WANG'S CARPETS

Greg Egan

Here's another story by Australian writer Greg Egan, whose "Luminous" appears elsewhere in this anthology. Nineteen ninety-five was a good year for Egan in short fiction, and, like Ursula K. Le Guin and Robert Reed, he published four or five different stories this year that might well have made the cut for a best-of-the-year anthology in another year; the story that follows, though, would be hard to match anywhere for the bravura sweep and pure originality of its conceptualization, as Egan provides us with a First Contact story unlike any you've ever read before . . .

Waiting to be cloned one thousand times and scattered across ten million cubic light-years, Paolo Venetti relaxed in his favorite ceremonial bathtub: a tiered hexagonal pool set in a courtyard of black marble flecked with gold. Paolo wore full traditional anatomy, uncomfortable garb at first, but the warm currents flowing across his back and shoulders slowly eased him into a pleasant torpor. He could have reached the same state in an instant, by decree—but the occasion seemed to demand the complete ritual of verisimilitude, the ornate curlicued longhand of imitation physical cause and effect.

As the moment of diaspora approached, a small gray lizard darted across the courtyard, claws scrabbling. It halted by the far edge of the pool, and Paolo marveled at the delicate pulse of its breathing, and watched the lizard watching him, until it moved again, disappearing into the surrounding vineyards. The environment was full of birds and insects, rodents and small reptiles—decorative in appearance, but also satisfying a more abstract aesthetic: softening the harsh radial symmetry of the lone observer; anchoring the simulation by perceiving it from a multitude of viewpoints. Ontological guy lines. No one had asked the lizards if they wanted to be cloned, though. They were coming along for the ride, like it or not.

The sky above the courtyard was warm and blue, cloudless and sunless, isotropic. Paolo waited calmly, prepared for every one of half a dozen possible fates.

An invisible bell chimed softly, three times. Paolo laughed, delighted.

One chime would have meant that he was still on Earth: an anti-climax, certainly—but there would have been advantages to compensate for that. Everyone who really mattered to him lived in the Carter-Zimmerman polis, but not all of them had chosen to take part in the diaspora to the same degree; his Earth-self would have lost no one. Helping to ensure that the thousand ships were safely dispatched would have been satisfying, too. And remaining a member of the wider Earth-based community, plugged into the entire global culture in real-time, would have been an attraction in itself.

Two chimes would have meant that this clone of Carter-Zimmerman had reached a planetary system devoid of life. Paolo had run a sophisticated—but non-sapient— self-predictive model before deciding to wake under those conditions. Exploring a handful of alien worlds, however barren, had seemed likely to be an enriching experience for him—with the distinct advantage that the whole endeavor would be untrammeled by the kind of elaborate precautions necessary in the presence of alien life. C-Z's population would have fallen by more than half—and many of his closest friends would have

been absent—but he would have forged new friendships, he was sure.

Four chimes would have signaled the discovery of intelligent aliens. Five, a technological civilization. Six, spacefarers.

Three chimes, though, meant that the scout probes had detected unambiguous signs of life—and that was reason enough for jubilation. Up until the moment of the pre-launch cloning—a subjective instant before the chimes had sounded—no reports of alien life had ever reached Earth. There'd been no guarantee that any part of the diaspora would find it.

Paolo willed the polis library to brief him; it promptly rewired the declarative memory of his simulated traditional brain with all the information he was likely to need to satisfy his immediate curiosity. This clone of C-Z had arrived at Vega, the second closest of the thousand target stars, twenty-seven light-years from Earth. Paolo closed his eyes and visualized a star map with a thousand lines radiating out from the sun, then zoomed in on the trajectory which described his own journey. It had taken three centuries to reach Vega—but the vast majority of the polis's twenty thousand inhabitants had programmed their exoselves to suspend them prior to the cloning, and to wake them only if and when they arrived at a suitable destination. Ninety-two citizens had chosen the alternative: experiencing every voyage of the diaspora from start to finish, risking disappointment, and even death. Paolo now knew that the ship aimed at Fomalhaut, the target nearest Earth, had been struck by debris and annihilated en route. He mourned the ninety-two, briefly. He hadn't been close to any of them, prior to the cloning, and the particular versions who'd willfully perished two centuries ago in interstellar space seemed as remote as the victims of some ancient calamity from the era of flesh.

Paolo examined his new home star through the cameras of one of the scout probes—and the strange filters of the ancestral visual system. In traditional colors, Vega was a fierce blue-white disk, laced with prominences. Three times the mass of the sun, twice the size and twice as hot, sixty times as luminous. Burning hydrogen fast—and already halfway through its allotted five hundred million years on the main sequence.

Vega's sole planet, Orpheus, had been a featureless blip to the best lunar interfer-ometers; now Paolo gazed down on its blue-green crescent, ten thousand kilometers below Carter-Zimmerman itself. Orpheus was terrestrial, a nickel-iron-silicate world; slightly larger than Earth, slightly warmer—a billion kilometers took the edge off Vega's heat—and almost drowning in liquid water. Impatient to see the whole surface firsthand, Paolo slowed his clock rate a thousandfold, allowing C-Z to circumnavigate the planet in twenty subjective seconds, daylight unshrouding a broad new swath with each pass. Two slender ocher-colored continents with mountainous spines bracketed hemispheric oceans, and dazzling expanses of pack ice covered both poles—far more so in the north, where jagged white peninsulas radiated out from the midwinter arctic darkness.

The Orphean atmosphere was mostly nitrogen—six times as much as on Earth; probably split by UV from primordial ammonia—with traces of water vapor and carbon dioxide, but not enough of either for a runaway greenhouse effect. The high atmospheric pressure meant reduced evaporation—Paolo saw not a wisp of cloud— and the large, warm oceans in turn helped feed carbon dioxide back into the crust, locking it up in limestone sediments destined for subduction.

The whole system was young, by Earth standards, but Vega's greater mass, and a denser protostellar cloud, would have meant swifter passage through most of the traumas of birth: nuclear ignition and early luminosity fluctuations; planetary coalescence and the age of bombardments. The

library estimated that Orpheus had enjoyed a relatively stable climate, and freedom from major impacts, for at least the past hundred million years.

Long enough for primitive life to appear—

A hand seized Paolo firmly by the ankle and tugged him beneath the water. He offered no resistance, and let the vision of the planet slip away. Only two other people in C-Z had free access to this environment—and his father didn't play games with his now-twelve-hundred-year-old son.

Elena dragged him all the way to the bottom of the pool, before releasing his foot and hovering above him, a triumphant silhouette against the bright surface. She was ancestor-shaped, but obviously cheating; she spoke with perfect clarity, and no air bubbles at all.

"Late sleeper! I've been waiting seven weeks for this!"

Paolo feigned indifference, but he was fast running out of breath. He had his exoself convert him into an amphibious human variant—biologically and histori-cally authentic, if no longer the definitive ancestral phenotype. Water flooded into his modified lungs, and his modified brain welcomed it.

He said, "Why would I want to waste consciousness, sitting around waiting for the scout probes to refine their observations? I woke as soon as the data was unambiguous."

She pummeled his chest; he reached up and pulled her down, instinctively reduc-ing his buoyancy to compensate, and they rolled across the bottom of the pool, kissing.

Elena said, "You know we're the first C-Z to arrive, anywhere? The Fomalhaut ship was destroyed. So there's only one other pair of us. Back on Earth."

"So?" Then he remembered. Elena had chosen not to wake if any other version of her had already encountered life. Whatever fate befell each of the remaining ships, every other version of him would have to live without her.

He nodded soberly, and kissed her again. "What am I meant to say? You're a thousand times more precious to me, now?"

"Yes."

"Ah, but what about the you-and-I on Earth? Five hundred times would be closer to the truth."

"There's no poetry in five hundred."

"Don't be so defeatist. Rewire your language centers."

She ran her hands along the sides of his ribcage, down to his hips. They made love with their almost-traditional bodies—and brains; Paolo was amused to the point of distraction when his limbic system went into overdrive, but he remembered enough from the last occasion to bury his self-consciousness and surrender to the strange hijacker. It wasn't like making love in any civilized fashion—the rate of information exchange between them was minuscule, for a start—but it had the raw insistent quality of most ancestral pleasures.

Then they drifted up to the surface of the pool and lay beneath the radiant sunless sky.

Paolo thought: I've crossed twenty-seven light-years in an instant. I'm

orbiting the first planet ever found to hold alien life. And I've sacrificed nothing—left nothing I truly value behind. This is too good, too good. He felt a pang of regret for his other selves—it was hard to imagine them faring as well, without Elena, without Orpheus—but there was nothing he could do about that, now. Although there'd be time to confer with Earth before any more ships reached their destinations, he'd decided—prior to the cloning—not to allow the unfolding of his manifold future to be swayed by any change of heart. Whether or not his Earth-self agreed, the two of them were powerless to alter the criteria for waking. The self with the right to choose for the thousand had passed away.

No matter, Paolo decided. The others would find—or construct—their own reasons for happiness. And there was still the chance that one of them would wake to the sound of four chimes.

Elena said, "If you'd slept much longer, you would have missed the vote."

The vote? The scouts in low orbit had gathered what data they could about Orphean biology. To proceed any further, it would be necessary to send microprobes into the ocean itself—an escalation of contact which required the approval of two-thirds of the polis. There was no compelling reason to believe that the presence of a few million tiny robots could do any harm; all they'd leave behind in the water was a few kilojoules of waste heat. Nevertheless, a faction had arisen which advo-cated caution. The citizens of Carter-Zimmerman, they argued, could continue to observe from a distance for another decade, or another millennium, refining their observations and hypotheses before intruding . . . and those who disagreed could always sleep away the time, or find other interests to pursue.

Paolo delved into his library-fresh knowledge of the "carpets"—the single Or-phean lifeform detected so far. They were free-floating creatures living in the equatorial ocean depths—apparently destroyed by UV if they drifted too close to the surface. They grew to a size of hundreds of meters, then fissioned into dozens of fragments, each of which continued to grow. It was tempting to assume that they were colonies of single-celled organisms, something like giant kelp—but there was no real evidence yet to back that up. It was difficult enough for the scout probes to discern the carpets' gross appearance and behavior through a kilometer of water, even with Vega's copious neutrinos lighting the way; remote observations on a microscopic scale, let alone biochemical analyses, were out of the question. Spectroscopy revealed that the surface water was full of intriguing molecular de-bris—but guessing the relationship of any of it to the living carpets was like trying to reconstruct human biochemistry by studying human ashes.

Paolo turned to Elena. "What do you think?"

She moaned theatrically; the topic must have been argued to death while he slept. "The microprobes are harmless. They could tell us exactly what the carpets are made of, without removing a single molecule. What's the risk? Culture shock?"

Paolo flicked water onto her face, affectionately; the impulse seemed to come with the amphibian body. "You can't be sure that they're not intelligent."

"Do you know what was living on Earth, two hundred million years after it was formed?"

"Maybe cyanobacteria. Maybe nothing. This isn't Earth, though."

"True. But even in the unlikely event that the carpets are intelligent, do

you think they'd notice the presence of robots a millionth their size? If they're unified organisms, they don't appear to react to anything in their environment—they have no predators, they don't pursue food, they just drift with the currents—so there's no reason for them to possess elaborate sense organs at all, let alone anything working on a sub-millimeter scale. And if they're colonies of single-celled creatures, one of which happens to collide with a microprobe and register its presence with surface receptors . . . what conceivable harm could that do?''

"I have no idea. But my ignorance is no guarantee of safety."

Elena splashed him back. "The only way to deal with your ignorance is to vote to send down the microprobes. We have to be cautious, I agree—but there's no point being here if we don't find out what's happening in the oceans, right now. I don't want to wait for this planet to evolve something smart enough to broadcast biochemistry lessons into space. If we're not willing to take a few infinitesimal risks, Vega will turn red giant before we leam anything."

It was a throwaway line—but Paolo tried to imagine witnessing the event. In a quarter of a billion years, would the citizens of Carter-Zimmerman be debating the ethics of intervening to rescue the Orpheans—or would they all have lost interest, and departed for other stars, or modified themselves into beings entirely devoid of nostalgic compassion for organic life?

Grandiose visions for a twelve-hundred-year-old. The Fomalhaut clone had been obliterated by one tiny piece of rock. There was far more junk in the Vegan system than in interstellar space; even ringed by defenses, its data backed up to all the far-flung scout probes, this C-Z was not invulnerable just because it had arrived intact. Elena was right; they had to seize the moment—or they might as well retreat into their own hermetic worlds and forget that they'd ever made the journey.

Paolo recalled the honest puzzlement of a friend from Ashton-Laval: Why go looking for aliens? Our polis has a thousand ecologies, a trillion species of evolved life. What do you hope to find, out there, that you couldn't have grown at home?

What had he hoped to find? Just the answers to a few simple questions. Did human consciousness bootstrap all of space-time into existence, in order to explain itself? Or had a neutral, pre-existing universe given birth to a billion varieties of conscious life, all capable of harboring the same delusions of grandeur—until they collided with each other? Anthrocosmology was used to justify the inward-looking stance of most polises: if the physical universe was created by human thought, it had no special status which placed it above virtual reality. It might have come first—and every virtual reality might need to run on a physical computing device, subject to physical laws—but it occupied no privileged position in terms of "truth" versus "illusion." If the ACs were right, then it was no more honest to value the physical universe over more recent artificial realities than it was honest to remain flesh instead of software, or ape instead of human, or bacterium instead of ape.

Elena said, "We can't lie here forever; the gang's all waiting to see you."

"Where?" Paolo felt his first pang of homesickness; on Earth, his circle of friends had always met in a real-time image of the Mount Pinatubo crater, plucked straight from the observation satellites. A recording wouldn't be the same.

"I'll show you."

Paolo reached over and took her hand. The pool, the sky, the courtyard vanished—and he found himself gazing down on Orpheus again . . . nightside, but far from dark, with his full mental palette now encoding everything from the pale wash of ground-current long-wave radio, to the multi-colored shimmer of isotopic gamma rays and back-scattered cosmic-ray bremsstrahlung. Half the abstract knowledge the library had fed him about the planet was obvious at a glance, now. The ocean's smoothly tapered thermal glow spelt three-hundred Kelvin instantly—as well as backlighting the atmosphere's telltale infrared silhouette.

He was standing on a long, metallic-looking girder, one edge of a vast geodesic sphere, open to the blazing cathedral of space. He glanced up and saw the star-rich dust-clogged band of the Milky Way, encircling him from zenith to nadir; aware of the glow of every gas cloud, discerning each absorption and emission line, Paolo could almost feel the plane of the galactic disk transect him. Some constellations were distorted, but the view was more familiar than strange—and he recognized most of the old signposts by color. He had his bearings, now. Twenty degrees away from Sirius—south, by parochial Earth reckoning—faint but unmistakable: the sun.

Elena was beside him—superficially unchanged, although they'd both shrugged off the constraints of biology. The conventions of this environment mimicked the physics of real macroscopic objects in free-fall and vacuum, but it wasn't set up to model any kind of chemistry, let alone that of flesh and blood. Their new bodies were human-shaped, but devoid of elaborate microstructure—and their minds weren't embedded in the physics at all, but were running directly on the processor web.

Paolo was relieved to be back to normal; ceremonial regression to the ancestral form was a venerable C-Z tradition—and being human was largely self-affirming, while it lasted—but every time he emerged from the experience, he felt as if he'd broken free of billion-year-old shackles. There were polises on Earth where the citizens would have found his present structure almost as archaic: a consciousness dominated by sensory perception, an illusion of possessing solid form, a single time coordinate. The last flesh human had died long before Paolo was constructed, and apart from the communities of Gleisner robots, Carter-Zimmerman was about as conservative as a transhuman society could be. The balance seemed right to Paolo, though—acknowledging the flexibility of software, without abandoning interest in the physical world—and although the stubbornly corporeal Gleisners had been first to the stars, the C-Z diaspora would soon overtake them.

Their friends gathered round, showing off their effortless free-fall acrobatics, greeting Paolo and chiding him for not arranging to wake sooner; he was the last of the gang to emerge from hibernation.

"Do you like our humble new meeting place?" Hermann floated by Paolo's shoulder, a chimeric cluster of limbs and sense-organs, speaking through the vacuum in modulated infrared. "We call it Satellite Pinatubo. It's desolate up here, I know— but we were afraid it might violate the spirit of caution if we dared pretend to walk the Orphean surface."

Paolo glanced mentally at a scout probe's close-up of a typical stretch of dry land, an expanse of fissured red rock. "More desolate down there, I think." He was tempted to touch the ground—to let the private vision become tactile—but he resisted. Being elsewhere in the middle of a conversation was bad etiquette.

"Ignore Hermann," Liesi advised. "He wants to flood Orpheus with our alien machinery before we have any idea what the effects might be." Liesi was a green-and-turquoise butterfly, with a stylized human face stippled in gold

on each wing.

Paolo was surprised; from the way Elena had spoken, he'd assumed that his friends must have come to a consensus in favor of the microprobes—and only a late sleeper, new to the issues, would bother to argue the point. "What effects? The carpets—"

"Forget the carpets! Even if the carpets are as simple as they look, we don't know what else is down there." As Liesl's wings fluttered, her mirror-image faces seemed to glance at each other for support. "With neutrino imaging, we barely achieve spatial resolution in meters, time resolution in seconds. We don't know anything about smaller lifeforms."

"And we never will, if you have your way." Karpal—an ex-Gleisner, human-shaped as ever—had been Liesl's lover, last time Paolo was awake.

"We've only been here for a fraction of an Orphean year! There's still a wealth of data we could gather non-intrusively, with a little patience. There might be rare beachings of ocean life—"

Elena said dryly, "Rare indeed. Orpheus has negligible tides, shallow waves, very few storms. And anything beached would be fried by UV before we glimpsed anything more instructive than we're already seeing in the surface water.

"Not necessarily. The carpets seem to be vulnerable—but other species might be better protected, if they live nearer to the surface. And Orpheus is seismically active; we should at least wait for a tsunami to dump a few cubic kilometers of ocean onto a shoreline, and see what it reveals."

Paolo smiled; he hadn't thought of that. A tsunami might be worth waiting for.

Liesi continued, "What is there to lose, by waiting a few hundred Orphean years? At the very least, we could gather baseline data on seasonal climate patterns— and we could watch for anomalies, storms and quakes, hoping for some revelatory glimpses."

A few hundred Orphean years? A few terrestrial millennia? Paolo's ambivalence waned. If he'd wanted to inhabit geological time, he would have migrated to the Lokhande polis, where the Order of Contemplative Observers watched Earth's mountains erode in subjective seconds. Orpheus hung in the sky beneath them, a beautiful puzzle waiting to be decoded, demanding to be understood.

He said, "But what if there are no 'revelatory glimpses'? How long do we wait? We don't know how rare life is—in time, or in space. If this planet is precious, so is the epoch it's passing through. We don't know how rapidly Orphean biology is evolving; species might appear and vanish while we agonize over the risks of gathering better data. The carpets—and whatever else—could die out before we'd leamt the first thing about them. What a waste that would be!"

Liesi stood her ground.

"And if we damage the Orphean ecology—or culture—by rushing in? That wouldn't be a waste. It would be a tragedy."

Paolo assimilated all the stored transmissions from his Earth-self—almost three hundred years' worth—before composing a reply. The early communications in-cluded detailed mind grafts—and it was good to share the excitement of the dias-pora's launch; to watch—very nearly firsthand—the thousand ships, nanomachine-carved from asteroids, depart in a blaze of

fusion fire from beyond the orbit of Mars. Then things settled down to the usual prosaic matters: Elena, the gang, shameless gossip, Carter-Zimmerman's ongoing research projects, the buzz of inter-polis cultural tensions, the not-quite-cyclic convulsions of the arts (the perceptual aesthetic overthrows the emotional, again . . . although Valladas in Konishi polis claims to have constructed a new synthesis of the two).

After the first fifty years, his Earth-self had begun to hold things back; by the time news reached Earth of the Fomalhaut clone's demise, the messages had become pure audiovisual linear monologues. Paolo understood. It was only right; they'd diverged, and you didn't send mind grafts to strangers.

Most of the transmissions had been broadcast to all of the ships, indiscriminately. Forty-three years ago, though, his Earth-self had sent a special message to the Vega-bound clone.

"The new lunar spectroscope we finished last year has just picked up clear signs of water on Orpheus. There should be large temperate oceans waiting for you, if the models are right. So ... good luck." Vision showed the instrument's domes growing out of the rock of the lunar farside; plots of the Orphean spectral data; an ensemble of planetary models. "Maybe it seems strange to you—all the trouble we're taking to catch a glimpse of what you're going to see in close-up, so soon. It's hard to explain: I don't think it's jealousy, or even impatience. Just a need for independence.

"There's been a revival of the old debate: should we consider redesigning our minds to encompass interstellar distances? One self spanning thousands of stars, not via cloning, but through acceptance of the natural time scale of the light-speed lag. Millennia passing between mental events. Local contingencies dealt with by non-conscious systems." Essays, pro and con, were appended; Paolo ingested summaries. "I don't think the idea will gain much support, though—and the new astronomical projects are something of an antidote. We have to make peace with the fact that we've stayed behind ... so we cling to the Earth—looking outwards, but remaining firmly anchored.

"I keep asking myself, though: where do we go from here? History can't guide us. Evolution can't guide us. The C-Z charter says understand and respect the universe . . . but in what form? On what scale? With what kind of senses, what kind of minds? We can become anything at all—and that space of possible futures dwarfs the galaxy. Can we explore it without losing our way? Flesh humans used

to spin fantasies about aliens arriving to 'conquer' Earth, to steal their 'precious' physical resources, to wipe them out for fear of 'competition' ... as if a species capable of making the journey wouldn't have had the power, or the wit, or the imagination, to rid itself of obsolete biological imperatives. Conquering the galaxy is what bacteria with spaceships would do—knowing no better, having no choice.

"Our condition is the opposite of that: we have no end of choices. That's why we need to find alien life—not just to break the spell of the anthrocosmologists. We need to find aliens who've faced the same decisions—and discovered how to live, what to become. We need to understand what it means to inhabit the universe.''

Paolo watched the crude neutrino images of the carpets moving in staccato jerks around his dodecahedral room. Twenty-four ragged oblongs drifted above him, daughters of a larger ragged oblong which had just fissioned. Models suggested that shear forces from ocean currents could explain the whole process, triggered by nothing more than the parent reaching a

critical size. The purely mechanical break-up of a colony—if that was what it was—might have little to do with the life cycle of the constituent organisms. It was frustrating. Paolo was accustomed to a torrent of data on anything which caught his interest; for the diaspora's great discovery to remain nothing more than a sequence of coarse monochrome snapshots was intolerable.

He glanced at a schematic of the scout probes' neutrino detectors, but there was no obvious scope for improvement. Nuclei in the detectors were excited into unstable high-energy states, then kept there by fine-tuned gamma-ray lasers picking off lower-energy eigenstates faster than they could creep into existence and attract a transition. Changes in neutrino flux of one part in ten-to-the-fifteenth could shift the energy levels far enough to disrupt the balancing act. The carpets cast a shadow so faint, though, that even this near-perfect vision could barely resolve it.

Orlando Venetti said, "You're awake."

Paolo turned. His father stood an arm's length away, presenting as an ornately clad human of indeterminate age. Definitely older than Paolo, though; Orlando never ceased to play up his seniority—even if the age difference was only twenty-five percent now, and falling.

Paolo banished the carpets from the room to the space behind one pentagonal window, and took his father's hand. The portions ofOrlando's mind which meshed with his own expressed pleasure at Paolo's emergence from hibernation, fondly dwelt on past shared experiences, and entertained hopes of continued harmony between father and son. Paolo's greeting was similar, a carefully contrived "revela-tion" of his own emotional state. It was more of a ritual than an act of communica-tion—but then, even with Elena, he set up barriers. No one was totally honest with another person—unless the two of them intended to permanently fuse.

Orlando nodded at the carpets. "I hope you appreciate how important they are."

"You know I do." He hadn't included that in his greeting, though. "First alien life." C-Z humiliates the Gleisner robots, at last—that was probably how his father saw it. The robots had been first to Alpha Centauri, and first to an extrasolar planet—but first life was Apollo to their Sputniks, for anyone who chose to think in those terms.

Orlando said, "This is the hook we need, to catch the citizens of the marginal polises. The ones who haven't quite imploded into solipsism. This will shake them up—don't you think?"

Paolo shrugged. Earth's transhumans were free to implode into anything they liked; it didn't stop Carter-Zimmerman from exploring the physical universe. But thrashing the Gleisners wouldn't be enough for Orlando; he lived for the day when C-Z would become the cultural mainstream. Any polis could multiply its population a billionfold in a microsecond, if it wanted the vacuous honor of outnumbering the rest. Luring other citizens to migrate was harder—and persuading them to rewrite their own local charters was harder still. Orlando had a missionary streak: he wanted every other polis to see the error of its ways, and follow C-Z to the stars.

Paolo said, "Ashton-Laval has intelligent aliens. I wouldn't be so sure that news of giant seaweed is going to take Earth by storm."

Orlando was venomous. "Ashton-Laval intervened in its so-called 'evolutionary' simulations so many times that they might as well have built the end products in an act of creation lasting six days. They wanted

talking reptiles, and—mirabile dictu!—they got talking reptiles. There are self-modified transhumans in this polis more alien than the aliens in Ashton-Laval."

Paolo smiled. "All right. Forget Ashton-Laval. But forget the marginal polises, too. We choose to value the physical world. That's what defines us—but it's as arbitrary as any other choice of values. Why can't you accept that? It's not the One True Path which the infidels have to be bludgeoned into following." He knew he was arguing half for the sake of it—he desperately wanted to refute the anthrocos-mologists, himself—but Orlando always drove him into taking the opposite position. Out of fear of being nothing but his father's clone? Despite the total absence of inherited episodic memories, the stochastic input into his ontogenesis, the chaoti-cally divergent nature of the iterative mind-building algorithms.

Orlando made a beckoning gesture, dragging the image of the carpets halfway back into the room. "You'll vote for the microprobes?"

"Of course."

"Everything depends on that, now. It's good to start with a tantalizing glimpse— but if we don't follow up with details soon, they'll lose interest back on Earth very rapidly."

"Lose interest? It'll be fifty-four years before we know if anyone paid the slightest attention in the first place."

Orlando eyed him with disappointment, and resignation. "If you don't care about the other polises, think about C-Z. This helps us, it strengthens us. We have to make the most of that."

Paolo was bemused. "The charter is the charter. What needs to be strengthened? You make it sound like there's something at risk."

' 'What do you think a thousand lifeless worlds would have done to us? Do you think the charter would have remained intact?"

Paolo had never considered the scenario. "Maybe not. But in every C-Z where the charter was rewritten, there would have been citizens who'd have gone off and founded new polises on the old lines. You and I, for a start. We could have called it Venetti-Venetti."

' 'While half your friends turned their backs on the physical world? While Carter-Zimmerman, after two thousand years, went solipsist? You'd be happy with that?"

Paolo laughed. "No—but it's not going to happen, is it? We've found life. All right, I agree with you: this strengthens C-Z. The diaspora might have 'failed' . . . but it didn't. We've been lucky. I'm glad, I'm grateful. Is that what you wanted to hear?"

Orlando said sourly, "You take too much for granted."

"And you care too much what I think! I'm not your . . . heir." Orlando was first-generation, scanned from flesh—and there were times when he seemed unable to accept that the whole concept of generation had lost its archaic significance. "You don't need me to safeguard the future of Carter-Zimmerman on your behalf. Or the future of transhumanity. You can do it in person."

Orlando looked wounded—a conscious choice, but it still encoded something. Paolo felt a pang of regret—but he'd said nothing he could honestly retract.

His father gathered up the sleeves of his gold and crimson robes—the only citizen of C-Z who could make Paolo uncomfortable to be naked—and repeated as he vanished from the room: "You take too much for granted."

The gang watched the launch of the microprobes together—even Liesi, though she came in mourning, as a giant dark bird. Karpal stroked her feathers nervously. Hermann appeared as a creature out of Escher, a segmented worm with six human-shaped feet—on legs with elbows—given to curling up into a disk and rolling along the girders of Satellite Pinatubo. Paolo and Elena kept saying the same thing simultaneously; they'd just made love.

Hermann had moved the satellite to a notional orbit just below one of the scout probes—and changed the environment's scale, so that the probe's lower surface, an intricate landscape of detector modules and attitude-control jets, blotted out half the sky. The atmospheric-entry capsules—ceramic teardrops three centimeters wide—burst from their launch tube and hurtled past like boulders, vanishing from sight before they'd fallen so much as ten meters closer to Orpheus. It was all scrupulously accurate, although it was part real-time imagery, part extrapolation, part faux. Paolo thought: We might as well have run a pure simulation . . . and pretended to follow the capsules down. Elena gave him a guilty/admonishing look. Yeah—and then why bother actually launching them at all? Why not just simulate a plausible Orphean ocean full of plausible Orphean life forms? Why not simulate the whole diaspora? There was no crime of heresy in C-Z; no one had ever been exiled for breaking the charter. At times it still felt like a tightrope walk, though, trying to classify every act of simulation into those which contributed to an under-standing of the physical universe (good), those which were merely convenient, recreational, aesthetic (acceptable) . . . and those which constituted a denial of the primacy of real phenomena (time to think about emigration).

The vote on the microprobes had been close: seventy-two percent in favor, just over the required two-thirds majority, with five percent abstaining. (Citizens created since the arrival at Vega were excluded ... not that anyone in Carter-Zimmerman would have dreamt of stacking the ballot, perish the thought.) Paolo had been surprised at the narrow margin; he'd yet to hear a single plausible scenario for the microprobes doing harm. He wondered if there was another, unspoken reason which had nothing to do with fears for the Orphean ecology, or hypothetical culture. A wish to prolong the pleasure of unraveling the planet's mysteries? Paolo had some sympathy with that impulse—but the launch of the microprobes would do nothing to undermine the greater long-term pleasure of watching, and understanding, as Orphean life evolved.

Liesi said forlomly, "Coastline erosion models show that the northwestern shore of Lambda is inundated by tsunami every ninety Orphean years, on average." She offered the data to them; Paolo glanced at it, and it looked convincing—but the point was academic now. "We could have waited."

Hermann waved his eye-stalks at her. "Beaches covered in fossils, are they?"

"No, but the conditions hardly—"

"No excuses!" He wound his body around a girder, kicking his legs gleefully. Hermann was first-generation, even older than Orlando; he'd been scanned in the twenty-first century, before Carter-Zimmerman existed. Over the centuries, though, he'd wiped most of his episodic memories, and rewritten his personality a dozen times. He'd once told Paolo, "I think of myself as my own great-great-grandson. Death's not so bad, if you do it incrementally. Ditto for immortality."

Elena said, "I keep trying to imagine how it will feel if another C-Z clone stumbles on something infinitely better—like aliens with wormhole drives—while we're back here studying rafts of algae." The body she wore was more stylized than usual—still humanoid, but sexless, hairless and smooth, the face inexpressive and androgynous.

"If they have wormhole drives, they might visit us. Or share the technology, so we can link up the whole diaspora."

"If they have wormhole drives, where have they been for the last two thousand years?"

Paolo laughed. "Exactly. But I know what you mean: first alien life . . . and it's likely to be about as sophisticated as seaweed. It breaks the jinx, though. Seaweed every twenty-seven light-years. Nervous systems every fifty? Intelligence every hundred?" He fell silent, abruptly realizing what she was feeling: electing not to wake again after first life was beginning to seem like the wrong choice, a waste of the opportunities the diaspora had created. Paolo offered her a mind graft expressing empathy and support, but she declined.

She said, "I want sharp borders, right now. I want to deal with this myself."

"I understand." He let the partial model of her which he'd acquired as they'd made love fade from his mind. It was non-sapient, and no longer linked to her— but to retain it any longer when she felt this way would have seemed like a transgression. Paolo took the responsibilities of intimacy seriously. His lover before Elena had asked him to erase all his knowledge of her, and he'd more or less complied—the only thing he still knew about her was the fact that she'd made the request.

Hermann announced, "Planetfall!" Paolo glanced at a replay of a scout probe view which showed the first few entry capsules breaking up above the ocean and releasing their microprobes. Nanomachines transformed the ceramic shields (and then themselves) into carbon dioxide and a few simple minerals—nothing the micrometeorites constantly raining down onto Orpheus didn't contain—before the fragments could strike the water. The microprobes would broadcast nothing; when they'd finished gathering data, they'd float to the surface and modulate their UV

reflectivity. It would be up to the scout probes to locate these specks, and read their messages, before they self-destructed as thoroughly as the entry capsules.

Hermann said, "This calls for a celebration. I'm heading for the Heart. Who'll join me?"

Paolo glanced at Elena. She shook her head. "You go."

"Are you sure?"

"Yes! Go on." Her skin had taken on a mirrored sheen; her expressionless face reflected the planet below. "I'm all right. I just want some time to think things through, on my own."

Hermann coiled around the satellite's frame, stretching his pale body as he went, gaining segments, gaining legs. "Come on, come on! Karpal? Liesi? Come and celebrate!"

Elena was gone. Liesi made a derisive sound and flapped off into the distance, mocking the environment's airlessness. Paolo and Karpal watched

as Hermann grew longer and faster—and then in a blur of speed and change stretched out to wrap the entire geodesic frame. Paolo demagnetized his feet and moved away, laughing; Karpal did the same.

Then Hermann constricted like a boa, and snapped the whole satellite apart.

They floated for a while, two human-shaped machines and a giant worm in a cloud of spinning metal fragments, an absurd collection of imaginary debris, glinting by the light of the true stars.

The Heart was always crowded, but it was larger than Paolo had seen it—even though Hermann had shrunk back to his original size, so as not to make a scene. The huge muscular chamber arched above them, pulsating wetly in time to the music, as they searched for the perfect location to soak up the atmosphere. Paolo had visited public environments in other polises, back on Earth; many were designed to be nothing more than a perceptual framework for group emotion-sharing. He'd never understood the attraction of becoming intimate with large numbers of strang-ers. Ancestral social hierarchies might have had their faults—and it was absurd to try to make a virtue of the limitations imposed by minds confined to wetware— but the whole idea of mass telepathy as an end in itself seemed bizarre to Paolo . . . and even old-fashioned, in a way. Humans, clearly, would have benefited from a good strong dose of each other's inner life, to keep them from slaughtering each other—but any civilized transhuman could respect and value other citizens without the need to have been them, firsthand.

They found a good spot and made some furniture, a table and two chairs—Hermann preferred to stand—and the floor expanded to make room. Paolo looked around, shouting greetings at the people he recognized by sight, but not bothering to check for identity broadcasts from the rest. Chances were he'd met everyone here, but he didn't want to spend the next hour exchanging pleasantries with casual acquaintances.

Hermann said, "I've been monitoring our modest stellar observatory's data stream—my antidote to Vegan parochialism. Odd things are going on around Sirius. We're seeing electron-positron annihilation gamma rays, gravity waves . . . and some unexplained hot spots on Sirius ?." He turned to Karpal and asked innocently, "What do you think those robots are up to? There's a rumor that they're planning to drag the white dwarf out of orbit, and use it as part of a giant spaceship."

"I never listen to rumors." Karpal always presented as a faithful reproduction of his old human-shaped Gleisner body—and his mind, Paolo gathered, always took the form of a physiological model, even though he was five generations removed from flesh. Leaving his people and coming into C-Z must have taken considerable courage; they'd never welcome him back.

Paolo said, "Does it matter what they do? Where they go, how they get there? There's more than enough room for both of us. Even if they shadowed the dias-pora—even if they came to Vega—we could study the Orpheans together, couldn't we?"

Hermann's cartoon insect face showed mock alarm, eyes growing wider, and wider apart. "Not if they dragged along a white dwarf! Next thing they'd want to start building a Dyson sphere." He turned back to Karpal. "You don't still suffer the urge, do you, for ... astrophysical engineering?"

"Nothing C-Z's exploitation of a few megatons of Vegan asteroid material hasn't satisfied."

Paolo tried to change the subject. "Has anyone heard from Earth, lately? I'm beginning to feel unplugged." His own most recent message was a decade

older than the time lag.

Karpal said, "You're not missing much; all they're talking about is Orpheus . . . ever since the new lunar observations, the signs of water. They seem more excited by the mere possibility of life than we are by the certainty. And they have very high hopes."

Paolo laughed. "They do. My Earth-self seems to be counting on the diaspora to find an advanced civilization with the answers to all of transhumanity's existential problems. I don't think he'll get much cosmic guidance from kelp."

"You know there was a big rise in emigration from C-Z after the launch? Emigration, and suicides." Hermann had stopped wriggling and gyrating, becoming almost still, a sign of rare seriousness.' 'I suspect that's what triggered the astronomy program in the first place. And it seems to have stanched the flow, at least in the short term. Earth C-Z detected water before any clone in the diaspora—and when they hear that we've found life, they'll feel more like collaborators in the discovery because of it."

Paolo felt a stirring of unease. Emigration and suicides? Was that why Orlando had been so gloomy? After three hundred years of waiting, how high had expecta-tions become?

A buzz of excitement crossed the floor, a sudden shift in the tone of the conversa-tion. Hermann whispered reverently, "First microprobe has surfaced. And the data is coming in now."

The non-sapient Heart was intelligent enough to guess its patrons' wishes. Al-though everyone could tap the library for results, privately, the music cut out and a giant public image of the summary data appeared, high in the chamber. Paolo had to crane his neck to view it, a novel experience.

The microprobe had mapped one of the carpets in high resolution. The image showed the expected rough oblong, some hundred meters wide—but the two-or-three-meter-thick slab of the neutrino tomographs was revealed now as a delicate,

grow?"

convoluted surface—fine as a single layer of skin, but folded into an elaborate space-filling curve. Paolo checked the full data: the topology was strictly planar, despite the pathological appearance. No holes, no joins—just a surface which meandered wildly enough to look ten thousand times thicker from a distance than it really was.

An inset showed the microstructure, at a point which started at the rim of the carpet and then—slowly—moved toward the center. Paolo stared at the flowing molecular diagram for several seconds before he grasped what it meant.

The carpet was not a colony of single-celled creatures. Nor was it a multi-cellular organism. It was a single molecule, a two-dimensional polymer weighing twenty-five million kilograms. A giant sheet of folded polysaccharide, a complex mesh of interlinked pentose and hexose sugars hung with alkyi and amide side chains. A bit like a plant cell wall—except that this polymer was far stronger than cellulose, and the surface area was twenty orders of magnitude greater.

Karpal said, "I hope those entry capsules were perfectly sterile. Earth bacteria would gorge themselves on this. One big floating carbohydrate dinner, with no defenses."

Hermann thought it over. "Maybe. If they had enzymes capable of breaking off a piece—which I doubt. No chance we'll find out, though: even if there'd been bacterial spores lingering in the asteroid belt from early human expeditions, every ship in the diaspora was double-checked for contamination en route. We haven't brought smallpox to the Americas."

Paolo was still dazed. "But how does it assemble? How does it ... grow?" Hermann consulted the library and replied, before Paolo could do the same.

"The edge of the carpet catalyzes its own growth. The polymer is irregular, aperiodic—there's no single component which simply repeats. But there seem to be about twenty thousand basic structural units—twenty thousand different polysac-charide building blocks." Paolo saw them: long bundles of cross-linked chains running the whole two-hundred-micron thickness of the carpet, each with a roughly square cross-section, bonded at several thousand points to the four neighboring units. "Even at this depth, the ocean's full of UV-generated radicals which filter down from the surface. Any structural unit exposed to the water converts those radicals into more polysaccharide—and builds another structural unit."

Paolo glanced at the library again, for a simulation of the process. Catalytic sites strewn along the sides of each unit trapped the radicals in place, long enough for new bonds to form between them. Some simple sugars were incorporated straight into the polymer as they were created; others were set free to drift in solution for a microsecond or two, until they were needed. At that level, there were only a few basic chemical tricks being used ... but molecular evolution must have worked its way up from a few small autocatalytic fragments, first formed by chance, to this elaborate system of twenty thousand mutually self-replicating structures. If the "structural units" had floated free in the ocean as independent molecules, the "lifeform" they comprised would have been virtually invisible. By bonding to-gether, though, they became twenty thousand colors in a giant mosaic.

It was astonishing. Paolo hoped Elena was tapping the library, wherever she was. A colony of algae would have been more "advanced"—but this incredible primordial creature revealed infinitely more about the possibilities for the genesis of life. Carbohydrate, here, played every biochemical role: information carrier, enzyme, energy source, structural material. Nothing like it could have survived on Earth, once there were organisms capable of feeding on it—and if there were ever intelligent Orpheans, they'd be unlikely to find any trace of this bizarre ancestor.

Karpal wore a secretive smile.

Paolo said, "What?"

"Wang tiles. The carpets are made out of Wang tiles."

Hermann beat him to the library, again.

"Wang as in twentieth-century flesh mathematician, Hao Wang. Tiles as in any set of shapes which can cover the plane. Wang tiles are squares with various shaped edges, which have to fit complementary shapes on adjacent squares. You can cover the plane with a set of Wang tiles, as long as you choose the right one every step of the way. Or in the case of the carpets, grow the right one."

Karpal said, "We should call them Wang's Carpets, in honor of Hao Wang. After twenty-three hundred years, his mathematics has come to life."

Paolo liked the idea, but he was doubtful. "We may have trouble getting a

two-thirds majority on that. It's a bit obscure ..."

Hermann laughed. "Who needs a two-thirds majority? If we want to call them Wang's Carpets, we can call them Wang's Carpets. There are ninety-seven lan-guages in current use in C-Z—half of them invented since the polis was founded. I don't think we'll be exiled for coining one private name."

Paolo concurred, slightly embarrassed. The truth was, he'd completely forgotten that Hermann and Karpal weren't actually speaking Modem Roman.

The three of them instructed their exoselves to consider the name adopted: hence-forth, they'd hear "carpet" as "Wang's Carpet"—but if they used the term with anyone else, the reverse translation would apply.

Paolo sat and drank in the image of the giant alien: the first lifeform encountered by human or transhuman which was not a biological cousin. The death, at last, of the possibility that Earth might be unique.

They hadn't refuted the anthrocosmologists yet, though. Not quite. If, as the ACs claimed, human consciousness was the seed around which all of space-time had crystallized—if the universe was nothing but the simplest orderly explanation for human thought—then there was, strictly speaking, no need for a single alien to exist, anywhere. But the physics which justified human existence couldn't help generating a billion other worlds where life could arise. The ACs would be unmoved by Wang's Carpets; they'd insist that these creatures were physical, if not biological, cousins—merely an unavoidable by-product of anthropogenic, life-enabling physi-cal laws.

The real test wouldn't come until the diaspora—or the Gleisner robots—finally encountered conscious aliens: minds entirely unrelated to humanity, observing and explaining the universe which human thought had supposedly built. Most ACs had come right out and declared such a find impossible; it was the sole falsifiable prediction of their hypothesis. Alien consciousness, as opposed to mere alien life, would always build itself a separate universe—because the chance of two unrelated forms of self-awareness concocting exactly the same physics and the same cosmol-ogy was infinitesimal—and any alien biosphere which seemed capable of evolving consciousness would simply never do so.

Paolo glanced at the map of the diaspora, and took heart. Alien life already— and the search had barely started; there were nine hundred and ninety-eight target systems yet to be explored. And even if every one of them proved no more conclusive than Orpheus ... he was prepared to send clones out farther—and prepared to wait. Consciousness had taken far longer to appear on Earth than the quarter-of-a-billion years remaining before Vega left the main sequence—but the whole point of being here, after all, was that Orpheus wasn't Earth.

Orlando's celebration of the microprobe discoveries was a very first-generation affair. The environment was an endless sunlit garden strewn with tables covered in food, and the invitation had politely suggested attendance in fully human form. Paolo politely faked it—simulating most of the physiology, but running the body as a puppet, leaving his mind unshackled.

Orlando introduced his new lover, Catherine, who presented as a tall, dark-skinned woman. Paolo didn't recognize her on sight, but checked the identity code she broadcast. It was a small polis, he'd met her once before—as a man called Samuel, one of the physicists who'd worked on the main interstellar fusion drive employed by all the ships of the diaspora. Paolo was amused to think that many of the people here would be seeing his father as a woman. The majority of the citizens of C-Z still practiced the

conventions of relative gender which had come into fashion in the twenty-third century—and Orlando had wired them into his own son too deeply for Paolo to wish to abandon them—but whenever the paradoxes were revealed so starkly, he wondered how much longer the conventions would endure. Paolo was same-sex to Orlando, and hence saw his father's lover as a woman, the two close relationships taking precedence over his casual knowledge of Catherine as Samuel. Orlando perceived himself as being male and heterosexual, as his flesh original had been . . . while Samuel saw himself the same way . . . and each perceived the other to be a heterosexual woman. If certain third parties ended up with mixed signals, so be it. It was a typical C-Z compromise: nobody could bear to overturn the old order and do away with gender entirely (as most other polises had done) ... but nobody could resist the flexibility which being software, not flesh, provided.

Paolo drifted from table to table, sampling the food to keep up appearances, wishing Elena had come. There was little conversation about the biology of Wang's Carpets; most of the people here were simply celebrating their win against the opponents of the microprobes—and the humiliation that faction would suffer, now that it was clearer than ever that the "invasive" observations could have done no harm. Liesl's fears had proved unfounded; there was no other life in the ocean, just Wang's Carpets of various sizes. Paolo, feeling perversely even-handed after the fact, kept wanting to remind these smug movers and shakers: There might have been anything down there. Strange creatures, delicate and vulnerable in ways we could never have anticipated. We were lucky, that's all.

He ended up alone with Orlando almost by chance; they were both fleeing different groups of appalling guests when their paths crossed on the lawn.

Paolo asked, "How do you think they'll take this, back home?"

"It's first life, isn't it? Primitive or not. It should at least maintain interest in the diaspora, until the next alien biosphere is discovered.'' Orlando seemed subdued; perhaps he was finally coming to terms with the gulf between their modest discovery, and Earth's longing for world-shaking results. "And at least the chemistry is novel. If it had turned out to be based on DNA and protein, I think half of Earth C-Z would have died of boredom on the spot. Let's face it, the possibilities of DNA have been simulated to death."

Paolo smiled at the heresy. "You think if nature hadn't managed a little original-ity, it would have dented people's faith in the charter? If the solipsist polises had begun to look more inventive than the universe itself ..."

"Exactly."

They walked on in silence, then Orlando halted, and turned to face him.

He said, "There's something I've been wanting to tell you. My Earth-self is dead."

"What?"

"Please, don't make a fuss."

"But . . . why? Why would he—?" Dead meant suicide; there was no other cause—unless the sun had turned red giant and swallowed everything out to the orbit of Mars.

"I don't know why. Whether it was a vote of confidence in the diaspora"—Orlando had chosen to wake only in the presence of alien life—"or whether he despaired of us sending back good news, and couldn't face the waiting,

and the risk of disappointment. He didn't give a reason. He just had his exoself send a message, stating what he'd done."

Paolo was shaken. If a clone ofOrlando had succumbed to pessimism, he couldn't begin to imagine the state of mind of the rest of Earth C-Z.

"When did this happen?"

"About fifty years after the launch."

"My Earth-self said nothing."

"It was up to me to tell you, not him."

"I wouldn't have seen it that way."

"Apparently, you would have."

Paolo fell silent, confused. How was he supposed to mourn a distant version of Orlando, in the presence of the one he thought of as real? Death of one clone was a strange half-death, a hard thing to come to terms with. His Earth-self had lost a father; his father had lost an Earth-self. What exactly did that mean to /u'w?

What Orlando cared most about was Earth C-Z. Paolo said carefully, "Hermann told me there'd been a rise in emigration and suicide—until the spectroscope picked up the Orphean water. Morale has improved a lot since then—and when they hear that it's more than just water ..."

Orlando cut him off sharply. "You don't have to talk things up for me. I'm in no danger of repeating the act."

They stood on the lawn, facing each other. Paolo composed a dozen different combinations of mood to communicate, but none of them felt right. He could have granted his father perfect knowledge of everything he was feeling—but what exactly would that knowledge have conveyed? In the end, there was fusion, or separateness. There was nothing in between.

Orlando said, "Kill myself—and leave the fate of transhumanity in your hands? You must be out of your fucking mind." They walked on together, laughing.

Karpal seemed barely able to gather his thoughts enough to speak. Paolo would have offered him a mind graft promoting tranquillity and concentration—distilled from his own most focused moments—but he was sure that Karpal would never have accepted it. He said, "Why don't you just start wherever you want to? I'll stop you if you're not making sense."

Karpal looked around the white dodecahedron with an expression of disbelief. "You live here?"

"Some of the time."

"But this is your base environment? No trees? No sky? NofurnitureT'

Paolo refrained from repeating any of Hermann's naive-robot jokes. ' 'I add them when I want them. You know, like . . . music. Look, don't let my taste in decor distract you."

Karpal made a chair and sat down heavily.

He said, "Hao Wang proved a powerful theorem, twenty-three hundred years ago. Think of a row of Wang Tiles as being like the data tape of a Turing Machine.'' Paolo had the library grant him knowledge of the term; it was

the original conceptual form of a generalized computing device, an imaginary machine which moved back and forth along a limitless one-dimensional data tape, reading and writing symbols according to a given set of rules.

"With the right set of tiles, to force the right pattern, the next row of the tiling will look like the data tape after the Turing Machine has performed one step of its computation. And the row after that will be the data tape after two steps, and so on. For any given Turing Machine, there's a set of Wang Tiles which can imitate it."

Paolo nodded amiably. He hadn't heard of this particular quaint result, but it was hardly surprising. "The carpets must be carrying out billions of acts of computa-tion every second ... but then, so are the water molecules around them. There are no physical processes which don't perform arithmetic of some kind."

' 'True. But with the carpets, it's not quite the same as random molecular motion.''

"Maybe not."

Karpal smiled, but said nothing.

"What? You've found a pattern? Don't tell me: our set of twenty thousand polysaccharide Wang Tiles just happens to form the Turing Machine for calculating pi."

"No. What they form is a universal Turing Machine. They can calculate anything at all—depending on the data they start with. Every daughter fragment is like a program being fed to a chemical computer. Growth executes the program."

"Ah." Paolo's curiosity was roused—but he was having some trouble picturing where the hypothetical Turing Machine put its read/write head. "Are you telling me only one tile changes between any two rows, where the 'machine' leaves its mark on the 'data tape' . . . ?" The mosaics he'd seen were a riot of complexity, with no two rows remotely the same.

Karpal said, "No, no. Wang's original example worked exactly like a standard Turing Machine, to simplify the argument ... but the carpets are more like an arbitrary number of different computers with overlapping data, all working in parallel. This is biology, not a designed machine—it's as messy and wild as, say ... a mammalian genome. In fact, there are mathematical similarities with gene regulation: I've identified Kauffman networks at every level, from the tiling rules up; the whole system's poised on the hyperadaptive edge between frozen and chaotic behavior.''

Paolo absorbed that, with the library's help. Like Earth life, the carpets seemed to have evolved a combination of robustness and flexibility which would have maximized their power to take advantage of natural selection. Thousands of different autocatalytic chemical networks must have arisen soon after the formation of Or-pheus—but as the ocean chemistry and the climate changed in the Vegan system's early traumatic millennia, the ability to respond to selection pressure had itself been selected for, and the carpets were the result. Their complexity seemed redundant, now, after a hundred million years of relative stability—and no predators or competi-tion in sight—but the legacy remained.

"So if the carpets have ended up as universal computers . . . with no real need anymore to respond to their surroundings . . . what are they doing with all that computing power?"

Karpal said solemnly, "I'll show you."

Paolo followed him into an environment where they drifted above a schematic of a carpet, an abstract landscape stretching far into the distance, elaborately wrin-kled like the real thing, but otherwise heavily stylized, with each of the polysaccha-ride building blocks portrayed as a square tile with four different colored edges. The adjoining edges of neighboring tiles bore complementary colors—to represent the complementary, interlocking shapes of the borders of the building blocks.

"One group of microprobes finally managed to sequence an entire daughter fragment," Karpal explained, "although the exact edges it started life with are largely guesswork, since the thing was growing while they were trying to map it." He gestured impatiently, and all the wrinkles and folds were smoothed away, an irrelevant distraction. They moved to one border of the ragged-edged carpet, and Karpal started the simulation running.

Paolo watched the mosaic extending itself, following the tiling rules perfectly— an orderly mathematical process, here: no chance collisions of radicals with catalytic sites, no mismatched borders between two new-grown neighboring "tiles" trig-gering the disintegration of both. Just the distillation of the higher-level conse-quences of all that random motion.

Karpal led Paolo up to a height where he could see subtle patterns being woven, overlapping multiplexed periodicities drifting across the growing edge, meeting and sometimes interacting, sometimes passing right through each other. Mobile pseudo-attractors, quasi-stable waveforms in a one-dimensional universe. The carpet's second dimension was more like time than space, a permanent record of the history of the edge.

Karpal seemed to read his mind. "One dimensional. Worse than flatland. No connectivity, no complexity. What can possibly happen in a system like that? Nothing of interest, right?"

He clapped his hands and the environment exploded around Paolo. Trails of color streaked across his sensorium, entwining, then disintegrating into luminous smoke.

"Wrong. Everything goes on in a multidimensional frequency space. I've Fourier-transformed the edge into over a thousand components, and there's independent information in all of them. We're only in a narrow cross-section here, a sixteen-dimensional slice—but it's oriented to show the principal components, the maxi-mum detail."

Paolo spun in a blur of meaningless color, utterly lost, his surroundings beyond comprehension. "You're a Gleisner robot, Karpal! Only sixteen dimensions! How can you have done this?"

Karpal sounded hurt, wherever he was. "Why do you think I came to C-Z? I thought you people were flexible!"

"What you're doing is . . ." What? Heresy? There was no such thing. Officially. "Have you shown this to anyone else?"

"Of course not. Who did you have in mind? Liesi? Hermann?"

"Good. I know how to keep my mouth shut." Paolo invoked his exoself and moved back into the dodecahedron. He addressed the empty room. "How can I put this? The physical universe has three spatial dimensions, plus time. Citizens of Carter-Zimmerman inhabit the physical universe. Higher dimensional mind games are for the solipsists." Even as he said it, he realized how pompous he sounded. It was an arbitrary doctrine, not some

great moral principle.

But it was the doctrine he'd lived with for twelve hundred years.

Karpal replied, more bemused than offended, "It's the only way to see what's going on. The only sensible way to apprehend it. Don't you want to know what the carpets are actually like?''

Paolo felt himself being tempted. Inhabit a sixteen-dimensional slice of a thou-sand-dimensional frequency space? But it was in the service of understanding a real physical system—not a novel experience for its own sake.

And nobody had to find out.

He ran a quick—non-sapient—self-predictive model. There was a ninety-three percent chance that he'd give in, after fifteen subjective minutes of agonizing over the decision. It hardly seemed fair to keep Karpal waiting that long.

He said, "You'll have to loan me your mind-shaping algorithm. My exoself wouldn't know where to begin."

When it was done, he steeled himself, and moved back into Karpal's environment. For a moment, there was nothing but the same meaningless blur as before.

Then everything suddenly crystallized.

Creatures swam around them, elaborately branched tubes like mobile coral, vividly colored in all the hues of Paolo's mental palette—Karpal's attempt to cram in some of the information that a mere sixteen dimensions couldn't show? Paolo glanced down at his own body—nothing was missing, but he could see around it in all the thirteen dimensions in which it was nothing but a pin-prick; he quickly looked away. The "coral" seemed far more natural to his altered sensory map, occupying sixteen-space in all directions, and shaded with hints that it occupied much more. And Paolo had no doubt that it was "alive"—it looked more organic than the carpets themselves, by far.

Karpal said, "Every point in this space encodes some kind of quasi-periodic pattern in the tiles. Each dimension represents a different characteristic size—like a wavelength, although the analogy's not precise. The position in each dimension represents other attributes of the pattern, relating to the particular tiles it employs. So the localized systems you see around you are clusters of a few billion patterns, all with broadly similar attributes at similar wavelengths."

They moved away from the swimming coral, into a swarm of something like jellyfish: floppy hyperspheres waving wispy tendrils (each one of them more substan-tial than Paolo). Tiny jewel-like creatures darted among them. Paolo was just beginning to notice that nothing moved here like a solid object drifting through normal space; motion seemed to entail a shimmering deformation at the leading hypersurface, a visible process of disassembly and reconstruction.

Karpal led him on through the secret ocean. There were helical worms, coiled together in groups of indeterminate number—each single creature breaking up into a dozen or more wriggling slivers, and then recombining . . . although not always from the same parts. There were dazzling multicolored stemless flowers, intricate hypercones of "gossamer-thin" fifteen-dimensional petals—each one a hypnotic fractal labyrinth of crevices and capillaries. There were clawed monstrosities, writh-ing knots of sharp insectile parts like an orgy of decapitated scorpions.

Paolo said, uncertainly, "You could give people a glimpse of this in just three dimensions. Enough to make it clear that there's . . . life in here. This is going to shake them up badly, though." Life—embedded in the accidental computations of Wang's Carpets, with no possibility of ever relating to the world outside. This was an affront to Carter-Zimmerman's whole philosophy: if nature had evolved "organisms" as divorced from reality as the inhabitants of the most inward-looking polis, where was the privileged status of the physical universe, the clear distinction between truth and illusion?

And after three hundred years of waiting for good news from the diaspora, how would they respond to this back on Earth?

Karpal said, "There's one more thing I have to show you."

He'd named the creatures squids, for obvious reasons. Distant cousins of the jellyfish, perhaps? They were prodding each other with their tentacles in a way which looked thoroughly carnal—but Karpal explained, "There's no analog of light here. We're viewing all this according to ad hoc rules which have nothing to do with the native physics. All the creatures here gather information about each other by contact alone—which is actually quite a rich means of exchanging data, with so many dimensions. What you're seeing is communication by touch."

"Communication about what?"

"Just gossip, I expect. Social relationships."

Paolo stared at the writhing mass of tentacles.

"You think they're consciousT'

Karpal, point-like, grinned broadly. "They have a central control structure with more connectivity than the human brain—and which correlates data gathered from the skin. I've mapped that organ, and I've started to analyze its function."

He led Paolo into another environment, a representation of the data structures in the "brain" of one of the squids. It was—mercifully—three-dimensional, and highly stylized, built of translucent colored blocks marked with icons, representing

mental symbols, linked by broad lines indicating the major connections between them. Paolo had seen similar diagrams of transhuman minds; this was far less elaborate, but eerily familiar nonetheless.

Karpal said, "Here's the sensory map of its surroundings. Full of other squids' bodies, and vague data on the last known positions of a few smaller creatures. But you'll see that the symbols activated by the physical presence of the other squids are linked to these"—he traced the connection with one finger—"representations. Which are crude miniatures of this whole structure here."

"This whole structure" was an assembly labeled with icons for memory retrieval, simple tropisms, short-term goals. The general business of being and doing.

"The squid has maps, not just of other squids' bodies, but their minds as well. Right or wrong, it certainly tries to know what the others are thinking about. And''—he pointed out another set of links, leading to another, less crude, miniature squid mind—"it thinks about its own thoughts as well. I'd call that consciousness, wouldn't you?"

Paolo said weakly, "You've kept all this to yourself? You came this far, without saying a word—?"

Karpal was chastened. "I know it was selfish—but once I'd decoded the interac-tions of the tile patterns, I couldn't tear myself away long enough to start explaining it to anyone else. And I came to you first because I wanted your advice on the best way to break the news."

Paolo laughed bitterly. ' 'The best way to break the news thM first alien conscious-ness is hidden deep inside a biological computer? That everything the diaspora was trying to prove has been turned on its head? The best way to explain to the citizens of Carter-Zimmerman that after a three-hundred-year journey, they might as well have stayed on Earth running simulations with as little resemblance to the physical universe as possible?"

Karpal took the outburst in good humor. "I was thinking more along the lines of the best way to point out that if we hadn't traveled to Orpheus and studied Wang's Carpets, we'd never have had the chance to tell the solipsists of Ashton-Laval that all their elaborate invented lifeforms and exotic imaginary universes pale into insignificance compared to what's really out here—and which only the Carter-Zimmerman diaspora could have found."

Paolo and Elena stood together on the edge of Satellite Pinatubo, watching one of the scout probes aim its maser at a distant point in space. Paolo thought he saw a faint scatter of microwaves from the beam as it collided with iron-rich meteor dust. Elena's mind being diffracted all over the cosmos? Best not think about that.

He said, "When you meet the other versions of me who haven't experienced Orpheus, I hope you'll offer them mind grafts so they won't be jealous."

She frowned. "Ah. Will I or won't I? I can't be bothered modeling it. I expect I will. You should have asked me before I cloned myself. No need for jealousy, though. There'll be worlds far stranger than Orpheus."

"I doubt it. You really think so?"

"I wouldn't be doing this if I didn't believe that." Elena had no power to change the fate of the frozen clones of her previous self—but everyone had the right to emigrate.

Paolo took her hand. The beam had been aimed almost at Regulus, UV-hot and bright, but as he looked away, the cool yellow light of the sun caught his eye.

Vega C-Z was taking the news of the squids surprisingly well, so far. Karpal's way of putting it had cushioned the blow: it was only by traveling all this distance across the real, physical universe that they could have made such a discovery— and it was amazing how pragmatic even the most doctrinaire citizens had turned out to be. Before the launch, "alien solipsists" would have been the most unpalat-able idea imaginable, the most abhorrent thing the diaspora could have stumbled upon—but now that they were here, and stuck with the fact of it, people were finding ways to view it in a better light. Orlando had even proclaimed, "This will be the perfect hook for the marginal polises. 'Travel through real space to witness a truly alien virtual reality.' We can sell it as a synthesis of the two world views."

Paolo still feared for Earth, though—where his Earth-self and others were waiting in hope of alien guidance. Would they take the message of Wang's

Carpets to heart, and retreat into their own hermetic worlds, oblivious to physical reality?

And he wondered if the anthrocosmologists had finally been refuted ... or not. Karpal had discovered alien consciousness—but it was sealed inside a cosmos of its own, its perceptions of itself and its surroundings neither reinforcing nor conflict-ing with human and transhuman explanations of reality. It would be millennia before C-Z could untangle the ethical problems of daring to try to make contact . . . assuming that both Wang's Carpets, and the inherited data patterns of the squids, survived that long.

Paolo looked around at the wild splendor of the star-choked galaxy, felt the disk reach in and cut right through him. Could all this strange haphazard beauty be nothing but an excuse for those who beheld it to exist? Nothing but the sum of all the answers to all the questions humans and transhumans had ever asked the universe—answers created in the asking?

He couldn't believe that—but the question remained unanswered.

So far.