landing systems (ILS). It would also make unnecessary the expensive Microwave Landing System (MLS) that the Federal Aviation Administration (FAA) plans to install to replace the existing ILS. (Sorry to belabor you with acronyms, but the text would otherwise become burdensome.) In March 1981, he published a technical paper about the concept in *Astronautics and Aeronautics*, the magazine of the American Institute of Aeronautics and Astronautics. It was followed by an article written for his fellow pilots in the July 1982 issue of *AOPA Pilot* magazine. Recently, the September 1983 issue of *AOPA Pilot* carried a follow-up article by O'Neill on a satellite-based location and navigation system called "Geostar."

The technical details of Geostar may be found in any of the three magazine articles. Although the following brief recap of Geostar capabilities and performances sounds fantastic, they are made possible by modern techniques of data processing, digital technology, microprocessors, and data transmission coupled with off-the-shelf, proven technology and equipment already available (just order by catalog number).

Geostar hardware required to locate or navigate a vehicle: One master ground station with associated computer plus backups; four geosynchronous satellites using old 1970 technology developed in the ATS-6 satellite program; one Geostar vehicle transceiver costing about $450, a unit that will include data storage, 32-bit microprocessing capability, and alpha-numerical liquid crystal display.

Capabilities of the Geostar system: *(a)* locate the position of any of more than four million Geostar transceivers to an accuracy of plus-or-minus ten feet or better (plus-or-minus 1 foot in some instances) in all three axes every second if necessary anywhere within the 48 continugous United States; *(b)* determine horizontal and vertical velocities of a transceiver as well as the rate of change of velocities; *(c)* locate a transceiver relative to any geographical point or, with outstanding accuracy, to any pre-positioned "benchmark" transceiver; *(d)* identify each transceiver; *(e)* provide collision avoidance between two transceiver-equipped vehicles; *(f)* provide terrain avoidance for any transceiver-equipped aircraft; *(g)* utilize handshaking 32- or 64-bit data protocol for error-correcting and redundancy; *(h)* transmit digitized messages in the form of 34-character "telegrams" to and

from each transceiver; and *(i)* have a mean time between failure of about 50,000 hours for critical microwave tubes and more than 2,000 hours for the mainframe computer.

Cost of the Geostar system: $350 million.

Time frame: Full services available by late 1987.

Gerry O'Neill took his concept to the FAA because it could solve the problem of air traffic safety forever. Once the Geostar system is in place, we can shut down hundreds of VOR and Vortac stations, hundreds of ILS installations, dozens of FAA computers which are already obsolete, and all of the FAA air traffic control centers, approach control facilities, etc. The expensive and user-unwanted MLS with its non-existent airborne avionics units could be forgotten. Billions of dollars of tax money now programmed for expensive new computer upgrades and ground-based air traffic control equipment could be channeled into improving the airports which all airplanes must use. Any aircraft equipped with a Geostar transceiver (which costs less than the primitive radar transponder now installed in more than 75% of the airplanes in America) could be operated with a level of safety far greater than that of today's band-aided air traffic control system. And *any* airport (or farmer's field in an emergency) automatically has a full instrument landing system capable of taking an airplane down to less than a hundred feet above the runway in less than quarter-mile visibility.

The FAA studied the Geostar system and decided NIH (Not Invented Here).

So Gerry O'Neill determined to do it as a private venture with a system designed at the outset for utmost efficiency and economy rather than to satisfy an arbitrary set of government specifications. Although O'Neill began studying the basic Geostar concept out of a concern for aviation safety, he and his colleagues quickly discovered that the system could make far more money if they sold its services as a general purpose, two-way digital data transfer system with position determination added automatically. The system can quickly relay messages between any two users.

He incorporated Geostar Corporation and mortgaged his house to pay the costs of forming the company. He was granted unpaid leave of absence from his position as professor of physics at Princeton University beginning July 1, 1983. Others who are with O'Neill include Nobel laureate Dr. Luis Alvarez who also won the Collier Trophy in 1946 for the development of the Ground Controlled Approach instrument landing system; Dr. Fred Rose, the president of Norland Corporation which makes high quality electronics in Fort Atkinson, Wisconsin; a fellow pilot, Davis E. Wine; and Dr. Stephen T. Cheston. Among the others who subscribed to the initial private stock offering of $500,000 was Dr. Tom Paine, former NASA Administrator and president of Northrup Corporation. These names are mentioned herein because people should know *who* not only had the technical smarts to dream up Geostar but who also had the guts to back up the dream with venture capital. The entrepreneurial syndrome isn't dead, nor is it even dying; it's alive and well and engaged in trying to do things in space that the government won't or can't do.

In June 1983, a second private stock offering of $1 million was fully subscribed. However, another $240 million will be required.

Ground-based systems tests of Geostar were made in mid-1983 with satellite systems on the tops of peaks in the Sierra Nevadas; these linked a prototype ground station to a set of prototype transcievers that were hand-carried or mounted on cars, trucks, boats, or aircraft.

Although aviation users will be able to subscribe to the Geostar System, it will have to remain a back-up for the present costly, ground-based, labor-intensive FAA air traffic control system because it hasn't been blessed by FAA. However, the major users of Geostar will be in other industries where it's important to know where things are. Trucking companies are interested. So are railroads because they don't know where all their freight cars are. The technology is there; the markets are there; it only remains to be seen if Geostar Corporation can be financed by venture capital in the amount of about $250 million.

This is an example of the basic problem we face today in making a better future. The technology is there or can be developed. The need is there once the technology is available. But financing it and paying for it remain the big problems.

We can do anything we want to do, provided we are willing to pay for it and to live with all the consequences.

My father was a surgeon and often observed, "What price the human life?"

An electronic black box costing less than a thousand dollars coupled with a satellite system that can be built today could have saved 269 human lives in an airliner that went off course because it had no redundant backup navigational system.

Of what use is space? What price the human life? ■

Our May issue features a couple of large-scale goodies. The first is the beginning of Vernor Vinge's serial, *The Peace War,* concerning a not-too-distant future from which war has been banished by the invention of "bobbles." A bobble is a special kind of "force field" which can contain weapons and hostile users where they can't do any harm. Like any new invention, of course, bobbles have some secondary properties, only some of which may be evident at first. Most of us would agree that peace is a highly desirable thing, but it's well to remember that not all peaces are created equal. Like any other term, that fine-sounding word can be twisted by usage into something quite different from what it started out to mean.

The other major attraction definitely scheduled for May is "Valentina," a novella which happens to demonstrate the value science fiction conventions can have. Both Marc Stiegler and Joseph H. Delaney have become well known to Analog readers, but "Valentina" didn't become a real possibility until they met face to face at the 1982 World SF Convention in Chicago. There Joe remarked that he had a story that he'd love to write if he knew more about computers, and it turned out Marc had been holding back on a similar one because he didn't know enough law. Well, Joe is a lawyer and Marc a computer expert, and Valentina . . . You can see for yourself what Valentina is next month. I think you'll enjoy her.

IN TIMES TO COME

ON GAMING

Dana Lombardy

The Company War is an SF board game based on the universe in C.J. Cherryh's *Downbelow Station*, which won a Hugo Award for Best Novel in 1982.

Included in the game ($17 at your local store, or direct from Box 5987, Chicago, IL 60680) is a "history" of the technology, fleets, and tactics of man's first interstellar war, written by Cherryh.

Two to four players fight over space stations and trade routes, representing the Mazianni, Union Military, Earth Company Merchants, or Union Station Merchants.

The Mazianni force was originally a fleet sent by the Earth Company to suppress the rebellion of certain breakaway space stations. Now, far from Earth and disowned by the Earth Company, the Mazianni have become pirates, preying on everyone.

The Union Military represent the main elements of the rebellion, based on the station of Cyteen and concerned with the elimination of the Mazianni and their raids.

The Merchants—both the Earth Company Merchants and Union Station Merchants—are primarily interested in the lucrative trade carried on between the stations, and the defense of their own stations. They would prefer to see an end to the war, with neither the Mazianni nor the Union Military victorious.

The Company War comes with a 19½-by-24-inch mounted strategic map in six pieces that fit together like a puzzle; a "turn" and victory point chart; two dice; a tactical map sheet; a six-page rules folder; a booklet with Cherryh's article, optional rules, and orders of battle of the ships of the Mazianni, Union Military, and Merchants; and 105 colorful, die-cut playing pieces representing space ships, supply counters, space stations, garrisons, combat and hit location counters, and counters to keep track of turns and victory points.

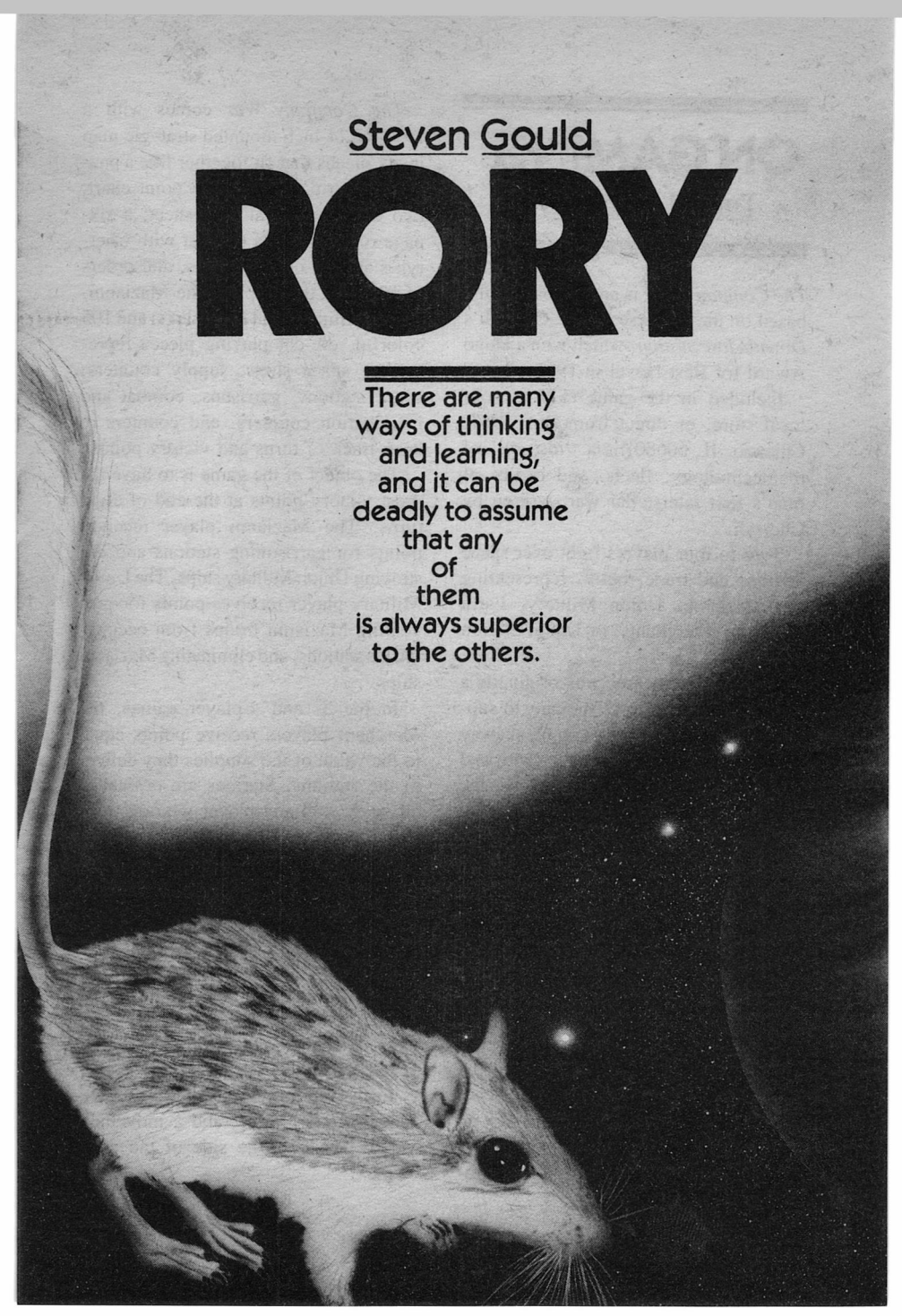
The object of the game is to have the most victory points at the end of eight turns. The Mazianni player receives points for garrisoning stations and destroying Union Military ships. The Union Military player receives points for preventing Mazianni troops from occupying his stations, and eliminating Mazianni ships.

In the 3- and 4-player games, the Merchant players receive points equal to the value of the supplies they deliver to the stations. Stations are critical to all sides, and any player who destroys a station loses 10 points (this amount of point loss is a disaster).

The game board shows the six Earth Company stations, four Union stations, and Cyteen Union military base as large blue dots with a picture of a station in it. There are 28 smaller dots without stations that represent jump points where ships can enter or leave faster than light speed (FTL).

Each ship has an attack value, a defense (screen) value, and a movement value. The opposite side of the piece

(continued on page 109)


Steven Gould
RORY
There are many ways of thinking and learning, and it can be deadly to assume that any of them is always superior to the others.

Dr. Anton Grebenchekov banged his head on a doorway for the fourth time that day and swore, *"Chyort vosmoi!"* His clumsiness infuriated him for many reasons, not the least being the several gymnastic medals he'd earned in college.

"Mind your head, Anton," said Dr. Ruth McMillian, the section head in biochemistry.

Anton winced again. She'd found nothing to approve of in him since his arrival six hours earlier. Starting with a piece of research he'd published four years before and finishing with his spoken opinions of minutes before, she'd attacked every concept he'd ever voiced.

And, more than anything in the solar system, Anton wanted Dr. McMillian to approve of him.

"Excuse me, Dr. McMillian, what were you saying?" He floated into the lab, still rubbing his head.

"Granulopoietin, Anton. You have heard of granulopoietin?" She turned to face him. Close-cropped, salt-and-peppered hair framed her unlined face. She wore an off-white coverall with a stiff, almost Roman collar. She was pretty in a stern way. Anton found her beautiful.

Anton blushed. "My degree *is* in biochemistry!" he said, almost angrily.

"I wasn't sure. That last piece you did in the *JBC* was so vague."

Anton's blush turned into a slow burn. Damn her eyes! "If you disapprove of my work and qualifications, why did you approve of my appointment here?"

"I didn't. That decision was made on Earth, by the head of the Institute."

"Dr. Herzig," supplied Anton.

"Hmmph. She probably sent you out here to learn some discipline—some precision in your thinking."

"And perhaps she sent me out here to put some originality in yours!" Anton cringed inwardly, wishing he hadn't spoken. He'd used all the resources available to him to get this position with Dr. McMillian. "I'm sorry, I didn't—"

She cut him off. "Perhaps you're right." Her face hadn't changed expression, but her voice was cooler. "I'll let you get settled in your cabin before dinner. Can you find your way?"

"Yes."

"Dinner at 1800." She turned and pulled a notepad from its clip on one of the lab benches and began studying it.

Anton hesitated for a moment, then left. On the way out, he hit his head on the doorway.

Rory flipped a switch on the dictionary clipped to his belt and said, "Define monarch."

The small black box hesitated an instant, then replied in a pleasant tenor, "*Monarch.* One: a person who rules over a kingdom or empire as *(a)* a sovereign ruler, *(b)* a constitutional king or queen. Two: someone or something holding a preeminent position or power. Three: a large migratory American but—" the device shut off in mid-sentence as Rory hit the interrupt key.

"Thank you," said Rory automatically.

"You're welcome," the dictionary said.

Rory kicked the wall nearest him and went flying down the passage. Halfway down, a large figure came floating backwards out of a side passage. Rory had

time to yell, "Look out!" before he collided with Anton's stomach.

He and Rory pinwheeled down the passage.

Rory detached himself in mid-flight and pushed gently away from Anton. They came to a stop against the frame of the next doorway. "You should look both ways before you go into a passageway. Some people go lots faster than me."

Anton stared at Rory while trying to draw a breath. Rory went on,

"You're new here. I haven't seen you. Did you just get here? Where did you come from?"

"Sorry," Anton finally managed. "I should've looked, but I was lost and trying to figure out where I was."

"Lost?" Rory scratched his head. "In the *station?*"

"Well, yes," Anton said, staring. He saw an oddly shaped male adult with slanting eyes, broad short head, and stubby, short fingers. Age was hard to guess, but Anton decided that he must be around twenty. "I'm Anton Grebenchekov."

"I'm Rory. Are you the one who's going to work with Dr. Ruth?"

"Dr. Ruth? No . . . oh, Ruth McMillian. Right. That's what I hope to do. What do you do, Rory?"

Rory grinned, and slapped his chest. "I'm the supercargo. That's because I'm special." He flipped the switch on the dictionary again. "Define mongolism."

The box beeped and said, "*Mongolism*. A congenital condition characterized by slanting eyes, by a broad short skull, by broad hands with short fingers, by trisomy of the chromosone numbered twenty-one in man, and by moderate to severe mental defi—" Rory hit the interrupt again.

"Thank you," said Rory.

"You're welcome," the box said.

"See? Special. According to Dr. Ruth, there isn't anybody else like me in space. She says I'm an 'investigator,' " Rory continued. "I investigate things."

Anton smiled slowly. "I see. Could you investigate something for me?"

"Sure. I'm good at that."

"How do I get to cabin Ten-C?"

"Ten-C? Oh, you're in the same pod as me. Follow me." Rory grabbed one of the lines running down the wall of the passage and pulled himself hand over hand back in the direction he had come with the rapidity of a monkey. Anton followed as best he could.

At every junction Rory paused, waiting for Anton to catch up. Then, looking both ways, he kicked off the edges of that containment bulkhead and zoomed down the next passge, often not touching a wall until the next intersection.

Anton gradually got the hang of it. Before long, he was jumping as far as Rory. And a few times he actually stayed clear of the walls. But he was slowed by sightseeing. They passed open doors with people working over equipment strange to him, or closed doors with intriguing labels like Astrophysics, Agronomy, Plant Physiology, Astronomy, Electronics, Metallurgy, Project SETI, Waste Reclamation, and Radiation Safety.

At regular intervals the windows looked out at other parts of the station (a bewildering construct of struts, tubular passages, and spherical chambers)

and the small asteroid known as Lucy to which the station was tethered. Anton also knew that if he looked in the correct direction, he could see the faint disk of Ceres, fifteen thousand kilometers away; and sometimes a bright flash of light as the sun caught the Ceres colony's surface installations just right, thirty-two hours away by shuttle.

"Here we are," announced Rory as they came to yet another junction with passages going right, up, left, down, and straight ahead. Each of the passages was marked with a letter. "C" was the one to Anton's right. Rory ducked into that passage. Anton followed. The passage ended with another doorway, pressure door pinned back on sprung hinges, ready to snap shut from any drop of pressure outside the pod. Another identical door was in the passage, ready for any pressure drop inside the pod.

Anton hoped he'd be on the correct side, if that ever happened.

The passage opened onto a spherical lounge perhaps seven meters in diameter. Twelve hexagonal doors, equally spaced, were set into the carpeted surface of the room. They were labeled one through twelve in white numerals, contrasting with the blue curving walls and green doors.

Anton had seen it briefly when he'd left his bags earlier, but the maze of station passageways had left him lost moments after leaving.

"Thank you, Rory," he said.

Rory grinned. "You're welcome." He bounced over to number seven and pulled the door open. "Wanna see Geary? He's my best friend."

Anton pushed off and came to a successful stop at the edge of Rory's doorway. Like all the cabins, Rory's had a half-meter-square window looking out on space. A ventilator outlet opened on one side of the room and an intake grille was on the other. A storage unit was mounted on one of the six side walls, and belongings were attached to other walls with Velcro fasteners.

"See, he's also special."

Anton pulled himself into the room. As he got closer, he saw a sphere made of wire mesh mounted rigidly before the ventilator intake. Bits of vegetable debris clung to the side of the sphere closest to the inlet. Then he saw the rodent floating in the sphere and looking back at him with black, beady eyes.

"This is Geary. He's sort of a Mongoloid, too."

"What do you mean, Rory?"

"He's a Mongolian gerbil."

Anton nodded. He'd seen the animals used in laboratories on Earth. They were extremely adaptable to temperature extremes, even if they tended to look more like rats than gerbils.

"Dr. Stan says his name really should be Al—Algernon, I think. I don't know what that means, do you?" Rory looked around at Anton.

Anton shook his head. "I don't know."

Rory continued. "Sometimes. I don't think Dr. Stan likes me."

In his cage Geary straightened out his tail, using it to push against one side of the sphere. This propelled him to the other side of the cage, where he hooked small claws in the mesh and squeaked.

"He wants food," said Rory. "Watch this." He traced his hand around the outside of the mesh sphere slowly. Clinging to the mesh within, the gerbil

followed the hand around. Rory's hand moved faster and the gerbil began running around the inside of the sphere, centripetal acceleration keeping the creature against the mesh.

"See? Isn't he special?" Rory pulled his hand away. Geary continued to circle the sphere for a few more circuits then stopped, watching Rory expectantly.

"Yes, Rory. He's very special."

Rory took a small paper packet from a drawer and opened a door in the cage. Sticking both hands in, he carefully tore the bag open. Almost immediately the seeds and dried fruit within drifted to the side of the sphere closest to the intake. The gerbil, already waiting there, started eating.

Anton checked his watch. It was 1740, twenty minutes before supper, and he hadn't the faintest idea how to get to the dining hall. "Rory, I need another thing investigated. . . ."

Life at the station soon became routine for Anton. He moved into the lab vacated by Dr. Nielson, the biochemist he had replaced, and started relearning every laboratory technique applicable to biochemistry. At least centrifuges were still the same. But techniques like column chromotography differed radically, requiring either separate centrifuges or vacuum to pull solutions through the appropriate medium. Any technique that *required* gravity to function properly had to be adapted.

Then again, some techniques worked better without gravity. Thin layer chromotography, using capillary action to transfer fluids, worked better in zero-g, and everybody knew about electrophoresis.

Still, the most minor tasks of handling fluids, powders, and mixing were complicated by no gravity.

As if this weren't a large enough headache, Dr. McMillian would pop into the lab to observe Anton's progress. Despite a growing skill in handling zero-g, every time she showed up Anton started fumbling objects or bumping into things. It also didn't help that she lived in C-pod, right next to Rory in cabin number eight. He couldn't seem to avoid her.

He took to spending more of his off time with Rory. When he did that, Ruth left him alone.

Rory constantly amazed Anton with bizarre combinations of insight and misunderstanding.

"I heared Dr. Stan talking about millions of queens and kings flying down the coast back on Earth," Rory said one day. "How do they fly? Is it magic? And how come there are so many of them? I thought only one person in thousands got to be king."

"Just what exactly did Dr. Peterson say?" Dr. Stan Peterson was a physiologist who lived in C-Twelve. Anton had talked to him only a few times.

Rory frowned, his eyes shut. "He said that it was really incredible to see the millions of mon, uh . . . monarchs flying along the coast."

Anton smiled. "A monarch isn't always a queen or a king, Rory. Among other things, it's a type of butterfly."

Rory considered that. "Ohhh. A butterfly is a flying bug, isn't it?"

"Close enough, Rory. Close enough."

Once Anton asked Rory how he came to be at the station.

"I was born here."

"Oh? How old are you?"

After a moment, Rory said with great precision, "Twenty-three. I have a birthday next month. I'll be . . . twenty-four! Dr. Stan once said I had the mind of a five-year-old, though. What did he mean by that?"

"I don't know, Rory." Anton was beginning to dislike Dr. Stan Peterson, and he'd only talked to the man twice. "Perhaps he meant that you have a fresh view on things." He changed the subject. "Where are your parents now?"

"My mother's on Earth. She sends me presents and messages. My father's dead. He died when I was real little—I didn't know him." He tilted his head to one side and looked at Anton. "Dr. Ruth is my guardian."

Anton stared at Rory, surprised. "She is, is she? That's very interesting." He stared off into space.

Rory waited a minute, then said, "You really like her, don't you?"

Anton nodded solemnly.

Rory scowled. "Darn. It would be nice if she liked you. You're my best friend after Geary." He batted at the carpeted wall of the lounge. "Sometimes I don't understand her at all. She was acting like she liked you. Smiling right after you'd leave the room and looking at nothing. You know, the sort of look you get on your face when you bang your head real hard on the doorway? I was sure she liked you!"

"You certainly couldn't prove it by me."

"Well, I thought she did. Then she said something rotten 'bout you."

"What did she say, Rory?" Anton wasn't sure he should ask, but couldn't help himself. What was another small pain?

"She was talking to Kim, what they call 'girl talk,' so they chased me out of Dr. Ruth's room, but they didn't close the door so I stuck myself to the floor and listened." Kim Cowlander was an electronics technician who roomed in Three-C. She was friendly, but brisk, except with Rory. With him she was patient and kind.

"Well, what did you hear?" Anton's stomach didn't feel very good.

"Dr. Ruth said you didn't do anything. No, that's not it. She said you were a lump. Or was it a large piece? No, no. She said you were a hunk! I didn't think that was very nice. You do lots of things! Why are you laughing?"

Anton had been speaking English since he was in grade school and had done his post doctoral work at Johns Hopkins in Baltimore. He had a more than adequate grasp of American slang. "It's all right, Rory. Sometimes it is a good thing to be a hunk. What else did they say?"

"Well, Kim said you certainly weren't her type." He looked sideways at Anton. "Dr. Stan says that Kim likes girls and she really likes Dr. Ruth but Dr. Ruth doesn't like girls that way."

Anton shook his head in amazement.

"Then I left. I was too mad to listen anymore."

"That's okay, Rory. Can we keep what you just told me a secret?"

"Secrets are for friends to keep," agreed Rory.

Just then, Dr. McMillian came into the lounge. She was wearing shorts and

a tee-shirt, and was flushed from working out in the two-g centrifuge. "Hello, Rory," she said warmly, adding, "Anton," somewhat cooler.

Anton nodded. "Dr. McMillan."

She looked at him suspiciously. "What are you smiling at?"

"Nothing," he said. "Nothing at all."

The accident occured right before dinner. Anton was watching the docking of the weekly shuttle from Ceres from his cabin window, so he saw most of it.

The shuttle, a spherical pressurized cabin with rocket motors and fuel tanks on struts, had completed most of its braking and was drifting toward the station's docking pod. The station's own two smaller shuttles were docked at two of the six available locks. A station hand floated in his suit, waiting to jump across with a line and warp the shuttle in. The shuttle fired braking thrusters one more time.

And then blew up.

Anton blinked.

Saw a glowing sphere of burning gasses expand from the far side of the shuttle.

Blinked.

Saw the shuttle break apart like an egg shattering or a water balloon exploding.

Blinked.

Saw major segments of the shuttle smash into the docking pod.

Blinked.

Saw the docking pod crumple in two places.

Blinked.

Saw an even larger explosion erupt from the docking pod.

Blinked.

Saw pieces of the pod smash into the station's shuttles.

Blinked.

Saw one of the shuttles fly off into space, with a caved-in, fractured look, and saw the other shuttle heading straight for C-pod.

Winced.

He drew a gasp of air to shout, but before he finished, the small shuttle passed out of view to his left, toward the station proper, and a shock jarred the entire room. There was a sudden draft and his ears popped as pressure suddenly dropped. The lights went out. Then there was a "whump" as the pressure door at the entrance to C-pod slammed shut on its rubber gasket.

"Rory!" Ruth McMillian shouted distantly. He scrambled for the door in the dark, found it, and shoved it open.

A lone emergency light mounted by the pod exit dimly lit the lounge. Anton saw Dr. McMillian tug at the door to Rory's room. It flipped open and Rory came sailing out. She grabbed him and ran fingers down his sides. "Are you all right?"

"Sure," he smiled. His nose was bleeding. "Just couldn't find the door latch. Blowout?"

There was a muffled screaming from Dr. Peterson's door. "Let me out! Let me out!"

Anton kicked his way over there and flipped the latch. Stan Peterson erupted into the lounge, clawing wildly with his hands at the edge of the door. Large areas of white showed in his eyes and he was visibly sweating. "Ohmigod,

ohmigod." He clutched his head in his hands and moaned.

"Claustrophobe," said a voice behind them. Kim Cowlander was pulling herself out of her room when Anton turned to look. She was still zipping up a sleeveless coverall as she floated out into the lounge. "What the shit happened?"

Dr. McMillian shrugged. Anton said, "The shuttle from Ceres blew up. It took the docking pod with it. The last I saw before we got hit was the number two shuttle zipping past my window. I think it hit the passageway."

"No shit, Sherlock," said Kim. "Let's see if we can see the extent of the damage." She shoved past the still moaning Peterson, ignoring him, and made her way to the passage door. Anton and Ruth McMillian followed.

"Holy shit," Kim said when she'd looked through the small port in the center of the door.

"You have a preoccupation with fecal matter, Kim?" said Anton, as he pressed forward to look past her shoulder. His eyes widened when he saw. "I take it back."

The shuttle had done more than damage the passageway—it had sheared it cleanly away. When Anton looked out the port he saw the station framed by a jagged and torn passageway—a lot of the station, and more every second. It was receding from them at a visible rate, and nothing connected them to it.

"Well, thank God the cutoffs worked," said Kim, "or we'd be trying to breathe thinner stuff than this. You can see where the power line tore, and there's the sewage and air lines. I don't see the water pipe—it must have torn closer to the hull." She was pointing through the little window.

"We'll just have to wait for one of the shuttles to come get us," said Ruth.

"Uh, I don't think that's going to happen," said Anton. "The last I saw of the number one shuttle it was traveling in-system looking like a cracked teapot, and it was shuttle number two that went through the passageway. I'd be willing to wager it didn't hang around afterward. And even if it did, I'll bet it isn't serviceable."

"Not to worry," said Kim to Ruth. "In a suit I could jump the distance with a line. They'll send someone after us with an EVA pack and a fishing line."

Anton thought about that and felt better, but his breathing was still faster than he thought it should be. Must be the thin air left over from the separation, he thought.

"Dr. Ruth! Anton!" It was Rory's voice, rising in a distressed wail. Anton kicked out hard against the port and shot across the lounge. Halfway there he tucked and flipped, then killed his momentum by collapsing his legs when he landed. Ruth was right behind, but not as graceful. She banged into the carpeted surface and would have bounced back off if Anton hadn't grabbed the sill of Rory's doorway and her leg.

"What is it, Rory?" asked Anton.

"It's Geary! Something's wrong with Geary!"

Anton looked at the cage. The gerbil was floating in the middle of the cage, twitching. Most of the seed shells, fruit rinds, and gerbil feces that normally plastered the side of the cage nearest the intake was floating freely about the mesh sphere.

Ruth pushed past Anton and moved foward until her face was right up against the cage. She took a deep breath and blew gently into the mesh. Almost immediately, Geary stopped twitching. After thirty seconds, the gerbil had recovered enough to start rubbing its nose vigorously.

"He was suffocating in his own carbon dioxide. The ventilators shut off when we lost power. What's more, it's happening to us, too." She unfastened the cage from the wall and handed it to Rory. "Keep moving around, Rory, and Geary will be fine." She looked at Anton. "The same thing applies to all of us."

Anton smiled. "Didn't know you cared."

She scowled back at him, but he was already leaving the room.

Peterson had stopped moaning when Rory, Anton, and Ruth had emerged from the cabin. Rory was carefully moving Geary's cage back and forth through the air.

Kim joined them. "Keep moving," Ruth told her. "Or you'll drown in your own CO_2."

Kim laughed harshly. "Go teach your grandmother. I haven't stopped moving since the accident." She poked a finger at Peterson. "Hey, Mr. Hotshot Physiologist! How long before we use up all this air?"

Peterson stared at her vaguely. He was breathing rapidly. Anton gave him a gentle shove to move him into fresher air. "What's the volume of this area? More importantly, what's the partial pressure of oxygen?"

"How should I know that? You're the scientist."

"What's the air pressure, then?"

"No, idea, Doc. Can't be much lower than 2 kg/cm^2. Even I know we wouldn't be conscious that low, what with the oxy/nitrogen mix the station runs."

"Could be anything from two hours to twenty. I don't know."

Anton felt his breathing speed up again and moved sideways. His head was beginning to ache. Rory had moved off with Geary in tow, and Ruth had moved back to the passageway door.

Kim was starting in on Peterson again when Ruth called. "I think they're sending someone after us!" There was a rush for the door; Rory stayed behind and Anton moved more slowly than the rest. He pulled open the door to the adjoining cabin instead of crowding in with the others and used the larger window inside.

He was appalled at how far away the station looked. It had to be a good kilometer distant. Still, he could see some activity at the airlock on one of the construction pods. As he watched, he saw a flash of brightness lighting up a section of the station in shadow. Then a dot started growing slowly closer. It took two minutes before the dot was a recognizable man. In that time, the station had grown appreciably more distant. After another minute, they could see the line trailing behind the spacesuited figure. It glistened against the black sky like a silver thread.

"Come on, baby."

"You can do it!"

Kim and Ruth were cheering the figure on. Anton moved again to help his breathing, but kept his eyes glued to the moving man. He was ten meters away —so close they could make out facial

features through the visor—when the line jerked him to a halt and sent him rebounding back toward the station.

"Aaaaahhhhhhh, shit! They ran out of line!" Kim screamed.

"Son of a bitch," said Peterson.

"It's okay," said Kim. "They'll link together more line and try again."

Anton frowned again. His head was killing him. "In the time they take to find every extra meter of rope, I'll bet we drift three meters. If we don't do something to push us back in the other direction or at least stop our movement, they won't be able to reach us."

Kim stared at him. "I hate know-it-alls." She began looking around the room. "So we need to fling some mass that way." She pointed in the direction opposite the station.

"What do we have in the way of propellant?" Anton asked. "The fire extinguisher!"

"Christ, yes." Kim jumped to the passageway and opened a panel marked with the traditional orange and red flames. A red cylinder with nozzle and valve emerged. "That's fifteen kilos at 140 kg/cm^2. That'll give us a healthy shove, but not enough."

"There are three more in this pod, though," added Ruth. "How will you vent it out?"

"I'll adapt it to one of the sink faucets, then open the faucet valve and squeeze the trigger. When it's discharged, I'll close the faucet valve and hook another extinguisher up. It'll blast out of the torn pipe!"

Ruth frowned. "But in what direction?"

Kim paused. "Whatever direction that torn end is pointed. It could have ripped on the bathroom side. That's the direction we want."

"And if it didn't, we'll end up blasting ourselves farther away!" said Dr. Peterson. "We can't take that risk."

"We can't afford not to, Stan," said Anton. "We'll hook it up, then try it with lookouts posted. We should see the crystals."

"And if it isn't the right direction?" asked Peterson.

"We'll have tried."

They started working.

Meanwhile, Rory was worried. Geary seemed to be doing okay, but you never knew. He paid more attention to Geary's movements than to the conversations around him. After a while, he found that he could keep Geary's cage moving best by giving it a slow toss across the room, then bouncing over and catching it before it hit the far wall. He kept doing this over and over again until Dr. Peterson said, "Rory, sit still. You're using up more oxygen by jumping around like that, you stupid little shit!"

Anton turned from where he was steadying one of the fire extinguishers while Kim taped its nozzle to the faucet with turn after turn of electrical tape. "Dr. Peterson, the next unkind thing you say to Rory you will regret. I mean it."

"Right," said Ruth from across the room. "So do I."

Dr. Peterson subsided, mumbling to himself.

Rory frowned. At least Dr. Ruth and Dr. Anton were getting along better. He moved away from Dr. Peterson and gave another toss to the cage.

Halfway across the room, Geary started running around the inside of the

mesh sphere like he did when Rory was about to feed him. Rory sat back and watched the rotating sphere and running gerbil. He was sure that Dr. Stan didn't like him. Well, he decided, I don't like Dr. Stan, either.

"Ready, all?" yelled Kim from the bathroom. In one hand she held the faucet handle, in the other the squeeze handle to the fire extinguisher. From the door port Anton said, "Ready." Ruth and Dr. Peterson replied from two different cabins.

"Here goes the first burst." She turned the faucet and felt the tape stiffen as the inside of her connection was opened on vacuum. Quickly, she gave a squeeze of the handle and a burst of chemical foam surged into the pipe system. Just as quickly, she shut it off.

"No good," called Anton. "It came out on my side, pointing at Lucy."

Peterson started moaning again.

"Well, damn it," screamed Kim. "Turn the fucking pod around!"

"How? Get out and push?" Anton snapped. "If I had one of the centrifuges from my lab, you could wire it to the battery and get some spin out of it. That would turn us."

Ruth said, "Maybe one of the other pipes is pointing tangential to the pod. If we fired one of the extinguishers out one like that, it would turn us."

Kim started crying. Ruth stared at her, shocked.

"No, damn it," Kim said. "This is the only outlet I can get to. The sewage cutoff I can't adapt to and the hot water pipe just runs to the heater there—then out the same pipe. It's so damn unfair!"

Peterson started moaning louder and twitching.

Rory came up to Kim and awkwardly stroked her hair. "Don't cry, Kim. I don't like for you to cry."

Kim tried to smile at him. "I'm sorry, baby. I don't mean to. I just wish this stupid old pod would roll over so we could go back to the station." She grabbed hold of him and buried her face in his chest.

Rory alternated between scowling and distress. "Don't cry, Kim. I'll turn the pod for you, if you won't cry."

"Oh, Rory. You can't, baby." She cried even louder.

Rory pushed her to arms length. "Oh, yes I can. You just watch!" He detached himself from her and went to the doorway of the bathroom. Anton watched, as Rory crouched and got both feet planted on the edge of the sill, then pushed off—not across the lounge, but along its surface. Before he ploughed into the rising carpet, he put a hand out and hit the carpet enough to bring his body tangential to the floor again. He began kicking out with his feet also, maintaining the momentum and improving it. Soon he was traveling around the room on all fours on a path just missing the open bathroom door at one end of the pod and the passageway at the other. With a spasmodic jerk, he stumbled erect and began running around the room. This increased his speed dramatically.

Kim looked at him, amazed, then jumped across the lounge to the passageway door. She looked across at the station. Slowly, almost imperceptibly, the station was dropping with respect to the window.

"I'll be goddammed. He's doing it. *He's doing it!*"

Anton started moving, too. As an athlete raised in a gravity well, he was able to get upright much faster than Rory. He kept on the side of the pod opposite Rory and followed the same path. Kim started laughing. "Come on, you rats. Turn this bloody squirrel cage!" She jumped back to the bathroom and gripped the handles again. Her eyes locked on the one small window and stayed there.

Rory started gasping, followed quickly by Anton. It wasn't that they were building up CO^2 again. In fact, their motion was acting as a crude circulating fan for the entire lounge. The problem was that the cabin pressure was equivalent to the Andean highlands, and there just wasn't enough oxygen in that air to support heavy athletic activity. They stumbled to a stop, but not before the pod was spinning at a respectable one-point-two rpm.

Kim looked back at them. "You can't quit. You have to start running in the other direction so the nozzle will stop pointed in the right direction!"

Anton gasped, "Don't be silly. Just fire the damn thing every time it's in position."

"Oh." She shut up.

The station swam into view from her position. She twisted the valve and squeezed the extinguisher handle for the ten seconds it took to pass out of view. After another minute and six seconds she repeated the process. It took her five minutes to empty the extinguisher and another two to attach the next one. Twenty minutes later she'd emptied all four extinguishers and the water heater's ninety liters of water.

Every revolution, the station looked slightly larger.

An hour later, a smiling space-suited figure impacted with the crumpled passageway frame and attached a nylon line to the pod. Two hours later, a jury-rigged pressure collar let the five of them into the station proper.

Two weeks after the incident, the station held a farewell party for Dr. Peterson in the cafeteria. Conspicuous in their absence were Anton, Ruth, Kim, and Rory. Kim was in her room with a female lab technician from Electron Microscopy, Rory was wandering around the station, and Anton was in his lab reading.

Ruth popped her head in the door. "What's this? I thought you communists went in for parties?"

Anton frowned. "*Vecherinka*, the Russian word for evening party or celebration, has absolutely no relation to *partiya* or *kompaniya*, the Communist Party."

"Spoilsport."

"Imperialist lackey."

"Commie pig."

"Capitalist dog."

She smiled and threw something at him. He snared it lazily out of the air.

It was a bound notebook, several hundred pages thick, with her name emblazoned on the cover. He looked back up at her quickly.

She had stopped smiling. "That's my baby—the write-ups on the work we've been doing out here for the last four years. I would like you to read it over and tell me what you think." She was looking off to the side, avoiding his eyes.

He licked his lips and looked back down at the book before carefully saying, "Certainly. It would be an honor."

When he lifted his head, Ruth was staring at him, the barest hint of a smile on her face. She nodded once. "Good."

Anton cocked his head to one side. "You perhaps should have Rory read it, too. That one's going to require watching."

She did smile then. "The son of a Nobel Laureate usually does."

Anton stared. "Rory *Herzig?*"

Ruth nodded. "When she was recalled to Earth, she thought he'd be happier here."

Anton nodded slowly, then smiled. "He *will* bear watching."

Over in J-pod, the extra-special investigator of the universe pushed a small button on a small box. Geary the gerbil listened as Rory said, "Define . . . *motion.*" ■

ON GAMING

(continued from page 95)

shows its reduced values if damaged in combat.

After determining who moves first by roll of a die, each turn is played as follows: the first player moves; the second player moves; combat is resolved; repairs are made to damaged ships; garrisons are placed on captured stations; new garrisons are raised; victory points acquired are recorded; advance the "turn" counter and start this sequence again.

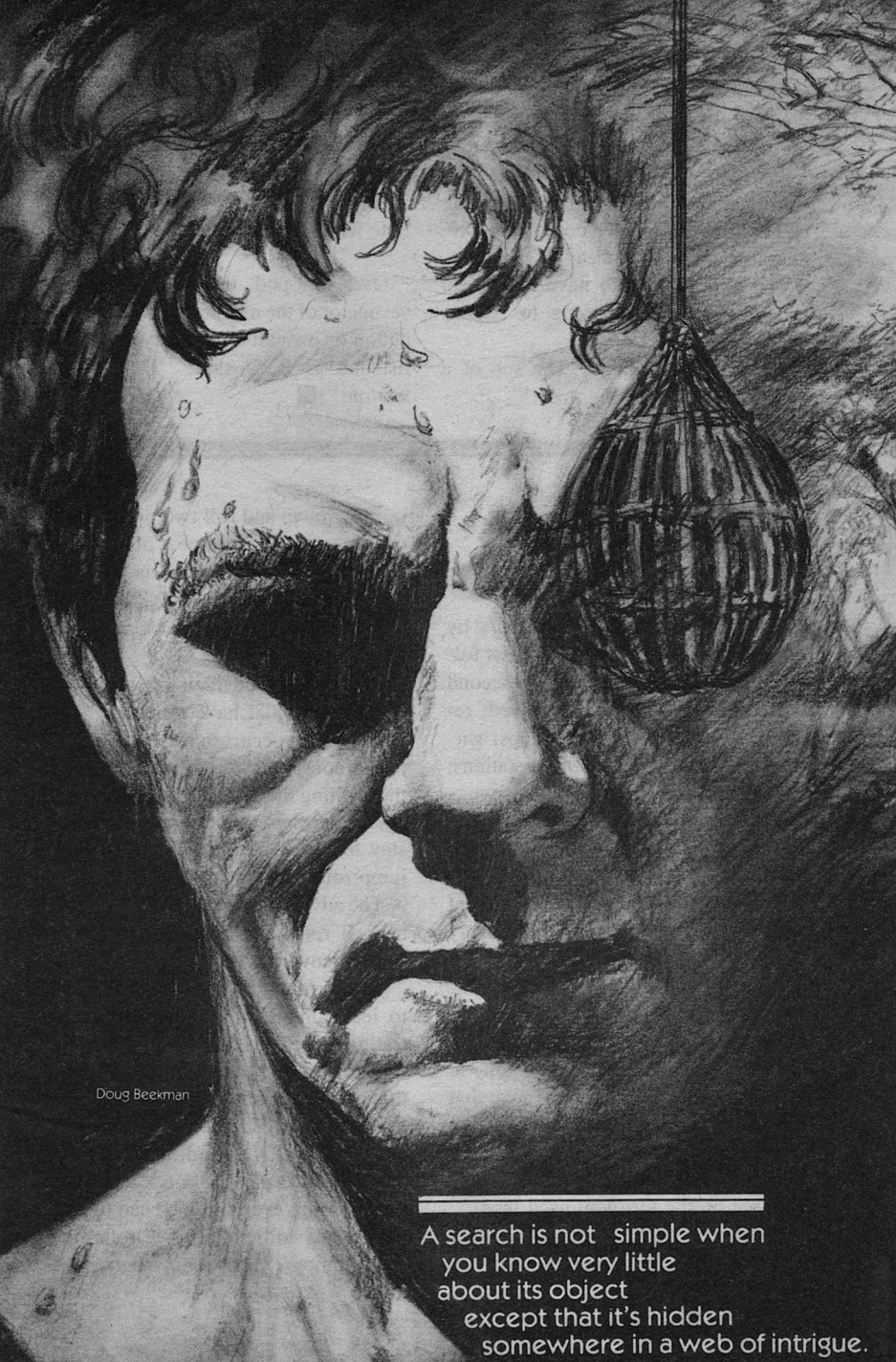
While each ship has a movement value that tells you exactly how many "jump points" it may move in a turn (in either good or damaged condition), you don't know how many ships you can move on any turn. This varies each turn since you roll a die and add one to see how many total ships can move that turn. This makes long-range planning very difficult, since ships you may be counting on for a battle may not be available on the turn you need them.

Once each game, the two military players may make a military fleet assembly move and roll two dice and add one to get the total number of ships that can move that turn. This is a critical maneuver and should be held back until play develops and the best opportunity presents itself.

Ships must end their movement on jump points that have an enemy ship. Combat then occurs in two rounds, each round consisting of each player firing, then rolling the dice and recording damage. After these two rounds, ships may stay to renew combat, or flee along a jump route.

The advanced game has more detailed tactical rules and a tactical map sheet for maneuvering opposing ships.

The Company War is a simple game to learn and play, but it can be frustrating. Dice rolls for ships available for movement, and combat results can produce extreme situations suddenly for either side. If you like the kind of challenge created by a fluid, uncertain play environment, as well as by your opponent's doing everything he can to upset your plans and exploit dice rolls, then you'll enjoy *The Company War*. ■


Doug Beekman
A search is not simple when
you know very little
about its object
except that it's hidden
somewhere in a web of intrigue.

Edward A. Byers

SIMPLE ACTS OF WAR

Prologue

Ambassador Gerald LeCount sat in the uncomfortable straight-backed relic in front of Timmons's desk and looked down at his hands and stretched to ease the stiffness in his neck. LeCount's hands were large, faintly freckled, the nails buffed into smooth crescents; they were not, however, the hands of an aristocrat. He glanced at his watch. It showed twenty past eight, the tenth of January. Snow swirled outside. Through it could be made out the damp black outlines of other buildings. LeCount shivered. It was never like this in Bouquatan.

"Sorry I'm late." Ralph Timmons, head of the Energy Department's Lambda Bureau, stopped just inside the door and smiled, his features gaunt, almost hollowed.

He did not *look* as though he would eat you, LeCount decided.

"Coffee?" Timmons asked, seating himself. His eyes were a clear hazel, the color of certain stones LeCount remembered picking up as a child. Agate, the stone was called, and it was as hard and sharp as it was beautiful.

"Tea, please," LeCount said. "No cream or sugar."

Timmons half turned. One finger punched a button on the apron of his desk.

"Massey!"

"Yessir?"

"The ambassador would like tea."

"Yessir—on the way." There was no sense of deference in his secretary's reply.

Timmons smiled then at his visitor and relaxed. He settled back, lacing his fingers together behind his head. "All right, Mr. LeCount. What's so important you couldn't go through channels? I'm told this meeting isn't even supposed to go on the schedule calendar."

LeCount gave a rueful nod. "My country has an effective intelligence arm, Mr. Timmons. I'm taking a chance talking to you at all. I'm doing it on behalf of an old friend—who can't do it himself."

"Oh, who?"

"Gene Christophe."

The ambassador was rewarded with a moment of silence. "He's dead," Timmons said at last, looking at him.

"Quite right," the other agreed. "Suicide. Several hundred people saw him do it."

"Then . . . ?"

LeCount leaned forward a little in his chair. "They say you met Christophe once, Mr. Timmons. Is that true?"

The Lambda chief shrugged, gave a nod. "He was in this country for nearly nine years. He had some interesting ideas, I recall, on tidal energy resources."

"So!" LeCount seemed pleased. "Did he perhaps strike you as a firebrand? Was he rash? Reckless?"

Timmons shook his head. "He was no firebrand—at least not here. And his work was thorough, based pretty solidly on precedent. What are you getting at?"

LeCount made a face. "Just this. The night he died Christrophe was honored as a Son of Bouquatan. He was given the rank of Commodore of the Citadel of Bouquaville, and awarded the medal of St. Anne. He stood there crying, Mr. Timmons, and for twenty minutes the crowd applauded, not allowing him the

opportunity to give his acceptance speech."

Timmons slowly unlaced his fingers and placed his hands on the desk before him. He raised his eyebrows and waited.

"All copies of his speech were later confiscated," LeCount went on, his voice suddenly hoarse. "All tapes, all records, all notes—were seized. But too late, of course. All that was after Christophe was through—after he had committed suicide."

"How did he do it?"

LeCount gave the bureau chief a probing look. "Death is sometimes a mocker, Mr. Timmons. Christophe went backstage, took down an ornamental lance from the wall. He braced the butt against a statue of Henri Lambeau, the founding father of Bouquatan. Then he fell on the lance, in full view of three hundred people."

"Was he insane?"

"Possibly." LeCount turned to the right and blinked. The office door opened. A red-haired woman entered, her form petite, her dress a trifle severe. Her arms were laden with a tea tray. She placed it at LeCount's elbow and granted him a brief smile.

"The tea is Indian blend, Mr. Ambassador. I hope it's satisfactory."

"My favorite," LeCount said. He shot her a puzzled glance. "How did you know I prefer Indian blend?"

Carol Massey's eyes twinkled behind dark-rimmed spectacles. "There are few things sacred to computer scans, sir. Your embassy uses a local link when they order supplies. It only took a minute to *de*-file that information."

"Ah." LeCount stirred his tea, looked up at the woman appreciatively. "There is, I believe, a block on that supply link."

Carol Massey nodded, red curls bouncing. "Level two. And it's a clever little mousetrap—*really*." She grinned impishly, looked at Timmons, then vanished through the door, closing it noiselessly behind her.

"So easy—" LeCount muttered, chagrined. He nodded toward the door. "You have a treasure there, Mr. Timmons." He took a sip of tea, sighed deeply.

The Lambda chief acknowledged the accolade with a tiny inclination of his head.

LeCount put down his cup, looked squarely at the other. "We were talking of Gene Christophe."

"Yes."

"I believe his speech—all records and notes—were confiscated because of a single thing Christophe said."

"What was that?"

"That he'd made a breakthrough—a *quantum jump*—to a new energy source!"

Timmons's reaction was no reaction. He shifted slightly in his chair, head tilted at an angle. Except for his eyes, he appeared totally indifferent to the ambassador's remark.

So cool, LeCount thought, watching him. Not for nothing is he known as a man without nerves.

"Were you there?" Timmons asked, breaking the silence. "Did you hear what he had to say?"

LeCount shook his head. "I was at the presidential palace. President Charles Fontierre was giving a party at that time. The president is not a fan of Christophe's—has not been for some years.

I received the information, pieced together and admittedly somewhat rambling, from Christophe's daughter, Dominique."

"You give it credence?"

"Yes. But not because of Dominique." LeCount picked up the teaspoon, looked at it, returned it to the tray. He said, "Fontierre himself believes it. He had his men scour Christophe's home."

"What did they find?"

"Nothing . . . nothing that I know of. But Dominique said they practically tore the place apart."

Timmons regarded the other musingly. " 'A quantum jump!' He used those words?"

The man from Bouquatan smiled. "I didn't poll everyone who heard him. But yes, it's my belief he said it."

"Those *exact* words?"

"He is reputed to have said, 'Quantum jumps do not occur very often. I have been blessed in discovering one. I should be home studying it right now.' "

Timmons's eyes gleamed. LeCount could suddenly sense the man's excitement. The Lambda Bureau existed for one reason only—to procure new sources of energy for a world that was quickly running down. Eventually, inevitably perhaps, the great Tokamaks would spew out nearly limitless amounts of energy, their source a bottled sun—nuclear fusion. Until that day the world would depend upon men like Timmons. *And* upon geniuses like Christophe, LeCount amended quickly to himself—*them* most of all.

"Could a man get into Bouquatan?" Timmons asked, peering at LeCount. "How tight a rein does Fontierre hold?"

The ambassador picked up his teacup, held it in his hand for warmth. The wind was raw outside; it rattled the windows. He shrugged, looking at Timmons. "Theoretically, at least, Bouquatan's borders are open. But if you send a man in, he will be watched. And if he *does* find anything it will be taken away from him."

The bureau chief gave him a thin smile. "Perhaps. I have a man in mind who might think otherwise."

LeCount finished his tea and set the cup aside.

"Who?"

"His name is Sam Callahan."

LeCount stared. He felt as though he'd been punched in the stomach.

"Callahan? The *murderer?*"

Timmons's long face took on an expression of pain. "The newsfaxes tend to overstate things, Mr. LeCount."

The ambassador stood up, despair and anger vying with diplomatic training. He had hoped the Lambda Bureau would rescue Christophe's genius from anonymity—or, to put it in the light of bloody reality—from downright theft. That wasn't to be—not if Timmons was insistent upon sending in Callahan. LeCount read the dispatches. Callahan was described as a berserk wild thing, a maddened animal, an out-of-control killing machine. LeCount cursed under his breath. Any way he looked at it, Timmons's decision appeared to be disaster.

He put his hands behind his back; with effort controlled himself. "Not Callahan. It won't do any good to deliberately antagonize Fontierre."

Timmons appeared startled by his reaction. He said mildly, "You misunderstand the situation. Believe me, Callahan is the man for the job. Along with five or six other languages, he speaks French like a native."

"Be damned!" LeCount squared his shoulders. His mouth tightened. He said stiffly: "I did not take you for a fool, Timmons—but this is the act of one. For the sake of Gene Christophe's memory, I'd like you to reconsider. Send someone else."

The bureau chief merely looked at him, and LeCount found himself flushing.

"I think I know what I'm doing, Mr. Ambassador," Timmons said formally, rising. He moved around his desk and extended his hand. Out of reflex LeCount took it.

"But goddam it . . ."

Timmons gave him a smile. "Let's wait and see, shall we?"

"But . . ."

"Goodbye, Mr. Ambassador. Massey will see you to the door."

LeCount began a reply, but Timmons had already turned away, his long frame as inscrutable as stone.

1

Sam Callahan was afraid.

He got out of the taxi in front of one of the brick buildings hugging Bouqueville's dusty main street, a tall man, no longer young, wearing a rumpled tan jacket and scuffed engineer's boots.

"Find Sparankrinov," Timmons had told him. "She's a correspondent for one of the wire services. She'll get you oriented, show you how to get up to Christophe's cottage. Christophe's daughter is expecting you."

The Lambda field man knew only one woman named Sparankrinov. Her first name was unpronounceably Russian. Everyone, including Callahan, called her Sparrow. A trouble-maker, Callahan thought, which was why she had been sentenced to Bouquatan.

He looked around, his eyes passing over two or three well-armed soldiers. The town was several centuries old, nestled between two minor peaks in a long mountain chain. Quaint, travel brochures would have said, had there been tourists. Below the city, glistening gold with light from the afternoon sun, lay Lake Borleau. Crescent-shaped and deep, it was reputed to contain the largest catfish in the world. Other than the soldiers, there was scant evidence of the grim little war that had been fought here—or of the new government with its grandiose plans.

"Hi, Callahan!" The speaker was small, dark-haired, unsmiling, thin. She was younger than Callahan by at least a decade.

Callahan nodded. "It *is* you. Hello, Sparrow."

The woman stepped forward and gave him a mock grin. "Welcome to the end of the world." She extended her hand.

"Thanks." Callahan shook the proffered hand, then bent to pick up his luggage.

"Car's down at the 'boot.' " Sparrow said economically. She gestured vaguely down the street. Callahan looked but saw only a series of dry ruts amid patches of cobblestones. He followed the woman, his long stride easily matching her quicker gait. Walking thus, he

reflected again on Ralph Timmons's final instructions. They had been succinct. "Gene Christophe found something —*they* say. Call me in a week or a month—tell me what *you* say."

Callahan grinned slightly at the memory of Timmons's cat-and-mouse expression. People said the man's brilliance was authentic, and Callahan knew of no reason to dispute it. The bureau chief's brain, vastly compartmented, seemed always to operate on several different levels at once. But, Callahan reflected anew, if there was a single man in the world whose enmity he feared, that man would be Ralph Timmons.

The street the two were following dipped, turned, finally ended. Ahead was a concrete pad, flat and smooth as a billiard table. It was roughly in the shape of a riding boot, with the toe abutting a precipice of several hundred feet. Callahan glanced down and involuntarily stiffened. Directly below was a ridge of serrated stone, its jutting points reminding him uncomfortably of sharpened teeth.

Sparrow moved away from the precipice. She indicated an ancient automobile with a nod of her head, then patted its dusty fender. "This thing has mountain goats in its bloodline." She grinned and opened a door. "Toss your stuff in the back and we'll get going."

Callahan did so, and then settled into the front seat beside the woman. "What is the boot used for?" He lifted his hand off the windowless door and pointed to the concrete strip.

The woman pumped the vehicle twice before cranking it into roaring life. She said obliquely, "You'll find a lot of strange things about this place, Callahan. For instance, there are fortifications all over this area. In the mountains—even inside the town itself." She twisted the wheel and whipped the car into a sharp turn. "The boot was built for two reasons. The garrison stationed here in the last regime needed a heliport. That's the real reason. The official version was that this end of the town was eroding away over that precipice."

"Anything to that?"

Sparrow shrugged, cast Callahan a doubtful look. "This mountain is granite. The town has been here since the beginning of the seventeenth century. Draw your own conclusions."

The road they were following angled sharply upward in a series of terraces, the outer edges of which were covered with a fine nap of green. The woman said little, intent upon negotiating the hairpins and switchbacks that appeared before them. Callahan let his mind wander. As always, it went back to the doctor's pronouncement, the senator's vehement righteousness—and Ralph Timmons's adamant refusal to be swayed.

"Sam Callahan is dangerous!" Senator Frank Heywood's authoritative tones were a dull rumble in the next room. Callahan, wrists manacled, the rush of powerful sedatives making his head buzz, stared sullenly ahead, painstakingly ignoring the guards posted at the door. Slowly, mercifully, the rage within him was dying.

"What is he charged with?" That voice belonged to Ralph Timmons. It was deep, calm, ungiven to alarm—but ungiving, too. Timmons was rumored

to have glacier melt running in his veins.

To Callahan's right was a wall, a blank white square with a picture of the city's mayor hanging on it. Two feet above the picture was a ventilation aperture. Without giving it thought, Callahan realized the voices were coming through the vent, but were as yet too soft to be heard by his guards. He shook his head to clear it. The bruise beneath his left eye began to throb with sharp pulsing pain. Callahan licked his lips, tasted blood.

Heywood spoke again, appreciably louder. "You can't ignore the man's behavior, Timmons. He's gone crazy! He's a goddam berserker! Three assaults in what—two weeks? And now finally, a deliberate attack on three policemen who merely stopped to question him."

"Three sounds fair." Timmons's voice was droll.

Heywood snorted. "Goddam it, this is serious! He killed that man, Rochirra. He's going to kill someone else."

"Classic Attack Syndrome." Dr. Arthur Baxter broke in.

"What's that?"

"When most people perceive aggression they're emotionally balanced between two urges. The first is to attack, the second to flee. Fight or flight. *Callahan has been pushed beyond that. He no longer exhibits the urge for flight—only the one to attack. He is, in a clinical sense, insane. He needs to be shut away."*

"But you haven't mentioned charges." Timmons's voice had grown steely. Callahan pictured his superior's thin features and piercing green-flecked eyes. A smile twitched the corners of his lips.

"He's been written up on nine counts," Heywood said in exasperation. "He's lucky. There could have been more." Heywood was a large man, heavy of bone and muscle. His expression was normally brooding, implacable. He had been Timmons's avowed enemy, Callahan remembered, for more than a decade.

"He's been with Lambda for thirteen years," Timmons said, his voice becoming a murmur. "He and I go back a long way. I'm not going to turn my back on him."

"But this time he's gone too far!" Baxter's voice was shrill. The man's fine patrician nose, Callahan knew, would already be several inches out of joint.

Timmons's response was a grunt. "There were *mitigating circumstances, for Christ's sake! He spent a goddam year in a bamboo cage!" Baxter attempted to override the bureau chief but Timmons refused to be quieted. "He was in Madagascar, let me remind you, at the specific request of a Senate subcommittee, guarding an American research team that had no business being there in the first place." Timmons's voice had become passionate, his words clipped.*

On the other side of the wall, Callahan found himself swaying dizzily back and forth. The bamboo "tiger cage" seemed suddenly very real. Drugs and manacles added verisimilitude to the horror. He bit his lip savagely to keep from crying out. Abruptly he threw himself forward, trying to stand, to get away from the wall—away from the

voices. Horribly, to his chagrin, he found his legs collapsing beneath him. He slumped back.

The voices behind the wall continued.

"That's damn good," he heard Heywood say. "We're supposed to feel sorry for him, forgive him, let him go on until he kills someone else. Right?" There was an abrupt laugh, half cut off, the sarcasm contained within it not even thinly disguised. "No chance. You can't sway us on this. Count on Callahan getting at least a year. Maybe that will give him time to settle down, fit in."

Very quietly, Timmons said: "If you lock him up, he'll die—it's as simple as that. That would *drive him over the edge." There was a silence. Even more quietly then, Timmons had said: "I won't permit that to happen."*

The old car had just crested a ridge, and before it lay a wide vista of deep valleys and sharply cleft hills. Sparrow pulled the automobile to the side and let it idle. She sighed deeply, her thin features relaxing. She looked at Callahan for a moment before speaking.

"Beautiful, isn't it?"

The Lambda man followed the woman's gaze. There were ridges of deep purple, strata lines of pure white. Far to their left were snow-capped peaks.

"Yes, it is," Callahan admitted. He took a deep breath. The wind, out of the northwest, was pungent with piñon and wild honeysuckle.

"Christophe's cottage is across the valley." Sparrow pointed toward a plateau halfway up the side of a nearby rise. Callahan guessed it lay no more than two miles away in a straight line, five or more if you followed the winding road.

"What was he like—Christophe?" Inside his suitcase was a file, thick enough to require an index and elastic binder. Callahan had read it through carefully, yet . . . somehow . . . the man remained a mystery.

Sparrow shrugged. She had high cheekbones and a faint overbite. It lent her features an angular quality that on another occasion might have piqued Callahan's interest. Now it did not. He merely felt weary.

"He was eccentric, brilliant, stubborn. All those things." She smiled. "I interviewed him only a week or so before he . . . died."

"Any idea why he committed suicide?"

She gave him a sidelong look. "There are a lot of people in these mountains who don't think he did. Including his daughter, Dominique. They think he was murdered."

Callahan looked at her, startled. "That's the first I've heard that."

Sparrow pulled a face. "Yeah—I know. Everybody saw him take down that harpoon or spear or whatever it was—and they'll swear there wasn't anyone within twelve feet when he rammed it through his gut. Hooray for eyewitnesses!" Her voice was laden with sarcasm.

"Did *you* see it?"

"Nope. I was in the States. They needed another pencil to cover a hurricane." She shrugged philosophically. "It wouldn't have made any difference. I couldn't have stopped it."

"That last interview with him. What was it about?"

Sparrow twitched an eyebrow. "Mostly about Dominique. She was due home in a few days from Switzerland. She attends a girls' school there." The woman's eyes clouded. "And that's one more reason it couldn't have been suicide. Gene Christophe loved that child." She stopped, shook her head, looked baffled. "It doesn't make sense, Callahan—any of it."

The Lambda man pondered that while his eyes sought a string of blue-tinged peaks rising murkily in the distance.

"How old is Dominique?"

"Twelve going on fifty," Sparrow said with humor. But there was a dryness to it, an astringent gravity, that was not lost on the other.

"How about her mother?"

"Ah, now you're getting to the heart of the matter." Sparrow shot him a quick glance, put the car into gear, and edged it back onto the road. "She's dead. She died a year after the war."

Callahan studied Sparrow for a moment. "Something special about her?"

"Verrry special. They even have a term for it here in the mountains. *La clé anglaise de neuf jours*—a nine-day monkey wrench."

Callahan stirred in his seat. "What does that mean?"

Sparrow sighed, then shrugged minutely. Her grip on the wheel tightened. "It'll take a minute to explain. You ever heard of *la Mariée Puante?*"

"No."

"Well—literally, it means the *fetid bride*. That's Aimée, the woman Christophe married."

Callahan turned in his seat and regarded the woman openly. She met his eyes briefly, smiling, before directing her attention once more to the road. She abruptly laughed.

"I had a roommate in college who had the syndrome. Two left feet. A social embarrassment. As likely to spill coffee on you as breathe. And—from what I've been able to find out—Aimée was the world's most singular example."

Callahan blinked in puzzlement. "That makes her a 'fetid bride'? It sounds terrible—like a curse."

"The term's local," Sparrow reminded him. "I've done some research on it—enough to know that monkey wrenches like Aimée are hysteric personalities. Hers was classic active-dependent, but skewed almost perpendicular."

The Lambda man cocked an eyebrow. "Dominique like that?"

"No, fortunately. Gene Christophe couldn't have lived with two like Aimée. Dominique is more like he was. She's . . . well . . . you'll have to decide for yourself." Sparrow shifted gears and slowed, the front end of the automobile easing into a deep gully. On the other side she gunned the engine, shifted into a higher gear, and risked a look at Callahan.

"By the way. President Fontierre has given up on Christophe's so-called quantum jump. Or, at least, that's the latest word."

"Oh? I wondered why I wasn't met with an interrogation squad." Callahan remarked ironically.

Sparrow swiveled her head, said sharply, "You'll make a mistake if you underestimate Fontierre. You saw those soldiers back in town. The government lets them run wild. They beat anyone

they find out after curfew. Don't stay here too long, Callahan. And don't cross Fontierre—he doesn't much like outsiders."

The Lambda field man rested his elbow on the door of the automobile and stared out at the shifting colors of the Bouquatan mountains. A thought crossed his mind and he turned to Sparrow to pursue it.

"Christophe's file is pretty full. According to it he and Charles Fontierre were not always enemies."

"Oh, sure. But those were bygone days." Sparrow fixed Callahan with a sardonic eye. She sniffed. "Thirteen years ago Fontierre was only a minor rebel chief. He couldn't make a dent in the Citadel, which is what Bouqueville was called in those days. He persuaded Christophe to come back. It gave his campaign credibility."

"They were friends?"

Sparrow tossed her head and snorted. "Balls no! But Christophe thought Fontierre would be better than Commodore Raymond Poulette. The 'old man' was bankrupting the country while his people starved." She turned toward Callahan. "It turned out he was wrong, of course. Better a dissolute mountebank than an unfeeling dictator bent on setting the world on fire."

"Fontierre's not a good administrator?"

"He tried at first; I'll give him that much," Sparrow said. She shifted gears and gunned the engine. "But this is a country plagued by all the afflictions of an economy going to ruin. There's terrible telephone service, routine power outages, burgeoning black markets, cultural stagnation. And," she added significantly, "an active underground. He's only managed to stay in control, so far, by using military force."

The car abruptly lurched and Callahan caught himself by grabbing the doorframe. Settling back, he looked around at the windswept rock, at the high cliffs with their inaccessible crevasses. Who would *want* to control such a place? For a moment it did indeed seem the end of the world.

Looking into emptiness, he allowed his mind to slip away, to wander.

"What will it take?" Timmons asked, voice grim.

"Jesus Christ—man! You can't just buy Callahan out of this!" Heywood's voice was muted thunder.

"Why not?"

"Because—"

"He's like the god Shiva," Baxter interjected, his words sputtered. "He destroys—that's all he knows! If we let him go he'll only finish the job that was started out there in the jungle."

Timmons said, "If he is truly Shiva, let him destroy me."

"What do you mean?" It was Heywood, querulous, demanding.

"Simple. Make the price high enough. Put a noose around my neck. I'll answer for Callahan."

"Do you know what you're saying, Timmons? We can take your job away, ruin you—you and your goddam bureau!" *There was a hoarseness to Heywood's words.*

"Only if he really is a destroyer."

"He is!" Explosively from Baxter.

"I'm betting he's not." Timmons's voice was flint.

"You'd lose!"

"I'll take the risk."

"Then it's your goddam funeral, Timmons. And I'm going to dance on your grave." Heywood began laughing maniacally.

2

"Well, here we are." The car wheeled around a last turn and braked in a cleared area beneath a cliff. Above Callahan a serpentine stone stairway rose yet another thirty feet. The woman pointed to it. "Christophe liked being isolated. Far as I know, that path is the only way up there."

Callahan dug his suitcase out of the back seat and glanced at the journalist. "Thanks for the lift. How will I get back to town when I'm ready to leave?"

"No problem." Sparrow smiled, the expression amplifying the angularity of her features. "Timmons said I'm to help you any way I can. Give me a call. I'll come get you."

"Right. Thanks." Callahan got out, watched the woman swing the car around, then turned and began climbing.

The cottage was a surprise, a friendly pile of gray stone sitting in the middle of a grove of dwarf oaks. It looked restful. Callahan smiled and then grimaced. It seemed sufficiently far away from the jungles of Madagascar. Probably that had been Timmons's intent.

The girl who answered his knock was as much a surprise as the cottage had been. There was Indian in her background. She had the short stature, round doughy features and straight dark hair of the Indian hill people. Her eyes, Callahan noted, were deepset and brown, larger than her face could efficiently accommodate.

He said, "I'm Callahan."

"Yes, I know. I've been waiting for you." She stepped aside just far enough to allow the Lambda man past.

Inside, the cottage was large and well furnished, vaguely Colonial, solidly French, comfortable. There were bookcases running the length of the living room, some of the texts recognizable to Callahan. Gene Christophe might have enjoyed his isolation, Callahan mused, but he also liked to be current in his reading habits.

The girl shuffled a step. "Did you know my father?"

"No."

Confusion made her squint.

"A field man named Warren was responsible for him while he was in the States," Callahan explained. "When your father came back here we lost track of him." He looked from the girl to the rough-hewn beams of the ceiling and then quickly around at the row of recessed lights behind the plush sofa. He caught the girl's eye, then raised a finger and held it to his lips.

"Oh!" The sound was squeezed from her, subdued.

Callahan took a pen from his pocket, held it in front of him as he walked quickly by the recesses. At the third one a light glowed in the tip of the pen. The Lambda man pointed, looked back at Dominique and then went on. There were two other places where the pen glowed, one in the entrance to Christophe's study, the other just off the kitchen.

Callahan did nothing to disable the bugs. Instead, he looped a silvery-looking chain around the girl's neck and then

did the same for himself. He gave her a conspiratorial grin.

"Acoustical diffusion. They'll hear mush, like we're outside their audio range, but only just."

She fingered the chain, her eyes bitter. "You're very clever people." She said it like an accusation.

"The design is Navajo," Callahan said unnecessarily. "If you have to take it off, make sure you refasten the clip. Otherwise it will destroy itself."

"They've heard me, everything I've done—everything I've said?"

"Probably."

"*Merde!*"

Callahan suppressed a smile and looked around for someplace to put his suitcase.

"In here." Dominique moved past him and indicated a tiny room beneath the curving staircase. It contained a bed and a single chair. Callahan placed his suitcase on the bed, then pulled the chair away and turned it around. Straddling it, he sat down.

Dominique's eyes watched him thoughtfully. "You're used to this."

"To what—eavesdroppers? Sure." The Lambda man laughed. "You go to bed, you get up, you look for fresh bugs. Those—" he pointed out toward the rest of the house, "—are nothing. Almost amateur."

"Not to me."

"No. We'll have to take the chains off now and then to give the bugs something to chew on. Okay?" Callahan bent down, kicked his boots off. "Ah—that's better!" He stretched hugely and looked up. "Why has Fontierre stopped the search?"

"Because his men went through the house four times when I was here—and more when I wasn't. They didn't find anything."

"Maybe there's nothing to find."

"If you believe that, why are *you* here?" The girl's round face gave little, hid much. Callahan decided it would be easy to underestimate Dominique Christophe. He scratched his chin, his eyes on a level with hers.

"Because—damn it!—I *want* to believe what your father said. I *want* to find his quantum leap. And I want to get it out of the country right *under* Fontierre's nose."

For the first time Callahan detected an upward tic in the girl's lip. "Good! I want that, too. You hungry?"

"I'll tell you," Callahan said soberly, truthfully. "I'm dragged out, bully beaten, toilworn. I'm zonked. I think I need about twenty good hours' sleep. But I'll settle for eight."

"Okay. I'll wake you up in the morning."

"Right. Thanks."

The Lambda man watched the door close and then moved off the chair onto the bed. He closed his eyes for only a moment.

Sweat streaked Callahan's body, and his mouth formed a rictus of anguish. A deep groan formed in his throat and then was abruptly cut off. He dreamed.

His legs were cramped beyond endurance. Sometimes he could get some respite by sliding them between the vertical bamboo slats, but not this time. The feet were too swollen to allow it. Even slight movement made his shoulders ache, but Callahan knew that was

necessary. If he rested them they would stiffen.

"Ho, Sam!" It was the pajama-clad devil Callahan had come to know as Tarto. The little native, with his almond-shaped eyes and sharp white teeth, looked upon the Lambda field man with gleeful indifference. Pain was part of life, and only death could bring about its cessation.

Callahan waited, not knowing what to expect. Tarto had a fertile imagination, and found Callahan an ideal subject upon which to exercise it. Now he cocked his head to one side and stretched his mouth into a grin.

"Balançous nous de haut en bas," *he said in abominable French. He stepped up very close and gave the tiger cage a push.*

The cage was shaped like a teardrop, with Callahan's cramped body occupying the bulbous lower portion. It hung suspended from one of the arching branches of a giant plane tree, its base about four feet above ground level. Briefly, with Tarto pushing, Callahan became a pendulum, the arc of the cage passing through forty degrees or more.

Callahan tried to keep the little Malagasy in view, but the cage twisted, giving him a kaleidoscopic view of sky and earth. When he saw the other again, his stomach twisted into a hard knot. Tarto was holding a long slender pole of bamboo, its end sharpened and already dark with Callahan's blood.

When the tip of the pole entered the cage, Callahan threw himself to one side, cursing. The bamboo spear raked across his ribs and bent almost double against the far side of the cage. Callahan had once tried to hold onto the end of the pole, to wrest it from the other's grasp. Tarto had solved that problem with typical Asian ingenuity. He had slit the end of the bamboo shaft and inserted razor blades.

The tiger cage swung out again, and back. Again Callahan watched for the flicking tip of the bamboo pole. This time he wasn't fast enough; it caught his thigh and penetrated to the bone.

Back and forth the Lambda man swung, and the rage within him grew. . . .

"Wake up! Wake up!"

Callahan saw a nimbus of light, a pale oval that beckoned to him. He struggled toward it, thinking of Tarto, wondering what trick the little Malagasy had for him this time.

"Callahan!" Something hard stung the side of his face. He looked down, into the white features and deeply frightened eyes of Dominique Christophe.

"My God!" He let his hands drop to his sides. He was sheathed in sweat, and his hair hung down in wet clumps. Around him the little bedroom was in shambles. The bed, overturned, broken, had been slammed with terrible force against the back wall. Blood stains were spattered over the rough panelling. The Lambda man glanced down at his hands, noted with no surprise that the knuckles were split.

"Callahan—what happened?"

He shook his head wordlessly. After perhaps five seconds he looked up again, gave the girl a crooked smile.

"Nightmare. I keep refighting an old fight—and losing."

"It sounded it," Dominique said, her color returning. "You'd better let me take care of those cuts." She led him

into the kitchen, where she cleaned and taped the Lambda man's hands. When she was through she put on a pot of coffee and took two cups from a cupboard rack.

"You were shouting," she said. "In French. Something about devils."

Callahan nodded, and glanced up at a wall clock. Past five o'clock in the morning; he had slept longer than usual. Most nights that same dream, recurring, rode him like a river-hag. It was a malignant force impelling him to fury —driving him to the killing edge of madness.

Be afraid, Callahan. . . .

He looked around at the bright kitchen, at the nutmeg-colored curtains, the patterned oak floor. He looked at Dominique, and found himself full of sudden wonder. Now that he was awake, he actually felt better than he had in days.

Dominique poured coffee and settled into a chair across from him. She regarded him gravely from moppet eyes.

"What do I call you?"

"Sam will do—or just Callahan."

"My father always called me Dom."

Callahan grinned. "Then with your permission, I will, too." He transferred his attention to the coffee. It was hot, rich, everything the aroma promised.

"Father was killed, you know. He didn't commit suicide." The words were matter-of-fact, even cold-blooded.

"Fontierre?"

"Yes."

"Why would Fontierre want your father dead?"

Dominique propped her elbows on the table. "He was a symbol. The people loved him. If there were free elections he would have won hands down."

"So he was a thorn in Fontierre's side."

"Yes. Eggs?" The girl was up and across the room and dabbing butter into a skillet.

"Two. Scrambled."

"Maybe you can find something out about my father's murder. Would you try?" Dominique broke eggs into a mixing bowl and shot a glance over her shoulder.

Callahan did not answer at once. He took another sip of coffee, reviewing what he knew of Gene Christophe.

As usual, the facts were simple—the man was not. When he was seventeen years old, he had left the mountains and become the boy wonder of the biologic world. As an undergraduate at Harvard he had presented two papers on amino acid pre-sequencing that had jaws dropping. But then, inexplicably, he'd switched his major to physics and disappeared into academe, surfacing years later with half a dozen patents on energy-related devices. The Lambda Bureau had twigged early, of course. Timmons had a computer for sniffing out people like Christophe.

Before he was thirty, Christophe had developed a speciality. Core Magnetohydrodynamics—a thirty-dollar word for producing energy by turning the principle of the electric motor on its head. Instead of rotating magnets around a wire coil, he had established a superior method for the flow of liquid metal between two supermagnets.

The method had shown potential, enough to generate considerable investment capital, as well as national attention. Very quietly, Ralph Timmons had

assigned a field man to follow the young man's progress.

And then—like a blight—had come Fontierre's revolution.

Callahan looked up with a start as Dominique placed a plateful of eggs and toast in front of him. Guiltily, he realized he had not responded to her question. What had it been? Oh, yes—she'd wanted him to investigate Christophe's death.

He said, "I don't think so. Maybe your father *was* murdered, maybe he wasn't. But the other side has hundreds of witnesses to prove he *wasn't*. How do you plan to refute that?"

"I don't." The girl sat watching his face. "I expect *you* to."

Callahan looked startled.

"You need my help to find his quantum jump. I need yours to prove Fontierre murdered him. I'll trade you."

The Lambda man made a face. "No deal. If I started asking questions, they'd either arrest me, kill me, or kick me out. Any one of the three would make my chief angry as hell."

"I can help. I know people who are in the underground. They could find out things for you."

Callahan shook his head. "I wasn't sent down here on a personal vendetta."

"Then you won't get far with the quantum." Dominique's voice took on an edge. She picked at her eggs without meeting Callahan's eyes.

The Lambda agent took a final sip of coffee and stood up, stretching his lanky frame. Then he went to the window and pushed aside the curtains. It was still dark outside, but there was a flush of pearl and salmon to the east. Dawn was not far off.

"You really think you can be useful?" He turned away, dropping the curtain.

"I convinced Ambassador LeCount to go see Ralph Timmons, didn't I?" the girl riposted. "I got *you* here."

That news was startling enough. Callahan studied the round brown face, the sturdy body, the short tubular legs. What had Sparrow said? Twelve going on fifty . . . not far wrong.

He sat back down and extended his hand. "It looks like we're partners," he said abruptly, grinning.

Callahan began with the study. It had a balcony that gave a breathtaking view of the mountains, solid furniture, several more bookcases. There was a desk with a large framed picture of Gene Christophe and a woman Callahan took to be Aimée.

The Lambda agent picked it up and looked at it. Christophe was a man of average height, with heavy shoulders, shovel-like chin, Indian eyes, and thinning hair. His nose was broad, and there were deep lines etched around his mouth. He looked as though he'd lived a hard life.

The woman, on the other hand, was blue-eyed, with a full head of sandy brown hair. Not beautiful in any sense that Callahan could name, but certainly attractive enough. She had not, of course, passed any of that along to Dominique, whose stubby body and pudding face had received the full brunt of those monkey-wrench genes.

A perfunctory search of the room revealed nothing. The Lambda field man stood in the center of the study, turning

slowly, his eyes scanning for—what? He didn't know.

Given enough men, enough time, enough incentive, almost anything could be found. Callahan didn't doubt it. Fontierre had the men, had had the time, and, most probably, had had the incentive.

It was possible nothing was here.

"Coffee?" It was Dominique, peering in at him from the doorway.

"Thanks."

"Find anything?"

"Not yet," Callahan said. "But I haven't really looked, either."

"Oh."

Callahan sat the coffee on the edge of the desk without tasting it. He straightened and stared at Dominique.

"Didn't Christophe ever confide in you, write to you, tell you what he was doing?"

The girl shook her head vehemently. "He kept everything in his head —always. And he made it a point never to discuss his work with anyone else until it was finished."

"But when you were home. When you were here—"

"I was only here on holidays. Besides . . ." She looked at Callahan and then at clouds visible through the balcony windows. "Fontierre had them use scopolamine on me just in case I *did* know something."

"Really."

"Yes—really."

"Did they use anything else besides scopolamine?"

"Yes." The girl's head turned just a little, and she shivered. "That was after Fontierre left, when they were alone with me."

"What did they do?"

"They used battery cables." The shivering returned. "If I had known anything I would have told them."

"Your father," Callahan murmured after a moment's silence, "he never left Bouquatan?"

Dominique wandered over to the desk and seated herself behind it. She was an Indian ragdoll with animated eyes.

"Once," she said. "He came to see me at school."

"In Switzerland?"

The girl nodded. "He was well known, even there. They treated him like royalty." She shrugged. "And he only wanted to meet my classmates."

The Lambda man picked up the cup or coffee and took a sip. He grinned. "He sounds like a lot of other fathers."

"I suppose so. But he talked with them the whole time he was there. And some of them I didn't even know."

"Were you jealous?"

Dominique squirmed fretfully for a moment or two, then looked at Callahan. Very faintly, she nodded.

Callahan divided the room into sections, none larger than two feet square. Then, meticulously, painstakingly, he began to examine each section. He found no hollowed-out beams, no empty spaces beneath the floorboards, no suspicious recesses.

The Lambda man took the books out of the bookcases one by one and shook them out, riffling the pages, looking in the spines for hidden pieces of paper. When he was through with the study he sectioned the rest of the cottage and spent the remainder of the day working methodically through each section.

He combed the area around the cottage until darkness obscured further progress. He discovered nothing of interest. Later that night, half asleep in the tiny bedroom beneath the stairs, he found himself speculating. What kind of man *was* Christophe? A secretive one, certainly. Callahan lay there, thinking. Where, he wondered over and over, would a genius hide the discovery of a lifetime?

3

Groaning softly, writhing, Callahan slept. Like the lure of tainted water to a thirsting man, the jungles of Madagascar drew him. . . .

Around the square thatched buildings were clumps of bougainvillea and trailing hibiscus. The color was riotous. Occasionally, when breezes blew just right from the west, Callahan could smell their heavy aphrodisiac aromas. Sometimes, then, he would discover himself weeping.

"Ah, mon ami*—Sam!" Tarto came out of a building flanking the plane tree. He had a slender bamboo pole, this one affixed with a loop of piano wire. Grinning up at him, the Malagasy proffered the loop to Callahan, feeding it through the small crack between cage door and cage. The Lambda man took it, drew in perhaps two feet of pole and, turning slowly, straddled it. He put the loop of wire around his scrotum.*

It was the sixth day of the week, the day when the accumulated filth and scabby encrustations would be washed off in the river. In spite of the humiliation and pain, it was a day Callahan looked forward to.

Gingerly, keeping firm hold of the pole, Tarto opened the cage door and let it swing wide. The result was a two-foot aperture through which Callahan could squeeze.

"Come out!"

The Lambda field man lowered himself stiffly, taking his weight on arms and shoulders until he felt the jungle floor pressing against his feet. He shuddered at the ecstasy of straightening to full height, was slow to move toward the river trail.

Tarto thrust forward on the bamboo pole, making Callahan stumble in haste to save himself pain. He started walking. The small Malagasy followed, singsonging "Go quick! Go quick!" in bad French.

As they passed beyond the limits of the plane tree Callahan twisted back to look at Tarto. His tormentor showed his sharp teeth, twisted the bamboo pole ever so slightly. "Go quick! Go quick!"

The trail down to the river's edge ended at a narrow sandbar. The water there was shallow, no deeper than Callahan's knees. Beyond the sandbar the river was a brown turbulence, the middle of it filled with savage undertows.

Tarto urged Callahan into deeper water. The Lambda man edged obediently forward, bracing his feet against the water's pull. Inwardly he cursed. If he slipped, or if the currents suddenly shifted, he had no doubt of the result. Emasculation, both swift and certain.

As well as he was able, Callahan washed himself, cupping handfuls of water and cascading them over his head and shoulders. Once he dared to duck his head beneath the surface, to feel the balm of the river against his eyelids.

"Come out now!" Tarto's harsh

voice hid a small triumph. He tugged on the bamboo pole, nearly upsetting his captive. Awkwardly, Callahan began to back toward the sandbar, turning his head now and then to find places for his feet.

Only when he was climbing out, the pole between his buttocks chafing painfully, did he become aware of the women. There were three of them, their breasts naked, upturned, their slender bodies the color of brown leaves. They stood wide-eyed, watching, baskets of soiled clothing at their feet. Inexplicably, one of them giggled.

Callahan turned with a snarl, the blood hot in his face. His captor merely grinned hugely and twisted the pole. Agony shot through Callahan's loins. He felt himself toppling and manged to catch himself at the last second, the rage within him turning to ashes.

Tarto squatted, looking at the other man, enjoying himself. Then he walked Callahan around in a circle until he was facing in the direction of the plane tree.

"Ho, Sam!" he said. "Go quick! Go quick!"

"Callahan!"

The Lambda man struggled awake, his body racked with several long shuddering convulsions.

"Sam! What's the matter?" Dominique's small form detached itself from the shadows and moved a little nearer.

"Nothing." Callahan drew himself up, felt the sweat-drenched bedclothes entangling him.

"Is it the nightmare?"

"One version of it."

The girl touched his arm lightly. "I'm sorry. You were crying."

"The hell you say!" The Lambda man responded huskily. He sat up suddenly, swinging his legs off onto the floor. "What time is it?"

"Same as yesterday."

He peered at her in the darkness. "Then why don't you go make coffee? I may have just figured out a way to find Christophe's quantum jump."

"The secret is in knowing *how* to look," Callahan. "As *well* as where." He was sitting at Christophe's desk, half a dozen books in a stack in front of him. He had taken them at random from the bookcase shelves.

"I don't understand." Dominique was watching him wide-eyed from the floor, chin propped up in cupped hands.

The Lambda man smothered a grin. He picked the top book off the stack.

"Poetry. Apparently your father was fond of it."

"Yeah. So what?"

"So what kind of poetry did he particularly like—or what particular poet?"

"That's easy," the girl said disgustedly. "He was always quoting—"

"—William Wordsworth," Callahan finished for her. He held the book in both hands, the pages having fallen open to *Intimations of Immortality*, an omen the Lambda man immediately picked as being significant.

"That's one," Dominique said, her eyes suddenly bright.

Callahan closed the book, allowed it to open where it would. He said: "Would you buy Michael Drayton?"

"Sure."

"Thomas Gray?" Callahan asked, letting the book fall open again.

"Yes."

"Ray Bradbury?"

"Yes." Dominique laughed and sat up.

"Does it begin to give you ideas?" Callahan closed the book of poetry and set it aside. He picked up the next one from the stack. "This one is on the Rydberg states of alkali-metal atoms." He let it fall open. "Christophe was apparently interested in the Stark effect. Know anything about that?"

"No."

"Not surprising." The Lambda agent quickly looked at the remainder of the books in the stack and then set them aside. "It's a long shot, but if we were to go through the books on these shelves," he pointed in a vague semicircle, "and make a graph, a listing, of the most often chosen topics—then we'd know in what direction Christophe was heading."

Dominique was watching him closely. "Only about *half* of the books are on science. And some of them are *new*."

Callahan gave her an enthusiastic nod. "That cuts the odds. We'll look at scientific texts, and we'll give more weight to the newest books."

"What about magazines?"

"What about them?"

"Can't we do the same with them? Father had subscriptions to a dozen or so—and to some journals."

"God, yes!" Callahan smote the side of his head. He looked at the girl approvingly.

"Sam?"

"What?"

"It's going to be a big job, isn't it? It's going to take a lot of time."

"Sure it is—and it may lead to nothing." Callahan picked up books in either hand, put them down again. "Christophe may have been onto something altogether new. In which case—this would be only an exercise in futility."

"Do you believe that?"

"No. I think whatever he was working on is in this room—if we can find it."

Dominique went over and looked at the biggest bookcase, then came back and stood in front of Callahan.

"I'll get started right away. That will give you time to work on my father's murder."

"Hold on," Callahan said wryly. "We'll both work on the books, and *tonight* I'll give his 'murder' some thought."

By midafternoon they had several columnar sheets filled with Gene Christophe's peculiar interests. They were varied enough to give the Lambda agent pause. Christophe was not a man whose life work engendered tunnel vision. And Callahan was mindful that the dead man had switched from biology to physics in mid-stride, so to speak. The crux of the situation, he admitted ruefully to himself, was that renaissance thinkers tended to be notoriously hard animals to pin down.

One book he ran across had a name written in the flyleaf. *Ex libris Jacques Charriere*. The Lambda field man turned it over musingly and studied the title. It was *Waves and Beaches*, written by Willard Bascom. The Lambda man recalled faintly that Christophe had once been interested in tides as a source of energy. But who was Charriere?

"Jacques Charriere," Dominique answered in response to his query, "was

one of father's old professors. He called him by his nickname, Jeudi."

"Oh. Were they close friends?"

"Very close. He often came here for dinner."

"Is he still alive?"

"Unless he's been caught." The girl looked at Callahan with something like amusement. "He's the leader of the underground—*la résistance*."

Toward dusk Callahan snapped on the study lights, opened the back of the telephone console, and plugged a thimble-sized distorter unit into the wiring circuit. Taps outside the direct link-up would receive any conversations in incoherent bits. Though a properly programmed computer could recombine the bits into intelligible words, the Lambda field man doubted Fontierre's intelligence arm had reached that level of sophistication.

Then he called Sparrow.

When her image came up on the screen, he said, "You alone?"

Sparrow gave him a brief, assessing look, and then a grin. "I didn't know you were the jealous type, Callahan. I may have the odd *caballero* around. Under the bed."

"Well, if you can tear yourself away, I need a car."

"And a driver?"

"Mebbeso. You know Bouqueville pretty well, don't you?"

The journalist gave him a sardonic look and raised an eyebrow. "Just so long as it's on the wrong side of the tracks. Though come to think of it, this place might not have a *right* side." There was an abrupt diminution of screen intensity. The woman faded out amid a flutter of lines and static. When she flickered back a moment later she rendered a short, pithy epithet that stopped just short of singing hair.

"Brownout! That's the second one today!"

Callahan nodded, reached for the switch. "See you in an hour?"

"Right." Sparrow gave him a mock salute and hung up, the screen darkening amid another dither of snow.

Callahan swung around toward Dominique. "If I were Fontierre, I'd have at least two men watching the house; I spotted one coming up here. Your father must have had a bolt hole. Where is it?"

When the girl hesitated, the Lambda man sat down in the closest chair and showed his irritation by burying his head in his hands.

"Ye gods, Dom! Charriere wouldn't have come here for dinner without a back door handy. Don't go silent on me now!"

"It's just that no one knew but father and me—and Charriere, of course."

"Well, now there'll be one more."

Dominique considered. At length she said, "You go out the back. The oak trees screen you from anyone up on the bluffs. About twenty meters in front of the cliff edge there's a crevasse. It's narrow, but it's climbable. Follow it until it deadends. There'll be a flat rock on your right; it's hinged."

"Where does it come out?"

"Right above the road."

Callahan bounded to his feet. "Mind if I borrow a few of your father's clothes? What I'm wearing might be a trifle conspicuous."

"They won't fit."

"They'll be close enough. I'm not going to a fashion show."

"What about the books?" The girl indicated several stacks, each nearly as tall as she.

"Keep working on it. There appears to be *some* kind of pattern forming." The Lambda man pointed to a column that seemed longer than the others. "*Combinatorial play. Right hemispheric sites. EEG Resonance states.* He had those three underlined. It must mean something."

"What?"

"Damned if I know."

Callahan was waiting when Sparrow pulled into the cleared area below the cliff. He slid in beside her, slammed the door, then leaned back with a preoccupied air.

"Migod, Callahan! Where'd all the sartorial splendor come from?"

The Lambda man glanced at the other, then grinned. He was wearing ragged trousers, a plaid shirt covered by a denim windbreaker, and a beret that bore a colored tassel.

"I've gone native."

"So I see. Where are we off to?"

"There's a part of Bouqueville called *le Désarroi*. Have you heard of it?"

"*The Confusion*? Sure." Sparrow's eyes shone in the darkness. "That's *really* on the wrong side of the tracks."

They drove for a while in silence. Then the woman gave Callahan a quick look, her angular face absent of expression.

"I've read all the dispatches on you, Callahan. There's a lot of them. Including one that says you killed a man in Madagascar."

The silence endured. They came up on a switchback and Sparrow geared down, swung the car around it, then shifted again to a higher rev.

"It's true," Callahan answered then. His voice sounded hollow.

"A member of the same team that rescued you? What was the man's name—Rochirra?"

The Lambda man shrugged. The fingers gripping his knees squeezed rhythmically, in unconscious reflex. He said only, "He was Malagasy. He picked up a bamboo pole."

"My God, Callahan! You killed him for that?"

"You had to have been there." Callahan's words were infinitely dry.

"I guess! Do me one favor, huh?"

"What?"

"In case I ever get into trouble—give me the name of your attorney."

They entered Bouqueville by one of the southern roads and Sparrow immediately turned their vehicle still further south, into the very heart of the Citadel. The streets were narrow, filled with debris and crush of the ghetto. From time to time Callahan saw soldiers, always in groups of three.

"*Le Désarroi*," Sparrow said at last. She stopped the car just inside a largish square full of shops and taverns. She cut the engine, then sat back and glanced at Callahan. "Who are we looking for?"

"They'll be looking for us. According to my source, if we put a red and blue emblem in the back window someone will contact us." He displayed a piece of cardboard colored in the manner he'd described.

"Your source being Dominique, of course."

"Torture will never wring it out of me," Callahan said lightly. He leaned far back and with one hand put the cardboard on the shelf just below the back window.

"Well, I hope she's right—and I hope they contact us soon. *Le Désarroi* can get very lively."

"Do soldiers patrol this square?"

Sparrow gave a short laugh. "In squadrons, maybe. Never less. Sentiment for the underground runs deep here."

They waited. After perhaps forty minutes the crowds began to thin a little, the tone of the square to take on a more strident, bellicose air.

"Some of the sailors come up here from the docks," Sparrow said, nodding at two men in black watch caps. The pair entered a bar further down the square, their swagger partly that of drink.

Callahan sensed the man's presence before he actually saw him. He glanced to his left. A short, squarely built man with several days worth of whiskers was leaning against a lamppost regarding them.

He approached, leaned in the window and gave Sparrow a leer. "You are visitors to *le Désarroi*, perhaps?"

"I was hoping to see Jeudi," the Lambda man said.

The man peered into the darkness at Callahan.

"Jeudi? What do you know of Jeudi?"

"Only that he will want to see me."

"Oh?" The other paused and appeared to consider this. He turned his head once and spat, just missing the door. At length he leaned foward again and gave a short nod, fixing his glance on Callahan.

"Take your car, follow the avenue just ahead." He indicated a branching street off to his left. "Go until you reach the small footbridge known as Manchot. Leave your car there and cross the bridge. Both of you. I will call ahead."

Callahan shook his head. "The woman stays with the car."

The man laughed, showing stained teeth. "You have just heard the conditions. Perhaps, after all, your business with Jeudi is not so pressing."

"It's pressing, but the lady is not involved."

"Ah, and so lovely not to be involved." The man spat again, returned his gaze to Sparrow's face.

"It's okay, Callahan." The journalist turned her head, regarded her companion fondly. She made a face. "Thanks for thinking of me, but remember my occupation. I'm not going to turn down an opportunity to see Jeudi—not if he's who I *think* he is."

The Lambda man thought it over for five seconds, then nodded.

4

The Manchot footbridge was a narrow arch over a stream half filled with filthy water. Partway across Callahan stepped to the railing and peered down. Light shone off discarded wine bottles and week-old newspapers.

"Nice place." Sparrow gave him a wan smile.

"You can go back."

"I could, but I won't."

Two men were waiting for them in the shadows thrown off by a tumble-

down wall. Callahan saw their cigarettes glowing, burning brief holes in the night.

"You wished to see Jeudi?" The voice was a growl, low, just reaching Callahan's ears.

"That's right."

"You'll both have to be searched."

The Lambda man nodded. "That's understandable."

"And blindfolded."

"As you say."

The man's voice changed, became cold. "If you are from Fontierre your body will never be found. There is a place we know of, a tar pit, that has swallowed a dozen already."

Callahan grinned tightly. "We are not from Fontierre."

The man threw down his cigarette. "Let's get started then, shall we? We have a long way to go."

Presently, lying flat in the back of an odiously smelling truck, his eyes covered with a thick fold of cloth, Callahan listened to the vehicle's screeching suspension as it hit uneven cobblestones. Next to him, lying partially on top of him, was Sparrow's thin body.

"Callahan—" she began, but the word was chopped off abruptly, harshly.

"Lie still!" It was the voice with the growl. The Lambda man smelled cigarette smoke, the rank stink of day-old sweat.

They rode for fifteen or twenty minutes, turning corners often, occasionally driving through tunnels. It occurred to the Lambda man that much of the ride was simply camouflage, to confuse the passengers. He gave up trying to count the turns. Finally the man above him grunted and moved forward toward the cab of the truck. The vehicle slowed, swung sharply left, and was abruptly braked.

Hands helped Callahan roughly to his feet. He was led down flights of stairs, the air around him turning clammy with moisture and cold. Then he entered a room and a door was closed behind him. "Sit here!" he was told. He sat, and the blindfold was removed.

The room was vaulted, like a cathedral; though the shaping had been done over centuries by water, not by man. In front of him was a table, its surface coarse-grained, badly finished.

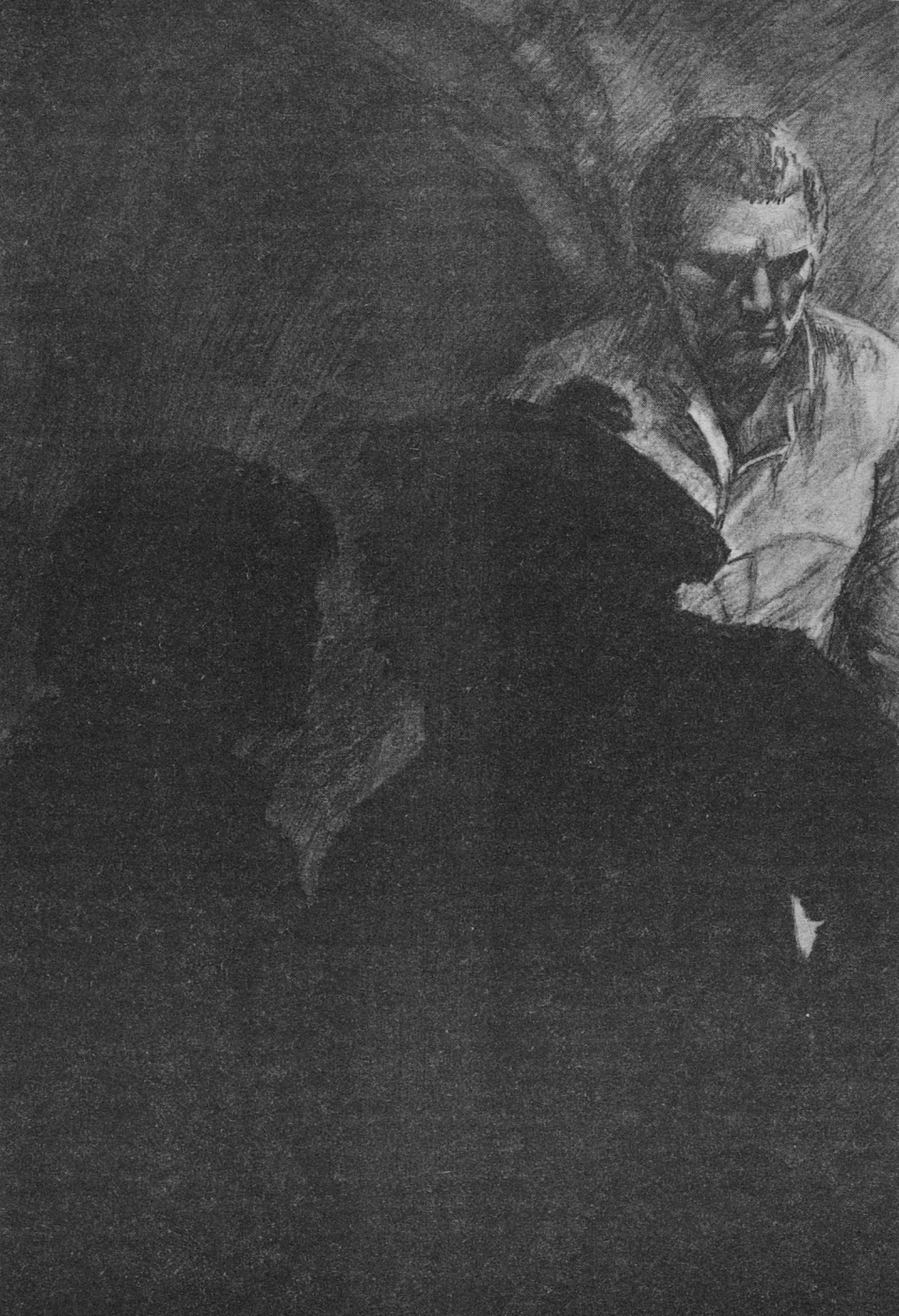
One of the four men sitting across the table from him said: "I am Jacques Charriere, though some intimates call me Jeudi. Do you know what that name means?"

Callahan shook his head.

The man laughed, a short cut-off bark. He reminded the Lambda man of an elderly, bearded version of Edward G. Robinson. "It comes from the nickname of the bridegroom who has been so foolish as to allow himself to be married on a Thursday." Charriere leaned forward a little, eyes glinting. "Gene Christophe gave me that nickname—because *I* was married on that day."

The Lambda man shrugged. The humor was idiomatic, evidently. He said, "I was given the name by Dominique. She sends her regards."

Charriere sat stiffly for a moment, looking from Callahan to the woman sitting by his side. The light, Callahan noted, came from more than a dozen candles spaced around the chamber. It filled the room with an eerie, if adequate, illumination.



Charriere said finally, "And how is young Dominique?"

"Angry. She thinks her father was murdered."

The old man stopped, then rocked back in his chair. He said in softer tones, "Very well, my friend. Who are you —why have you sought me out?"

As briefly as possible the Lambda man introduced himself and explained his mission. He indicated the woman with a small hand gesture. "Sparrow is with a wire service. She doesn't really belong here, though your people insisted she come."

"I've seen her around." The speaker was the man to Charriere's left. He was big, thick-muscled, his dark hair worn very short.

"It's easy enough to check out," Callahan said. "And so am I. Simply call Dominique—she requested I come to Bouquatan in the first place."

"Fontierre taps the phones," said the man fartherest to Callahan's right. "That wouldn't be wise."

"I've de-bugged *her* phone," the Lambda man shot back. Though he understood the need for it, often practiced it, he was wearying of such extreme caution.

Charriere whispered to the thick-muscled man, and that individual scraped back his chair, vanishing immediately into the shadows along the wall. The underground chief turned back, made a gesture. "Henri, get us a bottle of *pisak*. We might as well spend our time to useful purpose."

The man who had remarked on phone-tapping got up, returned a moment later with a dark bottle. He splashed liquor into several cups, handed them around. Charriere pushed two toward his visitors.

"Drink up. It will warm your bones."

Callahan drank. It was cognac, he decided—of a sort. It left his mouth burning, his throat half scarred. *Pisak*. Aptly named.

The thick-muscled man returned within ten minutes. He settled into his seat, picked up his drink, and drained it at a gulp. "They're clear," he said, turning toward his chief.

"Did you speak to Dominique?"

There was a quick nod. "I described him to her. It tallies. She said he's wearing Christophe's clothes."

"Ah. I thought there was something about that beret." Charriere laughed abruptly, refilled the glasses, looked at the Lambda man. "So. How may I be of service?"

Callahan considered. "Dominique said you were a close friend of Christophe's."

"That's true."

"Do you believe he committed suicide?"

The other man picked up his glass, studied the dark liquor within it. At length he said, "No, but there's no proof to the contrary."

"Did you know anything of his work?"

"He never talked about that—to anyone—until after it was finished."

"I see." Callahan cast about. "I understand you were a professor of his at the university. What *did* you talk about?"

"Can it be that important? We were simply two old friends, two colleagues, talking about the past." Charriere sensed Callahan's impatience and straightened a little. "Very well, let me think." He

sat for a moment musing, his eyes unfocused.

"Ah!" He sat up. "The last few visits we talked of the tides."

"Tides?"

"Not the ocean tides," Charriere said, memory flooding back. "The tides inside the Earth."

"There are tides within the Earth?" The words came from Sparrow, who was gazing in nonplussed fashion at the old man across from her.

Charriere sipped from his glass. "Yes, my dear. *Body tides,* within the Earth itself. The stone layers compress, the planet itself is crushed into deformity." He grinned at her as though she were a student. "It is nothing new. It has been going on since the Earth and the Moon first became companions."

"But there can be no tidal currents," Callahan said protestingly.

"No, of course not. And the amplitude of the Earth tides are very small, minuscule, in fact. But that does not mean they are insignificant. Remember, compression of the Earth's crust squeezes out molten rock like toothpaste from a tube."

Callahan drummed his fingers on the table top. "Why would Christophe talk about Earth tides?"

"Why should he not? I am a geologist, he was my student. Perhaps he was accommodating an old man's whim."

"Maybe. I don't think so." The Lambda man looked across the table at Charriere. "You're sure there's nothing else?"

"No. Only the product of the tides, the perturbations of crustal formations."

"What's that?"

The rebel leader shrugged. "The Earth tides engender shifting, sliding shears that sometimes give rather spectacular effects." He paused and grinned. "There have been reports of fire balls around fault zones, for example, and unexplainable lightning strikes. Christophe and I shared an interest in that sort of phenomena."

"He never talked about Fontierre?"

"Never. He was not a political man."

Callahan shook his head uncomprehendingly. "But he *knew* Fontierre—he *helped* him. And he knew you. That makes him political."

"Not in *his* mind. He came back to Bouquatan because Fontierre went to the United States and begged him to return." Charriere gave a short laugh. "And after the revolution he begged him to go."

"What did he do for Fontierre?"

The rebel lifted his shoulders in an ironic gesture. "Nothing. He was to have met with the 'old man,' Commodore Poulette. Poulette respected Christophe, you see."

"And . . . ?"

"The meeting never took place. Two days before it was scheduled Poulette's own men threw him out of one of the palace windows. Fontierre succeeded by default." Charriere looked grim. "He left Poulette hanging on the wall spikes for three days."

"And that was what—twelve years ago?"

Charriere nodded. He looked at Callahan with an expression of philosophical resignation. "You will find out soon or later; there is an irony. Fontierre, like Christophe, was a student of

mine. And like Christophe, he was formidably bright."

Callahan took another mouthful of the *pisak*. It left his tongue numb.

He said, "Let me guess what his field of study was. Biology? Physics?"

Charriere gave him a puzzled look and raised his eyebrows. "He studied those, of course, but he was in a premed program. Before he became disenchanted with Poulette he practiced almost seven years as a psychiatrist."

The trip back was more bearable. They were allowed to sit on a wooden bench in the back of the truck. And the man with the growl spoke to them with at least a modicum of courtesy. The blindfolds were removed as they stepped down onto the cobbled street.

There was a light mist falling, a prelude to soaking rain. Callahan stood for a moment, his face tilting up, watching the tail lights of the truck disappear beneath an arch.

"Well, did you learn anything?" Sparrow turned toward him, her eyes questioning.

"Yes, too much and too little," the Lambda man responded. He gestured ahead briefly and made a face. "Come on. I need something to wash away the taste of that *pisak*."

They were halfway across the bridge when they saw the soldiers. A patrol of six men, their destination undoubtedly the same bridge Callahan and Sparrow were on.

"What time is it?" Sparrow's face was white.

Callahan held his watch so that the weak light of a far-off streetlamp shone on it.

"Almost one o'clock."

"I *thought* we were in that place a long time." She crouched aling the railing and pulled at the other's sleeve. "What are we going to do now? It's way after curfew!"

"Let's go back." Callahan's instruction was a whisper. He took Sparrow's arm and began a crouching run back the way they had come. They reached the end of the bridge just as the patrol was starting across the other side. Ahead was open space and then the crumbling wall.

"Too far—we'd never make it!" the Lambda man hissed. He drew the woman toward him and then thrust her over the apron of the bridge, allowing her to slide down the embankment to the stream below. He followed in a headlong dive, swinging his feet around at the last moment to catch his fall. There was a splash as they hit the water, and Callahan cursed. Too loud!

"What was that?" a voice called out above them. There was an abrupt tattoo of running feet, and then wildly swinging torches. Not taking time for thought, Callahan pushed Sparrow back under the bridge, pulled both front packets inside out and reached frantically around for a discarded wine bottle. His hands grazed one just as the first beam of light struck him.

"You, come up here!" The order, harshly given, was backed up by a leveled rifle.

"They robbed me," Callahan said, peering drunkenly up at the light. "Robbed me and left me to die." He waved the wine bottle, held it upside down to show there was nothing inside, and dropped it.

"Come up here!" Several more rifles

were pointed his way. He nodded, blinking owlishly in the flashlight glare. Hurrying to obey, he fell forward, tried to gain purchase on the slippery bank, and slid back into the water.

"Get up here, you fool!" Two of the soldiers stepped over the apron and started down toward him. The Lambda man got to his feet, stood swaying for a moment, and then rushed forward, hands scrabbling desperately on wet grass. Strong hands grabbed his collar and pulled him unceremoniously up onto the apron. Many more hands lifted him bodily over it onto the road.

The patrol commander was hardbitten, grizzly-haired, and more or less of Callahan's own age. The Lambda field man noticed corporal's stripes on the man's sleeves, further down another stripe in the same gray material of the shirt. For some impropriety the man had been broken in rank.

The soldier on his left said, "He's drunk, Sarge."

The corporal who was nicknamed Sarge strode forward until he was eye to eye with Callahan. The Lambda field man looked blearily past him at the wet cobblestones leading to the ramp of the bridge. He belched suddenly, and the corporal look a half step back.

"Pisak!" Sarge looked at him with contempt and distaste. Callahan plucked at his sodden, ill-fitting clothes, some part of him in shared sympathy with the other.

Sarged turned half around and made a brief gesture. "Georges, Markos—come here!"

Two soldiers stepped forward and came to halfhearted attention.

"Give me your rifles." He took the proffered weapons, leaned them against the bridge railing. He jabbed a bony finger in Callahan's direction. "Teach that fool a lesson. Curfew is an hour past."

The Lambda man stiffened. One of the soldiers was rawboned, young, with a badly trimmed moustache. The other was short and stocky, with powerful arms and a nose that, once, might have been straight.

"No!" he shouted at them. He could feel something bestial come alive within him.

So close to the surface. So close . . .

"What did you say?" The corporal took half a step forward. There was a grin like a slash across the man's pale face.

Callahan swayed a little, then straightened. Why wouldn't they listen? He said, "Don't do this! Let me go . . . or else . . . I can't be responsible for the consequences!" In spite of the river soaking he could feel heat rising inside of him. He was sweating. His hands trembled. He licked his lips, looked wildly left and right.

"Consequences! We'll give you consequences, all right! Georges, Markos!" Sarge pointed wordlessly toward the tall man standing alone in the mists.

"Your signed resignation, Timmons! That's first. And your files on our Senate committees." Heywood's voice was like a drum in the next room.

"You'll have them in the morning."

"And access to your bureau computer?"

"That won't do you any good. Only Massey and I have the phrases to key it in. I'll get you the tapes." Timmons's voice seemed even, controlled, almost

neutral. But to Callahan, sitting on the bench in manacles, the words were fraught with nuance.

The blow from the stocky soldier landed high on Callahan's cheekbone. He had rolled a little, lurched really, and most of the force missed him. The man was off balance now, the side of his neck exposed. The Lambda man raised his hand, feeling the killing fury break loose within him, the berserk insanity Baxter called the Attack Syndrome. . . .

"Why are you doing this?" Heywood asked.

"Do my motives matter?"

"Come on, Timmons. You don't throw away a career over one lousy agent, and a crazy one at that. Get serious!"

"Senator, I make judgments. My judgment is that Callahan can still function. Will *still function. You see—I* know *Callahan, I know what he is capable of."*

"You're making the biggest mistake of your life, then." Heywood's snort was a triumphant bugle blast.

A voice in a higher pitch: "I think you're exhibiting signs of stress yourself, Ralph. You've been head of Lambda for how long—almost fourteen years? The pressures there must be enormous. It's nothing to be ashamed of."

"Don't you ever stop, Baxter?" Timmons's words were sheathed in quicklime.

Callahan saw the moustached man through a mist of red. He brushed a hand over his eyes. It was blood. Was it his own? He swallowed, the rage burning through him like a fire, consuming him. He took a single step forward. . . .

"There's going to be hair-pulling over at Justice."

"Your concern, Heywood. Not mine. You've created enough logjams; now you can break one up."

"I could sign a provisional release," Baxter said reluctantly. "On Timmons's authority, of course—making it his responsibility. Then we'd keep the data on Callahan under top-secret labels—until it's over."

"What are you going to tell the police?"

"Oh, my God—that's right!" Heywood's voice rumbled like a train entering a station. "I hadn't figured on the locals. They're going to raise a stink like you wouldn't believe. Goddamn it, Timmons, you cause more trouble than you're worth."

"Do I get Callahan? I want him out of here by noon tomorrow."

"You'll get him, you bastard! And I hope he breaks your *neck."*

"Damn! Oh, damn. Damn! Please . . . come on, Sam—wake up!" Sparrow's words were half sobbing, half pleading. She took his head, lifted it, held it in the cradle of her arms.

He moved, and a groaning sigh left his lips.

"Come on, Sam! Please. We've got to get to the car."

"I feel like hell, Sparrow," Callahan grunted. He stared up at her from the one eye that wasn't puffed shut.

The woman was caught between tears and laughter. "It's no bloody wonder! Why didn't you at least fight back? From what I could make out, they treated you like a human punching bag."

"Oh, did they?" The Lambda fought himself to one knee, grunting with the effort.

Sparrow looked into his face, then stared unbelievingly. She burst out: "You're delighted, for Christ's sake! Why? What's going on, Sam? What's the matter with you?"

Callahan made it to his feet. He stood there, swaying, grinning, the world suddenly a much brighter place. "It's a long story. Too long to tell standing here in the rain. Do you think between us you can get me to the car?"

5

Callahan remembered the trip back to Christophe's cottage in blurred, incoherent snatches. He woke up in time to tell Sparrow of the secret route leading to the crevasse, and with her help he managed to climb it. One of his ribs was broken, he thought. The pain was severe enough to make him stop and rest at more and more frequent intervals.

"We're almost there," Sparrow said. She pointed ahead, where the lights of the cottage made bright rectangles in the night.

"Dominique's working late," Callahan muttered *sotto voce*. "Keep behind the trees. We probably have watchers up on the bluffs."

"Fontierre's men?"

The Lambda man nodded, then tripped over a protruding stone and almost fell. Sparrow caught him before he could hit the ground. Clutching his ribcage, Callahan stood up and walked the remaining steps to the cottage's back door. His face was ashen.

"You okay, Callahan?" It was Sparrow, at his side again.

"Dandy!" The Lambda man knocked lightly four times, waited the space of two heart beats, and knocked twice more. When the door opened he all but fell inside.

He woke up briefly, once, when Dominique and Sparrow were undressing him preparatory to taping his ribs. As he drifted off again, he noted with approval—through his good eye—that the journalist was wearing one of the chain loops.

The pain in his ribs was like many other, remembered pains. Out there in the deep Madagascar night, hanging from the limb of a plane tree . . .

There was a small fire burning, its foundations of gum and acacia branches laid within the shell of a ten-gallon oil can. Callahan could not remember the fire ever having gone out. In wet weather the Malagasy rebels merely moved it indoors, preferring smoke and coughing jags to rekindling water-saturated wood.

For this night, the rain had stopped. Around Callahan the jungled dripped, turning small channels, briefly, into rivers.

"Sam!" Tarto looked up at him, then sat down on the looped root of a shrub acacia.

"I have surprise, Sam." The teeth shone and the eyes were dark holes within the shadows.

Callahan sat in a half lotus inside the cage. He concentrated on sounds in the jungle beyond the camp. It was always different, always quieter, after a rain.

"You cold, Sam?"

The Lambda field man turned his head a little, stared down at the Malagasy.

"No."

"You are *cold," Tarto corrected, his mouth stretching into a grin. He walked toward the fire, picking up a short length of bamboo as he passed one of the buildings. Presently, using the pole, he picked up the fire drum and brought it back, placing it directly beneath Callahan. The Lambda man felt the heat instantly, began choking on the rising smoke.*

As well as he was able, he lay on his stomach and passed an arm through the bamboo slats of the tiger cage. There were fully two and a half feet between the top of the fire drum and the bottom of the cage. Callahan's questing hand came an agonizing six inches short. Cursing, he began to rock the cage, throwing himself from one side to another, turning his prison into a pendulum.

"Ah, good, Sam—good!" Tarto's fox-like face registered approval.

Callahan found that as long as he maintained a steady swinging motion the fire was survivable. The problem was the energy expended. It took work, and he was too quickly becoming exhausted.

Tarto took the opportunity of Callahan's next swing to place a fresh piece of gum on the fire.

"Goodnight, Sam." The Malagasy yawned, picked up his pole of bamboo, and entered the first of the thatched buildings.

Callahan began to curse. After ten minutes he stopped, too weak to do that and rock the tiger cage, too. Tarto, it was evident, was not coming back.

Callahan gave it some thought. Instead of relaxing at the end of each swing, he pumped to increase the degree of arc. He was sweating now, and cramps were causing his legs to buckle beneath him. Higher! He needed to be higher!

He didn't know the height of the arc. But he knew his limits. There were too many variables to take all of them into account, so Callahan simply put them out of his mind. As the cage reached its apogee he turned around and lay with his chest on the bottom of the cage, working his arm out through the slats, extending it as far as it would go.

How much would the supporting branch give? Would the wet rope above him stretch at all? He refused to let his mind dwell on either question. Simple physics dictated that he should swing closer to the ground.

He hit it on his first pass, toppling the oil can, filling the night with brilliant sparks, a host of glowing embers. Damn! *Callahan's mouth suddenly hurt from grinning. He lay exhausted in the tiger cage and watched the wet earth extinguish each bright coal. He felt better than he had in months.*

"Coffee, Sam?"

The Lambda man opened his good eye and squinted. Sparrow held a lap tray containing, along with the coffee, eggs done the way Callahan liked them, bacon strips, and toast.

"God, yes!" He sat up. "What time is it?"

"Almost eight o'clock. Dominique says it's the first time you've slept this soundly in days."

His eyes widened. Eight o'clock! And he had been awakened from a dreamless sleep!

"Where is Dominique?"

"Going through the next-to-last stack of books." Sparrow pointed toward the study. "She got up about an hour ago. How do your ribs feel?"

Callahan touched his tender chest, nodded abstractedly. He took a sip of too-hot coffee, put the cup down, struggled to extricate himself from the bed covers. Then, kneeling, he pulled his suitcase from beneath the bed, dug out the thick file on Gene Christophe. He began flipping pages.

"What gives, Sam?"

"Plenty—I think." Callahan hesitated, worrying his lower lip. "Charles Fontierre went to the United States to talk to Gene Christophe. Why? They weren't particularly close, even though they had been students together."

Sparrow cocked an eyebrow. "Fontierre needed help from a fellow patriot."

The Lambda man shook his head and resumed flipping pages. "That's just the point. He wasn't. Christophe was apolitical. Zero. He wasn't in anybody's arena, let alone Fontierre's."

A tiny furrow appeared in the journalist's brow. "Then why?"

"One very good reason." Callahan looked grim. "He had access to Commodore Poulette."

"My father *was* murdered, wasn't he?" Dominique Christophe was standing just inside the doorway, brown eyes impenetrable and intense.

"I think so, yes." Callahan seated himself on the bed, the file still in his hands. He said, "I think he was murdered—*thirteen years ago.*"

Sparrow looked up, startled. Dominique, her gaze never leaving Callahan, came farther into the room and sat down cross-legged on the floor.

Callahan gestured at the file. "A field man named John Warren was watching things pretty closely in those days. I knew Warren—he was a competent man. He says," Callahan shook the file, "that Fontierre spent ten whole days with Christophe. That's more than enough time to make his case and get Christophe's refusal."

"But Christophe didn't refuse," Sparrow said. She sat down on the floor behind Dominique and drew the girl into the circle of her arms.

The Lambda man looked at them both. "I think he did. At least initially. Then Fontierre programmed him to return to Bouquatan—to kill Poulette."

"Oh, come on, Callahan! His own men killed him. Charriere himself admitted as much."

"That's right. They did. But that simply left Christophe up in the air—a guided missile without a destination."

Dominique's gaze was still on Callahan. She said, "*How* did he do it?"

"Fontierre? Drugs, probably. That would be the quickest method. He had medical training; he knew about neobarbiturates and other exotic hypnotics. And he was losing the war. It must have seemed expedient, Gene Christophe's life for Poulette's."

"I don't buy it." Sparrow looked at him over the top of the girl's head. "But for the sake of argument say it's true. What does any of that have to do with *Christophe's* death?"

Callahan closed the file, and sighed. "What if Christophe was not programmed to kill Poulette by name?

What if he was programmed to kill the Commodore of the Citadel?''

''So? There hasn't even *been* a commodore in Bouquatan since—'' Sparrow stopped and her eyes grew suddenly large.

''Since *Father* was given the title,'' Dominique finished for her. The girl's round face reflected no emotion at all.

There was silence, broken finally by the Lambda field man. ''It's all supposition, of course. None of it can be proven. Not unless the unlikely occurs, and Fontierre confesses.''

''It does make a kind of crazy sense, though,'' the journalist said. ''My God! A thirteen-year time bomb that finally exploded. What put you on to it?''

''That's a good question. It came out of the blue.'' Callahan stopped, seemed to consider, looked puzzled. ''I guess it was really the method of his dying. It meant nothing to me until Charriere mentioned that Poulette hung on the palace wall for three days. Those walls are topped with spikes, similar to the lance Christophe used to eviscerate himself.''

Dominique stood up, something of the ancient Indian in her expression: the hunting aborigine who uses flint and shaft and leather thong—something deadly and primitive. She said stonily: ''Any time during those years the command to kill could have been removed?''

''Yes,'' Callahan said.

''And Fontierre knew beforehand that Father was to be given that title.''

''Yes,'' said Callahan again.

Sparrow got up off the floor, set Callahan's breakfast tray to one side, and sat on the bed beside him. She spread her hands. ''So what will happen? We can't prove a goddamn thing.''

''We won't have to,'' Callahan answered. He turned his head a little. ''All that needs to be done is to tell the story. Proven or not, it will bring Fontierre down. Charriere would love to have it.''

''Charles Fontierre must not get the quantum jump,'' Dominique said suddenly, looking at the Lambda field man. ''*That* at least must be denied him.''

''My God, yes!'' Callahan stood up. ''What have you found?''

''Only long lists of things that seem not to make sense.'' She paused. ''My father had varied interests.''

''Don't I know it!'' The Lambda man managed a tiny grin. ''Let's go see.''

6

Callahan spent the next hour going over the inch-and-a-half stack of columned sheets bearing witness to the diversity of Christophe's genius. He found himself awed; the man's scope had been immense. The books on the shelves, all checked, bore small yellow chalk marks on their spines. A single small stack of books remained to be gone through. Sparrow and Dominique were taking turns opening them on the floor in front of the desk.

Patterns . . . Callahan thought back to a class he'd taken in graduate school. ''Look at two stones on a beach,'' his professor had said, ''and they're just that—two stones. Add a third, though, and the mind insists upon forming a pattern.'' Random dots on a paper are merely random dots. Thousands of them together form a picture. Callahan stared down wearily at the lists. *Some*where,

right in front of his eyes—maybe—there was a pattern.

Ultimately he found two, one pattern running off into a tangle of biologic speculation. Callahan glanced through a list of papers. Christophe had not entirely abandoned his earlier interests. He caught references to amino acids and the *corpus callosum,* the massive nerve bundle connecting the two halves of the brain. But what did that have to do with energy? The Lambda field man shook his head and moved on.

The second pattern proved more interesting. It was linked tightly to the world of inorganic chemistry. Callahan concentrated on the information before him. It was a list of inorganic minerals, some of them underlined, some of them not. He glanced down the list, checked those that had been underlined.

Barium titanate
Potassium sodium tartrate (Rochelle Salt)
Lithium sulphate
Lead metaniobate
Lead zirconate titanate
Tourmaline

What did they have in common? Of what importance were they? None, perhaps, but Gene Christophe had spent the last few weeks—perhaps days—of his life studying them. Therefore they interested Callahan.

He glanced up, caught Sparrow's eye. He gave her a half grin. "Help!"

"Find something?"

"Damfino—it needs research."

She grinned at him and ducked her head. "Then I'm your woman. Doing this beats mumblety-peg, but not by whole *bushels*full." She stood up and handed Dominique the book she'd been inspecting.

"See if you can find any common traits to these," Callahan said, giving Sparrow the list of minerals.

"What am I looking for?"

"Anything. Try molecular weights for starters. Then maybe specific gravity. There must be a commonality; they *fascinated* Christophe."

Ten minutes later Dominique added two more inorganic compounds to the list. Both were underlined.

Ammonium dihydrogen phosphate
Ethylenediamine tartrate

Sparrow, looking up from a reference book, announced sorrowfully, "It's not molecular weights. They vary by a bunch."

Callahan acknowledged her with a nod, looked up from his own researches. "There *is* one thing. They all show a cyrstalline-type structure. That's good, but it's not good enough. There has to be some *specific* tie-in."

Some time later Sparrow was able to rule out both specific gravities and the wavelengths of x-rays. There were zero correlations.

The Lambda man looked at the list again, something of despair flattening the planes of his face. It was like trying to find a needle in a haystack—without knowing which haystack to look into. He ran his finger down the list and stopped. Tourmaline was a gemstone, of course, but that would have been the least of Christophe's considerations. Callahan looked it up, found it to be a complex silicate of both boron and aluminum. He grimaced. Nothing there.

Dominique finished the final book in

the stack and added one more item to the list.

Silicon oxide

What was the goddamn tie-in? What?

Callahan tried crystal structure. Barium titanate, the first mineral on the list, was tetragonal. Rochelle salt, rhombohedral. And lithium sulphate, Callahan found to his dismay, was any of three: hexagonal, rhombohedral, or cubic. He still wasn't in the right haystack.

It was Dominique who finally gave him the answer. She said, "Maybe it's something they're not."

"What do you mean?" The Lambda man was sipping his fourth cup of coffee, its blackness matching his mood.

"I don't know. When Father couldn't find an answer to a question, he always tried turning the question around."

Callahan stared at her in wonder, then dived for a reference book. Fifteen minutes of searching showed him what Christophe's minerals didn't have.

They didn't have centers of symmetry.

So what the hell did *that* mean?

An hour later he still didn't have the answer. *Crystals without centers of symmetry*. Somehow, though it wasn't, that ought to be triggering bells. The Lambda man muttered to himself and strode out onto the balcony. It was mid-afternoon. Below him lay a wide panorama of valleys and cliffs. He sucked in a deep breath and let it out slowly. The colors were browns and reds and greens, and they were almost overpowering. No wonder Christophe had chosen to live isolated way up here.

"Bingo!" It was an exultant cry from Sparrow. Callahan spun around and entered the study at a dead run.

"The piezoelectric effect," the journalist said, looking at him. "It's only possible in crystal classes that don't have a center of symmetry."

Something clicked in Callahan's head, drawing him up short. He said, "If you compress certain cyrstals they'll give off electricity."

"That's it. And the reverse is true. Subject them to an electric field and they'll expand and contract along their asymmetric planes. They're used in industry as oscillators."

The Lambda man gave a wolfish grin and kissed Sparrow resoundingly. "We got it!" His grin widened. "And what's more, I know where Christophe's hidden it."

"Where?"

"The simplest place possible. Dominique, where are the circuit breakers for this house?"

"In the kitchen closet." The girl looked at him puzzledly.

"Go pull them."

In two minutes Dominique returned, carrying the circuit breakers. Callahan looked at them both, hesitated a moment for effect, then walked to the wall panel and flicked the switch. Light flooded the study.

Sparrow stared round-eyed. Dominique nearly dropped the circuit breakers. Callahan flicked the switch on and off a few times, then left it off and walked over to Christophe's desk. He said, "The other day when I called Sparrow there was a brownout in her apartment. But the study lights *here* were on, too—and they never dimmed.

There had to have been a separate source of power for this house.''

''The crystals.'' The journalist's angular features were wreathed in a smile.

The Lambda man nodded. ''Piezoelectric crystals capable of converting minute Earth perturbations into usable energy—using all the myriad episodes of shifting and shearing in surface rocks.'' He paused. ''Christophe is harvesting energy from the Earth tides.''

Dominique moved her stubby body forward a foot. ''And the power source—where is that?''

Callahan looked at her. ''Buried, but it should be easy enough to find. There has to be a power lead coming into the house from the cyrstals. Though Christophe could have been cagey about that, as well. The problem,'' he paused a moment, ''is that we can't go digging up the landscape without inviting company.''

7

They heard the copter well before nightfall, coming up over the low tier of mountains to the east.

''From Bouqueville,'' Sparrow said. She looked disconsolate. ''And there's no way they could miss my car. I parked it right on the turnaround.''

''Maybe it's only a reconnaissance copter.'' Callahan was peering out the kitchen window, trying to get a clear view of the aircraft.

''They came for me the last time in a copter,'' Dominique said ominously.

Within minutes of its landing there was a heavy knock on the door. The Lambda man opened it, saw half a dozen well-armed soldiers headed by a wiry-framed lieutenant. They looked crack. The officer saluted briskly, almost clicking his heels.

''You're Sam Callahan?''

''Yes.''

''President Fontierre sends his regards. He wishes to see you, Miss Dominique Christophe, and—'' he paused, looking over Callahan's shoulder at Sparrow, ''—Miss Sparankrinov, of course.'' He smiled, a bit too tightly for Callahan's peace of mind.

The sun was setting as the copter took off, the far horizon a hushed sea of burnt orange and crimson. Callahan found himself watching it bemusedly, his mind working on something else altogether.

They landed on the boot. There was a black limousine waiting, and it rushed the three through the streets toward the presidential palace. Steel doors closed behind them, a series of guard posts loomed ahead. Callahan could feel Dominique tremble beside him. Outwardly, however, she appeared impassive, her round features unreadable.

They were subjected to an ignoble body search, then hustled upstairs to a room comfortably decorated in brown leather and brass. There was a small fire burning on a hearth; it was the first fireplace the Lambda man had seen in Bouquatan.

''Good evening, Mr. Callahan. And ladies.'' The man who got up from one of the leather chairs was an inch or two shorter than Callahan and several pounds heavier. His thinning hair was dark and cut close to the scalp. Though conservatively dressed, he exuded an indefinable power of command. The Lambda

man nodded. This, then, was President Charles Fontierre.

Though there were guards present, Fontierre ignored them. He waved a hand toward the chairs. Wry amusement flickered across his otherwise impassive face. "You have been in my country for three days, Mr. Callahan. Yet we know distressingly little about your activities here. You must know, of course, that we've maintained a discreet surveillance of the Christophe residence. Since your arrival, the flow of useful information there has dropped from significant but uninformative to significantly nil."

Callahan's lips twitched. "Technology, Mr. President. We're always running along behind it. I wouldn't be surprised if someday it did us all in."

Fontierre leaned forward a little, still seemingly amused. "Nor I. And I appreciate your candor. What technology *did* you use?"

The Lambda man told him about the chain loops. He neglected to tell him that when they had been removed during the body searches the search teams had not bothered to refasten the clips. *That* they could find out for themselves.

"Very interesting," Fontierre said when he was finished. "Now perhaps you would be equally informative about what my surveillance missed."

"I think not."

"Oh?"

"The loops were only precautionary. I found out nothing. I *did* search, as your men did." He looked at Fontierre and shrugged. "Evidently there was nothing there to find."

"You're suggesting Gene Christophe lied? Why would he do that?"

Callahan shifted minutely in his chair. He spread his hands. "I never met the man—and I'm not trained to analyze other people's behavior. *You* perhaps would be better able to answer that question."

Fontierre's nostrils flared slightly. He gave the Lambda man a long look. He said, "You're right, of course. I am better qualified. And I have analyzed Gene Christophe's speech. I am of the opinion that he was telling the truth: that he found something."

Callahan evinced no emotional reaction. "The Lambda Bureau is interested in new sources of energy. It is not interested in playing games with dead men. Is it your intent to do so with us?"

The president of Bouquatan smiled, albeit thinly. "Let me ask again—you found no clue, no hint of what Christophe was referring to as a quantum jump?"

"You can't find what isn't there."

Fontierre got to his feet. "Very well. You are from the United States, Mr. Callahan, as is Miss Sparankrinov. Both of you work for organizations that—one way or another—help to determine policy around the world. You have clout, as they say; and I do not needlessly antagonize giants. I am sending you both home. You are *persona non grata* in Bouquatan from this moment on."

Callahan looked at the other man. He said nothing.

Standing with his back to the fireplace, Fontierre looked around at each of his three guests. He said softly, "Of course, Dominique Christophe is a Bouquatan native. She will stay. Perhaps, with help and encouragement, she can

tell us something after all. We shall see.''

''Damn you Fontierre—there's nothing to tell!'' The Lambda field man was looking at Dominique, huddling miserably in her chair. He could not send her back to the scopolamine and battery cables.

The Bouquatan dictator merely raised his eyebrows.

There was a brief silence, during which Callahan came to a conscious decision. He looked at Fontierre, pressed his lips tightly together. ''I'll make a deal.''

''I'm listening.''

''Send the girl with us and I'll tell you what Christophe's secret was.''

''No, Callahan!'' Dominique was out of her chair and across the room in under a second. She gripped Callahan's arms. ''Don't give it to him! No! No!'' Tears of frustration and anger formed rivulets down her cheeks.

''Sparrow—take her.'' Callahan pinioned the girl's arms and thrust her toward the journalist. Sparrow took her, cast a single look of loathing in his direction, and then bent to quiet Dominique.

As economically as possible, the Lambda man went over Christophe's discovery. When he finished, he said: ''Whether he invented a whole new form of crystal or simply an innovative energy-release paradigm, I don't know. We would have had to dig it up to find out—and your watchers prevented that.''

Fontierre looked musingly at him. ''I think I believe you, Callahan. It has the ring of truth.'' He paused. *''And* because of them.'' He pointed to Sparrow and Dominique. ''Emotional outbursts like that cannot be easily faked.'' He paused again, then folded his arms and rocked backwards on his heels. He grinned. ''I must congratulate you on your ingenuity. I would never have thought of looking through the man's books like that.''

Callahan stood up himself, looked at the other man from eyes gone suddenly bleak. He said, ''So when can we leave this place?''

8

When they got off the plane at Miami International, Callahan collared a flight attendant and asked where he could find a secured telephone. He was directed to the second floor of the terminal, across from the VIP lounge.

Sparrow and Dominique did not want to accompany him. They had pointedly avoided him on the flight, sitting as far away from him as possible. He hadn't questioned it; their anger was a too-palpable barrier to communication.

Now, ignoring their hostile reactions, he herded them toward the second floor of the terminal.

''Damn it, I have a story to file!'' Sparrow shouted at him. She tried to pull away, but the Lambda man had a firm hold on her arm. He felt a dull anger of his own and smothered it. There was no time—and no reason—to vent his own feelings.

The secured telephones were in small bare rooms lined with acoustical baffles. Callahan punched in the numbers for the Lambda Bureau and settled back in one of the plastic chairs provided by the airport. Carol Massey's face swam into view and her eyebrows zoomed straight toward the ceiling.

"Callahan! I just got word from State that you had been thrown out of the country. What happened?"

"I love you, too, Massey. Is the chief in?"

"Hold on." She was replaced by a gray flickering. Callahan had seen the pattern before. He was being scrambled and shot through on the bureau's hot line.

Timmons came on, his gaunt features shadowed by a day-old stubble of beard. He looked wearier than usual. Callahan wondered what forest fire his chief was stamping out at the moment.

The head of the Lambda Bureau gave his subordinate a two-second scrutiny. "Massey says you got kicked out," he said testily.

"That's an accurate statement."

"I see. And as the old bromide says, 'Accurate statements alone don't necessarily get at the truth.' "

"Right."

"So go ahead." Timmons's eyes flicked over Callahan's shoulder at Sparrow and Dominique. He acknowledged them both with a small tilt of his head.

For the second time that day Callahan went over the circumstances leading to the discovery of Christophe's energy source. When he was through, he said: "It has to be the world's best permanent battery. It will last as long as the Earth does."

"But you sense a flaw."

Callahan nodded. "It was in the words Christophe used. Quantum jump. Although it may be efficient, Christophe's power source really differs only in degree from conventional forms of procuring energy, not in kind. Furthermore . . ." Callahan paused for emphasis. "The amounts of electricity available from piezoelectric crystals have to be severely limited—by the size of the crystals themselves, and by the perturbations of the Earth."

Timmons nodded. "If I read you right, you're saying Christophe put together a perpetual battery—that just happens to be a toy."

"Correct."

"Then that's that." Timmons gave a sigh.

"Not quite." Callahan leaned forward a little, savoring the moment. "Christophe did know what he was talking about. There *is* a quantum jump!" He heard Sparrow's startled intake of breath and Dominique's sudden movement in the chair behind him.

"What is it?"

Callahan straightened his shoulders. "When I got to Christophe's house, I had no more idea than Fontierre how to tackle the problem. But the next morning I had a hunch Christophe had somehow left clues in his books. As you know, I was right about that." The field man paused, wishing he had a drink of water. "After I visited Charriere I had another hunch—insight, if you will—on how Christophe was manipulated, and finally murdered, by Fontierre. I'm certain I'm correct on that, too—but I don't have the data to prove it."

Timmons stared at him, waiting.

"Hunches," Callahan said. "Intuition. Revelation. Insight. What if someone had the ability to propagate that in others? Christophe thought someone did." He turned his head a little. "Dominique is the quantum jump!"

"What?" Dominique was staring

slackjawed at him. She glanced at Sparrow and then back at the field man.

Callahan gave them all a moment and then pressed his point. "Dominique came home on holidays. At those times Christophe may have suddenly discovered the answers to questions he'd been mulling over. When that happens enough a pattern becomes apparent. Christophe was demonstrably not a stupid man."

"*La clé anglaise de neuf jours*," Sparrow murmured, eyes wide. "A nine-day English wrench. Aimée's legacy to her child."

They all looked at Dominique. Her mouth was suddenly trembling, and Sparrow took the girl into her arms, hugging her until the trembling stopped.

"Hold on," Timmons said from the screen. "Why didn't Christophe notice any of this before? And for that matter, why didn't it show up where she was living in Switzerland?"

"My guess to the first question," Callahan said, "is puberty. As to the second, how do we know it hasn't? Christophe went to Switzerland, after all. He interviewed Dominique's classmates. He *must* have known something was in the wind."

Timmons scrubbed his face with long fingers.

"One other thing," Callahan said, squinting at him. "Christophe was doing a lot of research in the biologic field. Right-hand brain waves, resonance states, that sort of thing. He'd underlined references to it."

"It should be easy enough to check," Timmons said.

"Then I suggest we do it."

There was a lull in the conversation. Callahan felt wrung out, weary beyond belief. Yet he had one more thing to say. He met Timmons's gaze. "I have a hunch . . . that you wanted to pull me back from the edge. You set up a charade, in an office with a vent in the wall. You even drugged me so that I was unable to move away." He paused. "How did you get Heywood and Baxter to follow your lead?"

Timmons was silent. Finally, imperceptibly, a smile stole across his face. He said, "I called in a lot of old debts. And it worked, didn't it?"

"Yes," Callahan said. "It worked."

Afterward, walking through the airport terminal between Dominique and Sparrow, Callahan had a sobering thought. What would be the result of Dominique meeting Timmons? Christophe had been a genius, a bright star. But Timmons was something else altogether—a *nova*. Were the results based strictly on brainpower? If they were, he wanted to be there when Timmons had that first sure hunch. ■

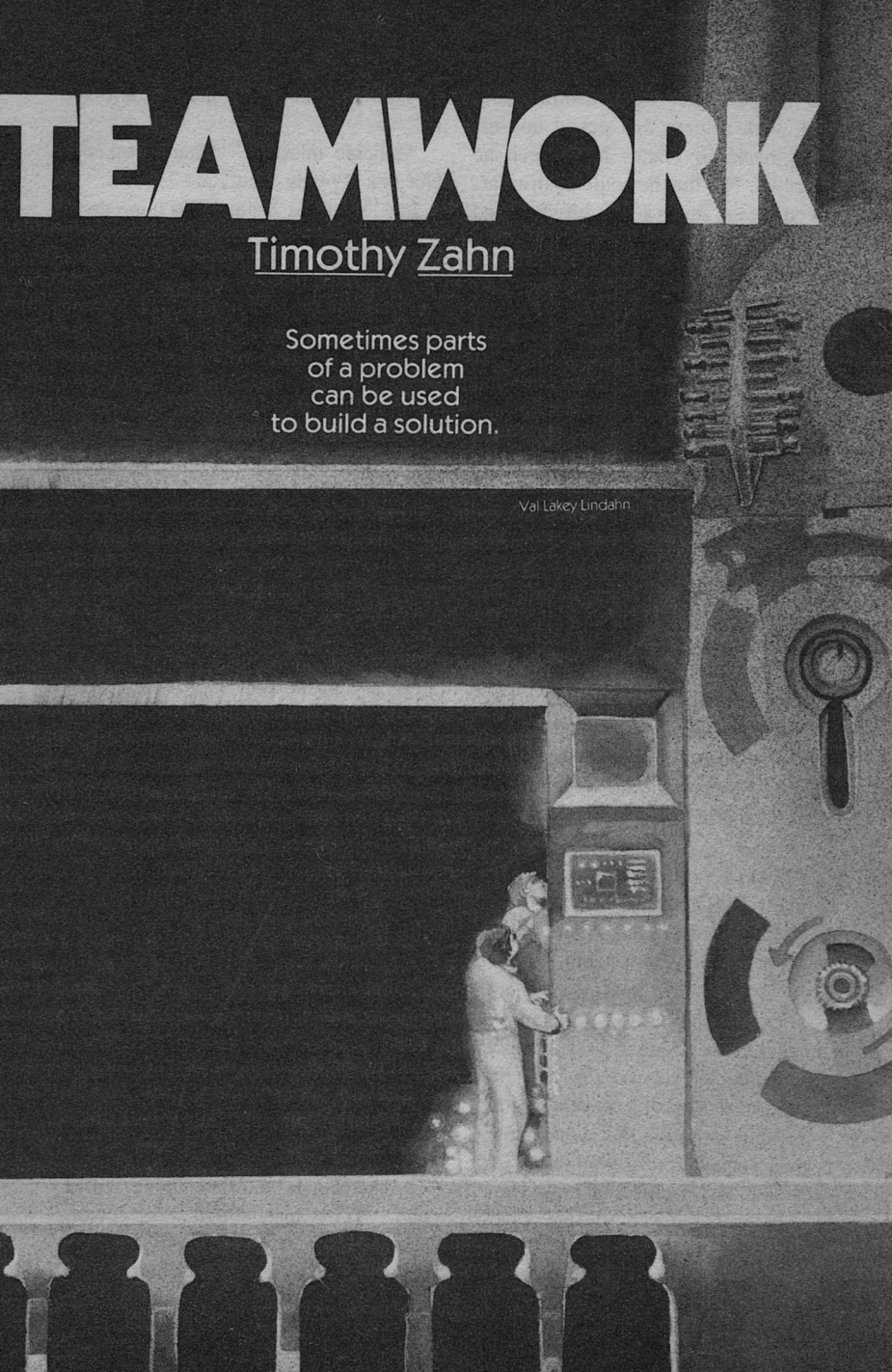
● The only purpose for which power can be rightfully exercised over any member of a civilized community, against his will, is to prevent harm to others. His own good, either physical or moral, is not a sufficient warrant.

John Stuart Mill, "On Liberty"

TEAMWORK

Timothy Zahn

Sometimes parts
of a problem
can be used
to build a solution.



The hospital bed was uncomfortably hard, with a lump that poked into his lower back no matter how much he squirmed. Not that he could squirm far, of course; the straps across his chest and legs were quite adequate to their task. Staring at the ceiling, tracing imaginary patterns among the holes in the acoustic tile there, he tried to shut out the gurgling sounds from the next bed. The gurgling he hated even more than the crying and laughing.

"Mr. Charles Bissey?"

New voices weren't common here. Lowering his gaze, he focused on the two men at the foot of his bed. One was Dr. Housman, who often appeared in his nightmares these days. The other, standing rather stiffly, was a stranger in a military-type uniform. "Yes," he acknowledged. "Who are you?"

"My name is Colonel Lee, Charles," the stranger said. "We need your help."

Charles glanced at Dr. Housman and sighed. "Sure you do. What is this, Doctor, another of your tests?"

"It's no test, Charles," Housman shook his head. "Please listen to the colonel. This is deadly serious."

"Charles," Lee said, "have you ever heard of the San Bernardino Dome?"

"I'm allowed to read newspapers," Charles told him mildly. "It showed up one night a week ago in a shopping center parking lot. The newspapers think it may be the start of a space invasion."

"Right, although the invasion angle is pure speculation at this point." Lee seemed to be relaxing a bit now. Doubtless he was relieved to find Charles wasn't a raving madman. "But we believe the dome to be a threat in other ways. We'd like you to help us destroy it."

"Suicide mission?" Charles asked. Not that it really mattered.

Lee shook his head. "We hope not. But it *will* be dangerous."

"Why should I help you? What do I get out of this?"

He was prepared for a lecture on patriotism, and Housman's words were therefore a surprise. "Perhaps," the doctor said quietly, "you'll have your dream."

Charles stared hard at him. So many times he'd hoped . . . so many times had watched it all crumble. But he had little else to live for. "I accept," he said.

The preliminary psychomedical work took two days. Charles was in hypnotic sleep a good portion of that time, but it was a strangely exhausting sleep, and he hoped he'd have a chance to rest after it was over. But Colonel Lee was apparently in a hurry, and within an hour he had called a mission orientation meeting.

"Good day to you all," Lee nodded as he strode into the room. "I know you're tired, so I'll make this brief." He touched a switch on the console next to his chair and a picture of a huge gray hemisphere appeared on the room's screen. Behind it could be seen a long building with several different business signs, as well as a section of a city street, all looking like it had been in a war. No people were in sight anywhere.

"The San Bernardino Dome," Lee said. "Thirty meters high at the center, ninety meters across at the base. Completely impervious to everything we've

tried against it. Even the best anti-tank missiles don't so much as scratch the surface.''

''How about atomic weapons?'' Arthur asked.

''We haven't tried anything that drastic yet, but all the extrapolations indicate that even that wouldn't do any good from the outside. From the *inside*, though . . . possibly.''

''Wait a minute,'' Frank growled. ''You're not gonna send us into that thing, are ya?''

''We could get hurt!'' Dennis piped up.

''Hold it, hold it,'' Lee said, raising a hand for order. ''Getting into the dome shouldn't be physically dangerous. There are already nearly a hundred people inside, by our estimates.''

''What do you mean, not *physically* dangerous?'' Susan asked in her prim alto. ''What kind of dangerous *is* it?''

Lee took a deep breath. ''Well . . . it seems that the dome is surrounded by a sort of . . . *effect*, I guess you could call it. Everyone who's gone inside a certain distance drops whatever else he's doing and heads straight for this door.'' He indicated a black triangle on the dome. ''We've tried sending people just over the edge of the effect and then hauling them back with ropes, and once they're back outside they're okay again. They report a tremendous compulsion to get into the dome, but no idea why they were wanted. Our experts say the effect resembles a strong hypnosis, but they have no idea how the order was implanted. What happens inside is anyone's guess; all we know is that the agents we sent in with bombs apparently never triggered them. Yes, Charles?''

Charles spoke up hesitantly, still shy in the presence of the others. He'd met them barely three hours earlier, and his natural bashfulness with strangers made his tongue feel awkward. ''I take it, Colonel, that you think we can get past this conditioning?''

''Of *course* he thinks that, dummy,'' Arthur snapped. ''Why else would we be here?''

''Actually, we *don't* expect all of you to get through untouched,'' Lee said quickly, perhaps seeing Charles's blush. ''Frankly, we'll be happy if any one of you can get in with enough control left to carry out the mission. We really don't know what will happen to you since—well—''

''Since everyone else who's gone in has been perfectly sane?'' Charles suggested.

''Now, Charles, don't pick on the colonel,'' Susan admonished.

Lee spread his hands in a gesture of helplessness. ''I know it sounds cruel and manipulative, but yes, that's precisely why we recruited you. The hypnosis isn't perfect; it has limitations—''

''How do you know?'' Arthur spoke up quickly.

''Because on that first morning people were dribbling into the dome in ones and twos until we set off the sirens; after that there was a general rush. From that we gather that the hypnosis wasn't strong enough to wake people up or make them walk in their sleep. People like you, we hope, will also be outside the thing's capabilities. The experimental technique that set you up with your new pseudotelepathic intercommunication may help, too—spread the effect around or something.''

"Or maybe it won't," Frank said. "If y'ask me, this is a whole lotta work for nothin'. The door to the thing's open, right? So toss in a nuke and get it over with."

"Frank!" Susan was aghast. "There are a hundred *people* in there. Not to mention whoever was there to begin with."

"So what?"

"Actually," Lee said, "we couldn't do that even if the dome were empty. There's an airlock sort of arrangement that seems to be made of the same material as the dome. As an absolute last resort, we might try sending in a volunteer with an activated time bomb. But even if that worked—which isn't at all certain—it would mean sacrificing anybody who may still be alive in there." He shrugged, looking uncomfortable. "Anyway, the high-level decision was made to give you a chance first."

"That's all well and good, Colonel," Susan said, "but I, for one, want to know why you want so badly to destroy this artifact. It doesn't seem to be doing anything threatening, so as long as you keep people away from it, what's the trouble? Death and destruction are easy, I suppose, but they're so *final*."

"The trouble," Lee answered, "is that, whatever the owners of the dome want with the people they've grabbed, they've decided they want more . . . and since we've evacuated the whole area they can't get them. So they're expanding their compulsion-effect field. The thing's pushed another hundred meters out in the past four days and shows no sign of stopping."

There was a long moment of silence. "Well," Lee said at last, "if there are no more questions or comments, I'll let you get some rest. You'll start a couple of days of saboteur training tomorrow morning. Good-bye for now."

The next two days were frantic, filled with intensive studies. Charles had always envied people who could assimilate knowledge quickly, and was more than a little surprised that he was actually able to keep up. He became adept at putting together the tiny nuclear bomb the team would be taking into the dome, and discovered that he had a distinct aptitude for solving logic problems. Though little time had been specifically set aside for the members of the team to get to know each other, Charles found himself becoming more relaxed in their company as they worked and learned together. He didn't consider them friends, of course—true friendships had been few and far between for him—but he no longer feared them as enemies, either. On the whole, that was already more than he'd hoped for.

All too soon, it was time. A midnight plane ride—with Dennis gurgling excitedly at the stars overhead—and a short drive brought the team to a line of grim-faced soldiers patrolling the deserted San Bernardino streets. A major pointed the way and offered good luck.

The first twenty steps were the hardest, at least for Charles. He felt as if he were walking through a mine field: never knowing when it would happen; wondering if it would hurt or not; almost hurrying so as to get it over with. Compulsively, he found himself counting the steps: nineteen, twenty, twenty-*one*—

And with the suddenness of a light switch a red haze seemed to drop over his vision, and all thoughts fled before

the overpowering desire to get into the dome. He broke into a run, dimly aware of the others but incapable of taking the slightest interest in them. The buildings around him were gray fog; but as he rounded one last corner a burst of color assaulted his senses. It was the dome, as bright and eye-catching as the finest sunset he'd ever seen and utterly irresistible. The triangular entrance beckoned; lowering his head he increased his speed. Ninety seconds later, he was inside.

"Well," Arthur said aloud, his words coming in short bursts as his wind slowly returned, "that was . . . quite a race. Everyone . . . okay?"

"Yeah," Frank said.

"I feel fine," Susan replied. "Dennis?"

"Wow! These roofs are really high," Dennis chirped, oblivious to the others' conversation. "Can we go up there?"

"*Ceilings,* kid, not *roofs,*" Frank growled. "Let's get movin' before someone comes along, huh?"

"Can we go up there?" Dennis repeated, more insistent this time.

"Not just now," Arthur said. The catwalks twenty feet above them were far too high for his taste. "Maybe later." He looked back down quickly and glanced around the room they'd wound up in. The walls were lined with pipes and strangely shaped machinery, but he could see what looked like a pair of doors in the far wall. "Looks like that's the way deeper in," he said.

"Wait a minute," Susan cut in. "Charles? Charles, are you okay?"

"I . . . I think they got me," Charles murmured. "I'm sorry."

"Damn!" Frank growled.

"Okay, relax," Arthur said, trying to keep his excitement from showing. He could be leader now! "Are you going to be fighting us, Charles, or are you just going to be dead weight from now on?"

"I don't know. I don't feel like shouting out the truth or anything. I just feel like doing what . . . I guess it's what they told me to do when we came in."

"Well, that'll do for now, I suppose. If it changes, let me know fast and we'll either sit on you or try to work around your conditioning. Now, what exactly—"

"Wait a second," Frank cut in. "Who died and left *you* in charge?"

"This is the pecking order Lee gave us, remember?" Arthur said. "Charles first, then me. *Then* you."

"Yeah, but—"

"Then it's settled. Dennis, stop that whimpering."

"Is Charles sick?" Dennis asked anxiously, his voice trembling.

"Oh, for—Susan, explain it to him, will you? We've got to get moving. Charles, what exactly did they tell you to do?"

"I'm supposed to go through the left door up there, down a corridor, right at the second cross corridor—"

"Hold it," Arthur interrupted. "Does all this take us further in or just around the edge of the dome?"

"Uh . . . I think all the way to the center."

"Then let's just go. What happens when we get to the center?"

"I'll be helping to put together some kind of machine."

The door opened into a narrow cor-

ridor. Glancing up, Arthur noted that the catwalks from the room extended over the corridor as well, passing through the six-foot gap between the tops of the walls and the arched ceiling. Would there be guards posted up there?

"This doesn't make any sense at all," Susan complained as they started down the corridor. "Why should the creatures who live in here need people to help build their machines?"

"Maybe they don't know how," Dennis suggested.

"Then how's Charles supposed to figure it out?" Frank snorted. "More likely they're all dead."

"Dead?" Susan sounded appalled.

"Or else never here," Arthur mused. "I didn't notice any effort to filter the air at the entrance. What kind of alien would be stupid enough to risk breathing our germs?"

"Then who's running this thing?" Frank argued. "Some kind of computer?"

"Why not?"

"Because whoever built it should have made sure it could repair itself," Susan said.

"Damn it, Susan, lemme handle my own fights," Frank snapped.

"Don't you swear at *me*," she returned icily.

"All right, everyone, take it easy," Arthur put in, desperately trying to hold things together. "Looks like we're coming into a main room up here. Everybody stay alert and look for a good place to plant the bomb."

The final door opened, and the sight behind it silenced even Frank. The room was *huge*—covering perhaps a quarter of the dome's floor area—and stocked with a bewildering collection of machines and what could only be the aliens' equivalent of electronic equipment. The other trapped humans were there, too, working at various tasks with a diligence uncomfortably reminiscent of ants. There was no talking or other obvious communication; it wasn't even clear whether the laborers were aware of each other's presence. And in the center of the room—

A miniature version of the dome itself.

Dennis was the first to say anything. "Wow! This is *neat!*"

"What the hell *is* this?" Frank asked, bewilderment in his voice. "Some kinda Chinese puzzle box?"

"You're thinking of Russian dolls, I think," Arthur corrected absently. "I don't think there are more than just these two, though—that little one's barely twenty feet tall, I'd guess."

"They're certainly paying a lot of attention to it," Susan pointed out.

Even as she spoke, a group of five people left one of the machines carrying a small device they had apparently been building there. Maneuvering it carefully, they worked it through the outsized triangular door of the smaller dome and disappeared inside.

"Wonder what that was," Arthur muttered.

"One of *those*," Dennis piped up, pointing to one of the machines lining the room's walls.

"Shut up," Frank growled.

"No, wait—he's right," Susan said. "See? It was a smaller version of that machine; same shape and color pattern." Abruptly, she caught her breath. "They're making a *baby dome*."

"Uh, excuse me," Charles spoke up into the silence, "but I'm supposed to be helping with something over across the room."

"Okay," Arthur said, making a quick decision. "Let's do it. You just go ahead and take the lead."

"*What?*" Frank snapped. "The hell with this. Let's just drop the bomb someplace and get outta here."

"What about the other people?" Susan asked.

"Hell with 'em."

"Absolutely not." Susan's voice left no room for argument. "They're not here of their own free will. We aren't just going to leave them to die."

"Besides which," Arthur said, overriding Frank's comeback, "we've got another little problem here. If that dome's made of the same stuff as the big one, we're going to have to put a bomb inside it if we want to be sure of knocking it out."

"So?"

"Don't be stupider than you have to, Frank," Arthur snapped, suddenly tired of him. "We *also* need a bomb out here . . . and we only have *one*. So until we come up with an idea, we've got to stay as inconspicuous as possible."

They reached the target machine a minute later, and their first close look at the human workers elicited gasps from Susan and Dennis and a curse from Frank. Two of the four people working over the machine looked like refugees of the Nazi starvation camps: gaunt and pallid, with thin arms and sunken cheeks. The other two weren't in much better shape.

"Colonel Lee said some of the people had been in here since the dome appeared," Susan said in a choked voice. "That's nearly twelve *days* ago."

"Maybe the dome doesn't know enough to feed them," Arthur suggested, feeling slightly sickened. "Still . . . I suppose that's good, in a way. It means the dome can't read minds."

"Arthur, we've got to get this over with as soon as possible," Susan said. "These people need medical attention right away."

"If you can suggest a way to make one bomb into two," Arthur grunted, "I'd be happy to do so."

"Well, why don't you just find one of the agents Colonel Lee said had come in and take *his* bomb?"

There was a short pause. "That's easy to say," Frank grumbled, sounding impressed in spite of himself. "But how are we gonna find any of 'em in this crowd?"

"He'll be wearing street clothing, for one thing," Susan pointed out. "At least half these people are in pajamas and nightgowns. We could just . . . well, frisk all the possibilities."

"Let's try just *looking* at their clothing to start with," Arthur suggested. "Everyone here's lost a lot of weight, and their clothes are hanging unnaturally. Check for any extra bulges or the kind of wrinkle lines you get with something heavy in your pocket."

The casual stroll around the room took several minutes, and it was Dennis who spotted it first. "Over there!" he bubbled excitedly. "Under his arm—see? I found him!"

"Looks like it, awright," Frank said.

"Lemme get it—he might put up a fight."

"Frank!" Susan snapped. "Don't you *dare*—"

"He'll do what he has to, Susan," Arthur cut in brusquely. "Frank has a job to do here, just like the rest of us. Let's *do* it." Without waiting for comments he headed toward the other man, pleased with his last speech. All good leaders, he knew, should know how to be eloquent when necessary.

As it turned out, both his speech and Susan's fears were for nothing. The agent kept at his job, offering no resistance as Frank lifted his coat and relieved him of the innocent-looking black box.

"Half-hour delay," Frank muttered, peering at the lettering by the uncrimped metal tube that held the bomb's chemical fuse. "Not any better than ours."

"Yeah," Arthur agreed. "Well . . . let's get ours put together. Then we'll figure out how to get one into the little dome—yes, Charles, what *is* it?"

"I've got to get back," Charles said, a hint of desperation sounding clearly in his voice. "I've got *work* to do—back at my machine—"

"Hey, hey, hey—don't go nuts on us now." Arthur thought quickly. "Frank, give me a hand here—we've got to hang onto him. Susan, get that bomb assembled, pronto. Charles, you just try to relax—or struggle, if that makes you feel any better."

"I'm . . . trying . . . to fight it," Charles whispered. "It's . . . *strong*. . . ."

"Susan!" Arthur snapped. "Hurry up."

"Almost done," Susan said, an island of calm in the tension. "We still haven't figured out how we're going to get these people out of here, though."

"Forget . . . 'em," Frank managed.

"Is Charles sick again?" Dennis spoke up timidly.

"He'll be all right," Susan soothed. "The machines in the dome are trying to make him do something he doesn't want to do."

"Can't you make them stop?"

"I'm afraid—Dennis, that's it!" Susan interrupted herself abruptly. "Arthur—all we have to do is to find and shut off whatever machine's doing this to Charles and the others. In fact, we don't really have to destroy anything else."

"The hell we don't." Without warning, Frank snatched a nutcracker-like tool from a man at a nearby machine. Before any of the others could act, he'd crimped the fuses on both bombs.

"*Frank!*" Arthur all but bellowed. "Why did you do that?"

" 'Cause we can't hold onto Charles forever," the other snarled. "What if he gets loose and gets all of us killed? I sure as hell wanna take this damn dome with me when I go."

"Frank, *when* are you going to stop thinking with your fists?" Susan groaned, her anger already turned to resignation. "Why must you *always* put things in terms of fighting?"

"Are we gonna plant these or not?" Frank asked impatiently, ignoring her.

"Of course we are," Arthur said. "There—that group heading toward the little dome. We'll put one of the bombs on top of that console they're carrying and make sure none of them tosses it

off. The other one can be put down anywhere out here."

If the group of workers so much as noticed Frank adding the flat box to their burden, they gave no sign. Disappearing into the small dome, they emerged a few minutes later empty-handed. Frank didn't wait for further instructions, but simply shoved the second bomb under the nearest machine.

"Now," Arthur said, trying not to show his tension, "we've got just twenty-five minutes to find that hypnosis machine and get out of here." He took a long, sweeping look around the room, and for the first time the enormity of that task hit him. There were literally hundreds of instruments lining the walls, not even counting the free-standing ones scattered around.

How were they going to find the right one?

"This is ridiculous," Frank said. "What're we supposed to do, smash everything in sight?"

"No," Charles gasped. "It's easier than that."

"What is it, Charles?" Arthur asked, suddenly alert. Charles, after all, had a sort of inside track here. "You know which one it is?"

"No. But—" He halted, as if having to fight out the words. "The people here . . . building and . . . and fixing things. We're not . . . working like we're . . . supposed to."

And suddenly Arthur understood. "*Aha!* Got it!" He scanned the room again, and this time he saw it. "Over there, on the wall—that gadget with eight people working on it. Let's go."

"But how do you know that's the right one?" Susan asked.

"Because no one was working over there when we first came in."

"Huh?" Frank asked.

"It's really very simple." Arthur grinned tightly. "We're not doing what we're supposed to; therefore, the hypnosis gadget must have developed a fault—and therefore, the dome's started getting people over there to try and fix it."

The workers had the instrument's cover off by the time Frank began shoving through the group. For the first time there was resistance to his advance, as if the dome had belatedly recognized the magnitude of the threat and was trying to counter it. But long starvation had left far too little strength to the men, and Frank brushed them aside as if they were children. Seizing the heaviest tool within reach, he began flailing about at the exposed circuitry. His first three blows seemed to have no effect; but at the fourth—

"That's it!" Charles shouted.

And all around the room activity suddenly ceased, replaced by an equally abrupt babble as all the frustration and terror of the past days found release in newly loosened tongues. But Charles was ready, and before the noise had time to reach panic levels, he filled his lungs and bellowed, "Everybody get out of here *now!* This dome will blow up in less than twenty minutes. The door's in that direction; *move!*"

Perhaps the time under hypnosis had left a residual susceptibility to orders, or perhaps getting out simply struck them all as the smart thing to do. But whatever the reason, they obeyed without question or complaint. It wasn't easy—in the absence of artificial com-

pulsion, the physical drain of their ordeal abruptly appeared. But with a lot of mutual support, they kept moving.

"I don't suppose there's any way to disarm the bombs," Susan said wistfully. "I mean, now that there's no reason to destroy all of this. . . ."

"No reason, my eye," Charles snorted. "You never felt how *strong* that hypnosis machine was. If anyone got ahold of it and figured out how to make it work again—"

"Would it hurt people?" Dennis asked.

"Very much," Susan sighed. "You're probably right, Charles. Let's just get out of here, then."

There was less than a minute to go on the fuses when they reached the first row of buildings, the point at which Charles had earlier gotten his first glimpse of the dome. "It was a lot more colorful before," he commented to no one in particular as he turned for one final look. "Must have been part of the hypnosis."

"Can we stay here and watch the bang?" Dennis asked eagerly.

"Probably won't be much to see," Charles told him. "The dome will contain most of the explosion, and anything that leaks out the door probably won't be very bright."

"Aw, what the hell," Frank said, to everyone's surprise. "Let's let the kid have a look."

"I thought you didn't like Dennis, Frank," Susan said.

"Naw, he's okay. And—look, he did his share, right?"

"Sure," Charles said. "Okay, we'll stay."

The seconds ticked by. "Even if we don't see anything, we ought to feel the ground shake when they go off," Arthur remarked, talking to cover up his nervousness. He had led them through the critical part of the mission; he alone was responsible for success or failure. And if—somehow—this didn't work, no one would ever let him be a leader again.

"Oh, I'm sure we'll see *some*thing," Susan assured him.

As it turned out, she and Charles had both rather underestimated things.

This hospital, he decided early on, was much nicer than the other one. Not only was the bed more comfortable, with no lumps or straps, but the nurses were friendlier and more attentive. His eyes still hurt a little beneath their bandages and the perpetual darkness was sometimes scary, but Dr. Housman and the others assured him he would be all right. Best of all, there were none of the horrible sounds of the other hospital here; no one laughed or cried or gurgled. He slept a great deal now, and nightmares were no longer commonplace.

"Charles?" a familiar voice asked softly. "Are you awake?"

"Hello, Colonel Lee," he said. "I didn't hear you come in."

There was the sound of a chair being pulled over to his bed. "I thought I'd drop by and let you know that all of the people you got out of the dome are off the critical list now, though most are still pretty weak."

"Glad to hear it. You ever figure out what went wrong that the dome needed them?"

"Only indirectly—you didn't leave us a whole lot to study, you know. But a couple of the others told us they saw

a bunch of things that looked like robots lying around one of the outer corridors. Best guess is that the dome had an accident and lost control of its automated workers. Whether recruitment of native help was already programmed in or whether the dome was smart enough to develop the hypnosis field from scratch we'll probably never know."

"So it really wasn't a threat, after all."

Lee must have heard the regret in his voice. "We don't *know* that. It's quite possible that it intended to cover the whole globe with copies of itself. And even if it wasn't deliberately threatening us, the people inside would have started dying very soon. Who knows how big the field would have become, or how many people would have been sucked in to die? No, Charles, you did the right thing. Now, I'm going to leave and let you rest, but I want you to hurry up and get well. The president is anxious to meet you—" he paused dramatically—"at the White House ceremony where you'll be getting the Medal of Freedom."

Charles tried to find the right words; finally gave up. "Thank you," he said.

"You earned it. All of you did." A hand briefly gripped his shoulder. "I'll drop back in next week, after the bandages are off your eyes. Good-bye for now."

Charles heard him walk to the door and open it. Another voice greeted Colonel Lee as he stepped into the corridor: Dr. Housman's, Charles recognized it. For a moment the two men talked by the open door; and while the conversation was obviously meant to be private, Charles had always had exceptional hearing.

"How's he doing?" Lee asked.

"Better than our best predictions, I'm delighted to say. That new hypnotic technique for intrapsyche communication was very helpful, but I personally think the success of his mission played a bigger role. Low self-esteem, you see, is often at the root of these really chronic cases. Eliminate that problem and you're halfway home."

"So who did I just talk to? I mean, who's where now?"

"The Susan and Dennis fragments have been completely integrated into the main Charles personality. Arthur and Frank are still separate—especially Frank; Charles still has a great deal of suppressed anger within him—but both are moving toward integration. I give them a month, maybe less. If you've got a few minutes I can show you the progress charts."

The voices faded as the two men moved away down the hall. "A month," Charles whispered to himself, savoring the sound of the words. One month . . . and he would have his dream.

He would be whole. ■

● The man who has everything figured out is probably a fool. College examinations notwithstanding, it takes a very smart fella to say "I don't know the answer."

Jerome Lawrence and Robert E. Lee

the reference library

By Tom Easton

The Crucible of Time, John Brunner, Ballantine/Del Rey, $12.95, 304 pp.
The Shattered Stars, Richard MacEnroe, Bantam, $2.95, 192 pp.
Damiano, R.A. MacAvoy, Bantam, $2.95, 256 pp.
The Anubis Gates, Tim Powers, Ace, $2.95, 416 pp.
The Aquiliad, Somtow Sucharitkul, Timescape, $2.95, ? pp.
Dangerous Visions, Harlan Ellison, ed., Berkley, $9.95, 544 + xxxii pp.
Gods of Riverworld, Philip José Farmer, Putnam, $14.95, 331 pp.
Thendara House, Marion Zimmer Bradley, DAW, $3.50, 414 pp.
Escape Velocity, Christopher Stasheff, Ace, $2.95, 249 pp.
Touch the Stars: Emergence, John Dalmas and Carl Martin, TOR, $2.95, 318 pp.
The Zanzibar Cat, Joanna Russ, Arkham House, $13.95, 244 pp.
Space Processing, Products and Profits, 1983-1990, David Gump, ed., Pasha Publications (1401 Wilson Blvd., Suite 1000, Arlington, VA 22209), $97.00, 278 pp.

This month's column is something of a landmark: it is my fiftieth. That puts my longevity well ahead of Spider Robinson's, and even of Lester Del Rey's. Lester only made it to his 38th column before surrendering. Spider didn't make it that far, and most of the other "Reference Librarians" since the column's inception have been good for only one or two shots apiece. According to my copy of Ashley's *Index* to the magazine, the "temporary" columnists have included Mrs. Dirce Archer, Algis Budrys, Sonya Dorman, Laurence Janifer, Anthony Lewis, Barry Malzberg, Sam Moskowitz, and Edward Wood. Before October 1951, *Astounding* ran "Book Reviews" from a host of contributors, including Forrest J. Ackerman, James Blish, Anthony Boucher, John Campbell, Jr., both de Camps, Heinlein, Willy Ley, and Jack Williamson.

I've left out one very important name,

haven't I? P. Schuyler Miller started writing "Book Reviews" in April 1945 and had them in 28 issues until October 1951. That was when his column became "The Reference Library," and he remained the Librarian for 280 columns, until January 1975. He delivered the news of books over 300 times in 30 years. That is an awesome and enviable record. And it will be a long, long time before I can even dream of getting out of my Number 2 slot. Heck, it'll take me eight more years just to reach the halfway point! *Twenty* years from now, I'll be just two columns ahead of him.

But enough of history. Let's look at a gem: John Brunner's **The Crucible of Time.** The book covers millennia on a distant world whose skies are dominated by a ring nebula, a chaos of dust and rock formed by a nova. The world has life, sentient life, and sages who can tell their home is headed straight for the nebula, where it will be pelted with meteorites until life must vanish.

The first of the sages are savages. They study the heavens, work ore, and invent the scientific method. They see that their species has a choice of destinies: destruction, or escape from their world to a safer realm. They form a brotherhood dedicated to spreading knowledge in space and time. And in time, despite setbacks caused by glacial melts and meteorite impacts and apathy, they succeed.

The scope of the book reminds of Aldiss's *Helliconia* trilogy, but the scale of time and the pace of invention seem more acceptable. There are no observing Earthlings, and the folk of the story are not remotely human (in fact, there is not a human in the book). The world is well painted, and the folk are very well realized in their biology and psychology—they are molluscoid, standing erect on mantles stiffened by tubules full of fluid, walking on toughened pads on the mantle's rim, and many of their words both fit their own context and echo our usages enough to be unambiguous (some are drolly apt—Antipads for Anti-podes—while others are just funny spellings). When starved, they lose reason; "dreamness" takes over, and though this may seem arbitrary, the August 20, 1983, *Science News* reported that poor nutrition, as it lowers the supply of energy to the human brain, leads to a shutdown of the reasoning parts of the brain; the limbic, emotional brain has priority even in us.

It is such touches that lead me to rate Brunner's effort well above Aldiss's. Both are monumental works of the literary art, but the Brunner is far more satisfying. I, for one, find in it much less to cavil at.

One of the more intriguing aspects of the book is the way the technology relies on biology. The nonhuman folk of the story find it easier to harvest telescope lenses and rocket fuel, to grow houses and heat pumps and telephone wires. They do, of course, find some more physical technology essential for working metal and building spacecraft hulls, and the conflict between the two provides one of Brunner's nicer grace notes.

The book's biggest problem may be the idea that male and female are essentially symbiotes of different species. When adaptation goes too far, fertility disappears until the genetic engineers can intervene. Brunner may be displaying a great and prophetic wisdom here, but he fails so greatly in his duty to be plausible that he strikes me as talking through his hat.

How big are the holes in your own hat? If they're too big, you'll probably miss Brunner's points entirely. If they're

too small, you probably don't read science fiction—or fiction—at all. If they're just right, you're gonna love this book. I did.

Richard S. MacEnroe's **The Shattered Stars** is good clean adventure. Moses Callahan is the owner and chief of a tramp steamer—excuse me, I mean a tramp starship. He faces bankruptcy, for the frontier on which he trades is fast becoming civilized, and the big shipping lines are moving in and snapping up all the profitable cargoes. Aground on Hybreasil, Moses faces the prospect of losing his ship to port fees and bills. He is saved only when a stranger offers an unidentified cargo.

Callahan's pilot is Deacon Hallorhan, an ex-soldier brainwashed into peacefulness. The engineer is Mitsuko Tamura, a secret telepath fleeing a society of her fellows that parasitizes the normal world. Deacon investigates and finds their cargo is a hellbomb. Their customer is killed. They are forced to take passengers who are proxies of a rogue telepath—a predator, not at all a parasite. Their master wants the bomb, the ship, and even the crew. He is not at all nice.

What happens? Using nightmares, the rogue's proxies try to brainwash Callahan into selling his ship. Mitsuko tries to help him, but she is busy on her own front. Her erstwhile colleagues have caught up to her; they want to continue her training as a parasite, and to train her enough to survive battle with the rogue.

At their destination, Callahan wants to turn the hellbomb over to the authorities. First, however, Deacon must surmount his conditioning and reawaken his superlative fighting skills. He and Mitsuko must face the rogue, and one of them must die. Only then may Callahan lift off once more, perhaps to meet another plot in his search for prosperity. Will there be a sequel? I don't know, for Bantam promises us only that the book is the first entry "in an exciting new future history."

MacEnroe coordinates his action well. The plot elements hang together. The story moves. The characters are thin, but the book is still worth reading, and MacEnroe's future works seem likely to be worth a look. However, I do suspect his aim will remain "mere" entertainment.

I've said it before: There's nothing wrong with entertainment. But I am vastly more entertained when there is something more to a story. Playfulness and zest and humor will do. Better yet is a striking originality of image or conceit. Best is an added measure of thoughtfulness.

All are there in R. A. MacAvoy's **Damiano,** a historical fantasy set in Renaissance Italy. I praised MacAvoy's *Tea With the Black Dragon* last year. I can praise her again now, and I hope to repeat myself when the next two volumes of the *Damiano* trilogy appear: they will be *Damiano's Lute* and *Raphael.*

Damiano is a sorcerer so hung up on music that he has summoned not the devil, but an angel to give him lessons. The novel opens with a lesson in progress. Damiano is awed; the angel, Raphael, is fond. Damiano is single-minded as only a musician can be, and he is unaware that his townsfolk have deserted their mountain town. Brigands have invaded, and Damiano is alone.

Damiano's lesson ends when his talking dog interrupts to report a soldier at the door. The soldier says his master wants to talk to Damiano. Damiano goes, turns down a recruitment pitch,

and sets out to follow his townsfolk. Adventures ensue—Damiano sits in the devil's palm, reaches a black apex of sorcery, and takes the powers of a Finnish witch—but through them all Damiano retains the innocence of soul that seems to endear him to Raphael.

MacAvoy has written a charming, delightful, original fantasy with some useful thoughts about the nature of evil. I recommend it to you heartily.

Tim Powers's **The Anubis Gates** opens in 1802, when Egyptian sorcerers, striving to restore their land's lost primacy by casting down England, summon their ancient gods. Their magic goes awry. The chief spell-caster becomes a hairy-faced dog-man with the power to shift into others' bodies. Windows open in time, and a 1983 captain of industry discovers them. His aims are nefarious, but they play small role in the story. More to the point is his incidental ploy to raise money: he arranges to take ten millionaires back in time, at a million bucks a pop, to hear Coleridge lecture, and he hires Coleridge expert Brendan Doyle as tour guide.

And then things begin to go wrong. The Egyptian mage Dr. Romany notices the time-hoppers, wonders how they do it, and kidnaps Doyle. Doyle escapes, becomes a London beggar, encounters the dog-man, and is kidnapped again. The gypsies pursue him, as do the beggars of Horrabin, a more local mage who wears clown makeup and stilts. Dr. Romany and Horrabin plot the takeover of England with the aid of a simulacrum of Lord Byron. Wickedness seems triumphant until the very end, when good wins out and Doyle finds happiness.

There is far too much in the book—and all of it fun—to lay it all out here. Suffice it to say that Powers uses Egyptian gods, sorcery, and local color well and extravagantly. He sets up all the right preconditions for his plot twists, and he uses them well, too. He never cheats, and he is very, very satisfying. Don't miss this book, and keep an eye on the author.

Somtow Sucharitkul's **The Aquiliad** offers us an alternative world in which the Roman Empire discovered America. It's a droll story whose hero, Titus Papinianus, has just a touch of Bertie Wooster (his Jeeves is the slave tutor Nikias). Titus is a general of limited competence whom the emperor would just as soon be rid of. Sent to subdue the Parthians, to rule a Roman colony in the Terra Nova, and to search for China, he is accompanied and rescued by the Indian chief Aquila. Their adventures include encounters with Olmecs who really do have dealings with flying saucers, with Sasquatch who turn out to be genetically engineered scions of one of the lost tribes of Israel (they live in the American Northwest for the smoked salmon they can get from the Indians), and with a time-traveling evil-doer who tinkers with history. This last, of course, is responsible for such things as the Sasquatch, the automobiles and bicycles on Roman roads, and the Roman discovery of the New World. The Olmecs are being helped out by the cops from the future who are hunting the crook.

The Aquiliad ran in pieces in *Asimov's*, where it was apparently fairly popular. That popularity wasn't because of the book's great characters, for they're cardboard. Nor was it for an earth-shaking plot or general literary quality. It was for a fun craziness that showed in putting Indian terms into Latin (would you recognize a *fascis medicinae* if you saw one?) and in warped *scientiae fic-*

tiones in-jokes such as references to P. Josephus Agricolae, Alienus Elysianus, editor of *Visūs Periculosi*, and Asimianus' *Fundatio: Fundatio et Imperium: Fundatio Secunda*.

I don't think I need to say much more about the book. As I said, it's droll, it has a touch of Wodehouse, and it's crazy. It's fun.

Speaking of Harlan Ellison (you caught it, didn't you?), his 1967 landmark anthology, **Dangerous Visions,** is now available as a fat paperback. Its 33 stories were often more than a little daring when they were new, and they did indeed, just as the cover blurb claims, change SF. Many of the contributors —Del Rey, Silverberg, Aldiss, Anderson, Leiber, Sturgeon—were distinguished then. More—Farmer, Niven, Spinrad, Zelazny—have earned all or most of their distinction since.

Buy the book. It belongs in every library.

And speaking of Philip José Farmer (did you spot him, too?), here is **Gods of Riverworld,** fifth and worst in the Riverworld series. Sir Richard Burton, Alice Liddell Hargreaves (Carroll's Alice), Peter Jairus Frigate (Farmer's alter ego), Aphra Behn, Jean Marcellin, Li Po, Tom Turpin, and a Sufi are dwelling in the tower at the Riverworld's North Pole, which they have taken over. Loga, that one of the Ethicals who have resurrected every human born on Earth between 99,000 B.C. and 1983 A.D., who has allied himself with and egged on the human rebels for his own purposes, is dead. Burton et al. are free to indulge themselves in sybaritic luxury and sophomoric philosophy while they hunt for Loga's mysterious killer, try to figure out the tower's computer, and seek a way to solve all human problems on the Riverworld.

The trouble is that the book is pedestrian, plodding, and talky. The novelty of the Riverworld idea was worn out at least two books ago, and Farmer fails to introduce enough new novelty to sustain interest for more than a dozen pages.

And the endless philosophizing! At one point, Farmer has his altar ego ask, "Will I ever graduate from the sophomore class?"

The answer is no. And I'm sure Farmer knew it, or he wouldn't have asked. He knew better, and he did it to us anyway.

In Marion Zimmer Bradley's **Thendara House,** sequel to *The Shattered Chain*, two women face and try to break the invisible chains—custom, convention, habit, expectation—with which people bind themselves and are bound. Magda is a Terran reared on Darkover, who once, on a mission to ransom her husband Peter, disguised herself as a Free Amazon, or Renunciate. Caught out by true Renunciates, she was forced to swear their oath and join them, forswearing all status as property of men. The oath struck a chord in her, and now she is on leave from her job with the Terran Empire, bound for training to the Renunciates' Thendara Guildhouse. Her training is largely a "deprogramming," a teaching of independence from traditional, conventional attitudes and of abilities in self-defense and self-support.

Jaelle is the Darkovan Renunciate who first took Magda's oath. She is now married to Peter and doing Magda's work for the Empire while Magda is in training. Once a man-hater, Jaelle now loves Peter, but her past and Peter's chauvinistic expectations conflict pain-

fully. Magda too suffers, but both women come to terms with culture shock and with the issues we recognize from modern feminism. The resolution is nicely nonextreme:

> "All her life she had believed she must choose between being Terran and Darkovan, Magda or Margali, Intelligence Agent or Renunciate, lover of men or lover of women, head-blind or *leronis* (psi-powered), and now she knew that she could never describe herself as either one thing or the other, she knew that she was all of these things and that the sum of them all was more than any or all of them.
>
> "I do not know who or what I am. I only know that I do what I must, no more and no less." (p. 341)

Bradley has worked out her resolution of feminism and humanity in the midst of a fairly active plot. There is no great amount of action or violence, but plenty happens on the interpersonal and political levels. But the plot hardly matters, except in that it makes her theme palatable, and at times unnoticeable. Bradley's goal was to work out and express a philosophy, and she did it far more effectively than Farmer.

Christopher Stasheff, author of the enchanting *Warlock in Spite of Himself* and the acceptable *Warlock Unlocked*, now tells us how the world of Gramarye came to be settled. In **Escape Velocity,** he gives us Dar Mandra of Wolmar, the prison world to which are banished all whom the Interstellar Dominion finds inconvenient, from criminals to . . . Well, Dar's boss is Cholly T. Barman, a university professor who wrote that university education should be universal, that teaching should be one-on-one, and that professors should have cover roles such as bartender. That made him unpopular with the educated, the university administrators, and the educators. He wound up on Wolmar while fleeing assassins, and now he is a bartender who inveigles shoveljockeys into chasing their booze with Descartes.

And then there's the psychiatrist governor of the penal colony, who has turned a mob of prisoners into a smoothly functioning society, largely by letting them discover a need for civilization. When his supercilious replacement, Bhelabher, arrives, Dar and his buddies swipe Bhelabher's bonafides, the governor gets him into therapy, and soon Bhelabher is taking over the computer section. Dar gets the job of running Bhelabher's resignation and word of a coup plot back to Terra, accompanied by Sam, a recent runaway from the home planet.

Dar's and Sam's chore seems simple enough, but among Bhelabher's entourage is a rat-faced security man convinced that his boss has to have been subverted by telepaths. He leaves Wolmar too, and Dar and Sam are soon the objects of a paranoid anti-telepath hunt. Fortunately they pick up with Whitey the Wino, a drunken bard akin to Heinlein's Blind Rhysling, and his daughter Lona. When they finally reach the home solar system they are shot down by the Patrol, only to be rescued by a miner whose ship's computer can wear various bodies, has a faulty circuit that makes it prone to fits, and answers to the name of Fess.

There's a Fess-inating link to the *Warlock* book there, but let's drop it. What happens on Earth? Dar, Sam, Whitey, and Lona find no sympathetic reception—the powers that be are all eager to nail them as telepaths, sacrifice them to the mob, and seize power for themselves. Their only friend is a wealthy descendant of the Society for Creative

Anachronism, whose answer to the incipient dictatorship is to gather his friends and lift ship for a fresh world. His plan is to build a new life, based on the medieval chivalry of his erstwhile role-playing, and make it real by wiping all memories of the past. Sam goes with him. Dar and Lona fly off together with Fess, taking the new name D'Armand.

Read the book. You'll enjoy it, for it has much of the charm of *The Warlock in Spite of Himself*, and it sets things up for Gramarye admirably.

In **Touch the Stars: Emergence,** John Dalmas and Carl Martin give us an enjoyable tale of individual competence, superscience, and power-mad scheming. American Indian Jason Roanhorse has established one of the hottest aerospace firms around, based in Scotland. He has had overtures from the Hamilton Club, a group of wealthy men who for more than a century have been trying to breed the human race into passive subjects for them to rule. He has rejected them, and now he promises to spoil all their play by releasing the human species beyond their reach: he has a stardrive.

The story is almost entirely Jason Roanhorse versus the Hamilton Club, Jason versus the assassins, Jason racing a hunch against time while the Hamilton minions prime a nuclear missile. And that's enough. Dalmas and Martin don't really need to give us more about the aliens whom Jason's explorers find at Alpha Centauri, or about the space-drive's details.

Will there be a sequel? I don't know, but if there is, I'll want to see it.

Joanna Russ's **The Zanzibar Cat** collects many of her best stories. It contains "The Extraordinary Voyages of Amelie Bertrand," "When It Changed," "The New Men," "A Game of Vlet," and more. All very literary, all very painful, all very earnest, and one gets the feeling that Russ doesn't have much fun in her writing. Though one does know better from her other work.

In the book's foreword, Marge Piercy wonders why women writers are so fond of vampires, especially as "enabled" characters. She suggests that the key is the question of powerlessness. That may be, but I wonder—and take it as a cheap shot if you must—if the truth is not that a vampire controls the flow of blood, and that flow is inward.

Space Processing, Products and Profits, 1983-1990, edited by David Gump, is a paperback compendium of information on NASA launch vehicles and their competitors (including the marginal); on commercial satellites and the corporations involved with them; and on space manufacturing. The book also reprints "Commercial Opportunities in Space," a report funded by NASA and prepared by McDonnel-Douglas, Booz-Allen & Hamilton, Ford Aerospace, and Geo Scientific Systems; the report is not available from NASA, though people can see it free at NASA reading rooms. Finally, the book tells how to get a free ride on the Shuttle for initial development work.

Packaged for the business market, the book marshals information that isn't available in one lump elsewhere, and it argues cogently for a space station. It may help convince industry that space is worth investing in; and if it does that, we will get the kind of space program we have been wanting for years. The book may even be worth its price: $97, or free if you subscribe to *Space Business News*, a six-page biweekly newsletter at $175 for six months and $295 for a year. ■

brass tacks

Dr. Schmidt:

I agree, but disagree, with your August editorial ("Word Games"). It says, as far as I understand it, that institutionalized "voluntary" prayer need not be as bad as you and I would first expect it to be; and that this is because a few brave children would resist it, endure the consequences, and emerge from the experience stronger.

Well, maybe. And maybe not. You said yourself that few children would choose to resist. Of those few, how many would succeed, and how many would knuckle under?

Maybe those few who succeed in their rebellion would learn the right lessons (independence, integrity, courage), but I think that more would learn the wrong lessons: conformity, hypocricy, comfort.

Your argument is one I've often seen in *Analog*'s editorials: that "bad" is not necessarily all bad, because it can force "good" to happen. This is true enough, and very reassuring, until you look at the other half of the paradox: that "good," in turn, can permit "bad" to re-emerge. It's two complementary processes, summing up to zero. The best that one can say about this paradox is that it keeps things stable. Also, even the best negative-feedback loop has limits, beyond which the system can't return to normal. Enough "good" is simply "good," not "bad"; enough "bad" is simply "bad," not "good." At any rate, it is best to keep the two concepts at least *partly* separate in one's mind, to remember that some opposites really *are* opposite. That's an important part of integrity. (The other part is to remember that other opposites really *aren't* opposite.)

The point you made in your editorial wasn't false, but it wasn't true either.

It was a half-truth. Well, one must expect this when dealing with paradox.

Your article ends with a question: how does one tell the conforming many about the dangers of conformity? One of my elementary school teachers tried one way; I still remember the lesson. She sent one boy away on an errand, and while he was away she told the rest of us what to do. When he got back, she held up a card with two lines on it. AB was half as long as CD. She asked us, one by one, which was longer; we each said AB.

When the boy's turn came, he agreed with us.

Very educational.

About Vinicoff's "Blue Sky": The projects he lists on p. 167 are what *I* would gladly call "social programs." In fact, that list reminded me of the CCC, the TVA . . . in other words, FDR's New Deal.

One question: Vinicoff mentions eighteen programs and lists eight. What are the other ten? Maybe Analog's writers and readers could come up with a list. (Here are my suggestions: Ending soil erosion; cheap seawater desalinization; a national electronic public library data bank.)

I loved Schenck's "Geometry of Narrative." The mathematical analogies were weak, except the strong central image, the Mobius strip. No wonder Ms. Lee was perturbed; the story was not *orientable*. Tell Mr. Schenck to write some more twisted tales.

NATHANIEL HELLERSTEIN
Berkeley, CA

PS: Vinicoff's "Blue Sky" reminds me of the following: recently both the L5 society and the Sierra Club sent me letters begging for money. I sent each alms plus a note saying that I had sent the same amount to the other. "I'm greedy," I explained. "I want humanity to have the earth *and* the stars." Either-or strikes me as a fool's bargain.

Actually, irony was supposed to be the dominant trait of that editorial. It mentions one good result that could come of all this, but had to strain pretty hard to find it. Surely there are better ways to get that result!

Dear Stan:

G. Harry Stine's tirade against the news media in "The Sky is Going to Fall" (August 1983) misses one vitally important point: the news media are not one huge, slathering, lumbering behemoth leaving trails of recording tape and newsprint behind them. They are—and I stress the plural, which media is—four major television networks (yes, CNN counts), upwards of a dozen national radio networks, several major wire services, and countless local newspapers, radio stations, and television stations. They do not think with one mind. Not even the networks, since a large part of their news coverage is provided by local stations "stringing" for the nets.

Why in the world should the news media want to shoot down the shuttle program? The Apollo program didn't suffer such a fate after the tragic deaths of three astronauts. And even as I write this, STS-7 is getting rave *positive* coverage from the national news outlets . . . even in lead position. This certainly doesn't show a decrease in the "news value" of the space program.

I don't doubt the value of space activists getting in touch with local news outlets, and Stine offers an effective means of doing so. I'd go one step further, and recommend those interested join established pro-space organizations or set their own up—reporters are more likely to interview the representative of a group than an individual. But as a reporter and science editor myself for

an all-news NBC affiliate radio station, I can honestly say that after nine years in this business, I have yet to encounter a reporter who has gone out of his or her way to slam the space program. And no, I haven't seen a news executive who has done so, either.

FRANK CATALANO

Seattle, WA

Dear Dr. Schmidt:

I'd like to add what I believe is a slightly different viewpoint to the "Evolution-vs.-Creation" or "Science-vs.-Religion" controversy that is sometimes reflected in your letters column. With some luck, I might even be able to offend both sides.

Religion can be looked on in at least two ways: first, as dogma, or a set of inviolable truths; and second, as a system of knowledge used by people to deal with the world around us. Science can similarly be looked on in these same two ways. While there are certainly scientists who use the scientific method and the knowledge built up over the centuries to further our understanding of the universe around us, there are, just as undeniably, those who take the words of eminent scientific personalities as inviolable dogma, ever true and unchanging. I like to call such people "Scienceists"—believers in the dogma of Science and Technology—and I suspect that it is more often these Scienceists who howl at "Creationists" than it is the true Scientists.

Only when *both* science and religion are viewed purely as dogma can the science-vs.-religion conflict arise: the religious dogmatist says, "*I believe* that the world was created in six days, and therefore science, which says that this isn't the way things work, is heresy." The Scienceist similarly says, "*I believe* that the universe is billions of years old, and therefore religion, which says that this isn't the way things happened, is heresy."

However, the true place that either religion *or* science takes in our lives must be defined in terms of its function, and that function is to serve as an intellectual framework to use in dealing with the universe: a basis on which to organize our human observations and experiences. Of course, the rules of the game may be different in each case—science takes discrete observations and synthesizes them into general principles, while religion starts from "revealed" principles and applies them to individually-experienced situations —but their function, and thus their nature, is essentially similar.

By the same token, the rules of the game *are* different in the two disciplines. Although their respective logics may operate similarly in familiar areas (and they must do so, to be practical), extrapolation into unknown areas will inevitably result in at least apparent contradictions. I, then, as a practical person, am faced with a dilemma. On the one hand, I believe in my religion, as revealed truth about the world; on the other hand, I have many reasons for believing in the rightness of science (among them being, first, that science yields practical results; and, second, that as a child of Western culture I'm a bit of a Scienceist myself).

Being a practical person, I resolve my dilemma practically. Why do I need either science or religion? As noted above, I need them as frameworks for dealing with situations in the universe around me. Well, then, I will (as we all really do) use *either one, as its principles help me deal with the situation at hand*. As an n-dimensional entity, reacting with forces and objects over time, I will employ the principles of science;

as an integrated being (ego, soul) dealing with the universe and people as wholes, I will use the principles of my religion. What about the perceived or real contradictions between the two sets of principles? I carefully put them away in a draweer labelled "to be resolved when more data are observed"! This is similar to what the physicist must do when he observes, for example, that some forces observe the inverse-square law, while others don't. He can ask why this seeming contradiction exists, but the data aren't yet in that will make his question meaningful. This, of course, doesn't mean he junks either part of his physical theory; he will use each principle in the realm where it works.

Is this a cop-out? If it is, then it's a practical one, which allows me to explore the furthest reaches of either science or religion, and be a functional "believer" in both. (I suspect that, on a less sophisticated level, this principle underlies the fundamentalists's annoying argument "but it's only a theory": as the conflict is in an unprovable area (the past), and he finds no need for science in his daily life, why should he disturb his comfortable principles for something that MIGHT have happened?) In my vanity, I like to think that this is truly the spirit of science in the Campbellian tradition: use it if it works, and don't bother tearing down theories until you have the data to back you up.

Before I sign off, I must take the opportunity to compliment you on the wonderful—I was about to say "miraculous"—job you've been doing as editor. Month after month, you manage to find really *new* stories and ideas, while somehow maintaining the classic *Analog* flavor. I hope you continue for many years to come!

ANDREW M. BLUMBERG

Brooklyn, NY

Dear Dr. Schmidt:

In reference to your editorial "The Technology Trap" in the October issue of Analog, this past week the Admissions Director at the college came to my office upset because his calculations of the percentage change of students from last fall to last spring did not agree with my published figures. (I am Director of Institutional Research.)

I found from his explanation that he was dividing the number of withdrawn students and the number of additions by the *spring* enrollment total rather than by the fall.

Then Friday night I read your editorial, and the point I wish to stress is the need for basic understanding of mathematics and language so that you can recognize garbage when it comes from the computer. If you don't have the mental means to ballpark the expected result you'll tend to accept whatever the machine gives you.

We are in the process of creating an elitist society where those who do understand the basic concepts of mathematics and language will rule the vast masses technologically trained to run our sophisticated machines but unable to judge the validity of the answers supplied.

When I first began work at the college 24 years ago I taught a senior course in Economic Geography. Partway through the course one of the students accused me of making him think—he had not done so before and he wasn't about to begin then. To my shocked mind, what was he doing in college? It behooves all of us in leadership positions to combat this slide toward mediocrity in any way we can. Thank you for raising your voice in this valid cause.

DR. LOREN GOULD

Worcester, MA

■

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a calendar of analog upcoming events

22-25 March
SWANNCON 5 (International Conference on the Fantastic in the Arts) at Boca Raton, Fla. Guest of Honor—Stephen King. Writers' and Teachers' workshops, readings, etc. Info: Conference on the Fantastic, College of Humanities, Florida Atlantic University, Boca Raton FL 33431.

23-25 March
STELLARCON IX (North Carolina SF conference) at Greensboro, N.C. Info: Science Fiction Fantasy Federation, Box 4, Elliott University Center, UNC-Greensboro, Greensboro NC 27412.

26-30 March
General meeting of the American Physical Society at Detroit, Mich. Info: A.P.S., 335 East 45th Street, New York, NY 10017.

29 March-1 April
Popular Culture Association Meeting at Toronto, Ont. There will be a section on Fantasy and Science Fiction. This is an academic meeting. Info: David Stevens, F/SF Area Chair, 224 Fifth St. #2, Charleston IL 61920.

29 March-1 April
AGGIECON XV (Texas SF conference) at College Station, Tex. Co-Guests of Honor—L. Sprague de Camp and Catherine Crook de Camp, Artist Guest of Honor—Don Maitz, Special Guest—James P. Hogan, TM — Wilson "Bob" Tucker. Info: AggieCon XV, Box J-1, College Station TX 77844. 409-845-1515.

31 March-2 April
ISTACON (Georgia SF conference) at North Lake Hilton, Atlanta, Ga. Guests—Anne McCaffrey, Michael Whelan, Frank Kelly Freas. Registration—$15 until 1 March, $20 thereafter. Info: Istacon, % Howell, 959-A Waverly Ct., Norcross GA 30071.

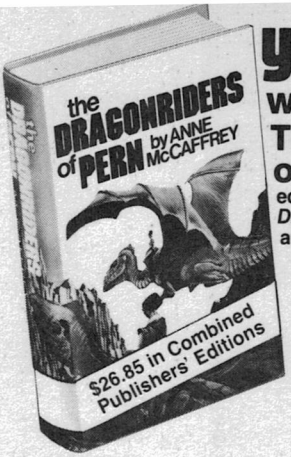
20-23 April
SEACON (Combined British Eastercon and Eurocon SF conferences) at the Metropole Hotel, Brighton, England. Five (5) Guests of Honour. Attending membership $16. Info: Mary Burns, 23 Kensington Court, Hempstead NY 11550.

20-23 April
EUREKACON (Australian National SF Convention) at Melbourne Town House, Carlton, Victoria. Guest of Honour—George Turner. Registration—$A10 supporting, $A20 attending. Info: Eurekacon, P.O.Box 175, South Melbourne, Victoria 3205, Australia. Use airmail.

27-29 April
CON*TRETEMPS 3 (Nebraska SF conference) at Omaha, Nebr. Guest of Honor—Patricia A. McKillip, Artist Guest of Honor—Real Musgrave, TM—Stephen R. Donaldson, SMOF—Rusty Hevelin, Fan Guest of Honor—Ken Keller. Registration—$14 until 26 April, $16 at the door. Info: Con*tretemps 3, Box 12422, Omaha NE 68112. Include S.A.S.E.

30 August-3 September 1984
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—$40 until 31 December 1983, more later and 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



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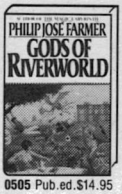

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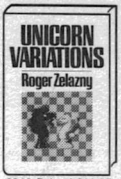

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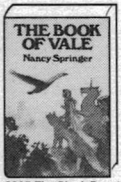

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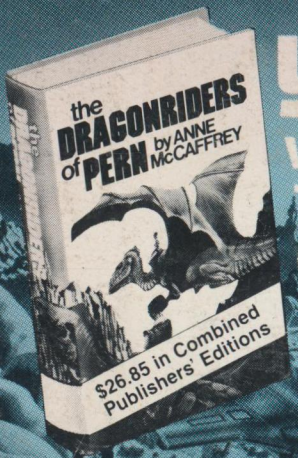

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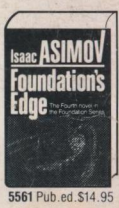

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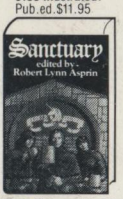

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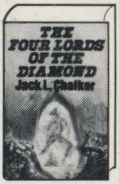

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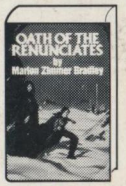

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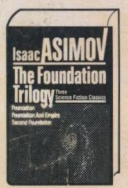

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