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Vol. CXXIX No. 5, May 2009

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Published since 1930

First issue of *Astounding* January 1930 (c)

"...think ... broken Help ... pl..."

Dispatcher Schneller scowled, straining to get the information that she needed—and an unidentified someone else needed her to have—through the static that nearly masked the cell phone signal. "Please speak slowly and loudly," she said, as distinctly as possible. "Where are you?"

But the caller apparently couldn't speak loudly, and only an occasional word got through. But Schneller already knew from the few she'd caught so far that somebody in her department's jurisdiction was in bad trouble. "Where ... are ... you?" she repeated.

For several seconds, nothing but rushing noise. Schneller glanced over her shoulder at Lekarz and whispered, "Still no GPS fix?"

Lekarz shook his head. "No. Maybe that part was broken in the crash. Or maybe it's an old phone that doesn't have it."

So they'd have to make do with the little information they could get through the lousy cell phone connection.

The faint, garbled voice surfaced again. "Help..." it repeated. "...baby ... help..."

I already know you need help, an irritable part of Schneller's mind muttered. Repeating it doesn't help either of us any more than this static. I need to know where to send it. Again speaking as clearly as she could, she asked, "What road were you on?"

Another long silence. Then she caught the single word, "...hollow..."

Schneller deliberated for a few seconds, then decided it was time to act. It wasn't much, but it was better than nothing.

There were three roads in the county with "hollow" in their names. She quickly located the deputies closest to Ramsey Hollow, Clark Hollow, and Metcalf Hollow Roads, and told each of them to drive the length of one of the roads, looking for a car in a ditch or against a tree.

Then she went back to the man in the ditch. "Help is on its way," she said, and she hoped it was.

* * * *

That little vignette might seem to have nothing to do with the political process, but I thought of it after talking to one of my more reliable fonts of inspiration shortly before the last election. He commented on the ironic conundrum that we're constantly admonished to become informed voters, but in practice that often seems discouragingly close to impossible. All we know about the candidates, he said, is what their campaigns tell us about how wonderful they are and how terrible their opponents are, and that's mostly lies. So how can we really know anything?

To a considerable extent, I had to agree. Probably most of us have noticed that in a typical campaign, precious little is said by either candidate about the important issues or what, exactly, he or she proposes to do about them. Still less is said to give us any reason to believe that promises made will be kept. As the campaign wears on (and "wears" is all too apt a word), even less is said about these important matters. The campaign degenerates into increasingly vicious mudslinging and name-calling, with both candidates hurling scurrilous and largely unsubstantiated allegations about the other's character and past

misdeeds. Many of these eventually prove to be, at best, loaded distortions of the truth. By the time the election rolls around, you could be forgiven for feeling that you wouldn't want to vote for *anybody* who acts like that.

And then, after the election, the loser congratulates the winner and everybody puts on smiles and affects mutual admiration and respect, acting as if none of those terrible things had ever been said. “Acting,” I fear, is another all-too-apt word, and the whole charade could easily make a cynical person wonder whether any of them ever meant *anything* they said.

And yet, on reflection, I couldn't *completely* agree that one can't be an informed voter. If I did, I would also have to conclude that there's no real point in voting. I can't believe that, especially after the special election in which my wife was unable to vote and a wildly unreasonable school budget passed by one vote. Every vote does count, sometimes very small numbers can make a crucial difference in the outcome, and often the outcome will profoundly affect the lives of a great many people. So it is important to vote, and it is important to base our votes on the best information we can get, even if that isn't easy.

And the dubious claims made by the candidates and their campaign publicists aren't really the *only* things we have to judge them by. We can get some clues to character by watching and listening for nonverbal clues when they speak, though the value of those is limited by the fact that successful politicians devote a lot of effort to learning to look and sound the way they want to be perceived. In other words, they have to be good actors; and as the cliché goes, once you learn to fake sincerity, you've got it made.

The one thing we can count on is that one of the candidates *will* be elected, and will then do things that affect the rest of us. So it's to our advantage to make our best efforts to pick the one who will do the best job—or at least the least damage. One bit of hard data that can be helpful is the past voting record of the candidates—especially in the *recent* past. That information is a matter of public record, and open to anybody's scrutiny. It's also worthwhile to listen to what they say while campaigning, though not necessarily with the idea of believing what they say about themselves or anybody else. Expecting them to actually keep their campaign promises is a long shot, but if a candidate is promising to do things that you would hate to see done, that's a pretty good reason to vote against him or her.

The voting citizen's situation is a little like that of the dispatcher in my opening anecdote. We can't get the information we need in the neat, clean, complete form that we'd like, but we must try to solve an important problem and we need to base our actions on the best knowledge we can gather. Not having a clean signal at our disposal, we have to try to extract the useful information from a lot of noise—static in the dispatcher's case, campaign bluff and bluster (and now rumors running amok on the internet) in the voter's.

But extracting a useful signal from a noisy background is hardly a new, unique, or necessarily overwhelming problem. Radio amateurs and professionals have dealt with it for as long as radio has been around, developing special technology to improve signal-to-noise ratio, and sometimes still just having to make their best efforts to extract the meaningful from an irreducible amount of hash. Scientists regularly deal with it: research experiments are normally efforts to isolate and measure a particular well-defined effect, but in the real world, actual measurements are always influenced by other factors and ways must be found to see through those.

In my thesis research, I was often trying to measure effects that only showed up as less than a one percent change in a radiation count. But radioactive decay is an inherently random process, so there's an inherent uncertainty in the “background” rate from which I was trying to measure a small deviation. The simple “solution” would have been to say that the statistical uncertainty would mask the effect I was looking for, so I should find another project. But the uncertainty can be calculated, and becomes a smaller fraction of the total count as the total becomes larger. So to measure our effects, we sometimes

had to run the equipment collecting data for more than a week, to make the uncertainty smaller than the effect we were looking for, and then use computer fitting programs to separate the part of the signal we were after from the random part that meant nothing to us.

Voters don't have such well-defined means of extracting a useful signal from a noisy one, but we still need to try. We'll never get as clean a signal as we'd like; but, like the dispatcher or a research scientist, we need to make our best efforts to extract as much real information as we can. There's too much at stake to just give up because it isn't easy.

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Analog Science Fiction and Fact (Astounding), Vol. CXXIX, No. 5, May 2009. ISSN 1059-2113, USPS 488-910, GST#123054108. Published monthly except for combined January/February and July/August double issues by Dell Magazines, a division of Crosstown Publications. One-year subscription \$55.90 in the United States and possessions, in all other countries \$65.90 (GST included in Canada), payable in advance in U.S. funds. First copy of new subscription will be mailed within eight weeks of receipt of order. When reporting change of address allow 6 to 8 weeks and give new address as well as the old address as it appears on the last label. Periodical postage paid at Norwalk, CT and additional mailing offices. Canadian postage paid at Montreal, Quebec, Canada Post International Publications Mail, Product Sales Agreement No. 40012460. (c) 2009 by Dell Magazines, a division of Crosstown Publications, all rights reserved. Dell is a trademark registered in the U.S. Patent Office. Protection secured under the Universal Copyright Convention. Reproduction or use of editorial or pictorial content in any manner without express permission is prohibited. All stories in this magazine are fiction. No actual persons are designated by name or character. Any similarity is coincidental. All submissions must be accompanied by a stamped self-addressed envelope, the publisher assumes no responsibility for unsolicited manuscripts or artwork.

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Novelette: **AMONG THE TCHI** by Adam-Troy Castro

Obviously, this story could only take place on a *very* alien world...

Brian Carlson emerged from the transport wearing the curdled expression native of any man who had just spent his entire journey enduring the disdain of all forty fellow passengers.

This was not an unusual experience for him. As a professional novelist, he was well used to the disdain of others; it was the medium in which he lived. But four days on a Tchi transport with nobody but grumpy Tchi to talk to was a little too much disdain even for a man who last four novels had “betrayed his minimal but undeniable early promise” (*New London Literary Journal*, Vol XXXVIII, ch 3, col. 2). Until realizing that his fellow passengers would have treated any human being no matter how accomplished with the same level of contempt, Carlson had spent most of the journey wondering if he'd spilled something on himself.

He was therefore encouraged to find another human being waiting at the gate, even if that human being happened to be Everett Finn, who had never been one of his favorite ten thousand people.

Finn was not just a novelist, but a critic as well.

Their relationship had never been happy.

For a moment, the two men glared at each other, each struggling to construct a witticism with sufficient pith. This was crucial. Whenever hostile novelists encounter one another in unclaimed territory, the author of the most cutting witticism is awarded dominance. The principle is so dear that some personalities, Dorothy Parker for one, are remembered by subsequent generations more for their barbed tongues than for anything they ever put down on paper. All these centuries later, Carlson knew nothing about Parker except that she drank, that she liked her tables circular, and that by all accounts anybody who wised off to her took his reputation in his hands. He wanted an immortality as lasting as hers and suspected, from his sales and reviews, that his prose would not get him there: the consolation being that, judging from his even poorer sales and reviews, neither would Finn's.

No witticisms materialized.

The two novelists resorted to locking horns.

"Finn," Carlson said, with the intonation he would have reserved for a highly suspect brown suspect on the sole of his shoe.

"Carlson," said Finn, in the manner of an ailing man who had just been told the name of an alien disease that would soon make his arms fall off.

The contest ended in a tie, complicated by the waves of revulsion on the faces of all the surrounding Tchi, who like most Tchi seemed to regard humans the same way they regarded suspect brown substances or arm-dissolving diseases.

Realizing that somebody had to act lest the face-off go on for hours, Carlson took the initiative, as per the one-time review in the *Neklortun Review* that had praised him for marching where so many lesser literary lights feared to tread. "What are you doing here?"

Finn responded in the bold, incisive manner that had earned his latest novel special kudos in a review printed in the *Xanan Journal of Letters*. "What are you doing here?"

Carlson made himself taller. "I'm going to be this semester's Author in Residence at the Tchi University

Seminar in the Fiction of Human Beings."

"Ah," Finn said, without changing his own height one millimeter. "How honored you must be."

Carlson's neck had already achieved full extension, but he managed to elevate his nose another millimeter. "They paid my fare, my expenses, and a healthy honorarium."

"More than you got for your last two novels combined."

"Yes," Carlson said. "How would you know?"

Finn said, "They paid me the same."

For the first time, Carlson suspected that his new sinecure would not be quite as exclusive as his agent and his ego had led him to believe. "I was told they'd send a driver."

Finn spread his arms. "I'm the driver."

Carlson struggled to maintain the illusion of great height, and for a moment or two succeeded in wrenching the space-time continuum beyond its natural parameters by peering down his nose at this upstart who according to all considerations involving sheer physical measurement was actually several centimeters taller than himself. The attempt failed only because he was unable to imagine any plausible series of events that could lead to Everett Finn agreeing to drive him anywhere that didn't promise explosive decompression at the destination. "Oh? You're on the support staff?"

"I'm one of the other Authors in Residence, you arrogant twit, and if you want to know why I volunteered to pick you up, it's because my overweening pride in the human literary tradition as a whole trumps the crashing tidal wave of contempt I feel for you as a particular individual. Period. You need to be warned what to expect before your press conference."

Carlson's heart fluttered. "Warned?"

"Yes, warned. We'll talk about it on the way back to campus. Carry your own bags, will you? I'm a harbinger of doom, not your own personal mule."

* * * *

The skimmer bore all the design joys of every other Tchi ground vehicle: unlike its human equivalents, which provided transparent surfaces on all sides to foster the illusion that the pilot bore some measure of control over the direction or speed of its flight, it was completely sealed in, providing only a narrow slit at what the typical Tchi passenger would have considered eye level. The glass there was translucent, not transparent; and tinted a sickly shade of amber that made the world outside look like it had been dipped in pudding.

Tchi architecture tended toward big puffy inflatables bobbing atop obelisks. The pedestrians were, of course, all Tchi; and though there was no way for any of them to have singled out this one unmarked skimmer as the one ferrying the famous *Hom saps*, the expressions of all the pedestrians within Carlson's truncated line of sight seemed to glow with a special scorn that couldn't have been explained away by their disdain for whoever programmed the skimmer with the Tchi rules of the road.

Carlson had been warned against dealing with the Tchi, who seemed poised to reward their advance reputation as a bunch of aggravating snots, but the art of the novel had just been declared dead for the ten thousandth time in about as many years, and like any scrivener not one of the current best-seller list's anointed five he had leaped at the first subsidy offered him. How hard could it be, to write on an alien world for one local year? To scratch his beard thoughtfully, while those aliens asked a hundred variations

of “where do you get your ideas?” and each time parrot back some version of the classic reply “Schenectady?” To offer himself as an accomplished eminence, attending parties, radiating knowledge and saying witty things while going home to work on the perennial One That Was Going To Change Everything For Him?

Not hard at all, he'd imagined. Especially considering just how much the Tchi were willing to pay: an order of magnitude beyond any speaking fee he'd ever received.

But judging on the intimations of doom expelled by the odious Finn, he'd overlooked something. He said, “I must have misunderstood the nature of the curriculum. I thought I was to be the only Author in Residence.”

“No such luck,” Finn said. “You're one of forty. Everybody's signed up for a year or more, and scheduled to arrive at staggered intervals of one every few weeks or so. That way there's always some new preening egotist primed for a rude awakening, and some empty shell counting the last days before his or her ride home. Generally speaking, you can tell those who've been here for a while by how gut-punched they look; I have most of the year still left to go and I look like I have gremlins eating my spleen.”

“Just what do they do that's so bad?”

“Nothing that isn't in your contract. You write your standard daily output on any project of your own personal preference. You make it available to the faculty. You show up once a week or so to read aloud and answer questions before an audience. If you produce nothing—and I assure you, some of us have tried that; there are Authors in Residence here who swear they'll never write anything again—they ask about your past work instead. Repeat as necessary until your time in hell is over.”

Carlson frowned. “All of that sounds pretty standard.”

“Oh, it's standard all right,” Finn said, with bleak finality. “The Tchi have it down to a science.”

“And this defeats people, how?”

“It defeats them by driving a stake through every creative impulse they ever had. Look. Remember Sandra Jaagin?”

Of course Carlson did. He'd shared a teaching fellowship—and for a while, an apartment—with her at the University of New Kansas. It was there, in fact, that she'd sold her first novel: also there that Carlson, whose own career had not been going well at the time, had burst into a jealous tantrum that turned everything sour for the few weeks their relationship still had to live. He had always wanted to run into her again, so he could apologize. “The Tchi made her stop writing?”

“She's well and truly blocked. These days she goes on a lot of long walks. And then there's Vera Lugoff.”

Carlson remembered Vera from several previous writing conferences. She was an odd twig of a woman, poorly socialized even by the sometimes generous standards afforded fiction writers, and she specialized in the production of epic doorstops about virginal frontier women and the shaggy-maned, bare-chested louts who loved them. The supreme sexual act for the couples inhabiting any Vera Lugoff novel seemed to be standing atop one windswept crag or another, and proclaiming their love in three-page sentences crammed with enough metaphors to make her pages sticky. Vera spoke much the same way, and always radiated scorn when her five-hundred declarations of nothing in particular failed to produce sustained replies in the same prose style. Carlson had never known another writer so much in love with her own work, or any other whose ego had seemed more impervious to criticism. He squeaked: “She's here?”

"She's here, nested flashbacks and all. The Tchi flew her in three months ago. And she was game all right: she flounced in, and read her first excerpt in a fit of high eloquence capable of flattening even the most demanding human audience in either satisfaction or sheer dumbfounded amazement. And guess what?"

"What?"

"It took less than a dozen sessions with the Tchi to break her. She's stopped writing. She just stays inside her bungalow and weeps, saying that she'll never write a word again."

"Vera said that? *Vera?*"

"Vera," Finn confirmed. "We've had suicide attempts, outbreaks of alcoholism, buzzpop abuse and other arcane addictions, perfectly good manuscripts fed to deletion programs, one nervous breakdown that left its victim declaring himself a mushroom, and at least a dozen talented writers who have found themselves unable to add a single word to their online files in weeks or months. Lord alone knows how many of them will produce again. I'm stronger than most, and my muse may have fallen down the well for good."

Carlson was horrified, intrigued, terrified, and defiant, all at once. The main reason he wasn't actually forewarned is that he was also a professional writer, which is to say he'd spent much of his life listening to all the learned voices, ranging from his parents to his ex-wives to the gray-bearded eminences who had plowed this ground before him, who had advised him of doom if he allowed his life to take this course. So instead of asking Finn for further details, he just ventured, "That won't happen to me."

And Finn exploded. Almost literally: a few additional grams per square millimeter pressure against the inside of his skull and he might have left most of his cerebrum plastered against the skimmer walls. As it is, his head bulged. "Oh, so you think you're better than us."

"Oh, come on, I never said that, it's just that you've always been hypersensitive to criticism—"

"Oh, that's it," Finn laughed. "And you're not? Forgive me for thinking otherwise! I know you're better than us! You can't be broken by the same forces breaking the rest of us mere mortals! I'll just cease doubting you and permit you to enter the lair of beasts without further warning!"

The goggling Carlson said, "I never—"

"No, to hell with you. I'll just let you get up before all those Tchi and learn for yourself. It's just about the only form of entertainment us poor scribes have around here!"

* * * *

At first, the press conference didn't seem any more, or any less, grim than most other public appearances of Carlson's experience.

There were the Tchi, of course: disconcerting enough when encountered in human space, where most people operating outside diplomatic circles rarely encountered more than one or two at a time. As on the transport, there was something about the way they raised their eyebrows or curled their lips at even the slightest human utterance that had always made Carlson wonder if his deodorant had failed, and when they performed their silent derision act in public, it was a little like having his fragile sense of self-worth pelted with invisible foam-rubber mallets. But Carlson had spoken at many other colleges in his career, including many that catered exclusively to the children of the entitled and privileged: he was well acquainted with the hostile blank stares of those who had never heard of him, those who had never had any interest in hearing of him, and those who resented him for their university's insistence in believing that they might want to hear of him. He found nothing in the many rows filled with Tchi grimaces he could not connect to those prior experiences.

Too, there was the comfort to be found in the presence of his colleagues: not just Finn, who stood in the back of the chamber, grinning nastily as he waited for the carnage to follow, and Vera Lugoff, who had affected an ancient widow's veil out of mourning for whatever she thought the Tchi had done to her, but also a number of individuals Carlson actually liked and respected. He was particularly pleased to see Sandra Jaagin: she was many years older, like himself, but showed the signs of regular rejuvenation treatments, and seemed kilometers removed from the broken woman Finn had described: she even smiled at him from her spot at the back of the room. Only the sudden urgency that flared in her eyes, when the Tchi moderator Dr. Flei Garkh stepped up to the podium to introduce him, gave Carlson another frisson of fear.

Garkh licked his minuscule lips with the distaste of a creature that had just found something moving on them, and said, "Today we are pleased to have with us the eminent *Hom sap* author, Brian Carlson, a man who exemplifies the state of the art insofar as it applies to his species. He is, in fact, a multiple award winner, demonstrating that his race judges him as near or at the top of their version of the quality scale. Carlson has joined our acclaimed Author in Residence program, where his regular contributions will provide us with vivid and repeated demonstrations of *Hom sap* preferences in story construction. He has agreed, in fact, to open today's conference with a reading from a representative sample of his work. Mr. Carlson?"

Defiant applause from every human being except Everett Finn, who kept his arms folded in angry challenge.

Well, to hell with him.

Carlson made the usual opening remarks about the great honor of being permitted to represent his species, and the tremendous importance of cross-cultural exchange, and the great hope that this might support even better relations between their two great species in the future, give me a break, blah, blah, blah.

Then he activated his hyltex link and began to read.

Carlson had built his reputation on two mutually exclusive genres: interspecies thrillers, in which he concocted clockwork interstellar conspiracies involving intricate alliances between alien races both actual and invented, which if left unchecked by his valiant heroes and heroines threatened to wreak horrific carnage of world-destroying proportions; and heartwarming bucolic adventures about a bookish young boy coming of age in the watery pastures of the ocean world Greeve. Both stretched the bounds of reader credulity, in the first case because his elephantine conspiracies never imploded out of poor management or internal rot, like most conspiracies on that scale, and in the second case because the young hero of his Greeve series, widely recognized to be a version of Carlson himself, hadn't aged a day despite more than thirty volumes detailing events that ate up an average of one year apiece.

Carlson's latest opus, of which he was inordinately fond, belonged to neither fictive universe: it was a truth-based love story involving a Cylinked boy and girl, who having rewired themselves into a new gestalt personality, now find a shared yen for each others' exes. It was an excerpt from this newest work that he read to the assembled Tchi, utilizing the expert command of accent and idiom that had once led him to consider a secondary career as a supporting actor in neurec drama.

Carlson projected. He drank in the silence of his audience and read it as appreciation. He lost himself in the story he had written, saw his audience in there with him, and for a few fleeting moments was not a fictioneer of undeniable but sadly limited gifts but a god glorying in the richness of the universe he had created.

He finished to polite hissing.

This he'd been warned about: it was the Tchi equivalent of applause. He took it as intended, and responded in the preferred manner, by pressing his palm against his forehead and rocking his head to and fro, all the while thinking, *I don't know what Finn's talking about, this isn't that bad.*

Then came the questions.

"Mr. Carlson: the sun in your heroine's sky—what was its distance?"

Carlson blinked. "I don't know. It's a warm world, though. The habitable regions are high tropical, by human standards. I describe the weather there in detail—"

"Mr. Carlson: Would you know its high altitude weather systems?"

"No. But neither would she. The schools—"

"Mr. Carlson: she eats with a utensil you call a fork. Four curved tines at the end of a handle. Would you happen to know why four tines became the standard, and not six?"

"That's deep background," Carlson said. "I suppose I—"

"Mr. Carlson: the female you write of. You say she has freckles. These are local variations in skin pigmentation, aggravated by ultra-violet radiation. You say that they fan out across both cheeks. What side had more? The left or the right?"

Carlson was just beginning to realize he'd entered hell. "Both cheeks were equally freckled."

"Mr. Carlson: would a medical examination confirm the accuracy of this count?"

"Human beings don't count their freckles," he said.

"As the author, Mr. Carlson, it was up to you to design her facial features. Announcing that she was freckled without offering a precise count amounts to abdicating your responsibility toward your readers. You must have a precise count."

"I don't."

"And yet you know for a fact that she had an equal number of freckles on both cheeks?"

"More or less!"

"More or less is not equal, Mr. Carlson. So you contradict yourself."

"I haven't—"

"We have noted similar inadequacies in the imagination of your fellow humans, Mr. Finn: their fictive creations deflate like empty vessels upon any rigorous examination. This is even true of your so-called classics. Are you familiar with the works of your famed earther, Victor Hugo?"

Hugo had been one of Carlson's earliest influences; he had written several papers on the man's work, had indeed spent a couple of semesters teaching it to bored university students who had needed two months of special orientation before they could appreciate the conventions and mores of an earthbound, pre-diaspora economy. He didn't have to hear the snotty intonation in the Tchi's voice to know that the bastard knew it. "Yes?"

"On the day Jean Valjean is released from prison, what is the humidity?"

"I don't know."

"Exactly how many insects infest his clothing?"

"I don't know."

"What is the state of his periodontal health?"

"I don't know!" he shouted. "It's irrelevant!"

"Irrelevant," the Tchi said. "Irrelevant."

"Yes, dammit! You don't need to know everything that's happening on every single centimeter of his body to get swept up in the story or to understand its underlying theme of social injustice!"

There was a pause. The Tchi sat silent, the collective force of their disapproval washing over him like a tidal surge. They didn't have to say anything; anything they put into actual words would have been superfluous.

Predictably, inevitably, without any gesture toward mercy, the words arrived, planting themselves one after another, with the pitiless finality of gravestones.

"So you admit," the Tchi said, "that human authors are inadequate?"

The Earth cooled. The continents formed. Life rose from the deep, was wiped out by the asteroid strike, and continued in bold new forms. The Renaissance came and went. The stars went black and died. Hell filled with souls and put out a NO VACANCY sign. Time stopped as all creation contracted to the size of a dot.

The Q & A seemed to last one full hour after that.

* * * *

For Carlson, light returned to the universe later that evening, and to the wine, cheese and condolence party the various human writers trapped in the hell of Tchi academia threw in their compound, to welcome the latest inmate of their shared hell.

It was not a bad place, as torture chambers go. In its own way, it was quite beautiful. The Tchi had built a circle of cottages around a glen wooded with popular species from human worlds and landscaped to provide walking paths and shade and plenty of sunlight for humans who liked that sort of thing. Maybe they did want to be good hosts. Or maybe they were sadists who realized gardens and sunlight could be torment to people already driven into despair.

The welcome party was held in the clearing. Carlson had already endured the sympathy of several mystery novelists, a memoirist, a satirist, and a writer of epistolary fiction once notorious for couching the letters his characters had written to one another in untranslated binary code.

Carlson had been told not to worry overmuch about a bunch of Tchi assholes; as long as his colleagues knew he was a good writer, and he knew himself to be a good writer, and he would one day be free to return to human space where at least one person in a couple of hundred thousand still had some use for good writers, he should not allow the Tchi mission to destroy him any more impact than a light spring rain.

Of course, he would have to endure a questioning just as brutal one week from now. And one week after that.

And just about everybody who offered him sympathy averted their eyes when he countered by asking them how their own writing was going. Their respective muses were all, if not shackled, then bruised to the point where putting pen to paper (or keystrokes to electron template, or neurally transmitted impulses to htextual database, or whatever) was too painful to bear.

The evening did not seem about to substantially improve when he recognized the next sympathetic face in line. He completely forgot the acrimonious nature of their parting and leaped up to say hello. "Sandra!"

She shared his embrace. "Brian. I'm so sorry. I would have warned you if I could."

"That's all right," he said, grinning with genuine happiness for the first time since the press conference. "How the hell are you doing?"

"Could be worse," she said. "I haven't been able to finish anything for months, but at least I have a sense of humor about it. You're looking good. Fatter, but still good."

"You too. Except for the fatter part." Back when Brian had first known and loved her, Sandra had been a slender, elfin thing with close-cropped black hair and the terrible habit some women have of punctuating every statement with a self-deprecating giggle, as if the mere act of speaking her mind deserved apology. Back then she'd defied her natural shyness with outrageous fashions, including those with animated holographic patterns and at least one that sounded a buzzer and turned transparent at randomly-generated intervals. She'd lost some of the slenderness, but the added weight balanced her face and made her more a woman than a waif; the sunny yellow tunic she wore now enhanced her features rather than distracting from them, like some of the things she'd worn in the old days.

Without wanting to, he felt a moment of deep, heartbreaking nostalgia for their times together. "God, but it's good to see you!"

"Wish I could say the same," she said, sending his spirits deeper into the basement. They bounced back a little with her next words. "You really do deserve better than this. Have you figured out, or has anybody bothered to explain, just what's going on here?"

"Ummm. Not really. Finn tried to warn me before the Q & A, but we butted heads and he never got around to finishing."

"Then it falls to me," she said, and grabbed his hand. "Come on, we'll find a quiet corner."

Once upon a time, Sandra would have died before presuming to guide anybody but a child by the hand; she hadn't had the self-confidence to presume herself a fit guide to lead anybody anywhere. Now she was like a bulldozer, expertly carving her way past the throng of inebriates in tweed, deflecting the one or two who still hadn't offered Carlson their sympathies. The last one she evaded was Vera, who wore the look of a ghostly bride glimpsed in the upper windows of some Victorian mansion; it was a good thing Sandra was able to spare him the encounter, because the one overriding quality in Vera's eyes was defeat, and Carlson didn't think he was in any state to be doused in any more of it.

The refuge Sandra found was a stone bench by a narrow brook, the rushing water just loud enough to serve as welcome white noise, obliterating the chatter of the other Authors in Residence. She sat him down, then took her own place beside him, and began, "I'm half-inclined to let you knock your head against the wall until it becomes obvious. You were a real jerk, way back when."

"I know," he said. "I've been meaning to get back in touch with you and tell you that. I'm sorry."

She studied his face. "Why didn't you?"

"I had a good excuse."

"Which was?"

Carlson spread his hands. "Cowardice."

She showed no surprise, just nodded, and looked away. "I figured as much. But you had a good heart, and that's rare enough among real people, let alone writers, so I'll spare you some of the confusion you must be feeling right now. Have you ever actually read any Tchi literature?"

With something like shame, Carlson realized that it had never occurred to him, not even when in the months between the invitation and the embarkation of the Tchi shuttle. "Uh, no."

"Then you don't know what they consider a good novel, right?"

"Well, I assumed..."

"That's right. You assumed that just because they invited you to be the guest of honor it was because they wanted to honor you."

"It usually follows."

She sighed. "How long have you been on the lecture circuit, Brian? Haven't you learned yet that sometimes they hire you because they want to do the exact opposite?"

Carlson remembered a small college he'd visited on the wheelworld New London. There'd been a symposium dedicated to his work. He'd wandered in, expecting kudos, and found that the main subject of discussion had turned out to be the flatness of his characters as shaped by the psychosexual inadequacies of the author. After three hours he'd become more evidence in the popular stereotype of novelists as raving egomaniacs who drink. He had sworn never to accept such an invitation again. But the idea of being honored by an actual alien race had overcome his misgivings, and...

...and for the first time in his life, he now actually felt the sensation novelists mean when they reference a sinking feeling. "What are they up to?"

"Tchi don't like human beings. They consider us violent, uneducated philistines, with a barely evolved sense of aesthetics and a pop culture that debases us and every other alien race that has ever developed an appreciation for any of our work. The curriculum of their Human Studies program is entirely devoted to reinforcing that thesis. When they invite our best writers here—at least, those who aren't warned off—they do so with the specific purpose of humiliating us with the inadequacies of our literary traditions as judged by the specific criteria of their own standards. In short, you're here to be held up as a negative example. To be humiliated. No story you write, no matter how good, can possibly meet with their approval. I mean, *no* story. They're particularly fond of ripping apart our classics. What they do to Jane Austen alone is enough to make a strong woman cry."

He gulped. "Why do we sit still for it?"

"Because we have no choice. We signed the contracts. We accepted their honoraria. We agreed to come and face their questions. If any of us refuse to cooperate, the penalties are more than any working writer could ever afford to pay; they'd end up owning everything you've ever written and everything you

ever would write in perpetuity, giving them the right to drive your reputation even further into the grave publishing annotated editions that exist only to support their perception of you as dishonest, demented, shallow, untalented, and unTchian in every way." She grimaced. "Do that and you'll be buried. I'd die before I let them do that to *Cold Victory*."

That had been Sandra's first novel, a portrait of a character secretly based on her remote and disapproving father. He remembered her saying that she'd cried herself blind while writing it. He remembered the acclaim it had received on publication, the lump it had raised in his own throat, the very real sense of closure it had given her. And then he realized that the questions the Tchi asked her must have included contemptuous ones about *that very book*, and how she would have had to sit and take them, on a weekly basis. Anger, the very real anger of a novelist faced with societies of evil critics, overcame him, and he said, "They can't be allowed to get away with this."

She snorted. "Oh, Brian. How can you stop them?"

"I haven't figured that out yet. But I'll defeat them. Don't you worry. I'll shut them down and leave them begging for mercy. This I swear."

Sandra just stared at him, blinking, for several seconds, before laughing out loud. "I almost believe you."

"You should believe me. I'm serious."

She touched a fingertip to his lips. "I know you are. But this is their world, their rules, their aesthetic. You can't write the kind of prose they like, and you can't make them like yours. It's a fool's game."

"Then I'm a fool," he said recklessly. "But I will defeat them. I will."

She sighed, looked upon him with a special kind of affection that looked like it did not want to cross the boundaries of pity, and gave him a chaste kiss on the cheek. "If you ever actually manage to do what you just said, you'll be my hero for life."

"Really?" he said. "Enough to be given a second chance?"

She was dubious, but desperate enough to consider it. "Sure. Why not."

And this, of course, was a challenge no heterosexual male novelist could have refused.

* * * *

The next day, his head pounding from all the drinks pressed into his hands by fellow writers eager to see another get as sloppily drunk as they'd seen themselves get, Carlson left the compound of the humiliated and found his way to the university's main library, where the Tchi on duty took one look at him and inquired, with just the right degree of scorn and condescension, whether he was really in the right building. Didn't the works here have subtexts and subtleties no human being could possibly understand?

He smiled and handed the withering snot a list of three titles alleged to be the greatest novels in Tchi history. The snot told him they were available via hytex link. Carlson smiled and said, "Aaaah, but the sheer sensory experience of holding the books in my hands, as I soak up the brilliance...!"

It required an interlibrary transmittal and consultation with the director of the Human Studies program, but by late that afternoon the Tchi authorized the replication of three volumes in approved Mercantile translations, printed and bound in the format Carlson always preferred when he read novels on paper.

This was a mistake.

None of the novels were shorter than three thousand pages.

Grimacing as much from the weight as the prospect of reading these behemoths, but adopting the fiction of happy anticipation, Carlson lugged them back to his bungalow and spent all of that night beginning the first and by reputation most honored among them.

After six pages he went back to the beginning, unwilling to believe that the story was unfolding as it seemed to be. Confirming the awful truth, and feeling more and more despair by the time he bulled his way past page one hundred, he rejected the impulse to feed the damned thing to a fire and forced himself onward, ever onward, paragraph by paragraph, tedious line by tedious line.

Somehow, heroically, he reached page two hundred that night, having already misdiagnosed the pain of getting that far as a dozen separate strokes. Before he collapsed, he flipped the remaining pages all the way to the end, confirming the awful truth.

In the morning he knocked on Sandra's door. "Want to take a walk?"

She was frowsy-haired, wearing a cloth robe and drinking something hot from a cup. "Depends. Given up on defeating them yet?"

"No," he said. "Actually, I think I might have a handle on the situation."

She raised an eyebrow and brushed a sleepy tangle of hair away from her opposite cheek. "I must say. Heroic fantasy's a new genre for you, Bri."

"No, I'm serious," he insisted. "I just need to clarify some things. Come on, take a walk with me." When she hesitated still further, he added, "Unless you'd rather stay home and try to write..."

The terrible truth about novelists is that precious few of them, given a choice of activities, would rather stay home and try to write. Faced with a way out, Sandra moved faster than any whirlwind.

An hour later, the two of them had settled beside the same stream where they'd last spoken two nights before. They'd talked about everything but Carlson's plan for a counter-offensive, but now Sandra had kicked off her shoes so she could dangle her feet in the water, and Carlson, who required all his might to ignore the sight of the sun glinting on her hair, needed to talk business or die. "I started reading *A Thousand Futilities* last night."

She coughed hard. "Oh, Brian. I'm so sorry. How far did you get?"

"Two hundred pages. Skimmed the rest."

"That's further than I got. I think Vera got to fifty. The poor thing's never been the same."

"I have two other Tchi classics," Carlson told her, "but a quick glance at those makes me fear for my sanity if I continue. Still, it remains possible that the equivalent of Dickens or Dumas or Hugo or even Quantum Cloud remains somewhere in the Tchi canon, so it would save me a whole lot of pain if you did me the favor of fact-checking my conclusions."

She gave him a thumbs-up, threw her head back so her face could catch the sun, and said, "Shoot."

He said, "As near as I can figure from my exposure to the greatest novel in Tchi history and, I must admit, from using the hyltex to consult academic papers our own best universities have written about their canon, Tchi fiction has never been about plot or character or even theme. It's about nested parentheses."

She swirled the water with her toe. "Interesting way of putting it."

"Historically, the typical Tchi novel has always been centered on the elaborations of the most minuscule subject matter they can concoct. Let's say, a vase bearing a single flower. What kind of flower? They describe that. Where was it picked? They describe the region and its entire economic development. What kind of vase? They describe the design, go into several pages about how the school of artists developed it. In further chapters they talk about the clay it was fashioned from and why potters find that clay preferable to that available down the road. Then they talk about the table. Don't get me started on how they go on about tables. Then they go into describing the room and every last detail about every single furnishing, and maybe, if they want to be really daring, an actual person sitting on a chair somewhere in that room. They describe that person and going into every last detail about that person's genealogy. The one thing they won't do, ever, is have that person get up and get himself involved in an actual story, because that's gauche, that's a betrayal of the kind of subtlety they prefer. And besides, if they did that, then they'd be likely to forget some more important details like the precise amount of fraying on the local area rug. It's this layering, this obsessive accumulation of detail, the more mundane the better, that the Tchi intelligentsia consider art. Am I correct so far?"

Sandra shuddered. "You are. And to think I used to have problems absorbing Joyce and Proust."

But Carlson was still warming up. "Tchi novelists seek to provide so much detail of a single static moment that the rest of the world can be inferred, whereas even the most leisurely human novelists move their narratives through time and sketch in only enough detail to enrich the story, an amount that must by necessity assume some details extraneous and therefore safe to omit. A Tchi writer, invited to a symposium like this, would be able to describe the precise contents of a desk drawer in the home of an academic living across the street from a house where his novel takes place. And it's not the kind of thing that can be faked, because if he doesn't put that detail in his book he will be asked that question not once or twice, but every single time his book is discussed in public. That's why their most respected books are all two thousand pages long. That's why they get longer when they're annotated by academics. In short, their platonic ideal as far as fiction is concerned is a bludgeon too heavy to lift and too motionless to endure. Do I have all of this correct?"

Sandra kicked at the burbling water, creating a silvery arc that achieved beauty of its own before collapsing forever. "Yes, you do. But you can't fight that, Brian. It's their world, their aesthetic standards. If you ever tell them to their faces that you think their literature sucks, they'll just blame it on your coarse human sensibilities and your inability to appreciate their finer subtleties."

"Oh, I know that," Carlson said.

"And you can't imitate what they do, either. Trust me, several of us have tried. Write ten pages of a novel in the true Tchi tradition, and your eyes will cross. Write fifty and you'll want to kill yourself. Write a hundred and you may never finish anything publishable in human space ever again. Manage to finish one—as one of us did, a couple of years ago—and you'll find yourself unable to defend it to the extent they require; try as you might, they'll find the contradictions, or the holes, and trumpet your failure even louder. You'll have tortured yourself for no reason."

"I know that too," Carlson said. "And I have absolutely no intention of trying."

She contemplated his expression for several seconds, frowned as she registered the confidence in his eyes, and splashed the water again. "But you said you can defeat them."

He grinned. "I know I can."

"In Juje's name, how?"

He picked up a rock in tossed it into the brook, enjoying the ker-plunk of the splashdown, taking special pleasure in imagining that the running water was the Tchi literary tradition and the stone his own special contribution, still to come. "By using their own nature against them. Come on. I think it's time that we go talk to the others."

* * * *

Two days later, it was Everett Finn's turn in the hot seat. As usual, he'd failed to produce anything new in the interim since his last weekly evisceration, so the Tchi had exercised the contractual clause that prevented the human writers in residence from simply abdicating their responsibilities and programmed a discussion on one of his past works: in this case a very sweet little autobiographical story about the ten-year-old Everett's first space walk. Finn had won a minor literary award for the piece, and still had some affection for it, though he now considered it juvenilia. The Tchi had spent the greater part of three hours demanding a full dissertation on orbital mechanics, down to the precise volume of canned atmosphere that bled into space when the airlock he'd used opened to vacuum. Finn kept to his usual strategy of sullen monosyllabic answers until the Q & A was almost over, at which point, as arranged, he allowed his voice to break and broke down sobbing into cupped hands.

The gathered Tchi took this with remarkable aplomb; it was, after all, the reaction they demanded. Garkh said, "Are you all right, Mr. Finn?"

Finn shook his head. "N-no. You're right. My work is sloppy and half-assed. It's not good enough. It'll never be good enough."

"Are you then changing your position and conceding the inferiority of the human literary tradition?"

"Y-yes," Finn said. "*I'm so ashamed.*" He wailed and stormed out, covering his eyes as a veritable font of tears gushed down his cheeks.

The Tchi did not see him slow down as he passed Carlson, fix his long-time rival with a glare of undying hatred, and mutter, "You better be right."

Nor did the assorted Tchi academics see the similar eye contact when every other human writer in the program, attending their own Q & A sessions over the course of the next week, succumbed to similar bursts of overwhelming faux despair. It wasn't all anger; some of the hysterical breakdowns the Tchi witnessed and failed to properly recognize were actual hysterical breakdowns of the mirthful variety. No Tchi were present the one fine evening that Vera Lugoff had a little too much to drink and giggled nonstop for close to an hour, wailing, "*I'm so ashamed,*" with a level of delight that rendered her intoxication redundant. There were lots of hangovers, that next week, lots: again, nothing unusual at a novelists conference, but the revels themselves were less the usual pits of auctorial despair than wild celebration at the prospect of striking back at their tormentors.

The Tchi could not be blamed for suspecting that something was up and were even more than typically offensive in their questioning when Carlson's turn came again.

* * * *

Following the lead the others had set on his instruction, Carlson failed to produce any new work by the deadline, and therefore had to endure the savaging of a favorite old work of his, which included questions like, "Exactly how many hair follicles did Suzie have?" and, "What was Professor Clump's blood pressure at this time?"

It took everything Carlson had to sit through the interrogation, but he did, surprising his hosts by not pretending to break down.

Instead, he rubbed his chin thoughtfully. "You know, you're right. You're absolutely right. The human literary tradition is inferior to yours. But it's not the only one that could stand improvement."

A murmur rippled through the gathered Tchi literati. "Specify," Garkh said.

"I've been reading some of your great classics, like *A Thousand Futilities*, and *Anarchy*, and *The Dust in the Purg-Farmer's Restroom*, and while I'm astounded at their brilliance and their wealth of detail, it occurs to me that your canon lacks the fresh, cleansing spirit of innovation necessary to keep any great art form alive. I believe that the addition of allusion and implication, wielded by an expert hand, can drive a volume with as much nested detail as even the greatest Tchi novels of all time, in but a fraction of the space. Indeed, now that my eyes have been opened, I believe that I'm about to produce a work as meritorious as even your immortal Vlurkh-Bom's *Nostril*, and that I'm going to fill it with all the verve and emotional truth and compelling relevance that has always been so praised among our own great writers. In short, give me one week and I promise you that I will come up with something capable of doing the great names of the Tchi literary tradition proud."

The room erupted. There were cries of "impossible!" and "one week?" and "a human?" and so on, not to mention a few scattered boos, but Carlson had expected that, and he continued to stand firm, his head held high, his chin outthrust as far as his rather flabby chin could thrust. In the human gallery at the back of the room, Everett Finn scowled, Vera Lugoff coughed into a handkerchief, and Sandra Jaagin beamed, her faith in the enterprise now so overpowering that it was enough to dispel all the dark clouds of negativity emitted by their combined patrons and tormentors.

Resisting the urge to wink may have been the single most self-sacrificial moment of Carlson's life.

Eventually, the hubbub died. Garkh emerged from a huddle with some of his colleagues, strode back to the podium, and sneered, "One week. You say that you can best our greatest literary works in one week."

"Yes," said Carlson. "I believe I can."

"We do not believe it, Brian Carlson. No human novelist has the brilliance or the subtlety to pull off such an unprecedented feat. But you have dictated the terms of your own challenge. We will meet back here in one week, where you will either read a composition as remarkable as your claims, or admit the inherent inferiority of not only your own narrative traditions but also the very creative potential of your species."

"Agreed," Carlson said, with reckless abandon. "On the condition that you put all responsibility for that question on my shoulders. Whether I succeed or fail, you must pay my colleagues the remainder of their honoraria, release them from the remainder of their contracts, and provide their transportation back to their respective points of origin."

Another colloquy, and Garkh returned again. "Agreed. With the understanding that by cutting off all further debate you allow the entire literary reputation of your species to rest on your own inadequate shoulders."

Carlson could barely contain his mirth. "In that case I had better get started. Thank you for your time." He stepped away from the podium, bowed, and strode down the center aisle, pausing at the exit so the rest of the human writers in attendance could join what had now become a mass exodus.

Everett Finn, who had maneuvered himself close to him, repeated his previous warning. "You had better be right."

Carlson kept his smile fixed. "Oh, shut up."

* * * *

The week that followed was an exercise in inexorably building tension, as the humans awaited the moment of truth and their hosts trumpeted the importance and the finality of the showdown to come.

Carlson didn't subject himself to much of what the Tchi media had to say about him, but he caught some of it by accident, and the big issue seemed to be just which of the culture's many superstar academics would eviscerate his work with the cruelest eloquence. The snottiest of the bunch were as famous as sports stars, their visages captured on collectable cards sold in packs along with a mucus-like gel the Tchi prized for its sweetness and chewability. The upcoming destruction of Carlson's reputation was such an eagerly-awaited occasion that it had even drawn a number of the field's all-stars out of retirement, prompting much speculation over whether the most incisive condemnations would come from masters like Khludt and Kyael, or such upstarts as Phyeeyilii.

Nobody on the Tchi side seemed to think that Carlson's upcoming opus could possibly be anything but a disaster. Which was pretty much how Carlson wanted it. He didn't talk about it much with the rest of the human writers, with the exception of one conversation he had with Sandra over waffles.

It was, it followed, the last thing he wanted to talk about, since it had been years since she'd made him waffles.

But she said, "You know they're lying in wait for you, right? That they're pulling out every stop to make this humiliating?"

He had been in the act of pouring his maple syrup, a moment that had possessed significant sensual pleasure all by itself, since it had been years since he'd indulged his famous passion for maple syrup and found extreme significance in the very fact that Sandra had managed to obtain some for him, here on the Tchi homeworld. "We've talked about this, my love. The more effort they put into destroying, the further I can throw them with my own brilliant rhetorical ju-jitsu."

"I'm just saying that you don't have to go through this just to impress me."

His fork hovered over the treasure on his plate. "Do you really think I'm doing this just to impress you?"

She colored. "Well, aren't you? At least a little?"

Carlson put down his fork while it still remained unwaffled. "I'm crazy about you, Sandra. I'll always be crazy about you, and I'll always count driving you away as the second worst mistake I ever made, directly behind that liability clause in my second novel contract. And it's a near thing, even there. But if you think I'm doing this for you, you're wrong. I'm doing this for Shakespeare, Dickens, Twain, Ibsen, Chekhov, Hemingway, Steinbeck, Vonnegut, Rowling, X'uffasch, Dawntreader, and everybody else those people have locked outside the city gates and thrown garbage at. I'm doing this because I want past those gates so the trash starts landing on the right heads for a change and because I happen to be the one who thought of a way to build a big wooden horse in the shape of a manuscript. Impressing you is just a wonderful added benefit."

Sandra's lips moved without emitting sound. Then she found her voice and said, "Eat up. Your waffles are getting cold."

He picked up the fork again, suppressing a helpless grin.

That was about as good as it got, until the day itself.

* * * *

On the day itself, the final confrontation was held, not in the modest seminar room of the earlier Q & A sessions, but in a vast off-campus auditorium, lit by balloons full of tumescent vapor, and filled to the very last seat with Tchi luminaries radiating waves of full-bore disapproval. The stage was furnished not only with the lectern where Carlson was expected to stand, but also two long tables, occupied by several of the venerable names Carlson had learned about from the collectable cards, their expressions already dour and puckered and suggestive of long unpleasant lives spent scraping disagreeable substances from the soles of their shoes.

Garkh absented himself from the carnage being plotted on the dais and strode to the lectern, where he was greeted by polite applause from the two rows of gathered human writers and energetic hissing from the remainder of the great hall's population. He said, "My fellow sentients, we are gathered here today to judge the work of the human being Brian Carlson, who has claimed himself capable of redeeming the sloppy and barely intelligible prose of his species with a work that incorporates and improves upon the finest accomplishments of our own. He has refused to submit his work for prior review, saying that he can only present it in its entirety this evening. If, like me, you doubt that this can be anything but proof of his self-deluded inadequacy, you will humor his madness in coming here with a reception as warm as the one you have given me. Gentlebeings, the human being Brian Carlson."

More applause. More hissing. Carlson strode to the podium, waited for the tumult to die down, and scanned the first row for the pair of eyes most important to him.

Sandra gave him a thumbs-up.

So did Everett Finn, who had taken the seat beside her. His poor opinion of Carlson had not changed, but he knew enough to root for his team, and had wished Carlson luck earlier that morning, with a final, begrudged, *Gotta hand it to you, Brian. You sure do know how to go out in style.*

Carlson smiled at both of them, communicating the absolute confidence he felt at that moment, then adopted his academic face and said, "Good evening, everybody."

"My name is Brian Carlson."

"I'm here, on this occasion, because I believe that I've completed a work that combines the vibrant narrative power of the best human fiction with the all-inclusive detail of the best Tchi work: a work that by implication captures every salient feature of an entire imaginary world, from the smallest blade of grass to the jagged peaks of its most majestic, snow-capped mountains. It is a world as richly imagined as the ones described in such pivotal Tchi works as *Pebble* and *Sleeping Fungus* and *Intestinal Distress*, yet as filled with drama and conflict as the greatest works on the *Hom sap* bookshelf: a book that has been pared down to its most essential facts, that nevertheless contains all the others as subtext and implication. I feel entirely justified in resting the reputation of all my race's finest accomplishments on this, the most important story I've ever written. It's called *The Rock*, and it's my supreme honor to present it to you, my colleagues, for the very first time."

He took a deep breath, allowed the silence to build build build, and then placed the manuscript on the lectern before him.

"*The Rock* by Brian T. Carlson."

"*The Rock*," he said, again pausing, imparting all the possibilities inherent in that one sad moment of silence, "*sat imbedded in mud beneath a gray, twilight sky.*"

Pause pause pause.

You could hear a pin drop.

Then Carlson took a deep breath and added, "The end."

Then he stepped away from the podium and bowed, waiting for the inevitable tidal wave of disbelief and rage.

It didn't take long. All at once, the audience exploded, humans with awestruck cheers and Tchi with helpless astonishment. One of the learned figures on the dais performed a perfect spit-take. Another reared back so violently he hit the back of his head on the backdrop. Unprepared for the suddenness of their cue, they glared at each other and at him and at the audience before getting it together enough to pelt him with incredulous questions.

"What?"

"Is that it?"

"Is that the whole thing?"

"Is this a joke?"

"Have you taken leave of your senses, man?"

"What kind of world does this take place on?"

"Is it inhabited?"

"Is there a civilization?"

"What's the average yearly rainfall?"

"Is this a big rock or a small rock?"

"How many grams does it weigh?"

"Is it igneous, sedimentary, or compound?"

"Are there ants on it?"

"How many ants?"

"What's the precise chemical breakdown of that mud?"

"How deep is it?"

"Is the water potable?"

"You haven't answered my question about the ants!"

And so on, and so forth, a veritable torrent of angry questions, pelting Carlson's bowed shoulders with all the force of a light spring rain.

Aware that his enemies thought they already saw their own victory on the horizon, when that prize was his the instant he elected to grasp it, Carlson basked in the moment, reflecting that his colleagues should have been able to do what he was about to do, as soon as they became aware of the trap they'd fallen into; certainly, storytellers had taken the same out since the first caveman told the first mammoth-hunting

anecdote around the first fire, and writers had been performing the same trick at academic conferences ever since. For some, it had even been the entire basis of their careers. It should have been just as obvious for those trapped here on the Tchi homeworld. Instead, Sandra and the others had acted like writers confronted by other writers, never once considering that the true solution to their woes had always rested in taking the traditional out so favored by writers confronted by academics and critics.

And yet it was simple. By the end of this day, Garkh and the others would be competing with each other to answer the very same questions they'd just been asking of him.

Content, already victorious in his heart, he waited for the weight of all those unanswerable questions to reach critical mass.

Then he fired his ultimate weapon.

He gave the learned figures on the dais the most incredulous look he could muster and demanded, "You mean to tell me you *don't know?*"

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This one's for the Members of the South Florida Science Fiction Society Writer's Workshop.

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Science Fact: **GEOLOGY, GEOHISTORY, AND “PSYCHOHISTORY”**: THE
(CONTINUING) DEBATE BETWEEN UNIFORMITARIANS AND CATASTROPHISTS by
Richard A. Lovett

Nobody knows why J Harlan Bretz (“J” was his full first name) first came to the scablands of eastern Washington. It was 1922 and he and a group of University of Chicago students were heading for the glaciers of the North Cascades when for some reason they stopped early.

Whatever the impetus, it was a decision that would reshape geology and ultimately play a major role in our understanding of Mars. First, though, it would get Bretz snubbed by his profession in a debate with intriguing parallels to Isaac Asimov's classic *Foundation* series (written more than two decades later).

Both for Bretz and Asimov, the issue was one of gradualism versus rapid change. In *Foundation*, the gradualists were engaged in the hypothetical science of psychohistory, which held that while individual human actions are variable, large groups of us respond predictably to social, psychological, and economic forces. But there was also a character called the Mule, a mutant with telepathic abilities that allowed him, individually, to bend the course of history.

Intellectually, Asimov appears to have sided with the gradualists, but was aware that unexpected events (the birth of the Mule) could undermine their predictions.

Bretz's gradualist colleagues (known in geology as uniformitarians) weren't as generous.

* * * *

The scablands are a region where the rich soil of Washington's wheat country is interrupted by raw gashes carved into the dark, basaltic bedrock. Bretz would later describe them as “wounds only partially healed—great wounds in the epidermis of soil with which Nature protects the underlying rock.”

These wounds baffled him. Summer after summer he returned, endlessly hiking: mapping, mapping, mapping. The more he mapped, the odder it looked. There were places where, in the words of Bretz's biographer, John Soennichsen, the hills seemed “V-ed off” at one end, as though they had once been half-eroded islands.[1] Elsewhere, valleys seemed half-formed, as though erosion had started, then abruptly ceased.

There were also giant rock basins that looked for all the world like river-bottom potholes. “But potholes are typically a few meters across at most,” says Victor Baker of the University of Arizona. “These are a hundred meters across and maybe fifty meters deep.”

It looked like the aftermath of an immense flood. A Noah-scale flood. The type of thing his fellow geologists would instantly pooh-pooh. The type of thing nobody would believe.

* * * *

Uniformitarianism says that geological processes occur slowly, over the course of what author John McPhee once dubbed “deep time,”[2] in manners we see happening around us, day to day. Thus, the Grand Canyon wasn't dug by one catastrophic gully-washing rain: It was formed millimeter by millimeter, by millions of years of perfectly ordinary spring floods.

To the geologists of Bretz's era this principle had nearly the force of religious dogma. In part, that was an outgrowth of science-and-religion debates in which scientists didn't want to resort to miraculous-sounding cataclysms to explain what they saw. But it was more than that. Many early geologists were devout Christians. “I think that distinction has been very much overplayed,” Baker says.

Rather, he believes uniformitarianism was a reaction to the type of scientific snobbery that sees field sciences like geology as poor relations to laboratory sciences like physics and chemistry. To counter this, geologists wanted a fundamental principle on which to base their science.

"Uniformitarianism was to make the science respectable compared to physics," Baker says. Physicists can perform lab experiments. Geologists don't have that luxury. "So people thought you needed a principle, to ground the science in something strong."

Soennichsen thinks it stemmed from a deep-set inferiority complex. "[Geologists] weren't guys in lab coats with test tubes—you were chipping away at rocks, which a five-year-old can do. The inferiority complex led them to latch onto this fundamental principle."

* * * *

As I was writing this article, I took a hike in Oregon's Columbia River Gorge. A 4,000-foot-deep gash through the Cascade Mountains, it's a place all of Bretz's water had to flow through en route to the sea.

Now that I know what to look for, there's plenty of evidence here, as well. On my hike, I found water-rounded pebbles hundreds of feet above the present-day river, with no creek in the vicinity to explain them.

Back in Portland, my own neighborhood also fits Bretz's theory. Not far away is an extinct volcano called Rocky Butte. Its east side—upstream at the time of Bretz's flood—is steep, eroded, stripped of soil. The west side has more soil, and downstream extends a residential area known as Alameda Ridge. In aerial views, the ridge has the classic shape of gravel bars I've encountered on many a canoe trip. But it's a gravel bar writ large, 200 feet above the present-day river.

One of my best friends once lived there. Digging a vegetable garden one spring, we kept coming up with rocks the size of hubcaps. Not only were they obviously water-rounded, they were made of granite or granite-derived metamorphics. But there's no granite bedrock in our part of Oregon. Her garden was full of chunks of somewhere far away, washed downstream by Bretz's flood and deposited in a gravel bar 200 feet high.

I have a book on my shelves about Bretz and his "Humongous Flood." *Humongous* barely begins to describe it.

* * * *

Even Bretz was a reluctant catastrophist. "He kept trying to explain that he'd gone back and looked again and again, and the only way [he could] account for this is [by] huge quantities of water," says Soennichsen.

He also had a problem: He couldn't figure out where all of that water came from.

If you're a geologist looking for a mechanism that might create big floods, one place to look is Iceland. The Icelandic floods are called *jokulhlaups*, and they're common enough to satisfy even the most ardent uniformitarian. The most recent, in 1996, produced three cubic kilometers of water in two days, crushing that country's largest bridge like a used tissue paper.

Jokulhlaups occur when volcanoes erupt beneath glaciers. Meltwater collects in ponds beneath the ice until there's enough of it to lift the ice high enough to give the water a way out. Then, poof, no more bridges, farms, or anything else that happens to be in the way.

But no jokulhlaup has ever come close to the scale needed to account for Bretz's scour channels. Nor could he find a place where big volcanoes might have erupted beneath ice—and fully aware of

jokulhlaups, he looked.

Then, in 1927, he was invited to Washington, D. C., to speak before an elite gathering of geologists. At last, he must have thought, he'd been given a chance to prove his case.

"He did a great deal of preparation," says Soennichsen. "He had all sorts of visuals, maps. It would have taken an hour and a half or more to make the presentation."

But he'd walked into an ambush. The assembled scientists had no intention of being persuaded, and one after another, they rose to squash his outrageous theory. Caught by surprise, Bretz made a poor defense, then, depressed, boarded a train and went back to Chicago.

* * * *

The problem with grand theories like uniformitarianism is that they blind you to what the data itself might be trying to say. "The grounding for a science is not a principle," Baker says. "The grounding is that you are open to what nature has to tell you. If you dismiss something as impossible, you will not learn anything about it. It's like being a detective. If you ignore a clue, it's the critical one."

In physics, scientists generally form hypotheses, then conduct experiments to test them. But geology is an observational science, in which experiments involve forming a hypothesis, then going out into the field to see whether you can find other things that are consistent (or inconsistent) with it.

"Again, it's like a detective at a crime scene," Baker says. "When they're on the right tack, things begin to fit a pattern that wasn't obvious before."

* * * *

It appeared that the uniformitarians had won. But Bretz had a secret supporter, a man named Joseph T. Pardee. During Bretz's presentation, Pardee reputedly turned to someone sitting near him and confided: "I know where Bretz's water came from."

Bretz had figured that it had to have had something to do with melting Ice Age glaciers, not far to the north. Pardee believed the source was farther east, in Montana. But the uniformitarian/catastrophist divide was strong, and Pardee wasn't willing to risk his career supporting a catastrophist. Not yet.

Then, in 1940, as he was retiring, Pardee dropped his bombshell in a vaguely titled paper about ripple marks in the bed of glacial Lake Missoula.

Lake Missoula was an Ice Age lake about the size of one of the Great Lakes. It had formed south of the great ice sheets, in western Montana, when ice blocked what is now the Clark Fork River, causing water to impound, up to 2,000 feet deep. Geologists had long known about it: Pardee himself had mapped its shorelines in 1909 and published his findings in 1910. But he'd not mentioned the ripple marks. Those, he'd kept to himself.

They were a lot like the ripples ordinary streams leave in sandbars. But they were enormous: thirty feet tall, a mile long, and spaced at intervals of 200 to 300 feet. Such features could only be created by an enormous current: the type of current that could only be produced if the entire lake emptied, practically overnight.

* * * *

Today, scientists know that ice dams are notoriously unstable. When the one that formed this lake broke, they estimate, water roared down the canyons at fifty to sixty miles per hour. It was, quite simply, one of the greatest flash floods of all times.

Pardee never bothered to say where all of that water went. He didn't need to. Anyone who'd heard of Bretz knew.

Today, scientists have found signs that ancient Lake Missoula may have formed and drained dozens of times over the course of several thousand years. Others have found traces of additional superfloods in Canada, Siberia, Mongolia, and Europe. Then in 1973, Mariner 9 returned the first good, close-up photos of Mars. One of the people who saw them was Baker, who'd done his doctoral research studying the Eastern Washington scablands. What he saw looked familiar. "It was pretty obvious that the features were similar," Baker says. Today, most planetary scientists believe that Mars too had enormous floods sometime in its history, though they are still searching for the source of the water.

Bretz himself lived to 98, old enough to watch the Martian discoveries and be pleased at hearing the newly discovered features referred to as scablands. Better yet, in 1979, the Geological Society of America (the very organization that had arranged the D. C. meeting at which he had been so thoroughly excoriated) awarded him its highest scientific honor, the Penrose Medal.

Bretz reportedly had only one complaint: "All my enemies are dead, so I have no one to gloat over."

* * * *

Today's question isn't whether there was a big flood in the scablands: It's whether even Lake Missoula was big enough to account for everything Bretz saw.

Today's "outrageous" hypothesis, Baker says, is that additional water came from beneath the ice caps—like a jokulhlaup but without a volcano.

The idea stems from findings in Antarctica, where scientists have discovered large subglacial lakes, one of them enormous.[3] More recently, they've discovered that water can flow from one lake to another via subglacial channels. Could a similar lake, perhaps filling part of the great trough of British Columbia's Okanogan Valley, have belched water big time?

The idea, Baker admits, is a long shot. "A lot of people would have thought the ice sheet was stable," he says. But, he adds, "it's a principle of science that if you dismiss something as impossible, you will not learn anything about it."

That sounds like a pretty good principle for any scientific endeavor. And in the wake of Bretz's vindication—not to mention subsequent studies regarding dino-killing asteroids—you might think the old gradualism/catastrophism debate would be finally put to rest.

But that's not the case. It's alive and kicking in history and archaeology. There are plenty of examples, but the one we'll look at is the eastern Mediterranean.

* * * *

Big Bang in the Aegean

For hundreds of years, the Minoan culture thrived on the island of Crete, dominating the entire region. Its most famous ruin is the palace of Knossos, whose warren of passageways probably gave rise to the legends of the Labyrinth and the Minotaur.

But then, about 3,500 years ago, Minoan civilization came crashing down. The ruins show clear evidence of fire and violent destruction, but what was the cause? Some early excavators suggested a cataclysmic event, but the idea fell into disrepute. By the late twentieth century, archaeologists tended to reflexively blame such cultural collapses on internal decay, possibly opening the door to invasion, says Amos Nur, a geophysicist at Stanford University.[4]

Nur attributes that attitude to one of the twentieth century's leading historians, Arnold J. Toynbee, who in 1939 argued that for the twenty-plus civilizations he examined, the cause of collapse was internal, not external. "The breakdowns of civilization are not catastrophes of the same order as famines and floods and fires and shipwrecks and railway accidents; and they are not the equivalent, in the experiences of bodies social, of mortal injuries inflicted in homicidal assaults," Toynbee wrote.[5]

In other words, in Toynbee's view you can't kill a culture with a single blow, (unless, perhaps, it is already dying of internal causes). It's basically a gradualist view, not all that different from that of the uniformitarians of Bretz's time.

And just as Bretz ran into trouble for proposing his gigantic flood, historians or archaeologists who suggested that civilizations may have fallen due to natural cataclysms have been mocked and may well have damaged their careers. The fear is so deep seated, Nur notes, that when one archaeologist suggested that an earthquake played a role in one city's collapse, she felt compelled to add: "Archaeologists of my generation ... were brought up to view earthquakes, like religion, as an explanation ... to be avoided if at all possible." [6]

But the Aegean and eastern Mediterranean lie in an extremely active tectonic zone near the boundaries between the African plate, the Eurasian plate, the Arabian plate, and the Anatolian (Turkish) platelet. As much as five percent of the earthquake energy released on the entire planet is concentrated in this zone, says Jelle Zeilinga de Boer of Wesleyan University in Middletown, Connecticut.[7]

There are also a few widely scattered volcanoes, the most famous of which is (or was) Thera, in the Aegean archipelago of Santorini.

Thera lies about seventy miles north of Crete. Sometime about 3,600 years ago, it erupted in the biggest volcanic blast in the history of civilization: an order of magnitude bigger than the one that in 1883 destroyed the Indonesian island of Krakatoa.

It's a little hard to determine when, precisely, the eruption occurred, but Zeilinga de Boer notes that sulfur deposits in Greenland ice cores date the event to about 1645 B.C.E. Tree-ring data from California, Turkey, Sweden, and Ireland, he says, all show a decade-long period of severe global cooling at about the same time,[8] while Chinese records show "yellow fogs," probably from sulfuric acid, as well as frost in July.

Nobody doubts that Thera produced a big, nasty bang. But the demise of Minoan civilization is normally dated at about 1450 B.C.E., nearly two centuries later.

For gradualists, that's proof that in the long haul, volcanoes are irrelevant. Healthy civilizations weather whatever disaster befalls them; unhealthy ones are collapsing anyway.

Zeilinga de Boer has a different theory. He calls it the "vibrating string," and argues that natural cataclysms can have impacts that ripple through history for years, decades, and centuries. Crop failures, for example, lead to famine and disease; ecosystem changes alter economies and, ultimately, cultures. It's a bit like chaos theory's famous "butterfly effect" or Ray Bradbury's classic short story, "A Sound of Thunder." [9]

Consider, de Boer suggests, a temblor that in 464 B.C.E. damaged the ancient Greek city-state of Sparta.

The Spartans were a relatively small warrior caste, supported by a much larger slave population. The earthquake, whose magnitude is estimated to have been 7.2, had an epicenter directly beneath the city. It knocked down many buildings and killed many soldiers. It also killed women and children, depleting the

ranks of the next generations of soldiers. Thus, the Spartans had to fill out their army with slaves, "which wasn't so good," Zeilinga de Boer says, "because those people weren't as interested in fighting for Sparta."

Sparta limped on this way for several decades, but eventually was defeated: an event that was one of the most momentous in ancient history because it opened the door for the rise of Athens and the ensuing Golden Age of Greek culture. Without the earthquake, he argues, the history of Western civilization might have been unimaginably different.

Nor are such changes limited to ancient history. In 1972, Zeilinga de Boer says, a magnitude 6.2 temblor in Managua precipitated revolution in Nicaragua by exposing the corruption of the government, whose officials used relief money to line their own pockets. That led to the leftist Sandinista regime, with major influences on U.S. Central American policies.

"Disasters have long-ranging after-effects," Zeilinga de Boer says. "If a major earthquake occurred in California, there would be so many social and economic impacts that people couldn't comprehend it."

It's a sobering thought. Then he carries it one step further: "We've already seen what a simple hurricane has done. Imagine when the earthquake that *will* occur finally raises havoc in San Francisco."

* * * *

So, what did happen in ancient Crete?

One possibility is simply that we've got the date for the collapse of Minoan civilization wrong, and that it actually occurred earlier, in the immediate aftermath of Thera. The generally accepted date for the end of Minoan civilization comes from matching up pottery styles in Crete and Egypt. But that's not rocket science. There could be problems, Zeilinga de Boer suggests, with either the matching or the Egyptian dates.

But there's no obvious reason to suppose the accepted date for Minoan collapse is wrong. More likely, if Thera did deliver the mortal blow, it simply took a long time to play out.

Zeilinga de Boer's hypothesis is that the eruption and associated earthquakes damaged Minoan cities, while the tsunami ruined harbors and boats, vital to a seafaring civilization. This opened the door for Mycenaeans (Greeks) to move in as the surviving Minoans dispersed. In an interesting side effect, he argues, the Minoan written language was adapted for use by the Greeks. Pre-Thera they had no writing. Post-Thera, they did. That ripple, far down Zeilinga de Boer's vibrating string from its initial source, might mean that the very philosophy and science of Western Civilization owes its genesis to a single volcanic blast. At the least, it's an interesting idea.

* * * *

Mycenae and other early Greek cities were not themselves immune to destruction. In 1993, Robert Drews listed forty-seven major archaeological sites in Greece, Asia Minor, Syria, and Israel that show clear signs of collapse, fire, and/or abandonment somewhere between 1225 and 1175 B.C.E. "Within a period of forty or fifty years ... almost every significant city or palace in the eastern Mediterranean world was destroyed, many of them never to be occupied again," he wrote.[10]

One was Mycenae itself.

Traditionally, blame for all of this destruction is laid at the feet of mysterious, marauding "Sea Peoples" who attacked, pillaged, then vanished. There's just one problem: Nobody has a clue who the Sea Peoples were or why they didn't hang around to enjoy their spoils. In fact, the reason they're called Sea Peoples is that nobody can figure out where else they might have come from.

In 1993 Nur visited the ruins of ancient Mycenae, where he was immediately impressed by the fact that the city's fortifications had been built atop an obvious fault scarp. Obvious to him, at least. To the ancient Greeks, it probably looked like any other cliff, which they happily incorporated into their fortifications. Nor, he realized, had archaeologists appreciated the significance of that cliff, whose surface was smooth, polished: a clear sign of geologically recent seismic activity.[11]

Thanks to their anti-catastrophist mindset, Nur adds, archaeologists haven't been all that good at actually looking for evidence of earthquake damage. That's unfortunate, because earthquakes and marauders leave different types of ruins. If a fault line cuts directly across a wall or fence, for example, movement of the fault will put a distinctive kink into it. And that's not the only smoking gun for earthquake damage. If raiders were to destroy a temple by pulling down its columns, the columns would probably fall every which way, depending on the angle at which they were pulled. The same would probably occur if abandoned buildings collapsed of old age. But when columns or pillars are knocked down by earthquakes, they tend to fall in parallel rows.

At least as tellingly, valuables—ranging from grain to gold—may lie beneath earthquake-collapsed walls: not likely if looters were instead responsible. In addition, crushed skeletons indicate that something brought everything crashing down a good deal more quickly than warfare was capable of doing in the millennia before gunpowder.

Nur believes that Drews' cites were actually devastated by a “storm” of earthquakes that struck one after another (though war may also have played a role, as rival kingdoms took advantage of the holes knocked in their enemies' defenses).

One of the arguments that had led archaeologists to dismiss earthquakes as a crackpot explanation is that Drews' devastated cities are spread over a 900-mile radius, a vastly larger area than could be affected by any single earthquake. But we now know that earthquakes can occur in sequence, as stresses shift along fault lines. That's exactly what happened in Indonesia after the mammoth Sumatran earthquake of December 26, 2004.[12] Barely three months later, an adjacent segment of the same fault was hit by another gigantic earthquake. And in Turkey, from 1939 to 1967, a string of seven earthquakes (magnitude 5.6 and larger) progressed westward along 500 miles of the North Anatolian Fault, which runs south of the Black Sea. That's just one of several faults that could have contributed to Nur's 3,200-year-old earthquake storm.

* * * *

Ultimately, all of this brings us back to Asimov, chaos theory, and the *Foundation* series.

From a theoretical perspective, many of us, like Toynbee, Bretz's critics, and Asimov's psychohistorians, are inherently drawn toward gradualism. After all, it offers the promise that if we can but tease out the rules by which the world works, past, present, and future events are well ordered, predictable, and under control.

On the other hand, predictability makes for poor stories. As readers, we are biased toward Bretz's flood, the Mule, Nur's earthquake storm: These have more the flavor we're looking for.

But it may be that Bradbury and chaos theory have it better: The laws governing the world may be well ordered, but maybe they are so incredibly sensitive to small changes that predictability is, to all intents and purposes, impossible. Zeilinga de Boer's vibrating string is a great model for alternate history. If he's right, the story options are virtually unlimited.

Scientifically, I like grand unifying theories like gradualism. In fiction? Give me a little bit of vibrating-string chaos, any day.

* * * *

1 Comments from Soennichsen come from personal interviews. His book, *Bretz's Flood*, was in press when this article was written and should be available now, from Sasquatch Books.

2 The phrase appears in *Basin and Range*, perhaps the most eloquent book ever written about geology. It's not clear, though, whether McPhee was the first one to use it.

3 See Richard A. Lovett, "Living at Extremes: Antarctic Lakes Yield Lessons for Mars, Europa, and Beyond," *Analog*, February 2002.

4 Fans of the Atlantis myth, on the other hand, were having a field day. Do a web search for "Atlantis," "Crete," "Minoans," and any other key word from later in this article, and you'll get an enormous range of hits.

5 A. J. Toynbee, *Study of History*, Vol. 4, as quoted by Nur, *infra*.

6 Elizabeth French, "Evidence for an Earthquake in Mycenae," in *Archaeoseismology*, 51-54, S. Stiros and R. E. Jones, Eds., 1996, as quoted by Nur, *infra*.

7 Jelle Zeilinga de Boer and Donald Theodore Sanders, *Volcanoes in Human History*, 2002.

8 The correlation among these dates isn't perfect. Some studies, Zeilinga de Boer notes, show cooling from 1630 to 1620 B.C.E.; others show it from 1637 to 1628 B.C.E. The difference may be due to the difficulty in calibrating dates half a globe apart.

9 Chaos theory holds that incredibly minor changes in "initial conditions" can have an enormous impact on the long-run future. The butterfly effect is a hypothetical example in which a butterfly, flapping its wings in China, could alter the weather, weeks later, in North America. Bradbury's story, which also involved a butterfly, suggested that over the course of time, the death of even a single insect could have enormous impacts.

10 R. Drews, *The End of the Bronze Age: Changes in Warfare and the Catastrophe ca. 1200 BC*. (1993), as quoted in Nur, *infra*. As the title indicates, Drews himself believed that improved military techniques were the primary reason why this occurred.

11 The visit is described in his book, *Apocalypse: Earthquakes, Archaeology, and the Wrath of God*, 2008, cowritten with Dawn Burgess.

12 See Richard A. Lovett, "The Great Sumatran Earthquakes of 2004-5," *Analog*, October 2006

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Novelette: **QUICKFEATHERS** by Alexis Glynn Latner

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Illustrated by Wolf Read

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We learn from our predecessors—but it's harder when we can't converse with them.

* * * *

Planet Green is a geological puzzle wrapped in an ecological enigma inside a planetological mystery. The geological puzzle is this: A planet that's had vegetation for billions of years should be oozing with petroleum. But we can't find it. Not in the places Earth-trained geologists know to look. The landscape west of Unity Base gets a lot of their attention anyway, because the geologists are convinced that the underlying rock formations will yield oil, if we can just figure out the rules of the geological game here.

I'm not convinced that we need to play this game. Green has other sources of energy—sun, wind, and above all, tides. Yes, oil is wonderful stuff that yields fuel and petrochemicals, plastics and medicines, but none of that will solve the crisis facing us now. Our compulsion to seek oil strikes me as a superstitious reflex; it's like resorting to black magic. It's because in all of our hearts, there's a cold core of fear that there may not be a human future on Planet Green.

My role in resource exploration is aerial survey. I fly a motorglider equipped with scanning and mapping instruments. The motorglider's engines run on biofuel produced from plant matter, but most of the time—more and more, as I learn my way around the sky—the motor stays off. I take advantage of atmospheric thermals, which are abundant in the long days here, and I work ridge lift when there's wind. So I usually don't need the engines to keep us aloft. By “us,” I mean myself and my observer. It's dangerous to be out alone on Planet Green. The danger has less to do with the environment than with what's between our ears—how we react to an environment we didn't evolve in—but that doesn't make the danger any less real. The buddy system is Standard Operating Procedure for everyone in the field.

Given the cross-training we've all had, my aerial observer could be anybody from a mechanic to a medical technician to a stray scientist. My favorite observer happens to be a theoretical molecular biologist. His name is Joe Toronto. After the long starflight from Earth, depending on how optimistic you felt about this new world—or how much trouble you were in on the old world—some of us changed our last name to honor our city of origin. Joe came from Toronto. I grew up on a farm near Brightwood, Tennessee. I chose to keep my family name, and I'm still Rebecca Fisher, but I named the motorglider *Tennessee Kite*.

Joe works long hours in Unity Base, and it's hard, risky work. He's repairing the human genome, damaged by our starflight taking hundreds of years too long. Every so often he likes to get away and ride with me in *Kite*. He is the most imaginative scientist I've ever met, which makes a surprising difference: He's better than anyone else at seeing what none of us expect here.

* * * *

The long days of Planet Green give thermals plenty of time to develop. And overdevelop. One day Joe and I found the sky getting crowded with clouds that had roiling gray roots and icy crowns. I diverted to one of my emergency runways, a stretch of rough limestone ridgetop marked by an orange emergency supply barrel anchoring a windsock. With a rainstorm bearing down on us, we jumped out of the motorglider, tied down the wings and tail, and ran for more substantial cover. Where the ragged ridge abutted a slightly higher hill there was enough of an undercut to provide a shelter from the storm.

We ducked into the undercut with a cursory look around for hazards like loose rocks that could turn an

ankle. We knew we wouldn't meet anything alive that was particularly dangerous. Animal life on Green tends to be small, slow, and soft. No dinosaurs, no birds, no herds of herbivores with carnivores stalking them. The most conspicuous life form on the ridge was a frilly blue lichen with chartreuse fruiting bodies. Planet Green is big on lichens.

At the back of the undercut I noticed a narrow gap with deep shadow behind it: a cave. I turned on my pocket flashlight to investigate the cave. At first I found nothing but stone, sand, and silence. Then I noticed a black substance coating the ceiling. I touched the black stuff with a gloved finger. It wasn't mold. It also wasn't sticky asphalt, but looked enough like some form of carbon to make my interest level spike very high.

"Back up," Joe said. The sharp edge on his voice told me he was either excited or alarmed. I backpedaled until I bumped into him. "Look down." He pointed past my shoulder at the floor of the cave, a fine-grained gray stone with sand drifted over it. The sand almost covered a long, shallow, curved depression. "Look at the whole floor. What do you see?"

The depression extended almost the fourteen-foot width of the cave floor, and it had an unmistakable shape. I yelped, "Wings!"

Rain lashed the ridgetop outside. The cave stayed dry and quiet. We brushed sand off the shape in the stone. Under my fingers there appeared a stony tracery of feathers at the edge of a wing. I was astounded.

Planet Green seems primitive, quasi-Devonian, yet life on Green is older than Earth itself. That's the ecological enigma. After peaking in complexity eons ago, the ecosystem on Green devolved from more apparent complexity to less. Lichens and ferns are ubiquitous, while we haven't found anything flowerlike. What Joe and I had discovered in the cave was far more momentous than flowers. We were looking at the fossil of an extinct Green bird. It had lain in fine-grained, water-saturated sediments, undisturbed, as its flesh dissolved and its form turned into slaty stone.

I've seen pictures of the Archaeopteryx fossils on Earth. Even the most intact of them looked like a run-over, smashed chicken. The creature on the cave floor was very different. With its wings outstretched in a lifelike way, crested head turned to one side, tail fanned out, it looked at peace. Entranced, I was only half aware of Joe prowling around the rim of the cave until I heard him take in a sharp surprised breath. He said, "Remember cuneiform—the first writing—marks pressed into clay with a stick to count sheep and vases of olive oil?"

Joe's flights of mind could leave me way behind. "What about it?" I looked up. My eyes had adjusted to the dim light, and I saw markings on the cave wall. Rows of marks spiraled from the ceiling of the cave to the bottom of the wall, where the marks were obscured by drifted sand.

Joe stood there smiling at the marks. "Anybody who can count can think."

As what he meant sank in, it made the hair on the nape of my neck rise. "The black stuff on the ceiling," I said. "It's soot from ancient fires."

* * * *

There's one possibly sentient species on Green that we know of, and they don't even live on land. The species in question is something like a cross between seals and sea cucumbers with some salmon thrown in. We call them Green seals. Every springtime they migrate out of the sea and swim upriver to reproduce by giving birth to live young, who then spend an undetermined amount of time living on land as what we call zucchini slugs. Joe is convinced that the Green seals devolved from beings much like us. "They discovered fire, worshipped a bird god and wrote in the cave, and later returned to the sea," he says.

Everybody else thinks the seals are boring, smell bad, and have unattractive offspring. The truth may lie in the Green seals' DNA, but it's not Earth DNA, and it'll be a long time until Joe can read it.

Green is a geological puzzle wrapped in an ecological enigma inside a planetological mystery.

The planetological mystery is Planet Blue: a moon as big as Green, but covered with oceans and rotating so rapidly that hurricanes ceaselessly spin across its face. A large moon is a very good thing for an earthlike planet to have. It stabilizes the planet's axis of rotation, providing seasonal change within a climate that doesn't vary wildly. It generates tides, making the interface between land and sea procreative. Earth's own moon had a lot to do with Earth's evolutionary success. Planet Blue, though, doesn't make scientific sense. No ecosystem as old as Green's should have a moon as close as Blue. Over billions of years, the two worlds would spiral away from each other, spin down, and end up phase-locked with each other, having the same period of rotation. Planet Green's leisurely day is fifty-two hours long. Fast-spinning Planet Blue's day is eight hours. That can't be, not unless there's been major interference with nature.

In the early days of the colony, we sent an unmanned exploration drone down through the hurricanes to sample one of the islands on Planet Blue. The drone came back with a chip of rock that turned out to be an artificial material. The island chains in the worldwide sea of Blue are artificial stuff. For reasons unknown, somebody long ago changed Planet Blue on purpose. It was remodeled on a mind-boggling scale, nudged back in from maybe ten times as far away as it is now, and spun up.

Blue's artificial islands show two hundred million years of weathering. Tens of millions of years is a long, long time for sentient beings. That long ago on Earth, there weren't even any mammals yet. Whoever the movers of Blue were, they're nowhere in evidence and are probably extinct. Could they have been the ones who wrote in the cave? That seems like the most unlikely hypothesis of all—that beings capable of moving a world would worship birds.

With all of us busy founding a colony, trying to understand ancient cave-writing rates as a sideshow, a hobby to be pursued in spare time, of which we have very little. Our brand new civilization will soon need to tap into Green's natural resources. Metals, diamonds and corundum, uranium, and, if you insist, petroleum. We won't repeat the chain of events that sent Earth's ecosystems to hell in a hand basket. Resource extraction on Planet Green will proceed delicately and deliberately. The first step is simply to map what's here and understand why various resources are where they are—to learn the rules of the geological game.

Everybody out in the field, though, keeps an eye open for the fine-grained, alluvial sedimentary rocks that can present bird fossils. Now that we know to look, we're finding lots of them. Most resemble the first one, fossilized bone, beak, and all, with wings fanned out. We've also found rock shelters, grottoes, and additional caves with writing on the walls. Some of the sites have been exposed to the elements for millions of years, and everything is weathered down to wisps. But a few of the caves seem to have been sealed off until relatively recent, minor seismic activity cracked them open. In those sites everything is well preserved, even the pictures scratched into soft stone or painted in colored pigments on the walls. Pictures of birds galore, trees, and quadrupeds and snakelike things—the kinds of creatures you'd expect to see on a world with plants, but we've never found here. But no pictures of anything with hands and tools.

Maybe this cave-writing race had a taboo about depicting itself?

Some of the writing did turn out to be tallies of numbers. But most of it was far more complex than enumeration. Even with the help of the starship's artificial intelligence, the meaning of the writing proved elusive. Meanwhile the tally of worshipfully fossilized bird fossils increased. There were three different

species. The first kind had long, tapering wings with a span averaging twelve feet. There was an even bigger species with long, blunt wings. A third kind of bird was much smaller, with relatively short wings.

Occam's Razor says you shouldn't multiply bird gods without a good reason.

One day I was thermalling in *Kite*, turning ascending circles on a bubble of warm air, not far from Story Bird Cave and over the same ridgy limestone landscape. The engine was off. *Kite* was functioning as a pure sailplane, and I imagined my own shoulders extending into the long white wings. I could feel the wingtips dip and lift, reading the textures of the air. Sailplane wings look deceptively plain—just long curves and smooth skin with faint stripes—but are as sophisticated as anything ever made by human hands. The ghostly stripes in *Kite's* wings are Sinha-Blazek deturbulator strips.

I only wished there'd been an Earth hawk, or even just a turkey vulture, sharing the thermal with me that day. On Earth, the only thing better than flying and feeling the wings of a sailplane as an extension of myself was doing so in the company of a hawk. It was something about Green that always made me a little sad—that the sky is devoid of feathers, flight and song. So I imagined thermalling with a Green bird. Happily climbing the sky with my imaginary bird friend, I remembered the marks in the cave, and the realization hit me like a bolt in the blue: Though the marks could have been made by pointed sticks, talons could do it too. Then I knew the key to translating the cave writing. It was simple.

Assume the cave writers are birds.

With that breakthrough, the ship's intelligence began to be able to translate the writing that spiraled down from the apex of Story Bird Cave. This is how it started:

The People were beset by dragons, but the People were brave and swift of wing, and the dragons didn't eat too many People.

* * * *

Dragons is a highly questionable translation. The ship's intelligence is working on more urgent problems, and for an artificial intelligence, it may be distracted. Or it may be eccentric in its old age. The journey here took a thousand years of relativistic time, with astronauts and colonists stored in cold stasis while the intelligence guided the ship. There's no other computer that old, except maybe on Earth, which is impossibly distant in space and time. Furthermore, Earth was wracked by war and eco-disaster when we left. I wouldn't bet on much remaining of civilization there, much less a computer of the same vintage as the ship's intelligence.

Elderly and eccentric as it is, the intelligence decided that it was dealing with a mythological history involving unearthly beings. When it translated Story Bird Cave, it upped and used supernatural terminology.

Between the deep sea and the high Hinge of the All, the world was long and rich. In warm marshes that teemed with fish-fingerlings, young People practiced how to be hunters of fish in the open sea. Dangerous monsters infested the sea, but the People were strong and maneuverable, and the brave-winged hunters always found fish to bring home. Except for the marauding dragons, the People were happy.

Then one day a great blue pearl appeared in the sky. It deranged the sea.

That bit stopped the translation in its tracks. Finally, Joe—at work in the lab in Unity Base, with our doctor, Catharin, who's his wife and my best friend—suddenly laughed. “The pearl in the sky was Planet Blue.”

Catharin isn't fazed by Joe's fugues of imagination. She countered, "Why call it a pearl?"

"Their universe was a bivalve. Sea in the bottom half, sky in the top half. The Hinge of the All was a high mountain range beside a long, narrow coastline. And their homeland—the coast between the mountains and the sea—was the meat in the cosmic shell."

I heard about Joe's guesswork that night at supper in Unity Base.

"Story Bird Cave could be a historical record," I said.

"That would depend on how the rest of the story goes," Catharin answered.

* * * *

The sea rose. Waves climbed onto the land and snatched at the People's nests. The sea flooded the nursery marshes, and sea monsters swam up into the marshes. The old People said: That sky pearl has deranged the sea. The sea is climbing out of its nest. Soon we will be caught between hungry dragons swooping down from the air and many-toothed monsters swimming up out of the sea, with nowhere safe for our young. The world is ending.

It's a mistake to think of anything on Planet Green in Earth terms, but I can't resist imagining a Cretaceous sea full of toothy plesiosaurs. Then the big blue moon gets shoved in *close*—as near to Green as Luna was to Earth, but six times the apparent size in the sky, and twenty times as bright. It twanged Planet Green hard—probably set off earthquakes and volcanoes, possibly induced global warming and rising sea levels, and certainly created tides like nothing the Bird People had seen before.

There was a bold young fish-hunter named Wander. Now Wander said: I have watched the sky. Not all clouds blow against the Hinge of the All and stop. The highest clouds freely go back and forth. Maybe there is another world on the other side of the Hinge of the All. I am brave and strong and [unclear]. I will go look.

The she-People, brooding eggs saved from the waves of the sea, clacked their bills in anger. They said: You should stay here guarding our nests!

But he set out anyway.

Clear as a bell, except for one word. In the phonetic notation we're using, the unclear word is /a*a/. It consists of the most common vowel sound in the language flanking a rasp or rattle from a bird's throat. /A*a/ probably means "smart," because next comes this passage:

*Wander was very /a*a/. He remembered what the old People said about dragons. He waited for a windless day and set out early in the morning because he knew that the dragons couldn't climb the sky then. Without a strong wind, dragons can only fly down.*

I visualize the story's dragons as pterosaurs. A survey team out in the field recently found a fossil like that. It looks mangled, as if it died by accident. Like pterosaurs, it would have been too big to get airborne without a headwind, too heavy to stay airborne without ridge lift or midday thermals to keep it up.

*A dragon leaped from a cliff, its greedy beak gaping. But Wander had /a*a/ feathers. He outflew the dragon. Unscathed, he soared into the high chasms of the Hinge of the All.*

That /a*a/ word perplexed me for weeks. Meanwhile, I carried geologists and their instruments all over local creation searching for crude oil. Green is very old and has been vegetated longer than Earth has existed. Plenty of organic matter should have accumulated underwater and been buried by silt and sand, heated and compressed and cooked into oil. The geologists have identified ancient basins, the ghosts of

long-dead seas, and deep beds of shale and sand. Places where oil should seep and puddle and pool under the planet's skin. Except geology on Green apparently didn't work that way. On some of my flights I imagined my Green bird friend again because the imaginary bird was better company than the frustrated geologist sitting in *Kite's* passenger seat. I pondered how a Green bird might feel about flying. I wondered what /a*a/ could mean. I've never seen a feather that's *smart*.

When I found a little spare bandwidth in the uplink to the ship, I talked it over with the intelligence. We decided on the word "quick." Wander was brave, strong, and quick. As a child he was a quick study. His feathers were quick in the sense of aerodynamic. An imperfect translation, but it'll do for now.

* * * *

Wander expected it to be hot in the Hinge of the All. Did the Sun not alight on the Hinge at the end of every day? Instead it was bitter cold. Frigid winds blew in Wander's face, tossed him to and fro, and tried to fling him against raw stone.

It took humans more than a century to learn how to fly up close and personal with mountains. Sailplane wreckage in the Alps and Andes and other mountain ranges attested to the danger of the learning curve. In that environment, hang-gliders have some advantages over sailplanes and airplanes. A hang glider in a bad patch of wind may be able to put his feet down and land. Which is what Wander did.

He took shelter in the lee of a boulder. Even there the wind disheveled his feathers. Cold and hungry, he longed for the nursery marsh of the People, the warm water full of sweet crabs and minnows. Then he heard a voice. It said: Hello!

A witch hovered in the air.

Witch? The intelligence's peculiar linguistic sensibilities are showing again.

Of the three kinds of Green birds that were interred in watery sediments, the smallest kind has opposable claws at the main bend of their wing. They were sometimes buried with artifacts, including polished stones and sticks just the right size for their opposable claws to grasp. Using sticks might have seemed witchy to Bird People like Wander who talked, but didn't use tools. Instead of "witch" I'll use the word "raven."

When I mentioned this to Joe, he shook his head. "No organism here is what we knew on Earth. Green birds aren't birds. Green seals aren't seals. Green genes are deoxyribonucleic acid, but with coding utterly alien to ours."

Joe may have been the smartest human being in the twenty-first century. He was a genetic inventor, creating genetic tools and marvels and a few monstrosities that never should have seen the light of day. Finally he made an enemy so powerful and so vengeful that Joe's only escape route was the starship. In *his* spare time, Joe tries to understand Green DNA.

I conceded his point about Green life. But convergent evolution happens. On Earth, both bats and birds had wings. A penguin's wing had the same cross-section as a fish's body to move efficiently in water. For my own paraphrase of an ancient story written by birds, I'm going to call the Green birds with short wings and opposable digits "Ravens." Not "Green ravens." Microanalysis of fossil feathers found evidence of color; their plumage was purple.

Now the Ravens were smaller than People and lived in all the nooks and crannies of the world, eating every kind of small thing with fur or scales or feathers. That included nestlings, so she-People on the nest spread their wings and clacked their bills whenever Ravens came near. The People's sentinels at the nursery marsh chased Ravens away. But in the bleak Hinge of the All,

even a Raven was better company than wind and snow and rock. Wander moved over and the Raven deftly landed beside him. The Raven carried a magic stick under his wing. Leaning on his magic stick for balance in the wind, the Raven asked Wander: What brings you here?

Wander answered: The world is ending. I want to fly over the Hinge of the All and look for another world.

The Raven cocked his head and said: You have long wings and quick feathers, but you don't know the ways of the wind in the mountains. I do. Let me ride on your back and let us go together. I'd like to see another world, but own wings are too weak to make it over that.

The Raven pointed with his staff. In the distance the highest part of the Hinge of the All stretched like a bleached sea monster's bony spine from one end of the sky to the other. Dismayed at the sight of it, Wander asked: Do you think there's a world on the other side?

The Raven answered: When I pry at stones or roots or leaves or ice, there's always something interesting to find. We should pry at the edge of the world and see what's there.

Never before had any of the People had a Raven for a companion. But the world had never been about to end either. Wander said: Hop on.

* * * *

The best guess from the intelligence is that the consonant in /a*a/ was a trill. Nice to know, though it would be nicer to know what the word means. It comes up again and again.

Now the Raven's name was Quickclaw. He preened his feathers smooth and perched between Wander's shoulders. Hunching low as he clung to Wander's feathers, he taught Wander how to ride the wild tangled winds. They threaded their way through the Hinge of the All until they saw a pale green plain among the mountains. Quickclaw shouted: We need to rest and eat. Fly down, but be careful because Sky Spiders live there. They go back and forth to the sky on strings, and they have many shiny things and pry even more than Ravens do.

God Almighty. Does “back and forth to the sky on strings” mean contrails? Could this be the intelligent race that moved Blue, and they had a space base on an altiplano on Green? Story Bird Cave might contain historical clues to the ultimate mystery of Planet Green—the huge blue moon. By pointing that out, I got the priority of translating Story Bird Cave upped.

The ship's intelligence soon produced this:

Wander spiraled down to a quick stream in the high plain. They thirstily drank. It was very cold that night, but Quickclaw found a hot vent in the ground. Snails clustered around the vent. They gorged on snails and stayed out sight of the Sky Spiders. After two days they saw strange flat clouds overhead. Quickclaw climbed on Wander's back and said: Fly high!

Wander flew up and up. Quickclaw urged him on: Fly higher!

Wander beat his wings and climbed higher into the sky than he had ever flown before. The breath sawed in and out of Wander's lungs until he thought his chest would burst from exertion. Then a strong wind seized him and lifted him up, higher than the Hinge of the All. The tallest mountain bore a smoking black crater on its peak. It was the Perch of the Sun, scorched from the Sun sitting there.

Quickclaw spotted lenticular clouds, a sign of mountain wave. Wander flew up into the wave and it

carried them over the highest mountain in the range, which was a live volcano. I wanted more about Sky Spiders and didn't get it, but I did get evidence that this story is reliable. It describes mountain flying realistically. People with wings would know.

The cold air was too thin to feed Wander's blood. He dizzily panted. The edges of his vision faded. Staring ahead, he saw the Sun gliding away from its Perch. Wander stretched out his aching wings and followed the Sun. Quickclaw shouted: Look! Under the Sun!

Below the Sun a green land stretched away into distant haze. Wander glided down into good thick air. Then he laughed. The Raven on his back chortled and cheered.

* * * *

The starship's intelligence really is eccentric. Stubborn. It doesn't like to speculate about what comes next until it's sorted out what it already has. I think its linguistic expertise was based on a professor who kept her cards up her sleeve until her conclusions were ironclad enough to publish. The next line of the story came out as *Beyond the Hinge of the All, they found many cathedrals*. The intelligence couldn't explain why it used that word. Then it wouldn't give me any more translation of the story. I wished we could bring a linguist-colonist out of stasis, but there was no way to justify that, for an incredibly ancient linguistic puzzle, when our colony's future had just hit an utterly unexpected roadblock.

Not only was there no crude oil in the sedimentary rocks, waiting for us to find it, but there were no diamonds in igneous rock formations. No copper or iron ores anywhere. No bauxite. No uranium. We came up empty-handed for every mineral resource on our shopping list. More people were awake now, revived from stasis, including the core of the colonial government. And the boneheadedness of our leaders was astonishing. They weren't interested in developing the resources that we had in abundance: sand, sun, sea, and tides.

When I fumed about the colonial government's stupidity, Catharin shook her head. "It's not simple stupidity. They're afraid, and they haven't yet faced it."

She knows about facing fear. As the starship's physician and chief medical researcher, she'd realized early what stasis that lasted a thousand years had done to us. It wrecked molecules, triggered autoimmune disorders and cancer, and, in insidious ways, damaged the human genome. She's battled biomolecular catastrophe ever since. To help her, she enlisted Joe, who had been no humanitarian on Earth. His unflinching genetic repair work represented a major change of heart, after he faced his own psychological demons soon after we got here.

Cat and Joe both knew that all of our original colony plans were dead on arrival at Planet Green, and for there to be a human future on Green, we'll have to invent new plans. When I advocated alternate resources, they backed me up. Meanwhile there was endless discussion about the puzzle of geology so deficient in metals, oil, diamonds, etc.

I had my own guess about that, but I only confided in Cat and Joe. I told them, "If Green was the cradle of a civilization powerful enough to move the blue moon, then on the way up they mined this world out. There won't be much left for us to find."

"The ground rules are different from Earth," Joe said ironically. "We knew that."

"Yes, but we can't comprehend what it means," Catharin pointed out.

In the end, the cathedrals riddle solved itself in the very next line of the story: *They saw no people in the branches*. Oh. To birds a *tree* can be a cathedral.

The rest of the Bird literature uses images even more poetic than that. There's one cave so large and with so many scratches on the walls that it might be a library. It's mostly untranslatable. The Bird People seem to have had a mystical Dreamtime concept, somewhat like that of the Australian Aborigines. The Green Dreamtime inspired reams of otherworldly poetry.

Story Bird Cave is a simpler type of literature. It has the earmarks of being ancient oral tradition that crystallized into writing soon after writing itself was invented. The original events were carried in the Bird People's unwritten memory for a long time and turned and cut and polished like gemstones. Whoever finally wrote it down added their own rudimentary literary sensibilities. But it's understandable. Mostly.

They glided down to a small river. Wander saw the ruffle that gave away a fish. He swooped to seize the fish in his talons. Wander ate the fish and it was very good. In the grass beside the water, Quickclaw snatched up a fat little no-legs. It quicked and he ate it with relish. Right now I don't like my translation of /a*a/ as "quick." The context makes the word seem to mean "twitch." Language is based on metaphors, and this particular metaphor isn't obvious to hominids like myself. Especially not in the next line. *Quickclaw said: This is a good world with plenty of quicking meat!* Evidently, /a*a/ can mean "delectable." Maybe food so fresh that it's still twitching as it goes down qualifies as really tasty....

At the end of the day the Sun fluffed its fiery feathers and settled into its nest at the end of the sky. Wander said: This is a good world. My people could live here.

Cleaning his bill, Quickclaw said: I would like for my mate to see this.

As far as we've decoded the Green Bird literature, there's nothing about Wander's people having mates. Maybe they were never monogamous. Or they always were. Either way, it wasn't a detail worth singling out. On the other hand, there's a lot in the literature about mated Ravens. Ravens in love, Ravens making babies, Ravens fooling around with Ravens other than their mates. Ravens in off-and-on mating situations that seem to resemble my relationship with our colony's chief helicopter pilot, Dom Cady. Humans are a lot like the Ravens.

* * * *

We know where the Hinge of the All is. Once it was a coastal range of high mountains, but eons of weather and the tidal assault of the sea eroded it down. On the seaward side, after the new blue moon's tides scoured away the Bird People's homeland, erosion rebuilt a wide sloping shelf of land. Salt marshes grew back again.

Inland from the mountains, a wide shallow basin filled in and heaved up into the ridgy limestone plateau that's there now. Finally we arrived and picked this timeworn mountain range to bear the first human footprints on Planet Green. Unity Mountain, with our base on its top, is an unimpressive mountain now. Two hundred million years ago it was the volcano called the Perch of the Sun.

At midday the Sun bypassed its Perch on its way to its nest at the end of the sky. At night the great blue pearl raced across the dark sky. The stars in the blue pearl's path dimmed, hiding from it. Wander said: At home in the old world, the blue sky pearl is driving the sea crazy. My People are in danger. I must go back to them.

Quickclaw said: We should pry at the valleys on this side of the mountains. We might find passes that will be easier going than flying over the mountains into the wind.

Now Wander had been thinking about the cleverness of Ravens and how, being much smaller than the People, the Ravens ate different things. Wander said: When we get home, let's invite your mate and your relatives to help my People fly the mountain winds, so People and Ravens together can come here to live. Ravens would all enjoy living here. Ravens could pry for a thousand years

and not find all of the new things in this new world.

Liking the idea, Quickclaw chortled.

Wander flew homeward with Quickclaw on his back. They picked their way through windy, barren passes in the Hinge of the All. Finally they reached Quickclaw's home territory. They soon found Quickclaw's mate. When she heard what Quickclaw had to say and saw how glossy his feathers looked from the nutritious food in the New World, she flew to tell her friends and relatives the news. But when Wander saw the old world again, he knew that he didn't have much time. The deranged sea was chewing on it. The world looked like a ragged blade of grass. The sight wrenched his heart.

I know how Wander felt.

Like Wander, after I grew up I journeyed far away from home. Farmers, including my parents, tend to want descendants who stay on the farm *and* an offspring or two who go find success in the wider world; belt *and* suspenders. I had three brothers, all hardworking farmers. I was the kid who left the farm. I became an engineer and an astronaut with missions to the Moon and asteroids under my belt. But when I came home for my first visit in ten years, I saw that we were in big trouble. Earth's oceans rising in the twenty-first century had triggered huge population shifts when people living in coastal areas were flooded out. Sunbelt cities like Chattanooga and Atlanta, burgeoning at the end of the twentieth century, grew even more wildly. That meant a lot of farmland paved over. It also meant family farm economics trumped by high-output factory farming. Factory farms bred not only livestock and crops, but pesticide-resistant weeds, anthelmintic-resistant internal parasites, and antibiotic-resistant diseases. Every one of those problems threatened the Fisher farm.

To top it all off, Earth's destabilized climate brought calamitous rains to the hills of Tennessee. Where the rains washed raw gullies in the hills, the land looked like it had been raked by monstrous claws. We Fishers, like everybody else in the county, had lost most of our crops. We were just lucky that the house and barns hadn't been in the way of a flood avalanche.

My parents called a family meeting about what to do. In truth, the question was where to go. American farmers had been moving to Central or South America for decades. But it had become almost impossible to find a country that wasn't aflame with violent civil unrest and arable land not overrun by desperate people displaced by the rising sea. My mother threw up her hands. "Where else in the world can we go?" We were sitting at the table of our rambling old farmhouse around a still-sturdy, century-and-a-half-old oak dining room table.

My father looked across the table at me. He said, "It may have to be to another world."

Until that instant, I'd been following the work of the Aeon Foundation with detached fascination. The Aeon Foundation intended to privately fund a starship to colonize a new world. It was a fascinating endeavor, but I knew I could never leave Earth for good, forever leaving behind the farm and the family I came from, the land I grew up on.

But the land was dying. And my family decided to go to the stars.

* * * *

In his sorrow for the ruin of the world, and because he had spent days in a dragon-free place, Wander forgot to look up. A dragon plummeted down at him and he barely dodged its gaping beak. He smelled its foul breath. But suddenly the air filled with Ravens, Quickclaw's mate and many others, all darting at the dragon's eyes and tail. The dragon swatted at the Ravens, but they were small and nimble. Wander wheeled close and raked the dragon with his talons. The dragon

turned tail and flapped away.

Wander returned to the People with a flock of Ravens in his wake. He told the People: I've seen the world beyond the Hinge of the All. And the Ravens are now my friends, and they will teach us all to fly in the Hinge's winds. Let's go.

But the She-people slicked their feathers down angrily. They said: Few enough eggs hatched this year and our young are just beginning to fly. Do you expect us to leave our young behind? Or let these Ravens eat them?

Wander said: Show the Ravens where to find fibrous marsh grass and stringy seaweed. The Ravens will weave nest-bags to carry everyone too young to fly to the New World.

Are we to carry burdens like that and fight off dragons too? demanded the suspicious She-People. Are you planning for us to carry snacks to the dragons?

He answered: I have a better idea.

With Quickclaw, he flew south to the land of the trolls.

For trolls, read huge carrion-eating birds with gray feathers. A better translation than “trolls” might be “teratorns”—the enormous Ice Age vultures of Earth.

The intelligence's persistence in translating the words for additional intelligent bird species as supernatural beings is very interesting. When you think about it, coexisting with an equally intelligent species was a situation we never had as humans on Earth. Or if we did, it was in the Paleolithic, when Cro-Magnons shared part of Europe with Neanderthals. By the Neolithic, the Cro-Magnons had the continent all to themselves.

* * * *

As I write this today, it's Green Year Twelve, the twelfth year since Starfall. My personal account of the Story Bird Cave translation was always a pick-up-and-put-down, spare time kind of amateur history, but the last time I touched it was six years ago. A lot has happened since then. Some things were good and hopeful. Other things were ominous or bad.

Earth crops in our pilot projects didn't grow as readily as we expected. The probable reason was microbe disconnect. Earth had an invisible world of microbes that the visible plants evolved to coexist with. The microbes of Green are alien. Until we get this figured out, until crops grow reliably, we won't revive many farmers from stasis. I may not see the rest of my family for a while.

Without mineral resources and terrestrial crops, what we have to work with on Green is sand, sun, sea, and tides. A certain amount of plastic and paints can be made out of native plant matter, and buildings out of concrete and glass. What we need more than anything else is energy. I went back to my original profession, being a structural engineer, and I designed a tide machine to straddle the river near Unity Base.

Building the tide machine has taken politics and persuasion, blood, sweat, and tears, and engineering that's never been done before. It's also cost me one of my best friends in the universe. The river is how the Green seals come inland to give birth to their sluglike young. Joe got upset because the tide machine might kill migrating seals.

I said, “Look, Joe, for humans to live, something has to die. It may be cows or catfish or pole beans, but that's always the cost of keeping people fed, clothed, and housed. Something has to die, even if it's just

the weeds on a fallow field when you plow it to plant a crop.” I didn't say out loud what I thought about the worldview of city people. For city boys like Joe, food is something that just appears. It costs only money. The universe doesn't work that way.

Joe said, “The Green seals aren't weeds.”

“No, they aren't, and they can learn to stay out of the tide machine.” I was so upset that I raised my voice, almost shouting at him. “I don't want to hurt the seals! I don't think the machine will hurt or kill many of them before they learn to avoid the machine.”

He scowled. “Killing any of them is too many.”

And then he relentlessly opposed the tide machine. His opposition fractured the colony. Some who took Joe's side were people I cared deeply about. Some on my side were careless young visionaries and others were politicians I don't trust. Catharin adamantly refused to take sides. She stayed on cordial terms with me, but I could no longer confide in her. For a long time I didn't have the heart to go back to translating Story Bird Cave.

On my forty-fourth birthday, celebrated with a small group of friends not including Catharin and Joe, I picked the story up again where the bird heroes went to talk to the big gray vultures.

The Teratorns lived on a plain of grass between the Hinge of the All and the sea. Herds of four-legs lived and died on the plain, and the Teratorns ate dead ones. Wander and Quickclaw arrived at the end of the day as the Teratorns returned to their roost on a ridge swept by the wind from the sea. Wander said: We flew over the Hinge of the All and saw another world. It has many four-legged grass-grazers, alive and dead, so there is plenty of carrion, as well as food for Ravens and my People. If we join forces, we can all get past the dragons and the mountains and reach a safer world. Rise as much as it will, the sea will never get over the mountains.

Most of the Teratorns laughed. But one she-Teratorn said: I can see with my own eyes how the sea surges higher with every tide. When it inundates the grass plain, we will have sea on one side and stone on the other, with the four-legs all swept into the water for sea monsters to feast on. Then we will starve. I see no reason to perch here while the world drowns. My clan will go to the new world.

Now the she-Teratorn's name was Sees-Far-From-On-High.

Another way to render her name is Descry. But it makes sense for vultures to have a long-winded language with many-syllabled names. Their lunch won't run away while they take their time saying things.

Quickclaw's relatives made nest bags, just like they made for their own young, but larger. Wander, Quickclaw, and Sees-Far-From-On-High decided that the middle of the day was the time to set out. Into the nest bags went the People's young and the oldest who could no longer fly far. Then the People climbed into the sky with Quickclaw and his mate and relatives, and the Teratorn clan carried nest bags full of the very young and very old People. Young Teratorns clung to the backs of their parents.

In the foothills the air swarmed with hungry dragons.

Not all stories have happy endings. I don't know how happily the story of our colony on Green will end, much less the story of my own life. I feel a need to find out how the Bird People's adventure ended. I'm guessing that it turned out pretty well. Even though it doesn't look that way now.

Ravens darted around the dragons, pecking at the thin skin of the dragons' bellies. The most daring of the Ravens pelted the dragons' eyes with sharp rocks. The People raked the dragons' throats with their talons. Dragon blood watered the wind. The she-People were the fiercest fighters of the People, keeping the dragons away from the Teratorns.

The Teratorns were almost as big as the dragons, but could turn smaller circles, Stretching out their wings in the air that swirled up from the Sun-warmed foothills, the Teratorns climbed the sky faster than the dragons.

Two young People fell out of their nest bag. A dragon snapped up one of them. The other one fluttered to land on a Teratorn's back. The Teratorn said: Hang on!

Teratorns with their burdens circled tightly and soared high while the Ravens and the People fought the dragons. Blood and feathers scattered in the air.

Everyone who was still alive soared after the Teratorns and escaped toward the safety of the mountain passes. Behind them the dragons hissed in fury. Wander was the last of all the People, and the dragons almost caught him. But his feathers quickened and he escaped.

In the mountains, the People regrouped and flew on, with Ravens teaching People how to fly the quick winds. The Teratorns were able to stay higher, in smoother air.

Deep in the mountains lay the high plain with its grass and snails. The People wanted to stop there. The Ravens warned them about the Sky Spiders. Then Sees-Far-From-On-High called out to her clan: Don't stop, stay high. I see Spiders getting in and out of shells with wings. And the Spiders have stretched their threads far and wide. They are cutting holes in these mountains, melting the mountains' hearts like ice, and bleeding the mountain hearts away. We are too big to hide from those Sky Spiders, and we should have nothing to do with them.

* * * *

Did a giant vulture just describe resource extraction? I think she did. We've been exploring the land westward of Unity Mountain for resources, but it looks like the Sky Spiders got there first and plundered the land. Surprise.

A new world wouldn't be new without some surprises—not always nice ones.

The People found flat clouds and lifting winds and flew over the smoking Perch of the Sun. The new world unfolded under their wings. The People told Wander: Truly it is a new world with rivers full of fish. Sees-Far-From-On-High said: There's more. Far to the west, between here and the Sun's nest, I see an inland sea, and it has many fish in it and many four-legs in the grass around it. This is a very rich new world. But in the air over the inland sea, I see dragons even bigger than the ones we left behind.

Oh, hell. The story started at the apex of the cave ceiling, where the lines of marks were obscured by soot when we first found it. Now the story is down to where the marks were half hidden behind sand at the bottom of the cave, they've got dragons in their new world, and the word /a*a/ is conspicuous by its presence in the last line of writing around the cave.

* * * *

A couple of day ago, I shared the sky with cloud-dragons: cumulonimbus clouds with lightning claws. I used gliding speed to dodge them, pushing *Kite* to the limits of its performance, and *Kite* outran the clouds. The Sinha-Blazek deturbulator strips on *Kite*'s left wing caught my attention. In the striped areas, the wing skin shimmered. The technically advanced materials on the wing were vibrating at just the right

frequency to damp down the beginnings of the turbulent separation of the air stream from the wing. Deturbulator strips let *Kite* fly better in more attitudes, open up the corners of *Kite's* performance box.

Just like that line from Story Bird Cave about how Wander got away from the dragons. *His feathers quickened.*

It had been under my eyes every time I flew *Kite*. Nature got there before Sinha and Blazek did. The feathers of raptors can vibrate in a highly specific way, deturbulating the air stream over a bird's wings. It may feel like a pleasant shiver to the owner of said wings. For Bird People, it attracted cultural meanings. Metaphorically, the word /a*a/ can mean *quiver with wonderful consequences*—speed; intelligence; harmony; goodness.

I told Joe about it. I added that maybe my own mind isn't very quick. I've been thinking like an optimistic and ox-stubborn engineer, intent on solving a problem without fully understanding it, plowing my way to the solution of an engineering challenge with principled disregard for unintended consequences. It hurt to admit that to a brilliant scientist. But my conscience said I had to.

Then I challenged him to figure out a way for the seals and the tide machine to coexist. He thinks he can get the seals to follow a channel around the machine. And I'm holding up the machine to let him.

* * * *

Maybe the Bird People were quick in a way we aren't.

At most of the fast-moving, tight-maneuvering moments of human history, we had turbulent separation. War. We've had whole civilizations clash and crash. Even on a new world on the other side of the stars, in a colony only twelve years old, we've already experienced an ugly rupture.

In the Green Bird's whole vast literature, we can't find references to wars among Bird Peoples. Territorial tiffs, yes. Conquests, pogroms, and world wars, no, and nothing about gods and kings either. Perhaps there's a connection. The Bird People's hyperevolved without the destructive turbulence that marked human history. What made them so quick? Green genes? Having wings? Not having a world rich in mineral resources because an earlier race mined everything out on their way to a level of technology high enough to move the blue moon?

Maybe all of those factors contributed, but I think the true answer is written in the last line of the story—the line that runs all around Story Bird Cave at the bottom of the wall.

Wander said: Ravens are quick of claw, the People quick of wing, and Teratorns have quick sight. We are all People, and we are quicker together than apart. Dragons or no dragons, this is the world for us.

Wander was a culture hero. For humans, a culture hero is the legendary person who discovered fire or founded a dynasty, or someone who invented a momentous machine at the dawn of history. On this new world, the dawn of history is now.

My tide machine works. It turns the river tides into energy enough for a city.

The seals are bypassing the machine in the channel that Joe devised. He figured out how to infuse the channel with water-soluble scents that mean *this is the right way*, while suffusing the tide machine's water intakes with smells that shriek *danger* to the brains of the seals. What gave Joe the motivation to devote months of his life to a side channel for Green seals, I'll never know; I think it has to do with expiating his old scientific sins on Earth. How an arrogant primate figured out the high points of the smell language of giant aquatic slugs is even harder to understand. But he did it. The seals are using the channel

and staying out of the tide machine.

Meanwhile the long, bitter rift in my friendship with Joe had the effect of mending fences between me and Dom. By the time Joe and I became friends again, Dom was firmly entrenched in the habit of being my husband. Our on-again, off-again marriage is on for good.

Dom is ferrying materials by helicopter to the site where we'll build the first human city on Green. It will be a city made of glass, with daylight and starlight streaming into it. Since you can't have a city without farming—food won't magically appear here any more than it did on Earth—we now have an all-out project to establish crop cultivation, with the intense involvement of microbiologists, and the results are starting to look good. To no one's surprise, or I should say, to no farmer's surprise, we have to have animal husbandry too. It takes cattle and sheep, their manure and their microbes, to successfully cultivate terrestrial plants here.

Before long it will be time to revive the other Fishers. My mother and two of my brothers are agricultural engineers. As farming gets started on Planet Green, there will be Fishers' hands on the plows and mass spectrometers.

Crops and calves wouldn't matter if we couldn't have children. But thanks to Joe's inventive repair work on the human genome, there will be a human future on Green. Some of the very first children born here have grown up and had healthy babies of their own. Maybe in a thousand years, Joe and I will be culture heroes for Green humans.

Wander, the bird-culture hero, invented the cooperation of intelligent species.

We don't know for a fact that *Homo sapiens* ever had that opportunity, but it might be a test we flunked in the Paleolithic by driving the Neanderthals into extinction. If cooperating with other intelligent species is a test the universe administers, then the Bird People of Green passed with flying colors. They used fire. They farmed shellfish and grains—I can't wait to inform my brothers that the first and finest farmers on Green were intelligent crows.

The Bird People domesticated dragons. They adorned themselves with jewelry, sang songs, dreamed dreams, made love, wrote a vast and subtle literature, and built cities on the shore of their inland sea. They buried their dead in the silt of the deltas where rivers met the sea. Above all, they cooperated.

A decade after the first time I saw Story Bird Cave, after years of poring over digital images of the cave and the computer's reprinting of the original writing, I went back in person yesterday. Joe went with me. Humans going out into the wilderness on Green still use the buddy system, especially when the big blue moon is nearly full.

I'm a first-generation leader now, with a lot of leeway if I want to use it. Yesterday I used it. I gave myself permission to light a small, clean fire in Story Bird Cave. Then I sat cross-legged in front of the long-winged fossil bird in the cave floor.

"I see why you wanted the fire," said Joe. "It makes the bird look alive." Flickering firelight made the fossil impression of the bird seem to breathe. The stone feathers seemed to quiver. "What do you think? Is it him?"

I said, "I think the Bird People regarded this as him, and it inspired them."

If humans flunked the test of learning how to cooperate with another intelligent species back in the Paleolithic, we may have another chance coming. So far on Planet Green, there were birds whose intelligence waxed after the waning of a civilization powerful enough to move the blue moon. That, our

government assures us, was two hundred million years ago, a span of time that takes the definition of ancient history to an extreme, and we don't need to worry about the world-movers. But one thing about petroleum is that there's such a thing as young oil that forms in ten or twenty thousand years. We haven't found any of that either. I think somebody used it up or took it away, long after the Birds, who never seemed to have done much with metal, much less oil. The latest guess is that the Bird People laid eyes on the Sky Spiders very late in their long oral history, long after the lives of their early culture heroes. The Sky Spiders probably had nothing at all to do with moving the blue moon. They might have been like us: an intelligent race from across the stars, intent on colonizing this old world—or this star system—with how much ultimate success, it's so far impossible to say.

I touched the feathers impressed in the fine-grained gray stone.

My intuition insists that we'll have a second chance to figure out how to cooperate with another species. Maybe in my lifetime. It might be the Green seals. Thanks to Joe, at least we didn't start out by setting up a machine that mangled them. Or maybe there'll be new arrivals from interstellar space. If we weren't the first newcomers, we probably won't be the last either. Or maybe we'll send a mining expedition to the asteroids of this sun and find the remote descendants of the Sky Spiders.

Somewhere not far away, there are people besides us. They have something to offer us, we have something to offer them, if both sides see it that way. It never worked out on Earth. But this is a new world. When the time comes, I hope we'll be guided by a kindred spirit named Wander, and get it right.

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Novelette: **RENDEZVOUS AT ANGELS THIRTY** by Tom Ligon

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Illustrated by Laurie Harden

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What does blurring the boundaries of reality do to ethics?

* * * *

The Bf 109 in front of me continued to jink erratically, attempting to spoil my aim. I rolled smoothly toward the kill position. I ignored his wingman, who was attempting to do the same to me, but had fallen hopelessly far behind. Both pilots were obviously inexperienced and had squandered their kinetic energy with high-gee maneuvers. The plane behind me was not an immediate threat and would not be unless I allowed myself to be led back within his range. I pressed my variable scissors attack on the lead plane, essentially a corkscrew pursuit that allowed me to keep my speed up without overshooting him. My opponent attempted an ill-advised reverse, and I was above him and inverted, an excellent position to counter the maneuver. I nudged the controls to drop in behind him, estimated the lead, squeezed off a quick burst, and was rewarded by little flashes against his wings and fuselage. I use API, a mix of two rounds of armor piercing, one incendiary, no tracers. Tracers give away your position. The incendiaries produce flashes when they strike, and ignite the fuel released by the armor-piercing rounds.

His plane became a torch. That made four.

A quick glance over my shoulder confirmed the location of his wingman. I let him close in behind me, not quite enough to allow a good shot. I own a Bf 109, and have trained on a simulated version. The slender fighter with the menacing sharklike fuselage and “greenhouse” canopy is the archetypical German fighter commonly depicted from the era, and no collection would be complete without one. I knew exactly where his blind spots would be. A flick of my forearm and a nudge on the rudder and my Mustang rolled gently inverted, then a little back pressure on the stick dropped me below his nose. He would expect I had performed a split-S, but once out of his sight, I transitioned into a big barrel roll. He predictably rolled inverted, expecting to dive onto my six, but my maneuver had kept me out of his field of vision. My left hand unconsciously worked the prop, throttle, and trim controls as I traded airspeed for altitude. In seconds, I was above him, also inverted, and slightly behind him. I could almost sense his confusion, wondering where I was, as I pulled back on the stick and poured forty-eight rounds a second of half-inch diameter, two-inch-long steel projectiles, traveling at three thousand feet a second, into his wings. His main spars disintegrated, and his wings came off cleanly. Unlike the last pilot, this one managed to bail out. That made five.

There are many myths about air combat. Most people think it is all about lightning reflexes and the ability to pull high gees. They believe it is best done by the young. I claim otherwise. If you rely on reflexes, you are reacting to the situation instead of controlling it. A good pilot will stay well “ahead of the plane.” If you rely on pulling high gees, you rapidly lose speed. Speed is life. Air combat is about figuring out a way to put your guns on the other guy without letting him put his guns on you. It takes patience, understanding of the maneuvers, and strategy. It is a problem to be worked, not a desperate and totally unpredictable dilemma. It takes experience.

I eased back the throttle, reduced propeller RPM, and adjusted trim, scanning the sky as I completed my roll back to horizontal. Except for my flight of Mustangs about a mile behind me, the sky was mine.

"Nice job, Hellfire," said the voice on my headset. "Ace in a day!"

"Eh, like shooting fish in a barrel," I replied flippantly. "Old age and treachery beat youth and skill. Okay,

end simulation."

The scene around my cockpit simulator dissolved. I removed my oxygen mask, unlatched and slid back the canopy, and began unplugging and unstrapping. The last of the nanoticles that had created the simulation faded into the quantum foam, or wherever they go when not needed, and revealed the walls of the simulator chamber. The hatch opened, and Wendy Taylor stepped in.

I wondered what she would look like without her dishwater blond hair pulled back in that hideous bun. Most young ladies try hard to catch my attention, not because I'm some stud, but for my money. Wendy was more interested in delivering on her company's claims for their simulator tech. I had to respect that. I try not to judge people by their appearance, but it is hard to not appreciate a healthy member of the opposite gender. Wendy would not meet the Hollywood definition of beauty, but she had an unusual and interesting face and intensity in her eyes that reinforced the overall impression of intelligence. The combination was curiously attractive.

"Well, Mr. Doyle, what did you think?" she asked.

I climbed out of the cockpit, trying to look casual. In truth, I was a little stiff and one foot was numb. "I can't tell you how many times I've flown Yeager's 'ace in a day' mission. The pilots are inexperienced, and the planes are obsolete. This was child's play."

Wendy rolled her eyes. "Okay, hotshot, you know what I mean. How'd it feel? Was that the most realistic feeling you've ever experienced in a simulator, or *what?*"

I pointed to my left foot. "The heater is only effective on my right foot. My left foot is nearly frozen solid."

"We can fix that if you like, but..."

"Fix it *hell!*" I pointed to my Mustang, parked across the hangar. "It is *exactly* like the real thing, in every respect I can tell. The gee forces, vibration, temperature ... you even got the smell right. But Walkin' Cane over there does not have real guns. I've flown simulators for decades, civilian and military. Most make a nice rat-a-tat-tat noise when you pull the trigger and shake a little. But this one ... incredible! I felt like a *god!* I felt like Thor hurling thunderbolts! It was frickin' *awesome!*"

Wendy beamed and then turned to admire Walkin' Cane. I tipped my head to suggest we walk over to it. Everybody loves P-51 Mustangs, which many consider both the best and the best-looking fighter of World War Two, and possibly of all time. Streamlined aircraft influenced art deco, but I wonder if art deco influenced the wonderful grace of the Mustang, including the characteristic belly scoop that housed the radiators. And Walkin' Cane is the D model, with the bubble canopy, the feature that was really the finishing touch. I keep her in polished aluminum with blue trim, and I can't imagine a prettier way to show her off.

"Can I touch it?"

I nodded. She stroked its sleek sides. I would polish it again after she went home.

"This one still flies? Is it original? Can you give me a ride?"

"Yes, reproduction, and no," I apologized. "Walkin' Cane III is a faithful reproduction, which means single seat. I have two others that are original, and in flying condition, but they're too precious to risk anymore. There's one back east in Kissimmee, a two-seat trainer, if you really want to give it a try. I could set it up for you."

"Wow!"

"Yup, wow. If you can get this simulation running as promised, you've earned it. And trust me, you couldn't afford it if you hadn't earned it. So, how long until you can integrate the time-drill snapshots?"

That took the wind out of her sails. "Months. The guy you really need is Rostov."

I laughed and switched to my best phony Russian accent. "What was thing that Rostov said? 'Not put hi-fi historical engrams in sims. Have tried. Not got ethics.'"

Wendy shrugged. "I can do it, but I'll just be following procedures. I have no idea how it will turn out. As far as I know, nobody has ever tried putting that high of a fidelity quantum snapshot engram into a simulated person before, much less a flight of eight pilots. And no way can we get ten bombers with ten men each in at that level, or the enemy aircrews."

"I thought we could set the nanoticle density as high as was needed," I countered. "What's the problem?"

"We can set the nano density to anything we want, but there's a fundamental bandwidth limit to the laser hologram that loads the simulation," Wendy explained. "They'll have to be at lower fidelity, but they'll still be very realistic."

"Can you at least make the bomber pilots and radiomen full fidelity?"

She shook her head. "It's all or nothing on a given aircraft. Even working a notch lower in fidelity, hi-fi sims are spooky to work with. They spot stuff that isn't real. They're damned near alive, and they have a lot of the memories and perceptions of the person they copy. Make a bomber pilot that real and his crew less real, and he'll think he's flying with zombies. The bomber crews and enemy pilots will have to be stock sim AI characters with personality upgrades based on the snapshots you provided. That's what's going to take all the time. I need to create a static character for each individual, pixelize their personalities down to a usable bandwidth, then manually cut and paste the personalities to the avatars. Speaking of which, how the hell could you afford all this?"

"I inherited a pretty good fortune," I confessed. "I invested it in space mining and transportation, back before the boom. And the stock market has been good to me."

"Okay," she said, eyeing me a little like a teacher talking to a spoiled brat, "so you're rich enough to have the World War Two project divert a time drill to Earth's location on the particular date and time where this engagement happened, get the needed quantum snapshots, and then pay for damned near a year's worth of transmission time on a broadband laser to beam it back here from deep space. But why such a minor engagement? Why not something with commercial potential like the Battle of the Bulge, or the Pearl Harbor attack, or maybe the Marianas Turkey Shoot?"

"Because this is not about making money." I shook my head. "This is personal. The flight leader, Captain Vince Doyle, is one of my ancestors. A few minutes after the snapshot, his whole flight vanished. Never found a trace. The original investigation suspected a big midair collision. Whatever the cause, they never met up with the bombers they were supposed to escort, and those guys got slaughtered. I think four planes limped home. The bombers suffered sixty-eight casualties on top of the guys in great-great-grandpa's unit."

"And I guess you don't buy that explanation?"

"Heck no." I shook my head emphatically. "They did take off into a low overcast, and that often caused midairs between pairs of aircraft, but usually near the base. Standard procedure was to fan out as soon as wheels were up, each plane taking a preassigned heading. Then, above the soup, they would form back up. We found them out over the English Channel, formed up and on course, approaching the Dutch

coast, but there's a rocket plane below them and I think that must be the answer. The snapshot a few minutes later shows nothing. They must have wound up in the Channel, and I intend to find out how. There was no official finding against Gramps, but it happened on his watch, and the stink of a suspected screwup bothers me, even if it was a minor incident nobody else cares about. I want to find out what happened, try to avert it, and see what they would have done if they had the chance to do their jobs."

"You could do that with a lower fidelity sim, you know."

I nodded. "But I also want to get to know this man. Flying is in my blood, from more than one side of the family. I got it from my mother, and I got it from Gramps." I smiled. "That's actually what his men called him, because he was the old man of the squadron. He was twenty-two."

"Do you really think you can get to know him, looking at him from, what, no closer than maybe a dozen meters? Because there is no way we can continue this simulation until you get back to England and land, without sims of this high of a quality spotting that it is all fake. It's one thing to simulate eight guys in the air. A fake airbase of hundreds of people on a fake island nation won't sell."

"You'd be surprised at the things you can learn about somebody's character from one cockpit over."

"And another thing," Wendy continued. "At this high of a nano density, if you get too close to these guys when the bullets are flying, they might as well be real. This is not just some laser hologram, we're dealing with synth-space and synth-mass here. Virtual particles still have a lot of the properties of the real thing. You could be killed."

"So I've read. I gather the dangerous volume is roughly a sphere, about the radius of their apparent wingspan. I'm not planning to sit on their laps."

Wendy shook her head. "At this level of realism, I'd double that, at least, and that's just if we had one plane at that level. With eight, plus your own, I have no idea what the sim will do. Space is distorted to fit your perspective and the volume of the chamber. At lower resolution, I've seen regions of high realism connect two nearby zones of high fidelity."

I looked her in the eye. "This has been my fantasy for *years*. That's a risk I'm prepared to take, but I'm not in the habit of letting the bad guys point their guns at me. I'm very, very good."

She looked right back. "Yeah, I know your rep. Gerald 'Hellfire' Doyle, world champion. One of the top five simulator pilots in the world. Twenty-something thousand kills. Well, superjock, this may technically be a simulator, but the fact is, you'll be up against what might as well be the real thing. And I believe a couple of those German aces had kills up in the hundreds, didn't they? *Real* kills, not simulated."

"Granted," I agreed. "But consider that I have more real flight hours in actual warbirds than most of those pilots ever did. Besides several Mustangs and a Spitfire, I own a Bf 109 and a FW 190, a reproduction Me 262 in flying condition, and a B-17. I have trained either in the real thing or faithful simulations of them. I have been in almost every conceivable flight combat situation, including a single Mustang against a hoard of modern jets, and I'm usually the last guy flying. Yes, I have around twenty-four thousand sim kills, some against AIs, most against other human pilots, but to accomplish that I've probably been shot down well over a thousand times. No real pilot in real combat situations can possibly do that and survive. I have learned from a thousand mistakes that would have been fatal for pilots in real combat. Ergo, no real pilot who has not trained in simulators can possibly have my level of combat experience."

"I'll tell you what," I challenged. "Set me up a combat situation. You should have sims of all these guys. Give me a flight including Walter Nowotny, Heinrich Ehrler, Heinrich Baer, Erich Rudorffer, Walter Schuck, and Erich Hartmann. I think all of them had over two hundred kills apiece. Put them in whatever

German aircraft from the Second World War you like. Put them a mile behind me at six o'clock high. Let's see what happens. You work on that, and I'm going to change into a warmer flight suit and fur-lined boots."

I'll admit, on the nano simulator they were more of a handful than I expected. I had to cheat a little and take the fight down to treetop level where I only had to worry about planes I could keep an eye on. When it was over, my plane was shot to crap, but I was the last guy in the air.

* * * *

The months passed slowly. It took all my willpower not to analyze the time-drill snapshots further. I was itching to know more about the enemy plane far below, but I already knew too much about the threats we would face. I had an unfair advantage, and that was nagging me. It would affect the realism of the simulation.

I acquired a few more snippets of information that clarified the history surrounding the mission. One fact became clear: The mission was planned primarily as a diversion. A larger fleet of bombers and fighters launched a little later, on a slightly different heading, and pasted its target thoroughly, with minimal losses. In spite of the catastrophic losses the diversion suffered, it accomplished this goal, and so there had never been a serious inquiry. They were expendable.

Looking at the area snapshots, those poor bomber crews had attracted way more than their fair share of fighters. Considering the fur-ball they found themselves in, they accounted well for themselves. Assuming I could get Gramps and his eight planes past whatever had killed them, they were still going to be up against formidable odds. An extra plane with good aim would help.

I looked over their files. The section was part of a squadron that called itself the Duxford Rascals, named by their former leader, a fellow who went by the nickname "Spanky." He had been killed in action a few months before this mission. Section leader Vince "Gramps" Doyle, flying the original Walkin' Cane, was leading the four-plane "green flight." His nose art depicted a withered old man clobbering Hitler with a stout cane. Charlie "Chatterbox" Power, Jay "Booger" Simpson, and "Crazy Joe" Walker were the remaining pilots in the flight.

Solomon "Preacher" Roper, the yellow flight leader, flew Bully Pulpit. Turner "Reb" Ashby, named for a Civil War ancestor, flew Black Knight of the Confederacy. Bill "Butch" McNair and John "Spud" Hottle rounded out the flight.

I was starting to wish the laws of physics allowed time travel and not just snapshots of quantum echoes of the past. I really longed to save these guys, but all I could do was reenact their final flight, trying to change a key event.

None of them were old enough to die. I remembered a quote by a Mohawk chief named Hendrick, looking over his warriors on the eve of a battle. "If they are to fight, they are too few. If they are to die, they are too many."

* * * *

The big day arrived. The simulator was set up to launch from the snapshot made before Gramps and his section vanished. The slower bombers were out of sight to the southeast, not yet threatened by fighters, and unescorted, over Allied-held France. The German fighter squadrons that had engaged the bombers were poised to launch as we crossed selected waypoints.

I adjusted my gear and settled in to the cockpit simulator. This rig was essentially just the insides of the cockpit, with all the controls and gages, topped by a bubble canopy. Inside the cockpit was normal space, and its surface insulated me from the bizarre physics of the simulator chamber in which it sat. It

was part reproduction, but many of the parts were originals. Some were removed as obsolete or unnecessary during civilian Mustang conversions of a bygone era or recovered from wrecks. The virtual plane the nanoticle simulator would create around the cockpit would bear the markings of a fighter group based in Leiston, with no nose art or name. Gramps and his squadron were based at Duxford. I would be looking for Mustangs with checkered nose cowlings. My oxygen mask was snugly in place and delivering good air. I checked my radios for the proper frequency, preset my throttle, prop, trim, and turbochargers for the airspeed and altitude, and gave Wendy the thumbs up. She closed the hatch on the simulator as I gave the checklist one last quick scan.

The air filled with an interference pattern as the laser hologram that would program the initial conditions fired up. The walls of the chamber faded as the nanoticles, the tiny virtual synth-space particles that created the simulation, materialized from whatever mysterious zero-point-energy place they come, and linked up to make an incredibly powerful massively parallel processor, capable of simulating matter, gravity, you name it. Don't bug me with the details. As long as I understand the stock market, I'll hire people like Wendy Taylor and the eccentric Dr. Rostov to do the dirty work.

A pronounced chill came over the cockpit as the tiny processors recreated the conditions at thirty thousand feet. The roar of amplified ripping silk filled the air and shook the cockpit as the simulated Merlin engine came to life. I don't know how Wendy managed it, but I could even smell aviation gasoline and hot oil. The simulated Mustang materialized around the cockpit, and my gages responded. As I scanned them, my peripheral vision revealed blue sky materializing above and pink-white clouds with occasional patches of gray sea below. The early morning sun was ahead to the right and would be an annoyance for the next hour or so. I kept one eye on the clock, the other scanning the sky as the last minute before the snapshot wound down. As the second hand neared the mark, the simulation reached lifelike clarity. In the few seconds remaining, I fired a short clearing burst on my guns, blasting away the tape that covered the gun ports. It wouldn't do to have my new companions chide me for forgetting to test my armament.

The moment arrived, and the planes appeared at ten o'clock, ten miles distant, and a thousand feet lower. For the uninitiated, pilots picture their horizontal situation as an antique clock face. Twelve o'clock is straight ahead, six is straight behind, ten is off to the left and slightly forward.

"Holy crap, anybody else see that flash?" the radio crackled.

"I did. Its like the sky suddenly changed color a little."

"I saw that too. Hey, bogey at four o'clock, ten miles!"

"Easy Booger, looks like one of ours."

"Jumpin' jeepers, how'd he sneak up on us like that? We must be snoozing."

I keyed my mike. "Green flight leader, this is Hellfire out of Leiston. I had a sick engine this morning and got a late start. They said I should try to join up with you guys." I eyed the clouds below nervously, looking for what I suspected would be an Me163 Komet rocket plane, a tiny thing with a bullet-shaped fuselage and swept wings like a swallow. Those little pests are fast and can climb nearly straight up. They're usually lightly armed and can't stay in the air long, but it was the only threat in the area. I'd seen accounts of one armed with a special weapon that could account for a sudden loss of an entire squadron. "I was wondering when you guys were going to spot me. Put your heads on swivels. We're in enemy air."

"Hey, Hellfire, is it? You know a guy named Bill Blystone? Used to wrench for us, transferred to Leiston."

I can't say Wendy didn't warn me. These were more like real pilots than AIs, and they probably had connections all over England and the States. It was going to be difficult to avoid getting tripped up.

"Cut the chatter, guys. That's not appropriate information over the radio in enemy airspace." A flash of motion from the cloud below caught my eye. A black speck emerged thousands of feet below Gramps and his companions. "Green flight, break left, yellow flight, break right. Bogey below you, straight down, rising fast off the cloud layer. Me 163." As I broadcast my warning, I was already advancing my propeller RPM.

Green flight executed a neat section turn to the left, while yellow flight did an equally pretty one to the right, just as a streak of dense grey smoke erupted from the nose of the Komet. That was no slow-firing cannon, that was a rocket pod. I watched in relief as the cloud, which had resolved into hundreds of spikes of smoke tipped with tiny sparks, shot through the space where the Mustangs would have been. I checked manifold pressure and RPM and advanced my throttle, then dropped my left hand to the rudder trim wheel to compensate for the torque. My plane began to accelerate.

"Hoooo-lee shit, what was that?"

"I don't know, but Hellfire, you can fly on my wing *anytime*."

I keyed my mike. "Well, boys, I suspect he only has that one shot, and he should be about out of fuel by now. Let's see if we can keep him from getting home."

The Komet, no doubt blinded by the smoke from his own weapon, shot through the gap between the two flights, which were not in position to go after him, and probably had not had time to advance power from cruise. The tiny rocket plane arched over toward the west, behind the fighters. It would have been a good choice, but he evidently had not noticed me. As he came over the top and lined up on the Dutch coast for the glide home, I slid in right behind him. A quick burst found his fuel tanks, and he must have had enough of the notoriously touchy hypergolic bipropellant for one last burst of speed, because he exploded instantly. His tiny plane totally disintegrated, and the pilot emerged from the fireball engulfed in flames and writhing. In all my years of simulations, I'd never seen anything like it. I've seen AI pilots close up many times, but never one that appeared to be in agony. I watched him fall to the cloud deck and never saw a chute.

I didn't even have to drop my external fuel tanks and a quick glance told me the other planes still had theirs, as well. The mission was still on.

"Hellfire, this is green flight leader. Nice shooting. Too bad you just shot down something they say the Krauts don't have. Would have made a nice score. But you're more than welcome to come down here and join us."

With my excess speed, I closed with them easily. "Green flight leader, I've been briefed. Sounds like we've got a fight coming, and I'm a little surprised you guys are using the radio so much."

"Shoot, Hellfire, that's our style. Heck, we hope the Krauts know we're coming. They just took a shot at us, and not only did they miss, we picked up another plane! If they keep it up, we'll be a whole wing by the time we get home."

"That'll be enough, Chatterbox. Hellfire, Gramps. I'm the squadron leader today. Pleased to have you aboard."

As I closed with them, I considered the situation. This was a section, not a full squadron, and I wondered if that was part of the ruse. Gramps could not say it, but considering the diversionary nature of their

mission, they may have been ordered to use the radio liberally. That may have been part of the reason they were killed in the real mission. Or maybe they were selected because "Chatterbox Charlie" would be with them. Maybe they were not just heading into trouble. Maybe they were trouble *magnets*.

They say bomber escort missions were hours of boredom interrupted by moments of stark terror, but I found the first leg of the flight entirely pleasant. The cloud deck broke up just inland, and the view was spectacular, but mostly I was just enjoying the company. I didn't say much for a while, I just listened to the jovial patter, while scanning the sky for signs of trouble.

Preacher spotted the bombers first. "Gramps, Big Friends at two o'clock, right where they should be. Been expecting to see them for a few minutes now. Funny, one second, nothing, the next second they were just there."

Oh, great! They spotted another limit of the simulation. The bombers were still a hundred miles away. Preacher must have eyes as good as Yeager and Anderson to have spotted that.

"Check your oxygen, Preacher," Gramps advised.

Not long after that, I spotted the first enemy fighters. "Bogeys at nine o'clock, maybe thirty miles."

Gramps looked to his left. "Tally ho! Got 'em. Okay, boys, get ready for a fight."

I watched the enemy planes, wanting ever so much to go bust up a few, but I smelled a rat. "I don't know, Gramps. Those are Bf 109s, and they don't look like they're interested in our Big Friends."

"Bee Eff? Look like Messerschmitts to me."

I shook my head. Man, was it easy to get tripped up by period terms. The historically correct Bayerische Flugzeugwerke designation for the plane was rarely used in the war. "That they are, Gramps, but I think they're a diversion. I'll bet they have inexperienced pilots in them, hoping to draw us away so the Focke-Wulfs get a clean shot at the Forts."

"Roger." There was a long pause. "Diversion. Right. Okay, guys, keep the mission in mind."

"Little friends, this is Sweet Rosie O'Grady. Are you our escorts?"

"Roger, Rosie. Be there in a few."

"Hey, can anybody see any red on their tails?"

"Naw, they're the hotshots with the checkered noses."

"Swell. Not many of them, either."

The bomber crews did not seem all that thrilled to see us. It occurred to me that the Red Tails were escorting the main body of bombers for which we were the diversion. "Guys, do you know why they were looking for red tails?"

Gramps answered. "They were hoping they drew the 337th, instead of us. I met some of those guys when they were the 99th. They were attached to my unit at Anzio."

"Those colored boys? Why would they want a bunch of darkies?"

"Hey Reb, ain't your plane the 'Black Knight'? That's one of their nicknames. I always figured you was just trying to pass."

"That does it, Spud. I'm a cuttin' off your bourbon ration."

"Hey, I've heard they've never lost a bomber they were escorting to enemy planes."

That was not quite true, but the legend was powerful, and not *far* from the truth. Evidently the bomber crews believed it, likely from direct experience. "So I've heard," I commented. And then an idea occurred to me. For me, simulated combat has always been a game, something I pursued for individual enjoyment and to rack up an impressive score. So why had I spent a fortune to come here and experience this terrible time? Why had I just passed up an opportunity to go bust up a bunch of unskilled pilots, a setup almost identical to the classic "ace in a day" mission? I've never enjoyed bomber escort simulations ... they're time-consuming, difficult, nerve-wracking, and it always bugged me if somebody screwed up and we lost some. If we failed to protect the bombers, so what? This was only a simulation.

But it certainly didn't feel like a simulation. I was keenly aware that the ten Flying Fortresses just ahead of us each carried ten men, with a job to do, and most of them would die or be taken prisoner if we failed to defend them. Dozens of German planes were converging on them, each carrying a pilot with loved ones somewhere down below. They might or might not be Nazis. They were men defending their homes from people intent on dropping huge iron bottles full of high explosives on those homes.

And those tons of high explosives were being dropped in hopes of hitting some target of strategic importance and thereby shorten the war.

And I, we, had a job to do. "Guys, do you want to know how those guys from Tuskegee chalked up that record? They're not in it for glory, and they don't give a rat's ass about their score. They're disciplined. They know their mission is to stick with the bombers and defend them. They don't go off chasing after fighters."

It was a little hard to tell, with several radios transmitting at once, but I believe I could make out cheers from our Big Friends. Pretty damned sophisticated behavior for AIs. I wondered just how much personality Wendy had managed to copy from their originals.

"Duxford Rascals, this is Gramps. Hellfire just nailed it. Let's show the Forts a checkered nose is as good as a red tail. Jerry likes to attack from the front of the formation, or from above. A tight formation of Forts will rip 'em up if they hit from the sides or behind. Yellow flight, blue flight, take up position ahead of the bombers and break into elements. Green flight, red flight, follow me. Break into elements to the right and left."

So, blue and red flights? Nobody said anything to contradict him, so maybe the radio chatter was part of their instructions after all. Either that or we had a squadron that was half phantoms.

"Hellfire, since you forgot to bring a wingman, you want to join my element?"

"I'll come up topside with you, but I don't need a wingman."

"Pride goeth before a fall." Preacher's voice.

"You wanna give me your widow's address before the shootin' starts? I promise I'll console her." That was probably Chatterbox.

What could I tell them? I had enough kills recorded, flying solo, to account for most of the Deutsche Luftwaffe? That I learned to fight on a gizmo called a computer against simulated pilots that were dumber than stumps, with wingmen that were no better? A good wingman can practically read your mind and works with you with minimal and very simple communication. But the simple simulators I first learned on,

and which most hobby pilots learn on, made wingmen useless, or worse. So I developed tactics for fighting solo, including the situational awareness to know where all the planes around me were, and what they were up to. I have since learned to fly with a wingman, but there are maybe a dozen pilots in the world I consider good enough to trust my six to, and, frankly, these guys, none of whom had hit sixty missions yet, were not on the list.

"I've lost too many. I don't want the responsibility. I can take care of myself."

I could sense the stunned silence over the roar of the Merlin.

Flying with a wingman has been doctrine for US fighter pilots since the first World War. The tactic is well proven. It saved lives and increased the success of our forces. They believed in it, heart and soul. But many notable aces, especially among the Germans, had mastered the art of solo combat out of necessity. The scores of the top US aces were tiny by comparison to people like the six I had tackled to prove my point to Wendy. I was better than the best the enemy could offer. Oh, and by the way, I'm a magic man from the future, and I can't be killed. There was no way I could tell these guys why I didn't want a wingman.

I considered the tactics they would probably use. Unlike the movies, where the best pilot leads the attack, smart leaders usually took the wing role for themselves. They put the newbies, fresh out of training and used to shooting at towed targets, out front, where they could focus single-mindedly on the target. The old pros, who had achieved that status by learning to keep a careful watch all around, defended the asses of their aggressive but careless young charges. And the old guys usually got plenty of chances to fight. The rookies were good bait.

That was more or less what I had in mind. I would be backup wingman for the two high elements. But I could not be everywhere at once, and I didn't want them counting on me. I would be like Richthofen, on the edges of the fray, diving in to save a comrade or pick off an unwary enemy.

"Bogeys at twelve o'clock high," Preacher announced. "Fifty miles, closing fast. I make out twelve—no, sixteen. Focke-Wulfs. The long-nosed model by the way they're moving."

Not good news. I *hate* Focke-Wulfs, especially the long-nosed later models that were designed for high altitude. They were as tough as P-47 Thunderbolts and nearly as ugly, with the blunt-nosed look and circular cowling of all fighters with radial engines. Their thick fuselages with small bubble canopies gave them a muscular look. The Thunderbolt was called "the Jug" because of that appearance, and I suppose the somewhat smaller FW190 could be called the soda bottle. They were armed like tanks, with multiple rapid-fire cannons intended to shred bombers, they were fast, and they tended to have excellent pilots. I frankly would rather have been up against an equal number of jets. And if anybody disputes my assessment that they are ugly airplanes, try looking over your shoulder and seeing one pointing those big guns at you, and you'll soon share my opinion.

We would have one thing going for us. On this first pass, the enemy planes would concentrate on the bombers and would ignore us as much as possible. We were about to experience a head-on pass with a combined closing speed over eight hundred miles an hour. The time available for a shot on target would barely be seconds against a thin head-on profile. We didn't have enough fighters to take them all on, and even if our marksmanship and luck were perfect, half of those nasty things were going to rip through the formation of bombers.

The only good thing to say about the situation was the B-17 is a pretty tough airplane, too, and the fast pass would not allow the Germans much shooting time. If we could force them to weave, we might spoil their aims. After that, we would have to see what the Germans would do for a second pass. They might

circle back around for another head-on pass where the guns of the Forts were weakest, but that took a lot of time. Or they might use their speed to climb and loop back over from the top, facing only the top guns of the bombers. We had to be ready for either tactic.

"Hey, Gramps," Preacher asked, "how close do you want us to our Big Friends? They make me nervous. Sometimes they shoot at anything small."

"Hey, squirt, we can tell the difference between a fat wolf and a skinny little pony. You got nothing to worry about unless some skinny little Messerschmitts show up."

"There's your answer, Rascals. Stay close enough to do the job and far enough away to do it in time," Gramps advised.

"Rascals, this is Rosie. If I may be so bold, we're not exactly defenseless. When you're between us and the enemy and closer than about a mile, try to keep our shooting lanes clear. Sometimes we feel kinda helpless when we can't shoot for fear of hitting our guys."

"Roger, Big Friends. We're a team. Rascals, time to drop external tanks."

As I switched to the internal wing tanks and reached for the release, I had time to remember an irony of the war. Compared to the Germans, the Allies were wallowing in fuel. The Mustang had one tank in the fuselage, tanks in both wings, and typically carried drop tanks. You used the fuselage tank first, because it made the plane tail heavy and foul handling in a fight. That meant there was generally plenty of extra fuel in the drop tanks when they were discarded. And it was good stuff, high-octane gasoline, not the crappy synthetic potato squeezings the Germans were forced to use by this time in the war. I wondered what the psychological effect must be on the German pilots, watching a swarm of Mustangs dropping so much precious fuel in one coordinated move. We could fly for hours and still be fat with fuel, but, even on short flights, they had to conserve every drop.

We were setting up for the first pass when Preacher announced, "Stay sharp. There's another wave about thirty miles behind these."

As I dove on the incoming fighters, I pictured the location of the bombers behind us and selected a pair of Focke-Wulfs I could rake without crossing the line of fire of the Forts. I let loose two quick bursts and saw hits on both. One began trailing smoke, but kept going. I think I hit the other in the windscreen, because his thick glass armor seemed to suddenly go cloudy. With luck, he would have difficulty aiming. The pass done, I pulled back and put my plane into climb, intent on looping back to stay close to the bombers, simultaneously keeping an eye on the enemy fighters and conserving energy for whatever would come next.

The smoker was done for the day. He lost altitude and quit after one ineffective pass. The one with the damaged windscreen fired blindly and pulled up to pass over the Forts. Caught in a crossfire of several top turrets and waist guns, his plane was torn to pieces. He bailed out of the wreckage. Two other enemy planes were destroyed on the first pass. I could see that the Forts were taking some damage, but it was difficult to judge the extent. Of the remainder of the enemy fighters, about half began to circle around for another pass from the front, while the other half pulled up for a looping attack over the top. Either way, they had to overcome the forward movement of the bombers, and so were playing catch-up. Advantage, us. Green flight went after the high ones, and yellow flight maneuvered to catch the low ones.

As the Focke-Wulf came over the top, still intent on the bombers, I picked one of the close ones and drove home an attack, admiring their courage for ignoring us. He presented me an irresistible belly shot, and I took full advantage of it, riddling his belly with half-inch holes. His engine spewed black smoke as he bailed out of the useless craft. I rolled on to the six of a nearby fighter and peppered him until he

broke off the attack, but did not pursue him. Instead, I picked one of his comrades, trusting the last one would assume I would stay on his tail and would thus not take advantage of my change of target to latch on to my six. It worked. I got hits on my next victim as well, hopefully damaging him enough that he would have to withdraw from the fight.

I had a few seconds of breathing room to assess the situation. Between the Rascals, the gunners on the Forts, and me, the first wave of fighters had been reduced in strength by about two-thirds, an excellent account. But the second wave was almost on us.

"Yellow flight, take the next wave," Gramps ordered. "Green flight, back on top and take these guys on their next pass."

I looked over at his element. The Focke-Wulf I had let go was sneaking up behind them. "Gramps, Chat, one on your tails."

"Break right," Gramps ordered, and the two planes started a defensive ballet, giving me time to dive in and finish the job. I started to count my kills so far and stopped at three. This was neither the time nor the place.

Things were a blur for the next few minutes, planes every which way, smoke, fire, and tracers crisscrossing the sky. I got a couple more, and the Rascals and bombers definitely did their part because the end result was that the Germans broke off and ran for home without crippling any bombers. It seemed too easy, until the first big black puffs of flak started to explode around us. The job of the fighters ended when the big 88mm guns on the ground took over.

"See you guys on the other side," Rosie declared. "We're over our IP, and you can't help with this stuff."

We formed up and watched as the bombers headed straight and true, navigating off of their initial point, straight toward their target, through the innocent-looking puffs that we knew spewed fragments of deadly steel. Those brave crews just had to hang on and take it, allowing their bombardiers to line up on their target and release their own lethal cargo.

"Where's Booger?" Preacher asked as we formed up. "Anybody see Booger?"

"He went down," Crazy Joe answered. "I didn't see a chute."

And in the silent moment that followed, we watched in horror as a Fort exploded over the target. From the looks of it, they caught flak in their open bomb bay. We saw no sign of survivors from that plane, either.

I was starting to get sick of this, when Preacher spotted another wave of fighters. "Messerschmitts, closing from four o'clock, fifty miles."

The bombers released their load, and I stole a few glances between my scans of the sky to watch the sticks of bombs fall interminably through miles of air, to finally strike their target. "Precision bombing" was what they called it. Precision was considered hitting within maybe half a mile of the target, in this case a small underground synthetic fuel plant. None of the explosions seemed to produce fireballs, and I hoped the result was worth the price. Today, we would send in an unmanned fighter, or a missile, and take out the target with a single dead-on shot. After releasing their loads, the bombers turned and began evasive maneuvers to avoid the persistent flak, until they could join up with us for the trip back to safer air.

As the new wave of Bf 109s closed with us, I hoped these would be the suspected inexperienced flight

we had spotted earlier. When I saw the markings on their planes, I knew otherwise. JG 52 were the terrors of the eastern front, with some ten thousand kills. Late in the war, several Staffeln were withdrawn for service in the West. I'd tangled with these guys before, and they were pros. "Look sharp, Rascals. These guys are trouble."

The rules had changed now that the bombers were done with their target. The Germans were no longer so fixated on the big planes. They wanted *all* of us dead. A furious dogfight ensued. Like it or not, I was Booger's replacement, and Crazy Joe was my wingman. Or, to be more accurate, I was his, since he was the less experienced pilot and needed my watchful eye to keep him out of trouble. The point became moot when he made a serious mistake and tried to snap his plane over too aggressively to go after a Bf 109. The Mustang is agile, but it does not like snap rolls, and that goes double for a heavy fully-armored warbird. His horizontal stabilizer snapped off, and his plane spun out of control. I watched him struggle to open the canopy and bail out. He made it out, but I thought I might have seen the tail hit him as he escaped. His chute opened and he drifted down to an uncertain fate.

It was then that I started to experience something I had never before felt in a simulation. I was angry. Hell, I was *enraged*. I had just lost somebody I was supposed to protect and was helpless to prevent it. I was sick of the whole situation, and I just wanted all of our tormentors dead. I went after them with a single-minded intensity I can't remember feeling before. In short order, I demolished two more, and was closing in on a third, when I noticed something amiss about my opponent. His performance suddenly fell off, and then I noticed his propeller was wind-milling. I was perplexed, because his plane looked undamaged. An engine failure? More likely, he was out of fuel. I felt no pity, and squeezed off a murderous burst intended to make sure he never bothered an Allied pilot again.

As I did, my plane began making a noise like a steel trash can being beat with a tire iron. A couple of holes appeared in my canopy, and something hit the back of my seat like a sledgehammer. Realizing I had stopped checking my six, I initiated a defensive roll. Then, as suddenly as it had started, the racket stopped. I looked over my shoulder to see a Bf 109 trailing smoke and flames off to my left. The plane rolled inverted, and the pilot fell free. Gramps and Chatterbox were close behind me.

"You're welcome, Hellfire."

I looked around. The bombers had made their getaway toward safer skies in France, and the remaining Messerschmitts had turned for home, no doubt critically low on fuel. We had the sky to ourselves. I counted. Six planes remained of the original nine. Spud was missing, and nobody remembered seeing it happen. Considering the damage we had done to the other guys, I supposed I should have been glad the casualties were so light.

They sure didn't feel light.

Flying back toward the coast, we maintained radio silence. All of the joking and bragging were gone. I had time to reflect that my timely warning had made it possible for the Rascals to lose only three instead of all just vanishing, and, as a result, we had saved all of the bombers but the one that was destroyed by flak. Fifty-five lives ... how many people would that affect by my lifetime?

But, really, that had not happened. As real as it felt, this was a simulation. I had not traveled back in time to save these brave men. I had simply created them again, to satisfy my own morbid curiosity about their fate. They had volunteered to face a level of danger I could hardly imagine, knowing they risked losing their lives and wonderful futures because they felt a duty to their country and the need to stop a genocidal dictator. They thought that was what they were doing in the hell I had just put them through. In fact, they were flying for my amusement. Worse, I knew I had wanted to show off my flying skills, gained by a technology none of that generation possessed, to my ancestor. And before long, I was going to tell

Wendy to end the simulation, and these wonderful ghosts would fade back into synth-space, as dead as they had been for over a century and a half.

It struck me then that I had brought them back to life just to kill them again.

England became visible in the distant haze.

"Almost home, Hellfire," Gramps announced. "I know a nice little pub in town. Think you can get permission to join us for the evening? You look pretty shot up, and I think this is an emergency."

"Man, that was a brand-new airplane this morning," Chatterbox added. "The emergency is gonna be when your crew chief sees what you did to it. You better land with us and put in for a transfer."

"I wish I could," I answered with more regret than they could possibly know. "I really wish I could. I've got to get back."

"Angels twelve," Preacher announced. "Okay to get these lousy masks off."

I confirmed our altitude was now below twelve thousand feet and reached up to un-strap my oxygen mask, letting it dangle to one side. I turned to look at Gramps, who up to now I had seen only as a pair of eyes wearing a leather helmet, goggles, and mask. I kept picturing him as the face I had seen in a few black and white photos, but here was the same boyish face in color, alive, breathing, so close, just out of reach. I wanted to give him a hug and buy him a beer, even a warm beer.

"Damn, Hellfire, how old *are* you?"

"I don't know, how old do I look?"

"Forty maybe. Even fifty. Did you train in Spads?"

I was tempted to say I owned one, but I preferred my Sopwith Pup, and was older than he had guessed. "I feel a lot older than that, right now."

"Well, I'll tell you what, old man, you sure fight like a wild man. If you want to transfer down to us, I'll sure as hell take you. How many did you get today, anyway?"

I shook my head. "Who's keeping score? Does it matter?"

"Well, at least tell me your name, so I can look you up."

"Hellfire. Just Hellfire. But it has been a privilege to fly with you, Captain Vincent Doyle."

And with that, I gave him a salute and peeled off in the general direction of Leiston.

As they faded into the distance, Wendy broke in. "The time is rapidly approaching. They're getting too close to home, and they're going to start recognizing something is wrong."

"Just a few more minutes," I pleaded.

"Two maybe, tops."

"Two, then. Don't ask again, just do it."

And two minutes later, the world began to dissolve.

* * * *

When the hatch to the simulator room opened, I was sitting in the cockpit, tears streaming down my cheeks, sobbing like a kid who had just lost his best friend. Wendy gave me a few minutes. When it looked like I had the worst of it out of my system, she walked over and stuck a finger through one of the holes in my canopy.

"I thought you promised you were not going to get too close. How the hell did this happen?"

I looked at the holes, and then thought about the impact behind the seat. At least the shock distracted me momentarily from my grief and I stopped my childish bawling. I un-strapped and climbed out, then pulled the flashlight from my pocket and examined the area behind my seat. I built the simulator from as many cast-off parts as were handy. Since virtually all civilian Mustangs had their armor plating removed to save weight and improve handling, I had plenty of it available from my stash of stuff. It had come in handy for mounting the cockpit components. The seat-back armor, a steel plate half an inch thick, had a huge dent in it, right at the small of my back.

"When this happened, I doubt I was within two hundred yards of any of the Rascals."

"A yard? What's that, the length of the king's pinky finger?"

"A yard is about a meter. Two hundred meters, probably considerably more."

She looked confused and cocked her head to think for a moment. "We'll play it back. I'll bet you were between two elements. The complexity of interaction between nanos is hard to predict. I'll bet they created a region of high fidelity between them. I warned you, nobody has ever run a simulation like this before."

"Yeah, and if wisdom prevails, nobody ever will again. Gramps and Chat were behind me, after the one that got me. The one I was after was heading for Preacher and Reb." I paused to remember. "It may have been more widespread than that. I saw things happen in there that I've never seen before. I think it was more real for the other characters too. I know damned well it was *way* too real for me. Rostov was *right*."

"They're not gone, you know." She handed me a tissue. "S'okay, I was getting kinda teary there at the end too. I saved the sim. But I'll need to erase it from the unit before you relinquish it."

"Let me talk to your business manager. I'll buy it or enter a long-term lease. Something. Although I don't know why. I can never give them their lives back. The world they knew, the world they thought they were fighting for today, is long gone. The best I could do is maybe give them a really nice night in their favorite pub."

"I doubt we could fake that well enough."

I shrugged. "Maybe I owe them an explanation. Maybe they need to understand this. But that would just compound the sin, wouldn't it?"

Wendy looked around the hangar. "Maybe you could bring them back, here and now. Turn this place into a museum. They could work in it."

I paused to consider it. The ethical implications were huge. "I need to think," I said. "I need to think."

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The author would like to thank Bill Gleason for allowing the use of his synth-space nanoticle

simulator technology and its inventor, Dr. Rostov.

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Reader's Department: **IN TIMES TO COME**

Our June issue has a couple of linked, unusual, and immediately obvious traits: the cover illustrates a piece of writing by the artist himself, and that piece is a fact article, not a story. Michael Carroll, well known and regarded as both artist and writer, recently got an inside look at NASA's plans for a project to build an actual settlement on the Moon in the relatively near future, and shares that vision with us here.

As usual, the fiction covers quite a bit of ground, including an alternate history in which Galileo Galilei is psychoanalyzed and “helped” by a chap with a suspicious resemblance to Sigmund Freud—told, not surprisingly, by Harry Turtledove. Donald Moffitt also ventures into the past with a time-traveling art dealer who hopes to get in on the ground floor with one of the Old Dutch Masters. And we'll have a broad spectrum of stories by Stephen L. Burns, Howard V. Hendrix, Richard A. Lovett, and whoever else we can fit in, all enjoyable and thought-provoking.

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Reader's Department: **RADIOACTIVE DECAY AND THE EARTH-SUN DISTANCE** by John G. Cramer

About 22 years ago, the physics world was briefly rocked by claims of evidence for a new "fifth force", based on reanalysis of data from an early twentieth century experiment. Baron Roland von Eotvos, a Hungarian nobleman, had performed extensive measurements of the correlation between inertial mass and gravitational mass and published them in 1922. The lead article in the January 6, 1986 issue of *Physical Review Letters* had the unassuming title: "A Reanalysis of the Eotvos Experiment" by Ephriam Fischbach, et al. Two days later the *New York Times* ran an article with the headline: "Hints of Fifth Force in Universe Challenge Galileo's Findings" describing the possible implications of Fischbach's work.

Peculiar experimental results from Eotvos' gravity measurements and from the behavior of "strange" K-mesons (kaons) were explained in the Fischbach paper by introducing a new theory that proposed a "hypercharge" force, a new fifth force of nature that was gravity-like, but that repelled rather than attracted nearby masses. (See my 15th AV column "Antigravity II: A Fifth Force?" published in the September 1986 issue of *Analog*.) Fischbach's work prompted a number of precision experimental "fifth force" tests. These results, when they became available a few years later, provided compelling experimental evidence that there was *no* fifth force of the type and strength that Fischbach's group had predicted. The fifth force idea had been falsified.

* * * *

Well, Ephriam Fischbach is back with a new reanalysis of old data. In a paper entitled "Evidence for Correlations Between Nuclear Decay Rates and Earth-Sun Distance," his group at Purdue University has reanalyzed data from long-duration radioactive decay experiments performed at Brookhaven National Laboratory (BNL) in 1986 and at Germany's Physikalisch-Technische Bundesanstalt (PTB) in 1998.

Both of these experiments were precision determinations of the half-lives of long-lived radioisotopes. The BNL experiment was a study of the beta decay of the isotope silicon-32 (^{32}Si), which has a half-life of about 172 years. Data was collected over a period spanning more than four years. As a control, the equipment also monitored the beta decay of the isotope chlorine-36 (^{36}Cl), which has a half-life of 301,000 years. Analysis of the data computed the ratio of ^{32}Si to ^{36}Cl decay rates in order to suppress apparatus-dependent systematic variations.

The PTB experiment was a study of the decay of the alpha-decay radioactive isotope europium-152 (^{152}Eu), which has a half-life of about 13.5 years. The measurement spanned over 15 years, and the equipment also monitored the alpha particle decay of the isotope radium-226 (^{226}Ra), which has a half-life of 1,600 years. The PTB group similarly used the data to compute the ratio of ^{152}Eu to ^{226}Ra decay rates, in order to suppress apparatus-dependent systematic variations.

The reanalysis of these data by the Fischbach group indicated that in both experiments there were similar time-dependent variations in the measured counting rates at the level of about 0.1%. Moreover, during a period of about three years in which both experiments were collecting data at the same time, the observed time variations showed a remarkable correspondence.

The observed time variations had a period of one year and appeared to be roughly seasonal. The Fischbach group compared the variations with a number of variables that had an annual cycle. They settled on one particular variable, the distance R between the Earth and the Sun, which varies annually by about (greater than or equal to) 1.7% because the Earth's orbit is slightly elliptical, so that the Earth is closest to the Sun ($R = 147,098,074$ km) on about January 3 and farthest from the Sun ($R = 152,097,701$ km) around July 4. (Curiously, because the seasons are dominated by the tilt of the Earth's rotation axis, the coldest weather in the Northern Hemisphere occurs when the Earth is closest to the Sun

and the sunlight is most intense, and the warmest weather occurs when the total sunlight is weakest.)

When the Fischbach group plotted the variations in $1/R^2$ (i.e., an inverse square law form) with those of the two radioactive decay rate measurements, they found remarkably good correlations. The formal probabilities that the observed correlations could have occurred by uncorrelated random statistical variation were extremely small: 6×10^{-18} for the BNL data and 2×10^{-246} for the PTB data. The variations appear to be real and to be correlated with the Earth-Sun distance.

* * * *

Radioactive decays are supposed to be fundamental processes that are well insulated from the influence of environmental effects. The Fischbach work raises the question of what possible physical phenomenon could produce this kind variation in the decay rate of two distinctly different kinds of radioactive decay, one dominated by the weak interaction and the other by the strong interaction? Or alternatively, what kind of unsuspected systematic error could produce almost identical artifact variations in two distinctly different physical measurements performed thousands of miles apart?

One possibility raised in the paper is that there might be a “scalar field” produced by the Sun that modulates the value of the terrestrial fine structure constant α and thereby changes the radioactive decay rates. They cite a theory that predicts such an effect, but note that the coupling strength that would be needed to produce the observed variations is about 14 orders of magnitude larger than the theory would predict.

Another possibility raised in the paper is that the radioactive decays are reacting in some novel way with the flux of neutrinos coming from the Sun. The intensity of solar neutrino flux would follow the inverse square law, and might also be modulated by changes in solar activity. In a follow-up paper, Jenkins and Fischbach noted that a statistically significant drop in the decay rate of the radioactive isotope manganese-54 (^{54}Mn) during the solar flare of December 13, 2006, with several drops in decay rate correlated with spikes in x-rays from the solar flare as detected by GOES satellites.

However, there seems to be a problem with this link to solar flares. The first paper suggests that a *decrease* in neutrino flux with increasing Earth-Sun distance reduces the radioactivity decay rate, while the solar flare paper suggests that the *increase* in neutrino flux during a solar flare reduces the radioactivity decay rate. You cannot have it both ways.

* * * *

Is it plausible that solar neutrinos could modulate the rate of radioactive decays present on the Earth? I would have to say no. There is no known link between solar neutrino flux and radioactive decay processes (particularly those like the ^{152}Eu alpha-decay that proceeds through the strong interaction) and our present understanding of fundamental interactions suggests that such a hypothetical link is extremely unlikely.

This, however, leaves us with two questions: (1) what is producing the variations that the Fischbach group reports? and (2) if such variations do, for whatever reason, depend on the distance from the Sun, are there other ways of looking for them?

Let's consider question 1 first. Decay rates, which are measured as particle detections per second, require a time standard that precisely divides time into well defined intervals. This is usually done with a crystal oscillator that, because of its physical dimensions, oscillates at a frequency that corresponds to an electrical standing wave in the crystal. The dimensions of such a crystal change with temperature. Temperatures, even in a controlled laboratory environment, can have seasonal variations that reflect the external outdoor temperature of environment and the peculiarities of the heating or cooling system.

Therefore, I would be very suspicious that the reported variations on radioactive decay rate might actually be reflecting some tiny seasonal variations in the time standard used in the measurements. I have no reason to believe that this is the problem, but I think that it should be carefully examined before invoking new physics to explain the observations.

As for question 2, the Earth's orbit has a very small eccentricity, so the annual variations in R are small. A better way of testing whether radioactive decay rates depend directly on $1/R^2$ would be to monitor a radioactive decay process within a space vehicle in a long elliptic orbit with a large eccentricity, so that R has a very large variation. As it happens, NASA has a number of space probes that match this description, because many space probes, particularly those that venture into the outer reaches of the solar system, are powered by radioisotope-driven thermoelectric power sources containing a strong radioactive decay source that produces enough energy as heat to power the vehicle. The power levels of such thermoelectric generators are carefully monitored because they constitute the principal power source of the vehicle.

Therefore, as a test of Fischbach's hypothesis, one should ask NASA scientists whether there is any evidence for variations in the output level on radioisotope power sources in vehicles in long elliptic orbits that would correspond to a $1/R^2$ variation in the radioactive decay rate. However, I suspect that I already know the answer to this question. If such power-level variations were present, they would be large and would long ago have been reported by the scientists and engineers of the space program.

* * * *

In any case, it's an interesting situation. We have suggestive but unexplained observations that may reflect a new and unexpected physical phenomenon. It's a situation that is familiar to readers of hard science fiction and usually leads to spectacular discoveries that drive the plot line. That could happen in this case, but I doubt it.

* * * *

AV Columns Online: Electronic reprints of over 140 "The Alternate View" columns by John G. Cramer, previously published in *Analog*, are available online at: www.npl.washington.edu/av.

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A MEASURE OF DEVOTION

Shane Tourtellotte

Full disclosure is not always an option....

"I heard you're having a debate on the starship program, Linny." Harris Kensil kept his upper body calm and still for the holo, though his foot was twitching out of shot. "I kinda wondered why I had to find out through the newsnets."

Evelyn Prothro had the grace to flush. "Oh, I'm sorry, Harris. You've been, well, quiet lately, and I guess the foundation's AI took you off the notification list. You're invited, of course. Front row, center."

Harris almost said yes, but held himself on course. "I had something closer to the action in mind." Now both feet were shaking. "Something on stage."

"Really?" Evelyn's eyebrows scrunched, the way they always did when she was dubious about something. "That's ... unexpected, Harris. I mean, it's been a while."

"I know exactly how long it's been." Down to the day. "I decided it was too long. So, is there any room for the old guard, or is supporting our brave explorers a job for the youngsters now?"

"You're scarcely old, Harris. That's not—" She stopped and gave him a shrewd look. "Age is not the point."

Well, trading on their shared maturity had been worth a shot. "Is there another point stopping me?" The tremble had reached one knee, and he casually lowered a hand to press it down.

Evelyn thought for a moment. "This deserves more attention than a simple holocall provides. Why don't we meet for dinner tonight? A new place just opened on the north side, and—"

"I'd prefer Dalton's," Harris said, "if that's okay. Something close, and familiar." She gave Harris another searching look. "Of course, I could always cook you up something here. That's been an even longer while."

That flustered her for an instant. "No, Dalton's is fine. Make it six thirty?"

"Perfect. I'll see you then, Linny. Good-bye." He waited until her image had faded completely from the platform before giving in to a single full-body shudder.

But he'd done it. At least the first part, the easiest one.

* * * *

It was natural, he told himself, to be anxious about meeting Linny tonight. He was angling to speak in front of an audience, both live and telepresent, while others tried to tear down everything he said. It was enough to give anyone butterflies, even discounting the two-year layoff. Fortunately, the walk to the restaurant was pleasant and calming. At least with a healthy slug of scotch in him it was.

He could see the Dalton's sign a block away when a noisy group of college-age kids rounded a corner and plowed into him. He felt an elbow, then the brickform of a wall against his back. The gabbling, solipsistic clot passed by without an apology, without even a taunting laugh.

Harris wanted to be mad at them, but the jitters took hold of him again, and he settled for being mad at

himself. It took a long look at his wrist-multi and a mantra of “You'll be late” to pry him off the wall and push him the last few hundred feet.

Things felt much better inside Dalton's. The low light off the dark-paneled walls, the muffled clink of glasses and cutlery, the hint of hearty smells wafting from the kitchen all worked to settle him. He wanted a couple of minutes to draw it all in and reach equilibrium, but the hostess, briskly solicitous, insisted on showing him straight to his table.

Linny was already there. She rose and took his hands in hers. “Good to see you again, Harris.” Harris began to offer his cheek, but there was no kiss coming, so he just sat down.

The menu appeared in the tabletop before him. “So how's the work going, Linny?” he asked as he tapped out his choices. “I don't mean the public relations stuff. How's it really going?”

Linny's eyes lingered on her menu. “It could be better. The election's not so far off, and there's a fair chance that all the candidates for the top spot could end up Homers. That's why we arranged the debate: not just to persuade, but to remind any party that'll listen that there's a real constituency for interstellar exploration.”

“A majority, last I saw,” Harris said, “even if it is getting thin.”

“It's getting *very* thin. A lot of people drawn by the novelty of FTL flight have drifted away, and others who joined us in the flush of the first mission's success have—” She sighed. “—gotten bored, I suppose.”

“Can't see how that's possible.”

Linny gave him one of those looks. “Harris...” She hesitated, then looked down. “Any suggestions for what I should order?”

“Oh, don't go by me.” He hadn't ventured outside three or four favorites in a long while, but he wasn't going to tell her that.

She gave the menu a few taps, and it went away. She looked back up, more resolute now. “Okay, Harris. Did you get bored?”

“What? No, no.” His foot gave a twitch. “I wanted to get back into physics, at least as a consultant. And I have been writing on the foundation's behalf. Some speeches, some essays.”

“All anonymous.”

“Yes. I've still been helping the cause, just more modestly, more quietly. And now, I think it's time that I stepped up and did more. I was hoping that you'd be glad I'd decided that.”

Linny studied him, not even shifting her gaze when the waiter rolled up to deliver their drinks and a bread basket. Harris knew she was measuring him, contemplating whether his old self was back. He bore the scrutiny passively, even stilling his foot.

“How much more were you thinking of doing?”

He sighed and reached for a roll. “I'm not aiming to hog the spotlight. If you had me just deliver opening and closing statements for our side at the debate, that would be fine.” Was he being too meek again? “Anything more would be up to you and the debaters.”

“Hm. Bookending the debate might come across as grandstanding. If you're going to be part of the team,

it needs to be as a full member. Can you handle that?"

He pulled some bread free from the roll. "My debate skills are probably rusty. But if that's what it takes for me to participate, that's what I'll do." He made himself eat the bread, despite a churning stomach.

Her frowning mouth lifted into a wry smile. "A few people at Far Flight will think you're trying to grab back power. They won't like it."

"I'm not trying to grab power, Linny. Earn it back, maybe, but that's for the future. One step at a time," he said, matching her smile.

She nodded. "All right," she said, reaching for the rolls. "Say you're assigned the opening statement. What kind of statement will it be? What will you emphasize?" She took a bite and chewed slowly.

Harris knew what this was: an audition. He could have taken offense, maybe should have, but he put that aside. He began talking, laying out points and arguments as Linny gradually worked through two rolls.

As he talked, an old feeling bubbled up within him, something close to exhilaration. Writing essays in a quiet corner of his home didn't bring it. Hearing others say the things he believed so zealously never produced it. Making the case himself, face to face, did. It made him think he could actually pull off this return from the shadows.

She didn't say anything after he finished, but her face told him he had passed the test. In the fading rush of the moment, he dared some frankness. "Time was, Linny, when I didn't have to prove myself to you."

She turned aside, covering her unease with a dab of her napkin. "That's true. That was two years ago." She looked back. "What happened, Harris? What took you away? What ... hurt you?"

"Oh, don't overdramatize things. There was no medical crisis, no stroke, no sudden onset of mental illness. That is what people were speculating, right?" That discomfited her enough to let him squeeze out of the question. "So what's the verdict? Am I in for next week?"

"Well..." The waiter rolled up with their entrees. "It's not all my decision, but I'll let you know."

* * * *

Harris switched off the holophone and started to whoop, but it came out as a squeak. He was on the team—and the hypothetical becoming a fact hit him hard in the gut.

He was going to be debating, not just declaiming. Linny had confirmed he would have to participate in the whole debate. He had agreed, of course, with a readiness he hoped was well feigned.

Now the nerves were hitting him, and he knew one way to combat them. He sat back down at his workstation and got cracking on his opening statement. With some diligence, he could have it in shape for the team strategy session tonight that Linny had mentioned.

He got only twenty minutes' work done before the house computer interrupted him. "There is an incoming call, sir. A member of the press requesting an interview."

Harris groaned. The point of the debate was publicity for their cause, but he had hoped to avoid this. "Put him off, please, but politely. Tell him I'm too busy preparing for the debate. Do that for any journalists, in fact."

"Understood, sir."

That silence, and the little bubble world that composing his remarks created around him, got him through until the evening. When the time arrived, he reset his workstation for immersive projection, and a conference room appeared around him. He was seated at a round table of smooth dark wood, with two of his debate partners already there.

"Ittai, hello. It's been too long." Ittai Haleri nodded his heavy head in reply. "And Mei-li, you're looking well." Hu Mei-li was giving a warmer greeting when the last member shimmered in.

"I don't think you've met Roman," she said. "Harris, this is Roman Feiffer, one of our rising talents. Roman, meet Harris Kensil."

"A pleasure, sir," Harris said, mastering a flutter of anxiety. Feiffer muttered something Harris didn't quite catch and quickly began discussing strategy with the others. Harris waited for an opening.

"I've got an early version of my opening statement already prepared." Copies appeared before each of them. "If you have comments, suggestions for revision, I'm all ears."

The others began reading, two of them with neutral faces, Feiffer with a fixed scowl. "I wish it were Ketta delivering this," he said.

"How's that?"

Ittai started to chastise Feiffer, who paid no heed. "You bumped Ketta Roselli to get on the team, Mr. Kensil. She's an excellent public speaker, but she was junior, so she had to go."

Harris instinctively began stammering out an apology, but the others beat him by apologizing for Feiffer first. The rest of the meeting felt like being squeezed in a vise. They got work done, but Harris was never unaware of Feiffer's resentment, or the reserve of Ittai and Mei-li. They were not what anyone would have called a team that night.

Things went much easier the next couple of days, as Harris spent them working alone. He incorporated all the suggestions from the meeting, even those from Feiffer that weren't outright sarcastic. They did improve the text, and Harris decided he'd have to thank Feiffer for a couple of acute points. Just not right away.

He set up mock debate sessions, with his house computer filling in as his adversary. The computer was limited, naturally. No computer was allowed to even approach the processing power where it could become self-aware: One Emergence War in history was quite enough. Still, his home-comp made an adequate sparring partner, with which he could restore some atrophied skills.

It was a pleasant solitary stretch, but the outside world insisted on intruding. A story about comments by one of his upcoming debate opponents climbed the news hierarchy, and Harris finally could not resist accessing it. It was nasty, and worse, it was about him.

"The Far Flighters are in the wrong," Dr. Myron Jakes said in the clip, "and they're hoping a stunt like resurrecting a dropout from their movement will cover that up. They don't see how it's going to backfire, or maybe they have no better alternatives. But really, what can they expect from someone going through the motions for a cause he no longer embraces?"

Jakes said more, all of it just as high-minded and complimentary. Harris was no longer listening, as he spluttered and raged at the air, until his home-comp politely asked if it should summon medical assistance. He declined that help, finally shut off the news link, and sat down to compose a scorching public rebuttal.

After twenty minutes of staring at his screen, he called Linny instead.

"Yes, I heard it, Harris. Pretty low stuff, I thought."

"I was thinking plenty worse. I'm ready to send a response in kind, if I have your leave."

"I'd ... rather you didn't. I've already talked to Drew and Ito on the board, and they're looking to take the high road on Jakes. We'll be issuing our own statement. If you insist on replying, at least run it past us first."

"I understand, Linny. I'll see what the board releases before I do anything more. Good-bye."

He cut off fast, before she could see through him. He had wanted her to spare him from responding. He felt no better for getting his wish. Linny might not think him a coward, but he'd know.

He called up his opening remarks and started another polish, to give him something else to think about.

* * * *

Harris walked onto the busy stage. His colleagues and adversaries were consulting with the moderator near the tables. Cameras were floating into position for the broadcast. Through the one-way curtain, he saw the last empty seats in the auditorium filling up. Seeing all those people gave his stomach a fresh lurch, but it passed.

Hu Mei-li came over. "Our esteemed opponents drew the long straw. They'll give their opening statement first, but we'll have last word at the closing." Harris nodded his head. Mei-li tipped hers. "Are you okay, Harris?"

"I'm ... yes. I think so." That good belt of scotch, plus the little something extra, seemed to be doing the job.

"Good. Let's introduce you around. I promise, most of them don't bite."

He knew the moderator from way back and exchanged pleasant words. He gave handshakes to the opposing debaters, even a quick cold one with Jakes. Small talk filled the time until the moderator sent them to their seats.

The curtain flashed three times, then evaporated. The audience began applauding ... and Harris felt like he was falling into a deep, deep well.

"...and welcome to tonight's debate on..."

He remembered the sensations of stage fright from the one time he had it, over thirty years ago. It hadn't been nearly this penetrating, this paralyzing. He started cursing himself inside. All his preparations, and for nothing.

"...four distinguished members of the Far Flight Foundation..."

No! He had to fight. He had to *think*. His opening remarks: How might he have to modify them, depending on how the anti-exploration side opened the debate? He felt a hand on his arm, but shook it off.

"...opening statement, Dr. Myron Jakes."

Fighting his spinning head, Harris fixed his attention on Jakes rising to speak. He noted a quick glance, and an even quicker sneer, before Jakes began.

With the first words, Harris felt back on solid ground. Jakes was rattling off all the needs humanity had, things like expanding the public personal databases, producing a universal telepathic interface, abating icecap reexpansion, even building up Martian infrastructure and broadening asteroid prospecting. All this, of course, would need money that interstellar exploration was siphoning off. The argument dated back to the twentieth century, and Harris knew how to dismantle it in his sleep.

"All those things must go ill funded," Jakes continued, "because of one faction, indulging a selfish pursuit of personal curiosity at others' expense." The personal slant stung, but Harris kept cool. "No practical benefit accrues to us. The findings from each system have carried a dismal sameness. We're assured that the next system on the list will bring something new and fascinating, a pledge we keep hearing.

"This time they're promising life. If they find it, that will be their excuse to demand much more funding. If they don't, that will be their excuse to demand much more funding, to learn why their expectations were disappointed. Everything will have to be bigger: larger budgets for larger ships going longer distances with bigger crews—and bigger computers."

The audience murmured, and Harris rankled. Exploiting fears of a Reemergence was demagoguery. Harris knew just how wrong Jakes's insinuation was—but he wouldn't be able to say how.

Jakes finished his statement—"It's time to stop the snowball, before it grows too big for all of us."—and sat down to moderate applause. Even before the moderator called his name, Harris was on his feet. He took a breath.

"Socrates knew thy—er, he said—"

He stopped, grabbed his water glass, and took a big drink. He fought down a twitch in his leg. He would not give in. He would not.

"Socrates said, 'Know thyself.' We are a part and a product of our universe, so to truly understand who we are, we must understand the underve—the universe. And as far as our horizons have expanded the last two hundred cent—years, the universe is still almost vast—too vast for our comprehension. So ... we have a lot of work ahead."

It only got worse. He felt his partners growing restive, the audience disdainful, his opponents derisive. The awareness only compounded his struggles. The snowball was, indeed, growing fast, but he had to keep talking.

"Lacking curiosity is a bad enough fault." His voice squeaked, and he thought he heard a snort from Jakes. "But dropping broad hints of nebulous dangers is worse. It plays on fear, and I'd like to think we're all above such fear here."

Titters ran through the audience. Down the table, he could see Roman Feiffer lowering his head. Part of Harris perceived the debacle this had become. The stubborn part somehow won out. Feiffer was biased, after all, and there were bound to be Homer partisans in the audience.

He muddled on to the end of his remarks. For the night, of course, it was only the beginning.

* * * *

The doorbell rang, and Harris winced. He'd told the house not to accept calls, but someone was persistent enough to intrude in person. "Voice," he told the computer, then, too loudly, "Who is it?"

"Evelyn."

Harris rubbed his aching head. Worse than the press: them he could ignore. "One minute," he said. He

thought of changing out of his pajamas and robe, but that would take too long. Better that he take his medicine quickly.

Linny marched inside the instant he opened the door. "Why did your house refuse my call?" she demanded.

"I've been busy this morning, and hello to you too."

She looked him up and down. "Have you seen any of the coverage, or were you too busy for that too?"

"Yes. I was too busy." He knew how weak the lie was. He was too scared to read and hear what he expected, and Linny could probably tell that at a glance.

"It was rough," she said, still curt. "Rougher than I expected, and most of it directed at you." He didn't try to keep his eyes raised, looking straight at her feet. "The consensus is that you cost us the debate, Harris. You're being mocked: the coward who wants us to be courageous. And I don't have a rebuttal for them."

"I'm sorry." He raised his eyes a little, up to her knees. "I didn't realize how rusty I was at public speaking. I have to work on that, get myself back up to snuff. In a few months, maybe a little longer—"

"Harris, no." Her voice had gotten hoarse. "We have to face the facts. You're not an asset to us any longer; you're a liability. You need to retire from the public side of our cause, this time for good. If you don't, if I don't have your commitment to quit before I leave your home, then the foundation's board will have no choice but to publicly disavow you as unfit to represent our cause."

And there it was. He could walk through the door or be kicked through. "The board," he rasped. "That's including you?"

"Yes. Including me."

A part of him was relieved, ready to accept her demand, craving the release of quitting. The part that was weak, the part that was mutilated. The part he hated.

He finally looked up, right at her stony face. "Do you have no choice but to stop me from writing as well?"

"No. If you remain anonymous, you can keep writing your speeches and essays. That's fine."

She looked pleased to drop him those crumbs. Such a good friend. "How generous of you, Evelyn," he croaked, turning away. "I'm glad there's some level at which I'm still tolerated."

"Harris, please!"

He heard her voice crack, but didn't turn back, not wanting to see.

"Harris, if you doubt me at all, watch the news reports, read the journals. Better, watch the debate over. Watch your performance and compare it to what you were doing three, five, ten years ago." She sniffled and gulped. "If you're honest with yourself ... if you're as honest as I had to be with myself..."

His head turned, against his will. He caught a glimpse of her face, reddened and anguished, before he flinched away.

"We're in the fight of our lives here," she said, "tougher even than getting the original program passed. We need our best public face at every moment, and I'm sorry, Harris, but that isn't you." She sniffled again. "Part of it's my fault. I was too easy to convince, too ready to believe. The board might have to

make an example of me too."

"They can't." His head snapped around. She looked more poised now, any tears wiped away. "Linny, that's not fair."

"Oh, none of it's fair. What happened to you ... whatever it was, whatever you won't tell me, I wish I could undo it. I wish I could have the old you back, Harris. The eloquence, the inspiration—and yes, the bravery."

Harris fought to say nothing, to honor the pledge he had made. He yearned for the understanding, but knew it couldn't be. The irony was so bitter: He was a coward today because he had been so courageous two years ago...

* * * *

The starship Saint Brendan the Navigator streaked through T-space, its entire crew in hibernation for the almost-concluded voyage. All except, in a sense, for one.

Harry was processing the geometry of the surrounding T-space as fast as the sensors could funnel the data to it. Only it could guide the ship through all of the weird topological kinks, sinks, gaps, and traps, making a smooth course toward Beta Canum Venaticorum. That was the reason it was created—or perhaps more accurately, recreated.

Mere computers could not navigate T-space. To meet its demands, they'd have to be far too large, well past the emergence point into self-awareness. Human intuition could handle the task with enough training, but human bodies could not maintain consciousness within T-space for more than a quarter hour. So they had needed human-analog minds.

Harry knew it wasn't a true human mind, but a partial copy imprinted into the blank crystalline matrix of a computer core. It was circumscribed, pared down for the task for which it was created. That thought could disturb it, in moments when it wasn't so busy.

Making one last check of its calculations, Harry powered up the interdimensional transiter, and at the right millisecond, shifted Saint Brendan back into normal space. Its reckoning was excellent: The ship popped out seventeen AUs from the primary, well below the ecliptic, in no collision danger.

And that was it. The ship's main computer began waking the crew and gathering preliminary telemetry and would handle all functions until the return voyage began. Harry could go dormant.

But why would it? The first visual feeds of the system's planets were coming in. Harry tapped into those feeds, taking in the sights it had traveled thirty light-years to reach. And there was the second planet, clothed in a green not quite that of Earth, but vibrant enough to know that something was living, thriving, down there.

Harry was not a true human, but when captured by wonders such as these, the distinction meant nothing.

* * * *

Harris remembered listening to the appeal of the head of the Combined Space Agency two years back. Even as Ms. Jabali had emphasized the risks of the dupling process, he had heard the desperation beneath, her need for someone who would say yes, and then say nothing. In a world that still didn't quite trust the restraints it had put on its computers, an innovation like this would scare many, many people, and almost certainly doom the exploration program if it became general knowledge.

But she had come to the right man, one with both discretion and nerve. He willingly offered his brain as the model for the third starship's navigational computer. He had the right grounding in interdimensional physics from which to train a pilot. Just as important, he learned, he had other things a pilot needed in the terrifying topography of T-space: adventurousness, intrepidity, simple courage.

Of course, the dupling machine worked extra hard to copy those traits. And, just as Jabali had warned might happen, the intensive copying process all but effaced them from his own mind.

"Harris? Harris, will you please say something?"

He so wanted to explain it all to Linny. More than anyone he'd ever known, she would understand. But he was bound by his word, and his convictions. The cause far outweighed the solace of one person, or even two.

"All right, Evelyn. You win."

She looked like he had slapped her. "I wasn't trying to win anything," she said, as a fresh tear rolled from her eye. "I don't feel like I've won anything."

"Then maybe this will sound better: You're right." He reached for her hand. "You're right, and I'm sorry I was too foolish to realize it before."

If that moment of self-abasement comforted her, she gave no sign. She didn't clasp his hand, merely tolerating his hold. He let her go, sparing her that discomfort. If he had broken their friendship, he would mourn it, but it was one more loss he would find a way to tolerate.

"You're right," Harris said one last time. "I've done enough for the cause."

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Novelette: **A STORY, WITH BEANS** by Steven Gould

People adapt, even if they don't fully remember what they're adapting *to*....

Kimball crouched in the shade of the mesquite trees, which, because of the spring, were trees instead of their usual ground-hugging scrub. He was answering a question asked by one of the sunburned tourists, who was sprawled by the water, leaning against his expensive carbon-framed backpack.

"It takes about a foot of dirt," Kimball said. "I mean, if there isn't anything electrical going on. Then you'll need more, depending on the current levels and the strength of the EMF. You may need to be underground a good ten feet otherwise.

"But it's a foot, minimum. Once saw a noob find a silver dollar that he'd dug up at one of the old truck stops west of Albuquerque. 'Throw it away!' we yelled at him. Why did he think they replaced his fillings before he entered the territory? But he said it was a rare coin and worth a fortune. The idiot swallowed it.

"We could have buried him. Kept his face clear but put a good foot of dirt over him. That could've worked, but there were bugs right there, eating those massive hydraulic cylinders buried in the concrete floor of the maintenance bays, the ones that drove the lifts.

"We scattered. He ran, too, but they were all around and they rose up like bees and then he stepped on one and it was all over. They went for the coin like it was a chewy caramel center."

There were three college-aged tourists—two men and a girl—a pair of Pueblo khaki-dressed mounted territorial rangers that Kimball knew, and Mendez, the spring keeper. There was also a camel caravan camped below the spring, where the livestock were allowed to drink from the runoff, but the drovers, after filling their water bags, stayed close to their camels.

There were predators out here, both animal and human.

"What happened to the noob?" the tourist asked.

"He swallowed the coin. It was in his abdomen."

"What do you mean?"

"Christ, Robert," the girl said. "Didn't you listen to the entrance briefing? He died. The bugs would just go right through him, to the metal. There aren't any trauma centers out here, you know?"

One of the rangers, silent until now, said, "That's right, miss." He slid the sleeve of his khaki shirt up displaying a scarred furrow across the top of his forearm. "Bug did this. Was helping to dig a new kiva at Pojoaque and didn't see I'd uncovered the base of an old metal fencepost. Not until the pain hit. There weren't many bugs around, but they came buzzing after that first one tasted steel and broadcast the call. I was able to roll away, under the incoming ones."

"Why are you visiting the zone?" asked Mendez, the spring keeper. He sat apart, keeping an eye on the tourists. The woman had asked about bathing earlier and the rangers explained that you could get a bath in town and there was sometimes water in the Rio Puerco, but you didn't swim in the only drinking water between Red Cliff and the Territorial Capitol.

"You can bathe without soap in the runoff, down the hill above where the cattle drink. Wouldn't do it below," Mendez had elaborated. "You can carry a bit of water off into the brush if you want to soap 'n' rinse."

Kimball thought Mendez was still sitting there just in case she did decide to bathe. Strictly as a public service, no doubt, keeping a wary eye out for, uh, tan lines.

The woman tourist said, "We're here for Cultural Anthropology 305. Field study. We meet our prof at his camp on the Rio Puerco."

"Ah," said Kimball, "Matt Peabody."

"Oh. You know him?"

"Sure. His camp is just downstream from the Duncan ford. He likes to interview the people who pass through."

"Right. He's published some fascinating papers on the distribution of micro-cultures here in the zone."

"Micro-cultures. Huh," said Kimball. "Give me an example."

"Oh, some of the religious or political groups who form small communities out here. Do you know what I mean?"

"I do." Kimball, his face still, exchanged a glance with the two rangers.

As the woman showed no sign of imminent hygiene, Mendez climbed to his feet, groaning, and returned to his one room adobe-faced dugout, up the hill.

The woman student became more enthusiastic. "I think it's so cool how the zone has ended up being this great nursery for widely diverse ways of life! I'm so excited to be able to see it."

Kimball stood up abruptly and, taking a shallow basket off of his cart, walked downstream where the cattle watered. He filled the basket with dried dung: some camel, horse, and a bit of cow. He didn't walk back until his breathing had calmed and his face was still. When he returned to the spring, one of the rangers had a pile of dried grass and pine needles ready in the communal fire pit and the other one was skinning a long, thin desert hare.

Kimball had a crock of beans that'd been soaking in water since he'd left Red Cliff that morning. Getting it out of the cart, he added more water, a chunk of salt pork, pepper, and fresh rosemary, then wedged it in the fire with the lid, weighted down by a handy rock.

"What do you do, out here?" the woman tourist asked him. Kimball smiled lazily and, despite her earlier words, thought about offering her some beans.

"Bit of this, bit of that. Right now, I sell things."

"A peddler? Shouldn't you be in school?"

Kimball decided he wasn't going to offer her any of his beans after all. He shrugged. "I've done the required." In fact, he had his GED, but he didn't advertise that. "It's different out here."

"How old are you?" She asked.

"How old are *you*?"

She grinned. "Personal question, eh? Okay. I'm nineteen."

"I'm sixteen. Sweet, never been kissed."

She cocked her head sideways. "Yeah, right."

"Kimball," one of the rangers called from across the fire-pit, "A quarter of the hare for some beans."

"Maybe. Any *buwa*, Di-you-wi?" Kimball asked.

"Of course there's *buwa*."

"*Buwa* and a haunch."

The two rangers discussed this in Tewa, then Di-you-wi said, "*Buwa* and a haunch. Don't stint the beans."

They warmed the *buwa*, rolled up blue-corn flatbread, on a rock beside the fire. Kim added a salad of wide-leaf flame-flower and purslane that he'd harvested along the trail. The rangers spoke thanks in Tewa and Kimball didn't touch his food until they were finished.

The woman watched out of the corner of her eyes, fascinated.

The tourists ate their radiation-sterilized ration packs that didn't spoil and didn't have to be cooked and weren't likely to give them the runs. But the smell of the hare and beans wafted through the clearing and the smell of the packaged food didn't spread at all.

"That sure smells good," the girl said.

Kimball tore off a bit of *buwa* and wrapped it around a spoonful of beans and a bit of the hare. He stretched out his arm. "See what you think."

She licked her lips and hesitated.

"Christ, Jennifer, that rabbit had ticks all over it," said the sunburned man. "Who knows what parasites they—uh, it had."

The rangers exchanged glances and laughed quietly.

Jennifer frowned and stood up, stepping over sunburn boy, and crouched down on her heels by the fire, next to Kimball. With a defiant look at her two companions, she took the offered morsel and popped it into her mouth. The look of defiance melted into surprised pleasure. "Oh, wow. So *buwe* is corn bread?"

"*Buwa*. Tewa wafer bread—made with blue corn. The Hopi make it too, but they call it *piki*."

"The beans are wonderful. Thought they'd be harder."

"I started them soaking this morning, before I started out from Red Cliff."

"Ah," she lowered her voice. "What did they call you earlier?"

"Kimball."

She blinked. "Is that your name?"

"First name. I'm Kimball. Kimball ... Creighton."

Di-you-wi laughed. Kimball glared at him.

"I'm Jennifer Frauenfelder." She settled beside him.

"Frauenfelder." Kimball said it slowly, like he was rolling it around in his mouth. "German?"

"Yes. It means field-of-women."

Di-you-wi blinked at this and said something in Tewa to his partner, who responded, "Huh. Reminds me of someone I knew who was called Left-for-dead."

Kimball rubbed his forehead and looked at his feet but Jennifer said, "Left-for-dead? That's an odd name. Did they have it from birth or did something happen?"

"Oh," said Di-you-wi, "something happened all right." He sat up straight and spoke in a deeper voice, more formal.

"*Owei humbeyo.*"

(His partner whispered, almost as if to himself, "Once upon a time and long ago.")

"Left-for-dead came to a village in the Jornada del Muerte on the edge of the territory of the City of God, where the People of the Book reside." Di-you-wi glanced at Jennifer and added, "It was a 'nursery of diverse beliefs.'

"Left-for-dead was selling books, Bibles mostly, but also almanacs and practical guides to gardening and the keeping of goats and sheep and cattle.

"But he had other books as well, books not approved by the Elders—the plays of Shakespeare, books of stories, health education, Darwin.

"And he stole the virtue of Sharon—"

The two male tourists sat up at that and the sunburned one smacked his lips. "The dawg!"

Di-you-wi frowned at the interruption, cleared his throat, and went on. "And Left-for-dead stole the virtue of Sharon, the daughter of a Reader of the Book by trading her a reading primer and a book on women's health."

"What did she trade?" asked the leering one.

"There was an apple pie," said Di-you-wi. "Also a kiss."

Jennifer said, "And *that's* how she lost her virtue?"

"It was more the primer. The women of the People of the Book are not allowed to read," added his partner.

"Ironic, that," said Kimball.

"Or kiss," said Di-you-wi said with a quelling glance. He raised his voice. "They burned his books and beat him and imprisoned him in the stocks and called on the people of the village to pelt him but Sharon, the daughter of the Reader, burned the leather hinges from the stocks in the dusk and they ran, northwest, into the malpass where the lava is heated by the sun until you can cook *buwa* on the stones and when the rain falls in the afternoon it sizzles like water falling on coals.

"The Elders chased them on horseback but the malpass is even harder on horses than men and they had to send the horses back and then they chased them on foot but the rocks leave no prints."

"But the water in the malpass is scarce to none and Left-for-dead and the girl were in a bad way even though they hid by day and traveled by night. Once, in desperation, Left-for-dead snuck back and stole a water gourd from the men who chased them, while they lay sleeping, but in doing so he put them back on the trail.

"Two days later, Sharon misstepped and went down in a crack in the rock and broke both bones in her lower leg. Left-for-dead splinted the leg, made a smoke fire, and left her there. The People of the Book found her and took her back, dragged on a travois, screaming with every bump and jar.

"They discussed chasing Left-for-dead and then they prayed and the Reader said God would punish the transgressor, and they went back to their village and spread the story far and wide, to discourage the weak and the tempted.

"Left-for-dead walked another day to the north, hoping to reach the water at Marble Tanks, but he had been beaten badly in the stocks and his strength failed him. When he could go no further he rolled into a crevice in the lava where there was a bit of shade and got ready to die. His tongue began to swell and he passed in and out of darkness and death had his hand on him."

Here Di-you-wi paused dramatically, taking a moment to chase the last of his beans around the bowl with a bit of buwa.

Jennifer leaned forward. "And?"

"And then it rained. A short, heavy summer thunderstorm. The water dripped down onto Left-for-dead's face and he drank, and awoke drinking and coughing. And then drank some more. He crawled out onto the face of the malpass and drank from the puddles in the rock and was able to fill the water gourd he'd stolen from the Reader's men, but he didn't have to drink from it until the next day when the last of the rain evaporated from the pockets in the lava.

"He made it to Marble Tanks, and then east to some seeps on the edge of the lava flows, and hence to the Territorial Capitol."

"Because the incident with Left-for-dead was just the latest of many, a territorial judge was sent out with a squad of rangers to hold hearings. The City of God sent their militia, one hundred strong, and killed the judge and most of the rangers.

"When the two surviving rangers reported back, the territorial governor flashed a message beyond the curtain and a single plane came in answer, flying up where the air is so thin that the bugs' wings can't catch, and they dropped the leaflets, the notice of reclamation—the revocation of the city's charter."

"That's it?" said Jennifer. "They dropped a bunch of leaflets?"

"The first day. The second day it wasn't leaflets."

Jennifer held her hand to her mouth? "Bombs?"

"Worse. Chaff pods of copper and aluminum shavings that burst five hundred feet above the ground. I heard tell that the roofs and ground glittered in the sunlight like jewels."

The sunburned man laughed. "That's it? Metal shavings?"

"I can't believe they let you through the curtain," Jennifer said to him. "Didn't you listen at all?" She turned back to Di-you-wi. "How many died?"

"Many left when they saw the leaflets. But not the most devout and not the women who couldn't read. The Speaker of the Word said that their faith would prevail. Perhaps they deserved their fate ... but not the children.

"The last thing the plane dropped was a screamer—an electromagnetic spike trailing an antennae wire several hundred feet long. They say the bugs rose into the air and blotted the sun like locusts."

Jennifer shuddered.

Di-you-wi relented a little. "Many more got out when they saw the cloud. I mean, it was like one of the ten plagues of the first chapter of their book, after all. If they made it outside the chaff pattern and kept to the low ground, they made it. But those who stayed and prayed?" He paused dramatically. "The adobe houses of the City of God are mud and dust and weeds, and the great Cathedral is a low pile of stones and bones."

"*Owei humbeyo.*" Once upon a time and long ago.

Everyone was quiet for a moment though Jennifer's mouth worked as if to ask something, but no sound came out. Kimball added the last of the gathered fuel to the fire, banged the dust out of his basket, and flipped it, like a Frisbee, to land in his rickshaw-style handcart. He took the empty stoneware bean crock and filled it from the stream and put it at the edge of the coals, to soak before he cleaned it.

"What happened to Sharon?" Jennifer finally asked into the silence.

Di-you-wi shook his head. "I don't know. You would have to ask Left-for-dead."

Jennifer: "Oh, thanks a lot. Very helpful."

Di-you-wi and his partner exchanged glances and his partner opened his mouth as if to speak, but Di-you-wi shook his head.

Kimball hadn't meant to speak, but he found the words spilling out anyway, unbidden. "I would like to say that Sharon's leg still hurts her. That it didn't heal straight, and she limps. But that she teaches others to read now down in New Roswell. That I had seen her recently and sold her school some primers just last month."

Jennifer frowned, "You would like to say that?"

"It was a bad break and I set it as best I could, but they bounced her over the lava on their way home and trusted to God for further treatment. She couldn't even walk, much less run, when the metal fell."

Jennifer's mouth was open but she couldn't speak for a moment.

"Huh," said Di-you-wi. "Hadn't heard that part, Left-for-dead."

Kimball could see him reorganizing the tale in his head, incorporating the added details. "Got it from her sister. After I recovered."

Jennifer stood and walked over to Kimball's cart and flipped up the tarp. The books were arranged spine out, paperbacks mostly, some from behind the Porcelain Wall, newish with plasticized covers, some yellowed and cracking from before the bugs came, like anything that didn't contain metal or electronics, salvaged, and a small selection of leather-bound books from New Santa Fe, the territorial capitol, hand-set with ceramic type and hand-bound—mostly practical, how-to books.

"Peddler. Book seller."

Kimball shrugged. "Varies. I've got other stuff, too. Plastic sewing-needles, ceramic blades, antibiotics, condoms. Mostly books."

Finally she asked, "And her father? The Elder who put you in the stocks?"

"He lives. His faith wasn't strong enough when it came to that final test. He lost an arm, though."

"Is he in New Roswell, too?"

"No. He's doing time in the territorial prison farm in Nuevo Belen. He preaches there, to a very small congregation. The People of the Book don't do well if they can't isolate their members—if they can't control what information they get. They're not the People of the *Books*, after all.

"If she'd lived, Sharon would probably have made him a part of her life ... but he's forbidden the speaking of her name. He would've struck her name from the leaves of the family Bible, but the bugs took care of that."

Di-you-wi shook his head on hearing this. "And who does this hurt? I think he is a stupid man."

Kimball shrugged. "It's not him I feel sorry for."

Jennifer's eyes glinted brightly in the light of the fire. She said, "It's not fair, is it?"

And there was nothing to be said to that.

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THE BROTHER ON THE SHELF

Philip Edward Kaldon

It's easy to romanticize war when it's too distant to seem real. But there may be new ways to bring the reality home....

Tuesday 14 July 2882

Summer streets had been dusty in Ames, Iowa for so long, it was just an accepted part of the season. Construction had removed some old homes on Lewis Street west of the university and the vacant lots added to the dust. Across the ruts left over from the bulldozers last year, two small figures maneuvered their bicycles with care. The enercells on the bikes were pretty run down, so they had to pedal with great effort in the lower gears without motorized boost to climb over the steep ridgeline made from great piles of construction dirt, but from there it became almost an easy glide down to the break in the chain link fence on the other side.

"Come on," Billy Johnson called out to his brother Connor. "Nobody in this unit falls behind!"

"Easy for you to say," the smaller boy scowled. There were three long years between them, but he still made an effort to catch up.

It was Tuesday and that meant Mr. McPherson had the new packets of trading cards in at the store—and the Johnson boys had to get there first.

* * * *

"What'll it be, gentlemen?" old Mr. McPherson leaned over his counter and smiled down at the boys.

"Coke," Billy said without hesitation.

Connor thought about it some, then settled on, "Strawberry."

"One Coca-Cola, one Strawberry Poporific comin' up," Mr. McPherson repeated.

As he opened the cooler and pulled out two stiff semi-triangular cylinders, the two boys stepped purposefully over to look at a rack display of foil packets. It all required a special kind of scrutiny. First of all, they were only interested in Series 118 today—the 118th week of the war against the Enemy aliens. Second, you really had to make sure the metal foils were intact. Third, you had to hold them up to the window and make sure the sunlight didn't make it through. Only then did you decide to take the chance and figure out which packets you wanted.

"Pop and two packs of FleetCards." Mr. McPherson checked the autoscan. "That'll be two dolleros thirty-eight each, gentlemen."

Each of the boys solemnly put one dollero coin and one two-dollero coin on the counter, and then collected the sixty-two centidolleros in change.

"See you gentlemen next week," Mr. McPherson smiled again at the two boys.

"Bye," Billy managed. Connor already was sucking on his drink.

* * * *

The bikes were carelessly dumped at the edge of the sidewalk, not more than three meters from the tree

the boys camped out under.

Billy tore open his first packet and began to sort the cards aloud, “Dead, dead, probably okay, don't know.” The piles were of Fleet warships he knew were destroyed in the war, and those that were at risk or not at all. A typical card showed the *USFS Broward T. Lee* (FFL-2714). The small Callisto frigates had been ordered out of the war zone early on, but a number had been caught out there in the first battles. The *Lee* wasn't one of those, so it was an easy bet it was probably okay today.

Speed was of the essence. An L-shaped conductive edging on two sides of each card formed an antenna to pick up the signals from the six Toyo gaming satellites—they passed roughly overhead every fifteen minutes, so sometime after they opened the packets, the cards would begin to update. Billy was already stuffing the cheap flat gum from his second packet into his mouth before Connor had finished sorting his first.

"What's that?" Billy demanded to know.

"Cruiser. CCK-7, the *USFS Geneva*," Connor replied without missing a beat.

"Huh. Don't know that one."

"I know," the younger brother nodded. Cruisers were good. A cruiser neither one of them had ever heard of was even better. Billy would want the new card, but Connor would have to be quick on the trade. The clock was ticking and a dead cruiser wasn't as valuable as an active-duty cruiser.

"Whatcha want?"

Connor didn't smile. But he was thinking two destroyers. Maybe one of the oddball Survey ships.

Billy's comm link shrilled in his pocket. He ignored the noise while he thought. This time Connor did smile. He now had a way to increase the pressure. “You gonna answer that?”

"M busy."

"Two destroyers. An' a Survey."

"You're crazy."

"Take it or leave it. I've got the cruiser." Connor held the *Geneva* card up towards the Sun, as if begging the satellite to come over the horizon and burn in the black death border—or not. “A ship of heroes.”

"You don't know that," Billy couldn't stand the taunt.

The comm link shut up. It meant another minute to go.

"All I know is that I got the cruiser."

"*Billy? Billy Johnson—this is your mother speaking.*"

The boy screwed up his face while fanning the cards in front of him. He ignored the voice coming from the nearest light pole.

"Your mother is speaking," Connor pointed out helpfully.

"She's your mother, too."

"I'm not the one she's tryin' to yell at."

"I'm busy."

"Billy—you have two minutes to get back here. And that goes for you, too, Connor Johnson."

"See?" Billy sneered at his brother.

"You want the cruiser?"

Billy stood up. Finally he spat on his right hand and held it out. "Deal."

Connor repeated the age-old ritual. "Deal."

* * * *

Saturday 20 May 2890

"This time tomorrow you'll be on the Moon," Connor said.

"Yup."

The two teens lay on the floor of Billy's darkened room, the ceiling blazing with a simulated view of the Orion Arm of the Milky Way galaxy. Connor waved his hand and zoomed in on some obscure star system mentioned in a news story about the war. Billy had signed up for Unified Star Fleet duty—you could get in at seventeen with your parent's signature—and he had to report for training on Monday.

"That's the battle at GK-6b," Billy said, taking in the star formations. "Three Enemy mediumweights and a heavyweight. The destroyer *Watchtower* took heavy damage and the cruiser *Bridgeport* destroyed with all hands."

"And the British cruiser *HMS Responsible*," Connor added. "Both toast."

"Not fair that the smaller ship survived and the two capital ships didn't."

"Well, the cruisers did double-team the heavyweight and take it out. That's just asking for trouble."

"Yeah, but it's still a pretty high price to pay," Billy said.

"We used to think it was all heroes being born out there." Connor paused then turned his head towards his brother, who looked very serious at the moment. "You still okay with joining up?"

Billy's big grin returned. "Oh sure. I mean, we both know what I'm getting into. Some ships buy it, a lot don't. It's a war—a real interstellar war with aliens. Fleet needs crews, but it's still a risk. There's probably a lot of enlistees who don't know the real score."

"We used to be such kids."

"Well, *one* of us isn't." Moments after the jibe settled into the darkness, Connor jumped on his brother. As they wrestled, the phrase *once more, for old time's sake* came unbidden to both of them, but they never mentioned it aloud.

Some things brothers just knew.

* * * *

Four days later and Spaceman Trainee Billy Johnson sent a picture of himself in a spacesuit standing on

the actual surface of the Moon for the first time. Space, he told Connor in a long phone call, was a *lot* more serious than they'd known on Earth. Already today they'd had one casualty when the massive gang airlock had gone vacuum. "But don't tell Mom that. She wouldn't understand." No one was yet saying whether the person whose suit hadn't been properly sealed was going to make it.

After the shock wore off, Billy assured Connor that he'd work as hard as he could in training.

"There's already talk that the war may end soon. I'm just hoping there's still something I can do before it's over."

"Besides come back," Connor had said, instantly regretting his choice of words.

But when Billy replied after the three-second roundtrip delay, his infectious grin was back. "There are a *lot* of people in Fleet dedicating themselves to bringing back everyone they can."

Thursday 11 January 2891

Connor Johnson knew he'd received a new letter before lunch, but he saved it until after school. Ever since his older brother took an early enlistment after his seventeenth birthday, Connor kept a little ritual with each new message. Only after he settled into the crook of their favorite climbing tree, four meters off the ground, did he pull out his datapad. This letter was dated Christmas 2890, "Somewhere in West Space." Whether Billy was being coy or under strict orders not to reveal their position, it wasn't a helpful description, covering half a billion cubic light years. What Billy could tell his brother back in Ames was that the rumors flying around about a Fleet victory were making it a question of *when*, not *if*. Contact had been made with Enemy worlds and they had the Enemy fleet on the run out of human space.

Billy served on a brand new Callisto frigate, the *USFS Milwa Burema*, and had told Connor of a few adventures during their shakedown out there. Once deemed too light for use in the war zone, the *Burema* held ten times the firepower of a prewar FFL and was fast, too. Most of this letter consisted of funny stories about life out there, along with two pictures of another young Basic Spaceman named Tonya, of whom Billy seemed to write an obsessive amount lately. It made Connor smile, even as he read the letter for the second time.

There was, however, one more part of the ritual. Stuck to the bottom of his datapad was a foil shield pouch, which contained one lone FleetCard. Billy had loved the big cruisers when they were kids, but every one of Billy's FleetCard cruisers now sported a black border. Pulling his last card out of the pouch, Connor sat quietly in the cold winter afternoon. It had been hard to find one specific warship out of the thousands of ships in Fleet, but he had a strong reason for having this exact card and so sought one from a dealer off the net. He stared at the image of the black and gray wedge, the notation FFL-2890 in crisp Fleet lettering. Twenty minutes later and still no change in the card, so Connor sealed it back up, then went home to show Mom the new letter.

It was terrible being fourteen when all this history was being made all around you every day.

* * * *

Sunday 2 August 2939

"Hold on," the old man said, as the three children chased a little girl around the patio chairs. "You're going to get hurt. What are you playing at?"

The others ran off laughing. The little girl looked up at her Grandpa Connor and folded her arms. "*They* wanted to play Fleet 'n' Enemies—they always make me play the nasty Enemy alien."

"Doesn't sound like too much fun," the old man nodded.

"It isn't," she assured him. Then she cocked her head to one side. "What did *you* do in the war, Grandpa?"

"Oh, I was too young to go," he said. "The war ended before I could sign up. You should go ask your Great-uncle Billy."

"Great-uncle Billy?"

"My brother," the old man said. "He's one of your dead uncles. Now he was in the war."

"He was?"

"Yup. He was a young man, too. Doesn't talk about it unless you ask. But he saw some action out there. And it was nothing like being chased around the house," he said with a twinkle in his eye.

"Hey, Jimmy!" his granddaughter yelled as she ran away.

He didn't hear the rest, instead enjoying his sit in the warm Iowa sunlight. No, Connor Johnson told himself, he hadn't been in the war. Just as well. He knew now it wasn't the romantic space adventure he and Billy had dreamed of so long ago. In his wallet lay an old FleetCard, the plastic long discolored with age, the black border from Billy's last misadventure with the Enemy still showing.

Go ask your Great-uncle Billy about the war, he thought. Does he have a tale to tell.

From inside the house Connor Johnson heard his brother Billy's laugh—forever seventeen-going-on-eighteen. The kids must've found him, turned him on, and told him that Connor wanted them to ask about the war.

The dead uncle would tell them, of course, but he was just a machine. It was Connor who had the real memories, such as they were.

* * * *

Sunday 21 January 2891

The *USFS Milwa Burema* almost made it. With news reports coming in of Fleet victory after victory in the previous week, Connor had taken to pulling out its FleetCard every day, just to make sure.

Pulling out his datapad to update Monday's school assignment, he hadn't meant to check the card just then, but after all those months its well-used protective foil pouch cracked open and the FleetCard fluttered to the floor. Even before he picked it up, Connor could see the border had gone black edge-to-edge.

He'd sat there for at least ten minutes, unable to move. When he did, it was to check the time. Perhaps it'd been a mistake—perhaps the next satellite update would bring it back. It didn't.

Two hours later, Connor heard his datapad chime—a new letter from Billy, sent some three weeks before on New Year's. It was the usual sort of letter: chatty, fun ... alive. And it made him feel awful.

* * * *

Monday 22 January 2891

The next day Fleet announced that the Enemy had been defeated. The first interstellar war with an alien species was over. *I don't actually know anything,* Connor thought, even as looked at the stark

black-bordered FleetCard.

That wasn't strictly true. He'd gone back to the net and looked for a dealer who had a new card—the price had dropped considerably. Typical for a dead ship.

A ship of heroes, Connor wanted to say. But the words wouldn't form in his mouth.

* * * *

Wednesday 24 January 2891

"Hey, Connor." It was two days after the end of the war. Connor had still not told their mom about the FleetCard and no one from the Unified Star Fleet had officially contacted them. Voice mail was unusual—doubly so with loud background noises. "Things are pretty much going to hell here. Look, I hate to do this, but you may have to tell Mom. I'm going to stay on and transmit as long as I can."

The noises became muffled.

"Just buttoned down my spacesuit. We're in a fight and right now I can see an Enemy mediumweight through the air curtain—it's probably less than a kilometer away. Ugly thing." A dull bang reverberated. "Uh, that was the atmosphere, we're in vacuum now. The Marines are lining up. I'm not sure who is going to board whom. Wait one, I've got to help cable up this deck gun..."

Connor closed his eyes, concentrating on the sound of his brother's hard breathing. This was not going to be easy—it couldn't have a happy ending, could it? Meanwhile Billy described the battle that had started the day before as the two ships slowly closed on each other.

"Oh, wow! A hit! And another! They've got the fire control system back up and we're pounding those bastards. You should see it, Connor. There are *holes* in that Enemy ship and big chunks of stuff breaking away. I ... *umph* ... The Enemy's opened up—we're taking hits now. Jeez, I thought these kinds of battles took place from too far to see, not up close! Connor, you've got to tell Mom..."

The communication ended and the datapad screen noted the end of record mark. He sat there steeling himself to get up and tell their mother that something awful had happened.

Then he heard the door announce they had two visitors.

* * * *

The old man came inside, watching the kids on the floor listening in rapt attention to the stories Billy was spinning.

"We were ten hours behind that Enemy mediumweight—chased them for five days while they tried to get into orbit around UY-343 VII. But we'd already tangled with them and neither ship could fire their weapons."

Billy's image glanced up and winked at him. Connor was proud of the dead uncle—he'd built the avatar in computer shop class back in high school, merging all the voice, text, and video they had in the house, plus hours of Connor's own reminiscences. Somehow his programming had captured the best of his brother's nature.

"Hey, Connor," Billy called out. "You still got that filthy old FleetCard? You should show the kids what my ship looked like."

"Oh please show us." *"Please."*

The old man smiled, reaching into a pocket for his wallet. There were other, better ways to show the kids Billy's ship. But this FleetCard was the only piece of history they had left and the avatar enjoyed looking at the card. Everything else was just data. Nothing had survived the battle except the data buoy with the last communications.

"Careful—it's old and probably wasn't built to last this long."

Nothing but the memories. At least, he realized with some satisfaction, he still had those.

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Novelette: **THE SLEEPING BEAUTIES** by Robert R. Chase

* * * *

Illustrated by William Warren

* * * *

Some mistakes take lots of time and patience to correct—if it can be done at all.

i.

I'll never court another girl

I'll stick to rum and beer.

"New York Girls"

* * * *

It was New Year's Eve 2057 and Peter Frondelli was on top of the world. On his arm was Angelina Lamont, the gorgeous bounce singer, and on her left hand was the diamond ring she had tearfully accepted from him the day before. Although the wedding date was three months away, they had already started planning the merger of apartments and careers. Now they stood off stage in the club where Angee sang. It was her break: the time when she could sooth her throat with water and lemon, and her two side men, Shinichi Kanayama and Jose Candanosa, could show their jazz chops to the audience.

"You have been holding back all day," Angee said. "What is it?"

She was looking out at the small stage, tapping her foot to Kanayama's bass accompaniment. Peter, looking at the way her blond hair cascaded onto her bare shoulders, wondered again how he had ever been lucky enough to snag a woman this beautiful. His self-image was of a man too dull-looking to achieve ugliness. He actually had the sort of regular features that are often considered handsome, and with a different hairstyle he might actually have been considered so. Instead, he had a crew cut because it allowed him to ignore his hair. He was tall and in good shape from biking and tennis, but many who talked to him came away with the impression of a man only intermittently involved with his own body, that in some ways he viewed it as a distraction from things that really mattered.

"I received an e-mail just before I came over. I have been selected for the Saturn expedition. Novak wants me to be his principal assistant in the exobiology section."

Conflicting expressions passed over Angee's face as quickly as summer lightning. "Why, that's ... wonderful. But I thought you had been passed over in favor of what's his name, uh, Zimmerman?"

"Josh died in a hang-gliding accident yesterday." Peter grimaced. Zimmerman had been a fierce competitor but immensely likable for all that. His death left Peter shaken. "Novak needs to fill the slot as quickly as possible to have a full complement at launch."

"Oh." Angee's shadowed face was thoughtful.

Peter put a reassuring hand on her shoulder. As usual, there was something akin to electric shock when his fingers touched her flesh. "I told them no."

"What? How could you? This expedition could make your career. It's the sort of chance that won't come again."

"I had not even met you when I applied to join the expedition. When Josh was chosen, I was actually

relieved. I had already decided to marry you."

Angee looked thoughtful. "Why didn't I know anything about this?"

"I had to convince you that you were in love with me." Then, with reluctant honesty: "I had to get enough courage to pop the question.

"Anyway, it's too late now. Five years is just too long to wait, or to expect you to wait. We have our wedding date. Professionally, there is more than enough work for me to do on Martian methanogens and the samples being returned by the cometary probes."

Angee might have said something, but the break ended and she went out to sing her second set. It ended exactly at midnight amid showers of confetti and popping corks. After that, things became hazy. Perhaps the goodnight kiss was a bit perfunctory. Perhaps they were both simply tired or feeling the effects of too much champagne.

In any event, Peter woke at eleven the next morning. His head throbbed, his stomach signaled incipient rebellion. Perhaps that was why he did not at first see the envelope that had been shoved under the front door of his apartment. It was strangely lumpy. A ring fell to the floor when he tore it open. There was a note.

DEAR PETER,

I THOUGHT YOU A MAN OF VISION AND AMBITION, ONE WHOSE TALENTS AND INTELLIGENCE WERE DESTINED TO LEAVE THEIR MARK ON THE WORLD. I SEE NOW THAT I WAS WRONG. WE SHOULD END THIS NOW BEFORE WE MAKE ANY MORE MISTAKES.

He was sitting on the floor without knowing how he got there. The world tilted around him.

Throughout history, young men in a similar position have gone out and gotten drunk. Peter was already hungover, so he was ahead of the curve in that regard. Others have fled into war or exploration. As soon as he could control his voice, Peter called up the message from Vaclav Novak and accepted his appointment to the Saturn expedition.

Some have been so disappointed in romance that they swore off women forever. Here, the last part of the twenty-first century, they had a previously unavailable option. The Neo-Victorian Age (called more darkly, by some, the Repression) was as fascinated by sex as the original Victorians had been. The plan to send a mixed crew of fifty, most of whom were not married (to each other, at least) seemed rife with possibilities, most of them bad.

For those who wished to avail themselves of it, there was an alternative beyond frustration or sin. A simple biochemical fine-tuning, completely reversible, decreased certain hormone levels and tweaked others. To call it gelding, as some did, was certainly unfair, while "chemical castration" was even more so. Medical practitioners preferred to refer to it simply as the Treatment. It put certain urges into the background, making them fond memories rather than steadily increasing torments. If one of its side effects was an increase in weight, that was considered a plus for those using the hibernation chamber.

A week later, Peter presented himself to Richard Beard, the physician in charge of the medical staff of the *Roc*. There he was poked, prodded, injected, and tweaked. After which he was put on a high-carbohydrate diet for a week and then put to sleep.

On March 15, 2058, while totally unconscious and with a body temperature of seventy degrees

Fahrenheit, Peter left Earth orbit on a five-year journey to go where no one, man or woman, had gone before.

* * * *

ii.

June 15, 2058

Waking was a slow, painful process. Lips and mouth and throat were so dry that they seemed to have fused together into an impenetrable mass. He was simultaneously famished and nauseated. He let the attendants sponge his lips, prop him upright, and swing his legs off the bed because he had neither strength nor will to resist.

"That's it, Peter. You're doing wonderfully."

It was more than just physical discomfort. He knew that something bad was lying in wait for him. He would remember it as soon as he was fully awake. Despite all the precise biochemical adjustments signaled by his embedded blood monitor, it did not hit him until he finished his first hour of physical therapy nearly an hour later.

Angee! It was like moving wrong and reopening an old wound. In his last few moments of consciousness, he had wondered if the Treatment would do anything to dull this continual ache. It was now clear that it would not. Physical desire was indeed gone, but it left in its wake a void, a feeling that his insides had been yanked out. More than half the hurt was bewilderment. How could he have been so wrong? He had been so sure she would be pleased by his decision, that she would take it for what it was, proof of his commitment to her, to them as a unit. If he could miscalculate that severely...

Then maybe he was a fool, deserving of her contempt.

Work through pain. It was the one way he knew to diminish the sting. He put in an extra hour in the exercise room. The *Roc* was a long tube housing the ion drive, bisected by a disk that rotated around the tube with just enough speed that the outer ring generated approximately 1g worth of centrifugal force. The exercise room was located along this outer ring. When he could push himself no further, he showered, left the exercise room, and followed the always upwardly curving corridor to the elevator and then up three floors to his workstation. It identified his thumbprint and lit the screen, displaying his schedule. It was heavy with increasingly strenuous physical conditioning, which was the main reason for breaking his hibernation period in the first place. Then there were meetings with the exobiology staff.

And there, in the upper corner, there was a blinking icon signifying an urgent message. He fingered it.

DEAR PETER,

WHEN YOU GET THIS, YOU WILL BE CLOSER TO THE ORBIT OF MARS THAN TO EARTH. THERE WILL BE NO WAY BACK FOR YOU UNTIL THE *Roc* RETURNS IN FIVE YEARS. SO I CAN ADMIT TO YOU NOW THAT I LIED. YOU TOLD ME WHEN WE FIRST STARTED DATING HOW MUCH YOU ALWAYS WANTED TO GO INTO SPACE FROM THE TIME YOU WERE FIVE YEARS OLD. THIS WAS YOUR CHANCE. I COULD NOT LET YOU THROW IT AWAY.

I KNOW HOW STUBBORN YOU CAN BE WHEN YOUR MIND IS MADE UP. THAT IS WHY I SENT BACK THE RING. IT WAS THE HARDEST THING I HAVE EVER HAD TO DO. THAT USED UP ALL MY WILLPOWER, SO I PROGRAMMED MY PHONE NOT TO ACCEPT YOUR CALLS. IF YOU HAD MANAGED TO GET THROUGH, I WOULD HAVE BROKEN

DOWN COMPLETELY.

LIVING FIVE WHOLE YEARS WITHOUT YOU IS ALSO MORE THAN I CAN BEAR. I DON'T WANT TO GROW OLD IN YOUR ABSENCE. IF I CAN'T AT LEAST TALK TO YOU THIS WAY, THERE IS NO JOY IN EVEN BEING CONSCIOUS. SO I WILL BE HERE IN HIBERNATION EVERY DAY YOU ARE. I WILL BE AWAKE WHEN YOU ARE. AND WHEN WE SLEEP, WE CAN DREAM TOGETHER.

I HOPE YOU WILL BE ABLE TO FORGIVE MY DECEPTION AND CLAIM THE DESTINY YOU DESERVE.

ALL MY LOVE,

ANGEE

Each member of the expedition had a bandwidth allotment. Most of this was supposed to be used for professional communications. Beyond that, there was enough for personal use for one fifteen-minute video message per week or effectively unlimited text messaging. (With a six-minute delay at this stage of the voyage, live conversations were already impractical.)

Peter reread the message half a dozen times, trying to tease out tone and nuance. Finally, setting his mouth in a determined line, he called up the voice software and began dictating.

* * * *

Goldie blew up when Angee told her the plan. "So, just when your career is about to go into high gear, when I'm able to line up dates and recording contracts, you decide you have to take half the year off in quarterly increments for, what, the next five years. Wake up call for Miss Lamont: You are not in the Tokano and Sinatra category. The dates won't wait for your convenience. If they can't get you for the dates they have open, the clubs will get someone else. Any momentum your career might have had gets tossed away.

"And why are you doing this? Because you drove away a guy who wanted to marry you, and now you're afraid you're going to grow old waiting for him to come back, supposing he will ever speak to you again. What am I not getting about this?"

Goldie was more than an agent. In the four years they had worked together, she had become a surrogate mother, warning her away from the wolves in the business, providing dietary advice, even making sure that she got enough sleep so that she would not need the chemical enhancers that were still the crutch (and the entry to more problematic drugs) for so many performers.

"I'm sorry, Goldie." Angee turned her face away, feeling guilty about her agent's anger. "I know everything you have done for me, and if you are saying that you don't want to be my agent—"

"Jesus Christ, kid, have you listened to a word I've said?" Goldie's carefully dyed hair shook with emotion. Her lipstick made it look like she had taken a bayonet in the mouth. "That is *not* what I am saying. I want to be your agent. I want you to make a lot of money so I can make a little bit to keep body and soul together in my lonely old age.

"Used to be, you weren't just talented, you were smart. You caught the craze for bounce music at its beginning, saw its relation to swing, and started featuring pieces from everyone from Benny Goodman to Big Bad Voodoo Daddy. That made the fans comfortable. Then you added songs that they might not have expected from the likes of Lennon-McCartney, Joni Mitchell, and Yoko Kanno. That kept them interested.

"Next week you have your first live performance vid-disk coming out and will you be around to promote it? No. Why? Because you'll be in hibernation dreaming about Prince Charming. You think just your career will melt away? How about Shinichi and Jose. You think they will just hang around waiting for you to wake up? They can't! They have to take the gigs offered when they're offered. They can't just drop everything for you."

That hurt because it was obviously true. Good sidemen are almost beyond price. Angee knew this from having worked with the not so good. As she had been able to command bigger fees for her appearances, she had increased what she paid Shinichi and Jose proportionately. But Goldie was right. They could not afford extended layoffs. She could only barely afford it herself.

"And here's the final thing," Goldie said. "Do you know what this is going to do to you physically? I don't, because the human hibernation process is still experimental. Some of the researchers talk about the Saturn expedition as just an extended field test to prove it out for excursions into the Kuiper Belt."

"I will be in a hospital annex," Angee said, "under the care of the people who invented the process. It will certainly be much safer than it will be for Peter and his crewmates."

"Not necessarily. Ever heard of bedsores? They're not a problem in free fall. Back here on Earth, it's a different story. Yes, they cradle you on a multisectioned air mattress that rocks you continuously, so that no one section of your skin is continuously under pressure. Still, there have been incidents. And settlements.

"I haven't even mentioned how you have to bloat up to survive three months without eating. You think your fans are going to like what that does to you?"

* * * *

In that respect, at least, Goldie had been wrong. You did not have to gain fifty pounds before they put you under. Instead, you were fitted with a gastrostomy port in your stomach. A watery, nutritious paste wormed its way through a plastic tube and into your digestive system.

Despite Goldie's fears, the system had worked as advertised. Angee woke three days before Peter's scheduled resuscitation. Time enough to get her strength back to walk about the city without artificial aids. Almost time enough for her digestive system to become fully functional.

She was walking to Holiday's to meet the musicians Goldie (bless her!) had lined up for her when rain whipped out of the dull gray sky. That, and an absolutely irresistible smell enticed her into the coffee shop she was passing.

NO ROBOTS, the sign on the door promised. ALL HUMAN STAFF. And so it appeared as she stepped inside, though some of the baristas looked so tired that the difference was not immediately obvious. Angee ordered a small cup and sipped carefully, not sure how her intestines would handle caffeine. Flipping open her notebook, she scrolled through a list of songs and began arranging titles, thinking how the sequence would first establish a mood and then build it, expand it, until suddenly the evening was over and the audience was clapping for encores. That's what you hoped for anyway. A lot depended on not straining your voice and the capacities of your sidemen—

The notebook chimed suddenly. A small but exquisitely detailed picture of Peter began flashing in the upper right-hand corner of the screen. It made him look so far away, as if she were gazing through the wrong end of a telescope. Angee raised her hand to the winking image.

And stopped. *Supposing he will ever speak to you again.* Goldie had touched on her greatest fear. How badly could you hurt someone, even for his own good, and expect him to be forgiving? Peter's

calm, professional exterior was only the mask worn by a proud and passionately focused man.

She stabbed the screen with her index finger. A message came up. There was no salutation.

I THOUGHT WE TRUSTED EACH OTHER, THAT WE MADE DECISIONS TOGETHER. NO LIES, NO DOMINANCE GAMES. A PARTNERSHIP OF EQUALS. NOW YOU SAY YOU LIED, THAT YOU COULD NOT LET ME THROW AWAY THE BIG CHANCE FOR MY CAREER. DO YOU HAVE ANY IDEA HOW LITTLE THAT MEANT TO ME COMPARED TO US? OR THAT I MIGHT BE THE ONE BEST ABLE TO VALUE MY CAREER?

I AM GOING TO STOP NOW BEFORE I WRITE SOMETHING BOTH OF US WILL REALLY REGRET.

Rain drummed on the glass, an irregular beat more suited to bebop than ballad. Angee did not feel the tears on her cheeks until a barista came by and put a hand on her shoulder.

"Don't take it so hard, hon. He probably isn't worth it anyway."

* * * *

iii.

"These are not the circumstances under which I wished us to have our first departmental meeting," Novak said dryly.

Peter wished he could see Novak's face, but he was three quarters of the way across the chamber, his view blocked by half a dozen heads. Wedged sideways as he was by the crowd, there was no way to get a better view unless he jumped. This was not an entirely absurd idea. This close to the hub, centrifugal force created an effective gravity no more than one-third Earth standard. He could probably jump high enough to bang his head painfully on the ceiling, which was barely a meter above his head. On the other hand, there was nothing to grab, and he would definitely look silly bouncing up and down.

Modern spacecraft had air-recycling systems, which made perfumes and colognes allowable shipboard. At the moment, the system in the chamber was close to being overloaded and these odors were obtrusively prominent. Still, those were the more pleasant smells. One of the less-publicized effects of free fall and near free fall was increased flatulence. All you could do was pretend not to notice it.

"Captain Zhen assures me that this flare should end in no more than six hours." The communal groan almost drowned out the end of Novak's sentence. "Be grateful!" Surely the man was joking. "Some solar flares last for days."

The situation was made doubly frustrating by the fact that it should have been completely unnecessary. A magnetic field extended twenty meters out from the ship's hull. It had been designed to withstand storms fiercer than this, as much to protect the electronics as the crew. Yet this was its first severe test of the voyage, and the Chief Engineer had declared that safety would be ensured through a belt-and-suspenders approach. Three "storm cellars" were situated around the hub of the wheel and until the magnetic field proved itself, they were mandatory shelters. Together they would provide more than enough space for all the passengers. Unfortunately, the alarm had gone off while all of Novak's staff was assembled in the ship's one large conference room and everyone had made for the nearest storm cellar. By the time it became obvious that this was a big mistake, the sirens had altered from preliminary warning to storm-in-progress. If the magnetic fields were insufficient, no one wanted to be outside while protons sleeted invisibly through the corridors.

"Think of this as an excellent opportunity to get to know your colleagues," Novak concluded.

That brought scattered laughter from some, who, like Peter, thought they might be getting to know their colleagues too well.

Peter peered about for one colleague in particular, Manuel Carreras. He had seen the astronomer briefly in the conference room and wanted to talk to him about anomalous spectrum readings he had made of Saturn's rings, particularly the E-ring. Manny had to be within ten meters of him, yet all he could see was a mass of (mostly anonymous) bobbing heads.

"You are Frondelli," said an alto voice behind him. There was a trace of an accent he could not identify. "The youngest member of the expedition. I am Part."

She said it as if he should know the name. Peter racked his brain as he slowly turned, trying not to throw an elbow in the stomach of the man on his left, apologizing for stepping on the toes of the woman on his right.

She was part of the medical staff, not the exploration team, he remembered. But she wasn't a medical doctor either. She was a sociologist, studying the effects of long-term confinement under extreme conditions. And there was something else, something about a controversial book or series of articles published about twenty years ago. At title popped into his consciousness: *Against the Repression*. Was this the woman who had given the current age one of its names? He dimly remembered other titles that had been notorious for a time: *Moral Tyranny*, *Sexual Immortality*.

He completed his turn and found himself pressed up against a woman only a few inches shorter than he was. A woman who could not possibly be the person he had been thinking of, since the author of *Against the Repression* had to be at least fifty, perhaps sixty, years old. Yet this woman, with her dark eyes and glossy black hair, looked hardly twenty.

And that was the explanation, of course. No one on this expedition was that young. Even for the brightest, it took longer than that to get the necessary credentials and training to be chosen for this expedition. Therefore, he was looking on an example of the horrendously expensive rejuvenation treatments that had been pioneered in Shanghai. And this was indeed Andrea Part, social critic and revolutionary.

"All of them," Part said, speaking softly into his ear, "kept inside their laboratories for years at a time, the color bleached out of their skin by fluorescent lights—"

There was a pressure on his thigh.

"—until their flesh was as white as their hair, what was left of it."

On the inside of his thigh.

"But we are not like that, are we? Our lives are not preserved in formaldehyde. Hot, red blood pulses through our veins. For us, no pallid passions fueled by grant applications or papers read to dozing colleagues."

Moving up the inside of his thigh, higher and higher. Part's breath was hot against his cheek.

The siren sounded again, this time in a set of descending tones.

"And there we are," Novak said, "even better than promised. The all-clear. Everyone's safe now."

* * * *

From *NYghtLife Online*, August 21, 2058

"She stands alone in the spotlight. "All." The word is spoken, almost as if it were the beginning of a Shakespearean soliloquy. "Or nothing at all." The bass comes in behind her, almost inaudible yet crucial as a heartbeat. Her voice rises and falls as, one by one, the other members of the quartet join in. Yet even now, there is the sense that this is not so much a performance as a tormented declaration. It is a love song, not so much for a person, as it is an assertion of what love must be if it is to have any worthwhile validity.

"It is an assertion which requires sacrifice and you can hear the pain in her voice. There is a reason for that. The reason is—"

* * * *

"Goldie!" Angee's tracy interpreted her exclamation as a command and placed the call.

"Mornin', kid. You got some great reviews. When they weren't jumping and jiving last night, you had them in tears."

"Goldie, did you tell the NYghtLife about my hibernation schedule?"

There was an incriminating pause. "No! Well, not exactly. I mean, people want to know where you've been. They're asking about why you're not accepting bookings for the next three months. I didn't want to offend anyone—"

"NYghtLife has spread my private life all over their review!"

"It isn't really so bad," Goldie said defensively. "There's a lot of interest in your situation. And sympathy too. It's very romantic."

"You make it sound like this whole thing is a publicity stunt." Angee's voice was getting higher and starting to quaver. "I am doing this for one person and one person only."

"Right. Right, kid. Your heart is pure. I know that. But remember what I said about the difficulty of getting you dates. We were lucky this time."

That was the simple truth. Goldie had booked an extended stay at Holiday's and even assembled a trio, bass, drums, and reeds, which became a quartet when Angee accompanied herself on piano. It worked out better than she could have hoped. None of it might be available during her next period of wakefulness.

"And talk about luck, I have you set up with a twenty-minute slot on DoriAnne's afternoon show on the thirteenth. Her fans worship her. If only one in ten were to download your live album, it would send you to the top of the charts."

"Goldie, I'm going back under on the seventh."

"Oh. Yeah."

* * * *

Peter had written his response to Angee's message while his emotions waged a civil war within him. Then he waited. He did not at first realize what he was doing. He thought he was getting acquainted with the other members of the planetary team, finding his way around the *Roc*, or working out on the treadmill. But one day, while checking the most recent technical journal downloads, he realized that he had been waiting for a response from Angee and becoming ever more concerned as the days went by and no

message appeared.

Did I get her so angry that she has written me off? Or: Have I hurt her so badly she can't bring herself to write?

One question, though, was far worse than the others. He was convinced that he was the aggrieved party. Would anything he wrote seem like begging? Was Angee so important to him that he had to risk that sort of blow to his pride?

The answer presented itself as soon as he allowed himself to ask the question. Yes, she was unquestionably that important. He could be angry with her without wanting to forever live in the desolation he had felt when she seemed to have walked out of his life forever.

Peter blanked the screen, called up Angee's e-mail address, and began to write.

DEAR ANGEE,

I'M SORRY—no, make that I AM VERY SORRY IF MY LAST MESSAGE SOUNDED what? Terse? Angry? Hurtful? I AM VERY SORRY IF THE WORDS OF MY LAST MESSAGE HURT YOU. I WAS ANGRY. Well, obviously. I WANTED TO MAKE A SACRIFICE FOR BOTH OF US. IT HURT TO HAVE THAT SACRIFICE REJECTED, EVEN WHEN I LEARNED THAT IT WAS DONE OUT OF LOVE. I REALLY, REALLY HATE BEING MANIPULATED, EVEN FOR MY OWN GOOD.

THE QUESTION IS: DO I HATE IT SO MUCH THAT I AM GOING TO THROW AWAY THE BEST THING THAT HAS EVER HAPPENED TO ME? NOT IF I CAN HELP IT. I HAVE CALMED DOWN ENOUGH TO REALIZE THAT YOU ARE MAKING SACRIFICES AS WELL, BOTH PERSONALLY AND PROFESSIONALLY.

PLEASE ANSWER THIS. THE ONLY THING WORSE THAN BEING AWAY FROM YOU FOR FIVE YEARS IS THINKING THAT YOU WILL NOT BE WAITING FOR ME WHEN I RETURN.

Peter read it over, considered several changes, and hit the send button. It was unsatisfactory and the best he could do.

That done, he felt a curious sense of relief. He had done everything he could. Either Angee would respond in kind—or she would not.

Nearly fifty minutes later, his screen buzzed at him and a flashing icon informed him that he had a message from Angelina Lamont. Peter frowned in confusion. His message had barely had time to reach Earth. The speed of light made it impossible for him to have a reply so soon.

DEAR PETER,

EVER SINCE GETTING YOUR LAST MESSAGE, I HAVE BEEN WONDERING WHAT I COULD SAY THAT WOULD MAKE YOU FORGIVE ME. I WAS AFRAID TO WRITE, FEARING WHATEVER I SAID WOULD JUST MAKE THINGS WORSE. NOW I HAVE DECIDED THAT IT IS IMPOSSIBLE TO MAKE THINGS WORSE.

IT WOULD BE SO MUCH BETTER IF YOU WERE HERE AND WE COULD JUST HAVE EVERYTHING OUT. (YES, I DON'T NEED TO BE REMINDED THAT IT IS MY FAULT THAT YOU AREN'T.) ALL MY FRIENDS TELL ME THAT THE WORST THING TO DO AFTER AN ARGUMENT WITH A BOYFRIEND OR HUSBAND IS TO OFFER UNCONDITIONAL

SURRENDER. THEY CAN HAVE THEIR LAUGH.

SO. I WAS WRONG. FROM NOW ON, NO DOING THINGS FOR YOUR OWN GOOD. WE TELL EACH OTHER EVERYTHING AND MAKE ALL DECISIONS TOGETHER.

THAT SHOULD BE IT. LET ME KNOW IF I'M MISSING ANYTHING.

Manny heard the eruption of noise down the hall and stuck his head in. "Are you choking to death," he inquired, "or is that supposed to be laughter?"

"I'll tell you later," Peter said. "I have a message to write first."

OK! I ACCEPT YOUR SURRENDER ON THE CONDITION THAT YOU ACCEPT MINE.
FROM NOW ON IT'S US AGAINST THE WORLD.

* * * *

Transcript: THE DORIANNE SHOW

January 15, 2059

DORIANNE: "And now, a warm welcome please, for my very special guest, the sleeping beauty, Angee Lamont."

Audience applause. Lamont enters stage right, frowning at her introduction for an instant. She crosses the stage as the band does the usual five bars of guest intro music and takes her seat across from DoriAnne.

DORIANNE: "It's delightful to finally have you on the show. Right now you must be the most famous woman in the country, if not the world. You and Peter Frondelli are being compared to Romeo and Juliet, Abel and [slight pause while checking her right eye monitor] uh, Lois, and all the famous lovers of myth and history. And of course with Prince Charming and the Sleeping Beauty.

"I think the most remarkable part of your story is the length of time the two of you must wait. Five years! I wouldn't think anyone could keep a relationship going under those circumstances."

ANGEE: "I wasn't sure myself, at first. Then I found that what I was doing was not really that uncommon. In the 1800s, the families of whaling ship crews would be separated for four years at a time. During the last century, soldiers in the world wars served up to five years or more without seeing their wives.

DORIANNE: "But it must be so hard!"

ANGEE: "It is, but hard is not impossible. It's just hard. And there is another thing that Peter and I have come to realize. As difficult as this is, the idea of giving up on each other was just too painful to be considered. So you must not think that we—or at least that I am showing great discipline or virtue. Once I realized that I could not live without Peter, I just took the line of least resistance."

DORIANNE: "Peter Frondelli sounds like he must be an extraordinary man. Can you share any of his love secrets with us?"

ANGEE: "No."

DORIANNE (shocked): "What?"

ANGEE (smiling sweetly): "Peter is a very private man. One of the things I value most about him is that he pulls me out of the spotlight. When I am with him, I am protected in place of calm and quiet.

"Beyond that, there are some things I share with no one else. Every woman, and most men, should understand that."

* * * *

v.

March 15, 2059

It was odd, but after being nearly smothered by his colleagues in the storm cellar, Peter woke from each successive hibernation phase to a ship that seemed almost deserted. The reason was obvious. At any give time, half of the complement was asleep in the dens. As a result, there was an unprecedented amount of space and privacy for everyone who was conscious. Sometimes, going down the silent corridor to his cabin, he came close to feeling that the ship was haunted. Right now, though, after a twelve-hour stint with Manny trying to make sense of E-ring spectrographs, he was too tired to be anything other than grateful for the quiet.

He was also too tired to realize that his cabin light would not come on until the door sealed shut behind him and he was in total darkness. There was a half-familiar scent and for one brain-fogged moment he almost believed that Angee was right next to him.

"Your secrets are safe from idiot box audiences," a low voice said, with an accent he still could not place. "But not from me. Awake sleeper."

Lips moved up the side of his neck and fastened on his mouth. A warm body pressed him against the wall of the cabin while hands deftly worked his coverall fastenings.

"I don't think you—" Peter began, or tried to. With an invading tongue wedged between his teeth it came out more like "I doan fink oo." In fact, it was becoming unpleasantly difficult to breath.

He raised his arms to push his assailant away, found his hands clasping warm breasts, nipples hard against his fingers. For a moment, curiosity nearly overcame caution. But then he continued resisting, impelled by the simple need to avoid asphyxiation.

The hands that had been working his coveralls ripped open the clasps and plunged in. Warm hands grasped him eagerly and then paused.

"You're ... not..." The alto voice was puzzled, almost hurt.

Peter tried unsuccessfully to stifle a sudden laugh. "No, I'm not."

"But you appear healthy in every way. Surely you're not—"

"The Treatment," Peter explained soberly. "I had the procedure performed when I came on board."

"Why would you maim yourself?" Andrea Part asked. "Surely not to keep yourself faithful to that immature Earthside chanteuse. Sex is the zenith of existence, the whole point of life."

"Actually," Peter said, "it's a pain in the ass a lot of the time. Though I suppose that's an unfortunate choice of words."

"It can be reversed," Part said urgently. "It would only take a matter of hours down in sickbay."

Peter allowed himself to consider it for a moment. "No," he said. "I think not."

Part's voice hardened. "Then you are nothing but a pervert. I should waste no more time on you."

There was a rustling of cloth. The door opened, and a shadowed form in deck pants and open blouse, fled angrily into the corridor.

Peter found the rheostat and turned it up. The room looked surprisingly normal after all the commotion. He himself was a bit worse for wear. His head throbbed with each heartbeat; his lips were bleeding where they had been bitten. There were scratches on his head and face. Various other parts of his body felt bruised.

He staggered over to his medicine cabinet, feeling oddly guilty that he had not cooperated in a more satisfactory manner with his own rape.

* * * *

"You are so damn lucky, it's sickening," Goldie said.

Angee looked up from the glowing mat that had been unrolled on the table. A three-month calendar spread across the surface. The square of each day displayed the venue in which she was performing and the group that was providing backup. Floating above the beginning of each gig was a rectangle representing the contract. By placing her finger on the rectangle, Angee could bring the contract in front of her and flip it open. The clever thing about this particular program was that the calendar appeared the same to both of them, though seated on opposite sides of the table, and by placing their fingers on the document at the same time, both could bring a copy of the contract in front of them.

"—and I don't think I go well with a big band, even though Marty Watanabe is one of the best. You know I do best in more intimate—what? Did you say something?"

"I said you were sinfully lucky." Goldie's voice was sour. "I tell you that taking three month vacations is going to kill your career. Instead, it makes you a rare commodity and bids up your price. I tell you to be nice to DoriAnne and after you stand her up on her first invitation, you come on her show and tell her to screw herself."

"I never said anything—"

"And what happens? Instead of your career being ruined, you spark an I Hate DoriAnne campaign that forces her to apologize to you. Who knew that so many people were so tired of her causes and video picks? We should change jobs and you become the agent, except that my voice makes chalk on blackboard sound like Nat King Cole."

Angee reached across to her friend. "Don't talk that way. You are the only reason I am not starving. You have been setting up my dates, lining up musicians, and keeping the media away from me.

"And those are the less important things. You are the only one I can really talk to. I wake up and you orient me to what's happened in the world while I was hibernating. You reassure my folks while I'm asleep. You keep me sane while I'm waiting—"

Her voice broke. Goldie took her hand and squeezed. "I'm sorry, kid. I know it's been tough. I'm just saying that for all that, things have been working out so well for you that I can almost believe in miracles."

"I'd throw it all away if it would get Peter back," Angee said simply.

"I know you would. And people ought to just let you alone to wait for him. But they won't. They'll pry and say and write whatever they think will attract an audience. If you don't give them enough to fill their columns, they'll make it up.

"I don't pay any attention to that."

"You may have to," Goldie said unhappily. "The gossips are carrying a story that seems to have originated somewhere on the *Roc*. They are saying that Peter has just been using you for cover, that his real interest is in young boys."

She watched Angee apprehensively for her reaction. For an instant, Angee's face was completely blank. Then she burst out laughing so strongly that she nearly fell off her chair. It took nearly five minutes for her to calm down sufficiently to speak again.

* * * *

vi.

December 20, 2059

None of the pictures relayed to Earth did justice to Saturn. It had a subtle beauty, made impressionistic by upper atmospheric haze, nothing like the flamboyantly bruised visage of Jupiter. The rings stretched out to either side of the half-lit face, thin as a Euclidean line segment, dotted by moons. Only the curved shadows thrown on the northern hemisphere gave any hint of their real structure. Titan, which the *Roc* was orbiting, was on the other side of the spacecraft, but its absence was not much of a loss, since all that could be seen in wavelengths visible to the human eye was a dull, orange haze.

"I heard the news," Carerras said, clapping Peter on the shoulder. "Tough luck. How did Novak explain not making his number one assistant part of the Titan landing team?"

"He had a number of explanations," Peter said, not taking his eyes from the view port. "He said that they couldn't risk the entire exobiology team on any given shuttle mission. And he said that by first refusing his offer to be part of the team, I forfeited my right to make the landing to the next in line."

"Punishment for insufficient enthusiasm?" Manny suggested.

"He seemed very ill at ease," Peter said. "He would not look me in the eye."

"Of course not," Manny said. "It had nothing to do with you and everything to do with who's sharing his bed."

Peter sighed. "Missing the expedition isn't the big disappointment. It's Vaclav. I was twelve years old when I read *Vaclav Novak and the Caverns of Mars*, the story of how he descended into one of those huge lava tubes, survived a tear in his pressure suit, and discovered the Martian archaea. He was my hero, the man I modeled my career after. I wish he were angry with me instead of just ... weak.

"When I was in school and got depressed, I would go on a road trip. Didn't really matter to where. Just to get away." He cocked an eye at Manny. "Feel like a road trip?"

"Uh, sure."

* * * *

Captain Zhen was skeptical. "The *Osprey* will be used for transport to and from Titan's surface. The *Condor* will be kept as backup in case the *Osprey* runs into trouble. Those are the only two craft with landing capability."

"We don't need landing capability," Peter said. "We want to traverse the E-ring and bring back samples. For that purpose a scout ship like the *Auk* will do fine. It's what it was designed for."

"You don't need the *Auk*," Zhen said. "Just step outside. We're in the E-ring now."

"Technically, yes," Manny agreed, "but the part in which we are most interested is downslope, centered on the orbit of Enceladus. There are unexplained oxygen spikes, traces of ammonia—"

"An organic compound," Zhen observed thoughtfully, "though in this case doubtless produced by inorganic means."

"Doubtless," Peter agreed.

Zhen rubbed her chin. "I have no pilots to spare."

"We don't need a pilot," Peter said. "Everything about the *Auk* is so automated that a real pilot would die of boredom. In any event, our intent is just to sweep through to the orbit of Enceladus on an elliptical orbit. Once we get the kick in the right direction, we just coast all the way in and all the way back."

Zhen snorted. "I am very surprised you have the time for this sort of sideshow. I was sure you would be part of Novak's Titan expedition."

"So was I," Peter said evenly. "I'm sure he has his reasons."

"I'm sure." Zhen stared at him, then seemed to come to a decision. "I will have Lieutenant Lakhdar do a complete systems check of the *Auk*. You will submit a mission plan for my review. Then I will make a decision."

* * * *

The E-ring was an anomaly in this arguably strangest of all planets in the Solar System. Its constituents were mostly microscopic and diffuse, more like a smoky haze than the pristine ice shards of the inner rings, mostly because there were some bodies a kilometer wide and a few as large as ten kilometers. Locating these and charting their orbits was part of Captain Zhen's excuse for allowing the expedition.

Peter and Manny had worked feverishly to prepare the craft in the final hours before launch. Under the watchful eye of Lieutenant Lakhdar, they had jury-rigged a series of externally mounted aerogel pallets to gather ring material for later examination.

Now the *Auk*, its superconducting wires extended fore and aft to support the magnetic radiation shield, accelerated down Saturn's gravity well. Titan dwindled above them. Rhea appeared on the starboard side and fled away aft. Dione approached from the port side, close enough that Peter was able to focus the ship telescope on its dazzling ice cliffs.

Within the crowded confines of the *Roc*, it was easy to forget the fact that they were farther from humanity than any group of people had even been in all of history. In the *Auk*, with only Manny for company, the feeling of near isolation weighed in on Peter. He had time to appreciate the irony of his situation. Angee had taken a desperate gamble to get him on this expedition in hopes that it would make his name professionally. Instead, he would be a footnote to the expedition, the xenobiologist who never landed on Titan. And the reason would be, indirectly at least, because he was faithful to Angee.

"Liar!" an inner voice accused. "The reason is you were so angry with her you had yourself gelded. The question is: Would you have been faithful had it been physically possible for you to be unfaithful?"

Thinking back on it, Peter decided that there had been something distinctly off-putting about Part's aggressiveness, something that seemed an attempt to mask desperation. "Yeah, I think so."

"My friend, you have a pensive look on your face," Manny said.

"Thinking how much I miss my fiancée."

Manny's laugh lit up the entire cabin. "I regret there is nothing I can do for you in that regard."

They received news from the *Roc* on a regular basis. The *Osprey* had landed on Titan. Novak publicly announced his belief that Titan's methane was biological in origin, just as he had shown the methane on Mars to be. Peter shook his head. There were good reasons for the consensus view that it was geological in origin. He doubted Novak could repeat past glory, though part of him still hoped he would.

Whatever the origin of the methane, there was plenty of it. A surprise methane rain turned the plain on which they had landed into a shallow lake. Novak's quick action was credited with saving several members of the expedition, including Andrea Part.

"The media will love that," Manny said.

"But will Andrea ever forgive him for rescuing her?" Peter wondered.

The *Auk* crossed the orbit of Tethys while the satellite was invisible behind Saturn. They swung in behind Enceladus, racing the moon into Saturn's shadow. The hard darkness, that had seemed so close you could open the airlock and touch it, suddenly acquired depth. Stars appeared, spreading outward to infinity.

Sharp, snapping sounds, which sometimes made the hull ring briefly, signaled the impact of microscopic ice flakes.

"It is like the first time I drove up north in the winter," Manny said. "Sleet blew out of the sky and pecked at my windshield. I had never seen such a thing."

"When I was going to school in Oklahoma," Peter said, "I would get depressed sometimes, and then I would get in my car, find a long stretch of mostly deserted highway and drive for miles." It occurred to Peter that he had been depressed on a fairly regular basis back then. Those mood swings had vanished after he met Angee.

"Anyway, one spring night my drive took me into a mass of the hugest mosquitoes I had ever seen. They coated the windshield, making it impossible to—"

There was a larger impact, not so much heard as felt through the deck and the chairs into which they were strapped. At the same time, something smashed into the forward view port, smearing its entire area. Cracks spiderwebbed its entire area. Peter held his breath, hoping the transparent sealant between the plates of the view port would fill in the cracks before the cabin's air pressure blew them all into the vacuum.

* * * *

The Specimen Examination Room was near the hub of the saucer so items, preferably living, brought up from any of Saturn's moons could be examined in something like their normal gravity. The room could be filled with water or a nitrogen-methane atmosphere or, as now, be kept in vacuum. Because of this, Peter and Manny had to conduct the examination in space suits.

This was actually the second examination of this specimen. The first, begun minutes after the *Auk* docked with the *Roc*, had taken a full eight hours to remove the corpse from the aerogel in which it had embedded itself.

Most of the room was dark. Spotlights trained on the specimen provided illumination for the work and for the cameras which were recording the examination, as well as relaying it throughout the *Roc*, and from there back to Earth.

The remains resembled a white tent pole that shimmered with iridescence depending on the angle of the light. Wires attached to either end held it motionless, about shoulder high.

"What we have here is two meters long and about three centimeters wide through most of that length," Peter said. "Originally, the creature was longer. How much, we cannot say. The posterior end extended beyond the aerogel pallet and was lost."

"How can you tell?" a curious soprano voice asked. The earphones made it sound like the woman was right next to him, even though she might have been in the main auditorium, where the examination was being shown on an IMAX-sized screen, or even watching in her own cabin.

"Excuse me?" Peter said.

"How can you tell front from rear?" the questioner clarified. "Or even if those concepts have any relevance for a creature like this?"

"Excellent question," Manny said. "The honest answer is that we cannot be sure. However, we will show you why we think we know which end is which."

"The main body is wrapped in three extremely thin membranes," Peter said. "We found it almost impossible to unwrap them without tearing. Luckily, Dr. Carreras came up with an alternative."

"This is an electron gun," Manny said, displaying a device that looked like a prop from a cheap SF video. "I put it together in the repair shop to transfer electrons at short range, causing a buildup somewhat larger than the static charge you might get from scuffing across a rug. That is why the supporting wires are not grounded."

He pushed the tip of the gun under the edge of a flap and depressed the trigger. For an instant, nothing seemed to happen. Then the edge lifted itself and began to unfold. When it had swung thirty degrees around the main body, Manny found the seam of another wing and began to open it as well. A few minutes later, there were three wings being unwound. Peter worked on the side opposite Manny with his own electron gun. Each wing was roughly triangular. Even with the repulsion of the static charge, they did not extend straight away from the body but rather curved in a way that, to the artistic, might have suggested a breaking wave.

"As you can see," Peter said, "each wing has a concave and a convex side. Shine a light on the convex side and you see iridescent whiteness. If you illuminate the concave side, however..."

Manny directed a flashlight beam at an inner flap. Peter heard murmurs of surprise in his earphones.

"More than 99 percent reflective," Manny said. "How much more, we have not been able to determine."

"Light sails?"

Peter recognized Lakhdar's voice. "We don't think so. Even though the whole body is extraordinarily light and we do not know the wings' actual area—" Peter indicated the torn edges. "—there does not seem to be sufficient surface for an efficient lightsail this far from the Sun. If we can move the lights around..."

Manny moved a bank of lights in closer and adjusted their angle.

"If we imagine those lights to be the Sun, we can see how the inner curve of the wings focuses the light along the body. We can deduce the reason for this by examining the interior of the body. To do this as noninvasively as possible, we use ultrasound. Manny, please display some of the images we took earlier.

"There, you see that in overall structure, the main body is like a thick straw—"

"—or an intestine that has been pulled straight, which probably gives you a better idea of its function," Manny said.

"I don't see a mouth." That was Jessica Levine, the xenobiologist who had taken Peter's place as Novak's primary assistant on the Titan team.

"Good observation," Peter said. "Neither do we. We sampled the interior with a hypodermic and discovered that it contains mostly water. My guess, and it is only that, is that E-ring snow impacts on the wings and is absorbed by them."

There were audible gasps, followed by a welter of clamoring voices. Peter grinned at Manny. Even if they received the Nobel Prize, it would never get better than this.

Levine's voice cut through the confusion. "You are saying these creatures actually live in space? Isn't it much more likely that this one was hurled into the ring from an ice geyser and was already dead when you ran into it?"

"Well, of course, with only one specimen to examine, we cannot say for sure," Peter said.

"And further study is definitely needed," Manny added, because you must always say that further study is needed if you want to keep the grants coming.

"But on the basis of the evidence so far, that seems the most likely explanation," Peter said. "Just consider the reflectivity of the inner wings. They would serve no purpose in a dark ocean under a forty-meter thick blanket of ice. In the ring, however, they appear perfectly adapted to gather sunlight."

"Where radiation, if nothing else, would kill them." Novak's voice. It was the strongest objection. The life he had discovered on Mars had been sheltered in lava tubes and deep caverns.

"Many, perhaps most, would be killed," Peter said, choosing his words carefully, "but not necessarily all. For example, *deinococcus radiodurans* can reconstruct its genome without error even after it has been smashed into thousands of pieces by ionizing radiation. Most research into that bacterium has focused on trying to understand how it can do that. A more interesting question might be: Why has it evolved this way? There are very few spots on Earth where such an ability would provide a competitive advantage, but it is so obviously advantageous to an organism outside a planetary atmosphere that one might be forgiven for wondering if that is where the trait evolved."

Everyone seemed to talk at once. Some members of the audience were arguing with themselves more vociferously than with Peter or Manny.

"Of course, this is only preliminary speculation," Manny said quickly.

"Of course," Peter agreed. "But getting back to this intestinal structure. Earlier today, we sampled its contents with a hypodermic and subjected them to analysis. Most of it is water, as you would expect of a creature grazing on the ice particles of the E-ring. However, we also found significant amounts of ammonia and antifreeze glycoprotein. Together these do more than keep the creature from freezing solid. Our calculations indicate that when two of the wings focus sunlight on the torso, enough heat is produced to vaporize small amounts of water, enough to serve as a propellant.

"So, though they look vaguely like manta rays, it might be closer to the truth to call them space squids."

There were more objections and questions, but there was something halfhearted about them. Peter and

Manny were quite open about their own ignorance. Only the examination of more specimens would provide the answers they needed. There might be more expeditions in the *Auk*, but eventually the *Roc* would have to leave Titan, which seemed to harbor no life at all, and fall inward until it orbited Enceladus, a moon with such prodigious amounts of life that it could be hurled into the void. Everyone realized this. No one mentioned it.

The last question of the session came from Captain Zhen. "How long will it take you to understand these creatures?"

It was a question that took Peter and Manny by surprise. Peter took an intellectual step back in an attempt to gain perspective. "Why, the rest of my life, I suppose."

* * * *

vii.

July 17, 2062

They rehearsed that night in Angee's apartment. Jose Candanosa had not been able to get in town until four that afternoon and had come over immediately, meeting Shinichi Kanayama on the way. It was good to have the old group back together. After the tour that had taken her to Tokyo, Paris, and Soweto, Angee would be back in a small club setting, with musicians she knew and who knew her well. Several times, they had only to start the first few bars of a song to know that they were perfectly in sync. After two hours, Angee felt confident that they had the set down for the next night's performance. She went into the kitchen and came back with a platter of sandwiches and pitcher of lemonade.

Shinichi was standing at the piano, picking his way through an unfamiliar page of music. Two bars in, he frowned, muttered something under his breath, and began again. This time it was noticeable that left hand and right hand were doing distinctly different syncopations, each hand running through a series of quick crescendos.

"It's not half bad," Jose said. Angee startled, nearly dropping the lemonade and throwing the sandwiches all over the room. "So that horrified expression must mean that it's your composition, which you do not want to show anyone just yet."

Angee nodded, carefully placing platter and pitcher on a table. "It's just something I've been playing with. I thought Peter might like it when he gets back. It started with a dream I had about those creatures he found in the E-ring."

Shinichi pulled out another page. His brow glistened. His concentration made Angee think of a gymnast negotiating a particularly tricky routine. Now the chords changed slowly, melting into one another in a weightless, timeless fashion. Jose found the rest of the score. Purely instrumental sections alternated with parts for piano and voice.

He whistled and shook his head. "Setting T.S. Eliot to music. Heavy stuff."

"It's been done before," Angee said defensively.

"For poems about cats," Jose said. "Not the *Four Quartets*, as far as I know. Who is publishing this?"

"Well, nobody, I mean, it's just for Peter, and most of my fans wouldn't know what to make of it."

"We will publish it anonymously," Jose declared. "Or under a pseudonym. The *Roc* trio, perhaps."

"It's not for a trio," Shinichi said seriously. "You want to score this for orchestra, don't you?"

Angee gave a quick nod. "I'll tell you the whole story as we eat."

* * * *

"...what we've done has been good," Angee said, a note of defensiveness still in her voice. "We have kept the standards fresh and showcased some new composers that otherwise rarely gets a hearing. But I found myself wanting more. I wanted the feeling I had the first time I heard Gershwin's Preludes, or heard Coltrane transform a simple, sappy tune into something so new and strange that it seemed I was suspended somewhere outside the Solar System. I didn't know anyone who was doing just what I wanted, so I started composing myself. A few bars, then a few pages. I never thought I had the talent to succeed.

"And what could I do with the result if I did succeed? It would leave most of my fans bewildered. Goldie would have a heart attack if she knew I was doing this."

Shinichi looked at Jose. "We are good at keeping secrets."

"How much time do we have?" Jose asked.

"I am up for the next two months, then asleep for three months. A month after that, Peter will be home."

"Six months," Jose said, "but only three with you. We must get to work."

* * * *

December 29, 2062

"I need a favor," Peter said. "A couple of favors, actually."

Dr. Beard frowned. "There is little that I can do for you. You were warned repeatedly that two hours of *intense* exercise *every* day were required to maintain minimal fitness levels, and that three or four hours were preferable for anyone wanting to minimize difficulties on returning to Earth.

"On the way out, your discipline was exemplary." This was said in the tone of a disappointed teacher. "While in the Saturnian system, however, not only did I have to put you on report repeatedly for falling below the two hour minimum, but much of the time you were in free fall on your collecting expeditions. Under such conditions, muscle atrophy and bone loss were inevitable.

"Realizing this two weeks ago, and also realizing that we would soon be back home, you then did one of the few things that could have made things worse. You began to overexercise and pulled a hamstring."

Peter grimaced. There was nothing to say in his defense because everything Beard said was true. While in orbit about Saturn, he had wanted to use every waking moment either studying Enceladans in their natural habitat or analyzing their remains in the *Roc*. There simply had not been enough hours in the day. The trip home should have given him plenty of time for the lab work, but then he had to deal with hibernation every three months.

"All very stupid of me," Peter agreed. "Tomorrow we enter Earth orbit. We are supposed to undergo extensive medical checks, taking up to a week, before being allowed to shuttle to the surface. The problem is, the day after tomorrow, a friend of mine will be premiering a composition for voice and jazz orchestra. I want to surprise her by being there. I need you to help me do that."

Beard stared at him. Peter stared back patiently.

"She is very beautiful," Beard said unexpectedly. "Was that, with her other qualities, worth throwing away your career?"

"I threw away nothing," Peter said. "My career seems pretty much assured."

"Now, yes," Beard said. "But when you ... made a certain enemy, that was not the case. Will you answer my question?"

"What? Oh yes, absolutely."

Beard smiled. The effect was almost shocking, like morning sunlight illuminating the depths of a cave. "I will have to pull strings with my colleagues in HEO Medical. But yes, I think I can help you. And there is one specific procedure you will need."

"Ah, yes," Peter said.

* * * *

The cab set down gently on the Kennedy Center's newly refurbished landing pad.

"You may debark now," the cab told Peter. "Please indicate if you need extra assistance." Cab sensors had somehow registered the exo-skeleton with which Beard had fitted him, though it was mostly concealed beneath his recreation suit, and decided he was an injured war veteran.

"I'm fine, thank you." And, indeed, the almost silent motors in the exoskeleton augmented his muscles sufficiently for him to swing out of the cab, stand on the tarmac, and walk with something like his normal stride toward the roof entryway. He stopped as he reached it and turned to survey the Potomac below and the city beyond it. The January air was crisp. Now and then, snowflakes stung his cheeks. If the front came through as expected, he would have to take ground transportation back to his apartment. He inhaled deeply, savoring dozens of subtle scents he had forgotten while on the *Roc*. Then he turned and took the escalator down to the box office.

He had been hoping to slip into the audience unrecognized, but his luck ran out as he picked up his ticket. The face of the girl handing to it to him lit up with astonishment.

"Dr. Frondelli! I saw the name but told myself it couldn't be you. The crew isn't due down for a week."

"This is a surprise for Miss Lamont," Peter said, "or at least it was supposed to be. I see that I'm already late."

"Just by a few minutes," the girl said. "Don't worry. I'll get you a chair backstage."

"Oh, I can't wait to tell my boyfriend. This is all so romantic, and I get to be here at the end."

"That is not why we did it," Peter said, a bit more stiffly than he intended.

"I know," the girl said solemnly. "That's what makes it all so sweet."

* * * *

Peter sank gratefully into the chair. Despite padding, the exoskeleton was chafing in spots. Beard had programmed it to assist him, but not to do all the work. Making Peter provide a proportion of the muscle power that increased every day would make him stronger and eventually complete his adjustment to one gee. Right now, it made him exhausted.

He sat in darkness, the only light being that which spilled over from the stage. Standing where she was, Angee would not be able to see beyond the first two rows. It was one reason she preferred playing clubs. There you could see your audience, make contact with them, feel the electricity of a good performance build. Here she would be half dazzled by the footlights.

Peter stared at her, wondering if she looked different than the last time he had seen her. Happier, certainly. Older? Hard to say. For all the time they had spent in hibernation, it had still been five years.

Maybe there was just additional confidence, a deeper maturity. He could hardly imagine that the woman he had known when he left would have performed, much less composed, the work unfolding before him. As much as they had stayed in contact through e-mail, it would take some time until they really knew each other again. If they had ever really known each other in the first place.

There was a screen behind her, just barely visible from this angle. Dots winked into being, extended into lines that curved, then connected into a series of semi-abstracts ... a fish, jumping from the waves, morphing into a bird, surrounded by stars, a man (floating in free fall?), an Enceladan, then the two of them revolving in a microgravity pas de deux, until they came together and merged....

* * * *

Warm lips pressing his. The trace of a scent that had once been so familiar and which he had missed for so long. Strands of hair brushing across his forehead so lightly that they almost tickled. A sigh.

"You fall asleep during my most important performance. I should feel insulted. I suppose I'm lucky you're not a critic."

Peter opened his eyes. Angee's smile filled the world. "My apologies. It has been a tough ... five years."

Angee's eyes dropped and saw the exo-skeleton poking out from a sleeve. Her expression sobered. "Yes, it has. Sometimes, when I slept, I would dream of you and cry when I woke. Kiss me again, so I can feel how good it is to be awake."

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Reader's Department: **GUEST REFERENCE LIBRARY** by Don D'Amassa

The Last Theorem, Arthur C. Clarke & Frederik Pohl, Ballantine, \$27, 299 pp. (ISBN 978-0-345-47021-8)

Implied Spaces by Walter Jon Williams, Night Shade, \$24.95, 265 pp. (ISBN 978-1-59780-125-6)

The January Dancer by Michael Flynn, Tor, \$24.95, 350 pp. (ISBN 978-0-7653-1817-6)

When Duty Calls by William C. Dietz, Ace, 24.95, 356 pp. (ISBN 978-0-441-01632-7)

Quofum by Alan Dean Foster, Del Rey, \$25.00, 286 pp. (ISBN 978-0-345-48507-6)

The Quiet War by Paul J. McAuley, Gollancz, (British pounds) 18.99, 462 pp. (ISBN 978-0-575-07933-5)

* * * *

Like any other living thing, the science fiction field is constantly changing. Popular themes and preoccupations from one decade fall out of favor in the next, perhaps to return a generation later. Alien invasions, telepathy, and robot fiction have become novelties in recent years, but space opera and first contact stories are enjoying fresh popularity. One of the classic genre novels of the 1950s was *Childhood's End* by Arthur C. Clarke, in which the human race is transformed by its encounter with a greater galactic civilization. *The Last Theorem*—a posthumous collaboration with Frederik Pohl, an author of equally memorable work—resurrects and reworks that theme. The passage of half a century has left its mark, however, not just on the authors but also on the field itself. During the 1950s, science fiction was primarily focused on macro issues. Humanity would be confronted by some event—a new scientific discovery, an unprecedented disaster, contact with another intelligence—and the author described its impact on our world as a whole. That focus has changed to the micro in recent years and *The Last Theorem* focuses primarily on the adult life of one individual who lives through a period of astonishing revelations and changes.

That man is Ranjit Subramanian, whom we first see as a Sri Lankan college student obsessed with proving Fermat's last theorem. Dissatisfied with a complex, theoretical proof provided by a computer analysis during the 1990s, Ranjit is determined to discover Fermat's proof, which must have been much simpler. Ranjit lives in our near future, a future in which brushfire wars have become even more prevalent than they are today despite hints of growing cooperation among the three major powers. The world has become an increasingly dangerous place filled with bellicose states squabbling over dwindling resources and old enmities. Unfortunately, the use of increasingly destructive weapons has attracted the attention of the Grand Galactics, an ethereal race that effectively rules the galaxy. Their agents are monitoring Earth closely and a preliminary order has been given for one of their subject races, the One Point Fives, to exterminate the troublesome upstarts. A massive fleet has been dispatched to accomplish that comparatively minor task during Ranjit's lifetime. Fortunately, there are signs on Earth that a group of influential people has recognized the serious nature of conflict on Earth and is about to employ a new technology to impose some relatively benevolent control over rogue states.

One of the difficulties with classic Utopian fiction is that the reader is presented with a mature society rather than shown the intervening steps that would demonstrate how such a new civilization might evolve. The authors in this case address that problem, although in the real world the situation would certainly be far more complex and imperfect. The story is also far less melodramatic than it might have been if published during the 1950s. Included are brief discussions of mathematical and other scientific problems that evoke a kind of old-fashioned sense of wonder about the universe without disrupting the flow of the

story. It is on the whole a remarkably intelligent reworking of a familiar genre theme.

* * * *

The opening sequence of *Implied Spaces* by Walter Jon Williams is slightly misleading, because it takes place in a world of orcs and trolls and beleaguered caravans crossing a desert filled with bandits. Rather than fantasy, however, it is a variation of traditional space opera. In the distant future, the human race has created thirteen immense artificial intelligences which orbit the Earth and which facilitate the creation of pocket universes in each of which the laws of nature can be altered to suit the inclinations of the designers. The protagonist, who has many names but is most commonly called Aristide, was one of the original designers, now virtually immortal since personalities can be backed up and downloaded into new bodies in the event of the death of the original. Aristide is interested in the implied spaces of these artificial environments, that is, the small details that evolve as a consequence of the design rather than by the conscious choice of the designers.

His sojourn in this primitive world leads to an unexpected discovery, however. Several artificially constructed priests have been causing people to briefly disappear, and then reappear with slightly altered personalities. Aristide returns to the external universe and learns that similar disappearances have been occurring elsewhere, and that the returnees are part of a mysterious and wide-ranging conspiracy. The most troublesome aspect is that this conspiracy could only be undertaken if one of the thirteen artificial intelligences were being suborned or somehow freed itself from its programming restraints. Once the existence of the conspiracy is revealed, the secret campaign is transformed into an open battle with a mysterious individual who has learned that the “original universe” is also just a construct of some larger meta-reality and who plans to forcibly unite all of humanity in a quest to confront their creators.

Williams is perfectly at ease with either swordplay or superscience, and he has a bit of fun while describing the two sides as quite literally throwing universes at one another. The interplay between Aristide and Bitsy, an artificial cat that is actually an avatar of one of the AIs, is crisp and amusing. There is a strong cast of supporting characters, a handful of entertaining and unexpected reversals, and some rewarding surprises, particularly in the latter parts of the novel.

* * * *

Space opera has enjoyed a particularly fruitful resurgence in popularity during the past few years, with major works in that form from Alastair Reynolds, Iain Banks, and Peter Hamilton, among others. Michael Flynn helps prove that this isn't just a British phenomenon with his newest, *The January Dancer*, a complex, panoramic story that incorporates a wide variety of traditional and more contemporary plot devices. Captain January and his crew are performing routine repairs on their ship on an uncharted world when they uncover the Dancer, a mysterious alien artifact whose function is unclear. He promptly cedes possession to a local commercial official, but only after his crew has proven to be remarkably obedient, a quality they had not previously demonstrated. Eventually the artifact's potential attracts the attention of a variety of searchers, some of whom wish to claim it for themselves, others hoping simply to deny it to those who might take unfair advantage of its powers of persuasion. From these disparate threads, Flynn weaves an interesting tapestry in a civilization that uses technology that verges on the magic but which no longer pursues science at all. There have been no new discoveries or inventions in countless ages. The backdrop is a richly implied civilization that features an uncomfortable truce among the two main powers and ongoing efforts by dislocated Terrans to secure the liberation of a now occupied Earth.

The cast of characters who are caught up in the chase is rich and colorful enough to populate a shelf of books. Many of them manage to be larger than life without losing their humanity. In fact, there are so many plots and counterplots, betrayals and secret alliances, that readers are cautioned not to let their attention stray or they'll find themselves paging back to discover the roots of an entirely new subplot. Some of the characters are working for government agencies, some for themselves, and others serve

causes that transcend the individual. Included are politicians, heroes, investigators, interplanetary agents, criminals, spaceship captains, conspirators, and bards, some of them admirable, others less so.

The novel is crammed full of plot twists and embellishments. There are space pirates and missing starships, assassinations and seductions, wormholes providing secret routes through space, concealed identities and surprise revelations, enigmatic alien artifacts, an extinct intelligent race, a mutiny, and a planetary civil war, to name a few. There are in fact so many elements in the story that they might have added up to incomprehensible confusion in the hands of a less able writer. Flynn, however, not only manages to hold them all in check but also employs each for a specific function in the story. The diverse strands are all drawn together in the closing chapters. This is the author's most complex and rewarding novel to date.

* * * *

Military science fiction tends to fall into two major categories: space-based, which is generally more about strategy; and planetary combat, which usually involves tactical and political problems. The latest from William C. Dietz, eighth in the Legion of the Damned series, falls into the latter category. The legion in question consists of cyborg soldiers, oversized humanoid war machines directed by human brains, commanded by Captain Antonio Santana, who is acutely aware that those under his command are not just expendable assets. His efforts are hampered to a degree by his new commanding officer, Liam Quinlan, who is more interested in his own career than in the welfare of his troops. A minor plot complication is the existence of the Clone Hegemony, an offshoot human civilization that doesn't believe in using natural reproduction, preferring a more rigid caste system.

The human-dominated Confederacy is locked in a battle with the insect-like Ramanthians, and portions of the novel read like a cross between Robert A. Heinlein's *Starship Troopers* and accounts of the Japanese army's resistance during World War II. These are useful shortcuts because military SF almost always places the emphasis on the military side of things, and its readers are less interested in lengthy descriptions of an alien culture or other peripheral matters. Several of the standard elements emerge—the small band of defiant guerilla fighters on one of the occupied Clone worlds, the contingent of troops cut off from support on a largely hostile planet, the conflict between a savvy front-line soldier and his inexperienced and thoughtless superior, and difficulties with supply protocol that deny the front line troops the readily available equipment they require. Dietz selects his puzzle pieces so that they complement each other and fits them together to emphasize action and excitement.

One of the puzzle pieces is the political component. A delegation from the human worlds hopes to take advantage of the Ramanthian attack on the Clone Hegemony to forge a permanent alliance. Unfortunately, this means making major political concessions that don't sit well with their own senior military officers. This is particularly problematic because there are signs that internal dissensions among the clones may be almost as serious as the invasion itself. Those dissensions, and the essential differences in culture between the two strains of humanity, will prove to be major factors as the battle unfolds.

Dietz doesn't break any new ground, but that's not his intention. Military SF is intended to be predictable in form if not in detail and Dietz is one of its most reliable practitioners. There is no single central focus to the story, which employs several viewpoint characters so that the reader can observe events from various levels within the military and civilian authority, and even from among the alien Ramanthians. Although this necessarily means that the characterization is relatively sketchy, Dietz skillfully differentiates his characters with brief but incisive scenes that establish them as individuals. One small caveat, however: The specific campaign central to this story is more or less brought to a conclusion, but the saga of the Legion does not end. The war with the Ramanthians and other issues remain unresolved.

* * * *

Alan Dean Foster's novels are frequently set in the context of the Commonwealth, a future interstellar civilization created jointly by humans and the Thranx, a race resembling oversized beetles. His latest, *Quofum*, involves a joint expedition by five humans and one Thranx to a mysterious planet first reported by a robot probe which observed that the planet seemed to blink in and out of existence from time to time. Although the odd data is dismissed by the expedition as erroneous, the reader is obviously aware that there is some mysterious quality to the planet because if there wasn't, there wouldn't be much of a story.

Their arrival is uneventful and they discover an astonishingly fecund world filled with disparate forms of plant and animal life. Although they are initially caught up in the wonders surrounding them, they begin to suspect that something is wrong. In fact, they take a surprisingly long time to conclude that the ecology is not natural, something which the reader will have realized almost from the outset. They encounter five separate intelligent species within a few days of landing, each of which appears to have followed a separate evolutionary path, and not all of the indigenous creatures are even carbon-based. Their reaction to this strange environment is not always entirely plausible, but the story is not about the people in it as much as it is about the world itself. Their adventures are almost an afterthought in what is essentially a catalogue of bizarre forms of life.

The situation changes when the ship's technician identifies himself as a professional criminal and hijacks the ship, marooning two surviving humans and one Thranx. His escape is foiled by the peculiarities of Quofum's existence, but that doesn't help the three stranded scientists, who struggle to remain motivated even after realizing that their situation is hopeless. It is only then that they begin to discover the true nature of the planet, and the purpose underlying its peculiar nature. Although Foster explains the major mystery, the future of the three surviving scientists, and possibly that of the entire human race, will remain unresolved until the next book in the series.

* * * *

The human race has yet to reach the stars in Paul J. McAuley's *The Quiet War*, but the solar system is littered with human settlements, although the definition of human has changed somewhat. Using genetic engineering and mechanical enhancements, humans colonizing the remote parts of the solar system—known as the Outers—have adapted themselves to that environment. This disparity has added to the political and economic tensions separating them from an Earth where a collapse of the present civilization has made Brazil and a Pacific coalition the major powers on the home planet. Although those commanding the power structure consider the physical variations among the Outers as virtual heresy, they're not above creating genetically designed, cloned soldiers or turning others of their citizens into cyborgs when they feel it is to their advantage.

Although there is an uneasy peace between the two, there are powerful pressures building in both societies. The Outers are concentrated in a few locations and have limited numbers, but there are many among them who want to spread throughout the rest of the solar system, diversifying the human form in order to realize its potential in a variety of ways. The repressive forces on Earth express their disapproval of tampering with God's work with increasing stridence, but in fact the most powerful objections come from those who realize that an evolving and expanding Outer society will marginalize their power. The battle then is not only about what it is to be a human being but also the question of who determines the shape of our collective future.

It would be impossible to tell a story of such great breadth from a single viewpoint, so McAuley shows us the developing situation by means of several protagonists, representing both sides of the issue, although it is obvious where the author's sympathies lie. The specific plot involves a number of separate but divergent elements including an accidental death that might be murder, the passing of a prominent politician, espionage, and other intrigues. The conflict of societies is reflected in the struggle between

individuals and vice versa. The author mixes a great variety of ingredients in his pot, stirs well, and provides his readers with a masterful story of a future that is very much unlike the present in many ways, but which still manages to be convincing and gripping and somehow familiar. As the crisis approaches—which will be dealt with more fully in a sequel—the line of battle is clearly drawn and those who hoped to negotiate a peaceful settlement are forced to choose sides for the final confrontation. McAuley successfully blends serious issues with high adventure.

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Reader's Department: **MINI-REFERENCE LIBRARY** by Tom Easton

Fiona Kelleghan, *The Savage Humanists*,

Robert J. Sawyer Books (Red Deer Press, Fitzhenry & Whiteside), \$15.95, 302 pp.

(ISBN: 978-0-88995-425-0).

* * * *

In *The Savage Humanists*, Fiona Kelleghan stakes out the perimeters of another New Wave. Using stories by James Morrow, Jonathan Lethem, Kim Stanley Robinson, Gregory Frost, Connie Willis, John Kessel, Tim Sullivan, and Robert J. Sawyer, she defines a voice marked by “a cry for reason to prevail over irrationality and hypocrisy, a preference for the scientific method over credulity and faith, and a certitude that, with Reason and Science (as much tools as modes of thought), it may yet be possible that the plight of most humans on this planet and the ongoing despoliation and ruination of the resources of Planet Earth ... might be ameliorated and even remedied.” That explains the “humanism” of the title, and it is of course a very secular humanism. The “savage” is “because the satirical style of their best work—indeed, the best science fiction written today ... is colored by a facetiousness of tone and a violence of plot development expressed as ... anger at the perfidies of modern society and contemporary science fiction.”

* * * *

Kelleghan makes her case at length and chooses excellent stories to illustrate it, from Frost's “Madonna of the Maquiladora” to Morrow's “Veritas.” But is this New Wave so new? I would argue that satire of the sort she recommends to us has a very long history and the best SF—reaching back at least to Kornbluth's *Marching Morons*, Harrison's *Make Room, Make Room*, and just about everything by Brunner—has often fit her rubric. If there's anything new in her New Wave, it has to do with the way her savage humanists often comment upon other science fiction, as Kelly's “Think Like a Dinosaur” takes Tom Godwin's classic “The Cold Equations” to vicious task. But Barry Malzberg might well remind us that even that has precedent.

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Reader's Department: **BRASS TACKS**

Dear Stanley Schmidt,

Many times you have laid the blame for the world's problems at the overpopulation door. I agree. The worst one, of course is global warming. But has anyone ever calculated the (duh!) effect of billions of 98.6-degree heat and moisture machines? Or does it take a low-end genius like me to point it out?

I have subscribed to *Analog*, *Asimov's*, and *AHMM* for decades. I may be a 60-plus woman, but at heart I still read like a teenaged boy. Thanks for cover-to-cover fun ten times a year.

Edee Craig,

Anaheim, CA

* * * *

Dear Dr. Schmidt,

I have just finished reading your September 2008 issue of *Analog*. I have always made it a point to read your editorials, finding them well written and often hitting the nail on the head regarding your subject matter. I must, however, take some exception to a part of this one. I am one of those "humanities" types whose arrogance you complained of. I fully agree with your rant about their nose in the air dismissal of scientific and technical books from a list of the most important non-fiction. I submit, however, that you may have missed an important point. Unless a book is intended for a narrowly limited audience (and depending on that audience and the book's contents, it may well be influential) to truly be "important," does it not have to reach a fairly wide audience? I suspect that if it does not, it will not have much effect and therefore is unlikely to be important. I do not denigrate the value of such a book or the validity of its contents, merely its importance. What I am coming to with this is the criticism I must sometimes make of the science fact articles in *Analog*. I am assuming that many of the books you are referring to are similar in style to those articles. If I am in error in that assumption please say so. If not, many of these articles strike us non-scientific types (history major and 33 years administrative law judge) as being made up of a barrage of Greek letter formulae followed by a cavalry charge of charts that are invariably on another page than the material they seek to illustrate. Besides being inconvenient, these deficiencies serve to adversely affect their chance of appealing to the wide audience needed for importance because they lack readability. If the scientists and engineers who write these books might keep this fact in mind, they might make such lists of important writings. I don't believe this is by any means the only reason they fail to make the cut, but it might have something to do with it. Please do keep up those delightful editorials as I do so enjoy them.

Respectfully,

Steve Altman

—

I heartily agree that scientific writers, especially for non-specialist audiences, should strive for the utmost clarity that they can muster, and I recognize that some do this better than others. It isn't easy. However, I also think that some people who have characterized themselves as nonscientists are too quick to glance at a piece of scientific writing and toss it aside because it requires a little effort to digest.

What does "important" mean? If you measure it by the influence it actually has, or the size of the

audience it reaches (as you seem to suggest), then the National Enquirer must be very important indeed. I respectfully suggest that at least sometimes the claim of importance might be better justified by content of such pressing relevance to the prospective readers' future lives that they need to make an effort to understand it—and that lists of the “most important” should at least occasionally try to call readers' attention to books that warrant such attention and effort.

* * * *

Dear Doctor Schmidt,

Who proofreads *Analog*? It has been clear for some time that at least a computer does, because all of the text passes the “sounds like” test. Computers are good at finding typos, but not very good at finding “thinkos.” I have been willing to put up with the goofy word usage, believing that the person typing made a typo that the computer corrected to the wrong “sounds like” word. But the errors have been going beyond what can be considered an over-reliance on spell check software, leaving me scratching my head and silently mouthing “Huh?” Now these errors are showing up in work by *Analog* regulars (you and Doctor Cramer) and seem to indicate that no one is reading for content prior to printing.

I am sure there are many reasons for it being difficult to publish a good product. I am not sure there are many (if any) good ones. I am one of your readers who bought their first issue of *Astounding* by returning soda bottles for deposits, and was able to become a regular reader when I got a paper route. I held off subscribing until *Analog* began to disappear from retail outlets, but I have many boxes of past issues. Of these approximately 50 years of reading the magazine, only the last few have burdened me with having to forgive errors such as those mentioned above. Please tell me why.

Steve Schaefer

—

An occasional error does not prove that “no one is reading...” though it does provide yet another illustration of the obvious and widely known fact that none of us is perfect. Furthermore, few of us in practice can be even as perfect as we could be if we had unlimited time to devote to seeking perfection.

*As for “these errors have only been appearing recently,” it just ain't so. I've been getting letters of that sort throughout the 30 years I've been editing *Analog*. I've also gone back through many of those older issues, all the way back to the beginning, while editing anthologies; and I can assure you that they're nowhere near as immaculate as old-timers fondly remembering them think they are.*

* * * *

Dear Dr. Schmidt:

I have been a subscriber to *Analog/Astounding* for well over a half a century, I believe. I was struck (not stricken) by the short piece “Aliens” in your December 2008 issue. I look to this as a contrived, snide, cheap political shot. Who is Rick Norwood? Does the article represent your own views? How can this particular article be worthy of publication in *Analog*?

Very truly yours,

William F. Fisher

—

Actually, it was a story, not an article; and I'm sorry you didn't like it, and even sorrier that you chose to read it as you did. Not everyone agreed with you (see the following letter), and we're well aware that we can't expect to please anybody with everything or everybody with anything. (But who the author is, and what my views are, are completely irrelevant to the value of the piece.)

* * * *

Hello Stan,

My only problem with Rick Norwood's "Aliens" in December's Probability Zero is that I would put it at a much higher possibility than that; sadly, I think it's closer to 70%. I usually get a chuckle from reading those. Thanks for challenging my expectations.

Robert Johns

Marysville, WA

* * * *

Dear Stan,

"Rocks" starts off with "The huge rock spiraling into the planet's atmosphere..." Poetic license is certainly acceptable, but this seems to me to be a bit much. It has been estimated that the diameter of the cometary body or asteroid that formed the Chicxulub Crater was some 10 km. A body of this size traveling several km/sec would not be affected by the Earth's rather thin atmosphere and would therefore not spiral into the planet's atmosphere. I think a better description might be: "It went plunk." I must admit that that isn't very poetic, but more accurate maybe?

Best wishes for a good year in 2009.

Yours truly,

Fred Bushnell

Pfalzgrafeweiler

Germany

—

It sounds like you're picturing the wrong kind of spiral, like a corkscrew. The atmosphere has nothing to do with it; what's happening here is pure gravity: a rock passing close enough to the planet to be drawn into a decaying orbit, making a plane spiral and ultimately hitting the surface.

* * * *

Dear Stan,

Discussing the story "Tracking" in the October 2008 issue, reader Robert P. Odenweller mentions "Shazam," Billy Batson's legendary incantation that turned him into Captain Marvel, but is unsure of its derivation.

The acronym was derived from the names of Solomon, Hercules, Atlas, Zeus, Achilles, and Mercury, each of whom supposedly contributed something to the Captain's powers (though he didn't have Achilles' notorious weakness). It was also apparently the actual name of the ancient wizard who gave Billy his abilities.

Gomer Pyle's usage was far from the last. In the 1970s, DC Comics, which had bought the rights to the Fawcett characters, revived Captain Marvel (literally—the Captain and his supporting characters were shown as having been in suspended animation since the 1950s). At first rendered in the cartoony style used by creator C.C. Beck, the Captain has been revamped several times since then and is now drawn “realistically” and generally written straight rather than for laughs.

Eric B. Lipps

Staten Island, NY

* * * *

Dear Stanley,

First of all, I haven't finished your editorial. I just happened to be near my computer as I read it. You may cover this later.

You need to consult with some economists before you get into a lot of economic commentary. If you have, you need to consult with some others. Two quick points.

If you dump your waste on your neighbor's property, you have infringed on his rights. It doesn't matter whether you throw it over the fence or if it washes down from rain or river. You have still dumped it on his property and he has a right to complain. The same thing applies to wind-born garbage. It isn't always enforced, but that doesn't mean it doesn't exist.

At this point there are no property rights to most fish or other aquatic creatures in the typical river. In fact, in the US, there are no property rights in the rivers; they are owned by the government. This is too bad because fishing upstream does not infringe rights that don't exist. OTOH, there are property rights to most land animals. Grab your neighbor's cattle and you could get arrested for rustling.

There has been a lot of theoretical work put into developing a theory of property rights in river life. At this point I don't think anything has been decided, although I am not really current on that.

Bob Peirce

Venetia, PA

—

True enough, but you're talking about legal rights and I'm talking about moral (or ethical) rights—which are not necessarily the same.

* * * *

Stan,

I'd like to comment on Jeffrey Kooistra's thoughts on the current “energy crisis.” I too, waited in gas lines in the 1970s and once again I see that our efforts at conservation are motivated by dollars and cents when we could have had the sense to change our energy diet back then and conserve our dollars in the bargain.

For the last seven years I have become passionate about living sustainably and have committed a lot of my time and energy toward education and reducing waste and carbon emissions. To that end, my wife and I both own clean burning hybrid vehicles. She bought the 60MPG Honda Insight in 2000 and I found a used 2006 Ford Escape Hybrid SUV in 2008 that gets over 30MPG on average. (And yes Jeffrey, it took me five months to sell off my old gas guzzling SUV!) I have built a solar augmented heating system

for my workshop that uses propane and wood as backup. I also installed solar collectors on our home for our domestic hot water that offsets 75% of fossil fuel consumption annually. I also organize and present public talks on energy awareness and sustainability. So clearly I have become quite well informed on the issues.

The point that I think Jeffrey missed is that he is still embracing the current paradigm of centralized power generation. From that premise he postulates gigantic solar arrays as unrealistic—when in fact such arrays are being constructed on a slightly smaller scale all the time all over the world. A good source for world news about solar energy deployment is: www.solarbuzz.com

He goes from his premise that large scale solar is unrealistic to his somewhat viable proposal that nuclear is a more reasonable option. I have no significant argument with nuclear power in principle—it certainly has provided relatively safe, and relatively clean power for decades throughout the civilized world. The problem I have with implementing nuclear in the US is that it will take too long and cost too much. It also remains a political hot potato that will likely defer large-scale deployment of nuclear energy implementation indefinitely.

So one alternative is to incentivize *all* alternatives to fossil fuel at *all* scales. For instance, Germany implemented a feed-in tariff law some years ago that made it very sensible for small businesses and individuals to install solar panels on their roofs and in their fields. The utility pays a significant premium to these micro generators for the power they feed into the grid, and the premium is funded by a small tariff added to the bill of all rate payers. The owners of these small systems are rewarded by maintaining their generation capacity at peak performance. The return on investment is short enough that it makes good sense and the sudden surge in solar installation in Germany caused a global spike in the cost of solar panels a while back. I believe that Germany now has the highest solar energy generation capacity per capita than any other country as a result of this very successful policy. Yes, the percentage of power produced by solar in Germany is still below 4%, but it is a significant paradigm shift. Some states here in the US are seriously looking at legislation based on the German law, including (by the time this goes to print) the state of Maine where I live.

But my main point here is that centralized power generation is an obsolete paradigm that does not serve us well. By embracing decentralized power we level the playing field and allow anyone from an individual homeowner on up to become an energy producer. This empowers individuals to take direct action and become micro utilities for profit. Decentralized power increases our energy security by limiting the potential for cascade failures of the electric grid. It allows *all* viable options to be explored at every scale, from a few kilowatts on up. Power to the people—literally!

I'm not saying that this is the only alternative to nuclear, I am merely suggesting that it could be deployed a lot sooner and have a positive impact in a reasonable time frame. We also need to effect a culture change in energy awareness. Living sustainably is a social issue. If we can reduce and re-use, we won't need to build as many power plants or drill more wells.

Analog readers—this is my personal call to action to you as individuals. I believe that we are all intelligent, resourceful future-oriented individuals. Every one of us can and should do everything that we can, and then go and get your friends and neighbors involved in living more sustainably! To learn about my family's efforts to live sustainably go to www.arttec.net/SustainableLiving—hopefully you will be inspired to take some steps that you had not considered.

Guy Marsden,

Woolwich, Maine

* * * *

Dear Dr. Schmidt,

I have been a reader of *Analog* for over 50 years, and an advertiser for the last 20. I must admit my readership has been spotty in recent years as much of what you publish I barely recognize as science fiction by the standards of years past. Tastes do change, but considering I cannot keep copies of 50-80 year old *Analog/Astounding* magazines on my webpage, there is still considerable interest in the older variety that I like.

I did read some of the latest issue but found little to like in the fiction. What I did read in entirety was the editorial, and let me say that I was seriously disappointed. The subject was the fact of global warming or the fiction thereof as some would believe. The position you took was to defend the orthodox politically correct establishment point of view. Regardless of the facts, I would have expected a different point of view. Why is this so?

You inherited an old magazine, once well respected in the field. John Campbell made it so. I started reading not long after he became editor, and while his early editorials look simplistic by today's standards, by the 1950s they became the reason I subscribed to the magazine. I remember one editorial position that cancer caused cigarette smoking. I doubt he really believed that, but it was well argued and made a point I have not forgotten to this day. That is, the two groups used in a survey sample may not be identical, so different outcomes may be for unrelated reasons. In this case, he argued that smokers may be totally different personality types than non-smokers. That is, smokers may be naturally nervous types, who would come down with cancer more often than the general population, even if they did not smoke. Perhaps the calming effect of smoking may even reduce their cancer rate to a level below the normal rate for the group, but still higher than the control group of non-smokers.

Ridiculous? Probably so. But what prompted this letter was an article I read online about the benefits of exercise. People who exercise regularly at age 65 are likely to live five years longer than people who do not. Are these two groups the same? It is quite likely that people who exercise on a regular basis at 65 are in better health already than people who do not, and would have lived longer anyway.

Taking this back to global warming, I was disappointed to read the orthodox position—I can find that everywhere. In a science fiction magazine, I would expect better. You do not have to be a kook lunatic to consider the possibilities. As a thermodynamicist in the aerospace industry for 50 years, I can offer other possibilities that Campbell might have proffered. My own personal view is that variation in the output of the energy from the Sun has far more to do with climate than anything man can do. Anecdotal evidence that temperatures are increasing on Mars and Jupiter as well as Earth would support this thesis. Considering CO₂ levels, it is just as likely that temporary global warming from variation in the Sun's energy output to the Earth is causing an increase in CO₂ levels rather than the other way around. A lot of CO₂ is dissolved in oceans, other bodies of water, and soil. When temperatures increase, water can hold less CO₂ in solution, so increasing amounts would be dumped back into the atmosphere. Whether this is true or not is beside the point. Taking a contrary position such as this or a dozen others I could think up forces people to think.

That should be the point of editorials in an SF magazine—shake up people! Make them think, or even better, think outside the box! That should be your mission, not defending the orthodox.

Best Regards,

Ray Bowman

Carmel, IN

—

Actually the magazine is still well respected in the field, and if you read it less spottily you'd probably know that I do sometimes do what you describe. But I don't require myself to do it all the time. Orthodox positions are not necessarily always wrong, and sometimes it's more important to be right than to be contrary. When your house appears to be on fire, you shouldn't spend too much time pondering all the ways it could be just a clever illusion before you call the fire department.

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Reader's Department: **UPCOMING EVENTS** by Anthony Lewis

22-24 May 2009

ConQuest 40 (Kansas City area SF conference) at Hyatt Regency Crown Center, Kansas City, MO. Guest of Honor: John Scalzi; Artist Guest: Oberon Zell; Anime/Media Guest: Jerry Gelb; Fan Guest: Ed deGruy; Toastmaster: Ellen Datlow. Membership: \$30 until 1 January 2009; later to be announced. Info: www.conquestkc.org/; ConQuest 40, P.O. Box 36212, Kansas City, MO 64171

22-24 May 2009

OASIS 22 (Orlando area SF conference) at Sheraton Orlando Downtown, Orlando, FL. Writer Guest of Honor: Peter David; Special Guest Writer: John Ringo; Editor Guest of Honor: Toni Weiskopf; Artist Guest of Honor: Johnny Atomic. Membership: \$35 until 30 April 2009, \$40 at the door. Info: www.oasfis.org/oasis; OASFiS, PO Box 592905, Orlando, FL 32859-2905.

5-7 June 2009

SOONERCON 2009 (Oklahoma SF conference) at Oklahoma City, OK. Guests: Eric Flint, Selina Rosen; Artist Guest of Honor: Brad Foster. Info: www.soonercon.info; info@soonercon.com; SoonerCon, c/o Atomic Comics, 6006 S Western, Oklahoma City, OK 73139, (405) 632-2848.

2-5 July 2009

WESTERCON 62/FIESTA CON (Western North America science fantasy convention) at Tempe Mission Palms Hotel, Tempe, AZ. Artist Guest of Honor: Todd Lockwood; Writer Guest of Honor: Alan Dean Foster; Editor Guest of Honor: Stanley Schmidt; Fan Guests of Honor: Jim & Doreen Webbert; Toastmasters: Patrick and Teresa Nielsen Hayden. Membership after 31 December 2008 to be announced. Info: www.fiestacon.org/; fiestacon@leprecon.org; (480) 945-6890; FiestaCon, c/o Leprecon, Inc., PO Box 26665 Tempe, AZ 85285

6-10 August 2009

ANTICIPATION (67th World Science Fiction Convention) at Palais des congrès de Montréal, Montréal, Québec, Canada. Guests of Honor: Neil Gaiman, Elisabeth Vonarburg; Fan Guest of Honor: Taral Wayne; Editor Guest of Honor: David G. Hartwell; Publisher Guest of Honor: Tom Doherty; MC: Julie Czerneda. Membership: until 15 July 2009 (see website for latest details): CAD/AUD 240, USD 195 GBP 130; EUR 150; JPY 18000000; supporting membership CAD/AUD 55; USD 55; GBP 25; EUR 35; JPY 6000. 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. Nominate and vote for the Hugos. Info: www.anticipationsf.ca/English/Home. C.P. 105, Succursale NDG, Montréal, Québec, Canada H4A 3P4

4-7 September 2009

North American Discworld Convention (conference dedicated to Terry Pratchett's Discworld books) at The Tempe Mission Palms Hotel, Tempe, AZ. Guest of Honor: Terry Pratchett; Other guests: Esther Friesner, Diane Duane, Peter Morwood. Info: www.nadwcon.org, info@nadwcon.org, (480) 945-6890, North American Discworld Convention 2009, c/o Leprecon, Inc., P.O. Box 26665, Tempe, AZ 85285.

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