

Around the Curve of a Cosmos

by Gregory Benford

Cley sensed them first by their stench.

A tangy reek like old bile curled into her nostrils. Quickly came a flat, metallic smell. She had time to sniff, look around—and there was the first of them, gaudy in its slick mix of blues and reds. Mats of it spun in the air, humming.

Then it was gone—*pop*. Intrusions from higher dimensions were like the weather—occasionally spectacular, mostly a side effect of larger action elsewhere. They usually meant trouble.

"That wasn't just tech leaking through," Cley said. "It was alive—Morphs."

"I agree. More than passing strange," Seeker said in its curious accent, as though the long, black-ribbed mouth were lingering over each word.

The technology for spanning dimensions had only been rediscovered recently, left over from the Third Tech Age. The process relied on a virulent state of matter termed "quagma"—quark plasma that seared like magma.

Once such quagma-driven geometric bridges had been a source of great adventures and even commerce, the history slabs said. That lay many centuries behind humanity now, and the technology was difficult and dangerous. Cley had not studied it—the past was a vast labyrinth of decayed wonders—though Seeker had.

She set about her labors again, clicking micro-excavation tools to her hand neurals. Her companion stood frozen, though.

Cley was used to the occasional encroachments of other dimensions, both subtle and rude. Since humans had again begun experiments into higher dimensional physics, momentary overlaps would drift away from the experiment sites. Since a 4D perspective could move rapidly in 3D, these could appear very nearly in two distant places at once.

But they were mere flashes, lasting seconds. Cley took no note, once the oddness wore off.

Seeker, though, never lost its unending wonder at the twisted shapes that came across the gulf of dimensionality. They had worked together for years, but Cley got used to whatever came along. *The world was odd, yes? Next question ...*

Not so the quick-witted pseudo-animal, which stood sniffing the air with an expression Cley took for wonderment. "C'mon, let's get this stuff catalogued."

They both set about their labors again. They were working in the Library of Life, an ancient city

of genetic and tissue information that was older than records could show. Certainly it came after the Era of Ur-Humans, when technology had first shed its enveloping light over all humanity. Cley's genome dated from that distant eon. She was a recreation of some distant ancestor of the Supras who now governed the Earth.

Now something made Cley uneasy, though. The 4D Morphs had smelled *wrong*. She wondered if this was her ancient hunter-gatherer instincts coming to the fore again. Automatic fear of the strange. Such responses had been ironed out of later human sub-species. She shook her head and concentrated on her work.

Some of the microscopic slabcasts they studied went as far back as the early centuries of the Space Age, well over a thousand years ago. They found it exciting to recover genomes and sometimes even whole glassified organisms from Earth's distant past. Especially if they came from before the Age of Appetite and the following Era of Excess.

Theirs was a privileged task. It required both careful attention and a certain skewed way of looking at what they found among the ancient canisters and recording devices. This was where Seeker excelled; nonhuman intelligences were essential in plumbing the currents of the ancient ecospheres. The mind riding in that raccoon-like body was as aslant from human minds as anyone had yet created.

Seeker took joy in carefully rooting in the ruins of this, the fifteenth subsurface level of the Library, in the southwestern quadrant. It enjoyed using its finely articulated, yet rugged hands to pry up slab-entries and discern their contents. Cley listened to Seeker's mutters and smiled. A cool breeze wafted over them, ruffling Seeker's fur, provoking from it an uneasy purr.

Cley had long ago gotten used to the raccoon-creature's oblique intelligence. She could see that forebodings stirred in that mind now; its black lips twisted and the broad face wrinkled with complex, unreadable, expressions. It allowed itself a low growl as it worked.

Very little of humanity's history had survived the rub of the last millennium. Over the yawning chasm of eons, meanings altered beyond recognition. The two of them had once labored at a site rich in radioactives, gingerly harvesting the lode to great benefit ... only to discover that the ancient technociv had thought this richness was a pollutant to be buried, with stern, immense markers to warn off their presumably primitive, ignorant descendants. This had been a source of much comedy.

The present Library of Life told of the vast experiments that had yielded such strange fruit as Seeker, but not how those had been achieved. In a way, working here was an expedition of self-discovery, for Cley herself was not a true lineal descendant of the ancient genomes; and certainly not an Original. Scarcely anyone was, in all of present humanity.

"Something's ... coming." Seeker's ears pricked up. "That earlier incident—the sea shell, remember? Several days ago?"

"I wasn't here," Cley said, looking up. Was that a cool, dry breeze stirring her hair again? In the heat of the day? "Some sort of vandalism, I heard."

"I wish it had been something so innocuous. Look—" Seeker pointed.

Blobs and rods floated nearby. Slick, red and white, shimmering.

The cutting stench again—

The micro-slab Cley was working on vanished.

She looked up into a hovering mass of sickly green, shot through with glowing crimson dots. It emitted a low moan. "Morph!" she cried, tumbling backwards.

Several more shelves of slabs disappeared. "Damn!"

Seeker was there immediately, springing at the Morph. In its lean paws it held a gray equipment tarp. It wrapped the tarp around the churning Morph and scampered around the shape, pulling. "Grab the end!" Seeker called.

Cley caught the tail of the tarp and Seeker grabbed both ends, jerking them together. It made a bag around the Morph. "Hold—it!—"

Seeker grappled with the tarp. It was poking and jerking. Cley got a bear hug around the violently struggling package. The Morph punched her in the nose and she punched back. "What—"

Something yanked on them—the world dwindled dizzily—and they were flying.

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It was as if immense objects swept through a high, vaulted space that they could see only in quilted shadows. An immense cathedral of perceptions sped by. Passages yawned, beckoned, fell away. No gravity tugged at them—and then a huge force knocked the breath from their lungs, plunged them down and then jerked them aside, then—was gone.

Floating. Shadows sliding by in their obsidian mystery. Ground rushing up, branches of trees—they snapped off pieces as they went, tumbling—and hit hard.

They were buried in shredded fronds, branches and pancakes of fungi. Seeker snarled and snapped and thrashed.

Cley looked around. Purpling growths in a tangled, gray-green forest shimmered in the vanilla glow. Light seeped from the ground, not from above. They had fallen through the spotty, lavender canopy that hovered above on snaky vines. Debris like helical fronds, fruit of their plunge, lay around them.

They got to their feet, checked, found no broken bones. It had been over an hour, by Cley's inboard time meter, yet they had seemed to fall only for frightened moments.

They got themselves in order. She had tears in her unisuit. Seeker, of course, never wore clothes; its fur was an elaborate signaling medium for its species, using codes no human was privileged to know.

They stood among tangled vegetation, light gleaming up from the hard ground. A persistent breeze sighed.

"What ... happened?" Cley asked.

"Maybe we got sucked along when the Morph escaped from our space."

"So where are we?"

"Ummm... This place has a curious curve to it," Seeker said.

Cley looked at the forest rising to right and left, disappearing into a white mist overhead. A drop spattered in her eye from a frond overhead. "We're in a bowl, I guess. Never mind the sightseeing—what *happened?*"

Seeker chuckled, showing pointed teeth. "I do not know. My 'sightseeing' is the only plausible way we shall answer your question. I do not see anyone who is likely to tell us what this place is."

Seeker was the puzzle-lover, Cley more practical; most archeo teams had such a balance. Cley decided to stick to the practical.

She studied the luminous ground. The light here seemed eternal, seeping through the odd, stony soil beneath them. The soil itself seemed like ground glass held together with translucent webs. The twisted trees grew in the stuff.

A steady breeze stirred the canopy of limbs, fronds, leaves and pads. The trees seemed of many sorts, some rough, others smooth. Small animals made rustling excursions nearby. The air was thick, moist and almost milky as Cley drew in breaths. Carefully they explored back and forth along the "axis" of the forest, but found no large clearings. They both wearied, and finally found some comfort in a bed made of the tree leaves.

"We knew something strange was afoot," Seeker said, lounging back. It was always good at taking its ease when there was no point in not. "Recall, one of the big symbols at the Library of Life site entrance was a huge seashell, beautifully shaped into a detailed spiral, of precious luster-metal. Then that one day it disappeared. Sheared off from its mount, somehow. A few hours later, it reappeared. You were off exploring the Library's labyrinths days later, I recall, when it popped back into existence. I heard the sound, went running. No ordinary person returned it—the spiral just came back, its connection at the shear point flawless."

Cley frowned, not getting it. "I heard there was something funny, yes."

"More than that. It had been lifted, I believe, out of our 3D space. When it returned, it was not quite the same."

"A Morph took it—"

"The way you could pluck an ant off a sheet of glass." Seeker gazed at Cley significantly. "That same ant you could see from above, or below, just by lifting the glass over your head. From such a superior perspective, it will appear differently, yes?"

Cley's frown deepened. Another Seeker puzzle, one of their games with each other. She had long since stopped trying to find her way through the miasma of advanced physics. Still, she did know a little mathematics, so: "Ah—the spiral was backwards, that's it."

"Indeed. None of us noticed it at first."

Cley brightened. "I see! Same as the ant on glass, if you look at a spiral from below, it goes from right-handed to left-handed. "

"I suppose the 4D Morphs took our spiral, passed it through our 3D universe, then pivoted it about their dimension. That left it reversed when they so kindly returned it to us."

"As a warning?"

"The calling card of the Morphs. A signal, had we read it right—"

"Which we didn't."

"They showed us who they were, free of the constraints of language or symbols."

"Polite—a calling card. But why did they attack us, steal the slabs?"

Seeker shrugged. "They are like us? They also study human origins? A mere guess; I apologize."

"Um. That would explain a lot ... It's easy to think others aren't like us, just because they're mysterious. They'll give our slabs back?"

"Why don't they give *us* back? I suspect our being dropped here was an incidental."

"Sure didn't feel incidental."

"This is some sort of place between our 3D universe and their 4D one. We may have gotten sheared off into it, while the Morphs were passing through."

"This place is *between* 3D and 4D?"

Seeker shrugged. "I reason by analogy—a classic human trick, which I borrow frequently."

"You're welcome."

"Thieves do not offer thanks. Nor did our Morphs."

"What's between dimensions?"

"A space contrived for passage? I do not know. If they have built a roadway between dimensions, perhaps this is the ditch beside that roadway. Forgive the analogy."

"So we're ditched?"

Seeker waved its hands broadly. Leathery and black, they were in their fully deployed posture, and its long hands tapered to thin fingers of great delicacy. "And perhaps our slabs are, too."

"The Morph was pretty agitated."

"In a hurry to get back, it dropped us. And the slabs."

"But where?"

"You humans made your reputation by pushing beyond the horizon. I suggest such a strategy here."

"Huh? There *is* no horizon."

"Somewhere in this tube world, there must be a place where the connection to our 3D universe gets manufactured. Not necessarily nearby, I suppose. We were inducted here by some curious property of the quagma, so I suppose."

"Or by something that lives here."

"Life seems unlikely in such a narrow place," Seeker said distantly.

"Why? The Morphs have all our three dimensions, plus extra to play with."

"We are fond of carbon, thinking it the root of life. True enough—here. But in 4D, there are more choices for molecules to make, ways to hook to each other. Carbon might take longer to form life-helping compounds."

"Sure, but there might be more available, too."

"With that I cannot argue. Then there is the problem of what an intelligent organism might look like in 4D. In 3D the design is obvious—"

"Human?"

Seeker laughed. "You tool-users are all alike. No, you and I are both mere tubes. Body-bags filled with modified sea water. That is the basic design blessed by three dimensions."

"Ugh! I'd like to think we're more than that."

"I am speaking of basic body design—nothing personal." But Seeker grinned the mock-fiendish grimace that meant it was enjoying this—as usual, for mysterious reasons.

"What's a 4D tube look like, then?"

"They will have a greater surface area for a given volume ... " Seeker screwed up its long mouth, obviously trying to visualize. "That ratio rises as dimension increases, I gather. Brain and heart—if they have one—could be kept deep inside, for safety, and digestion done on the outside."

"A gut as outside skin? Ugh!"

"Ours are 'outside' our bodies, too, geometrically ... just lying along a tube, tucked nicely in the middle, where we can't see them work."

"That's how I like it."

"I doubt the design was made to satisfy our sensibilities."

"What use would digestion on the outside be?"

"Easier flow of air and fluids," Seeker said. "One could treat 'the runs,' as you term them, directly, inspecting the issues by eye."

Cley tried to imagine this and failed. She sniffed, sampled—and finally, out of hunger, nibbled at some seeds they had found. No bad effects. Pretty soon, she wished there were a lot more of them.

"I think we should determine the geometric properties of this place," Seeker said decisively.

"How? Measurement?"

"Geometry is a global property. We must travel."

"Me, I'm more interested in finding some fresh water, getting a splash in the face, a drink."

"I smell water upslope—there." Seeker led her a surprisingly short way to a dense clump, shadowed, moist. It quickly fetched a fat fish from the shallows and began eating. Fastidious, it carefully washed each piece of flesh before popping the morsel into its ample, black-rimmed mouth. Cley stripped and plunged in. When she came out, feeling far brisker, Seeker was gone.

"Damn!" She never quite got used to the ways of her companion. You kept thinking of it as human like, but its greatest asset lay in its difference. Seeker needed time alone, and wanted to explore—so it just vanished, and might be gone for a moment or a month.

Cley would not have watched Seeker scamper away into the forest of purple-speckled, knotted trunks, and not followed. Seeker knew that, and knowing the human propensity to argue, simply evaporated.

Seeker had other ways of ... well, of feeling. Cley studied the snarled growths all around her. They seemed to writhe like sluggish vines, stirred by a breeze she could not feel ... or else they moved on their own. She kept checking nervously behind her.

On the way to the pool she had watched Seeker disappear into the snaky mat, moving with surprising speed. The trunks warped behind it into a puckering pattern ... almost, she thought, as though the things were enclosing and digesting Seeker ...

Silence. She shivered. Seeker never showed true fear, and she wished she could share that talent. She suspected that the creature had accepted death in a way the fretful human mind could not. Animals lived without such foreknowledge, or so the conventional wisdom went. Shaped from raccoon genetics, amplified and tuned in countless fashions, these hybrids carried a quality humans could not readily attain. Death was only one element in their thinking, not an ever-present background tone. Seeker seemed at times oblivious of danger, even in this frightening place, after nearly breaking its neck in a fall ...

She stood gazing fruitlessly at the forest where Seeker had vanished. What now? The gauzy, alabaster light seeped up from the glassy soil, casting vertical shadows ... Though the forest seethed and fretted, it made none of the sounds she associated with vegetation—no sighing, creaking, swish ... except, she now heard, a deep rolling bass note, at the limit of hearing, like a

great slow breath of some immense beast. *The Morphs? Looking for them?*

The thought made her wary and she wished Seeker would reappear, where the slow swaying pucker in front of her was smoothing out—

She jumped. Something had touched her shoulder—

"Interesting geometry," Seeker said. It stood nonchalantly at the end of a track that led back into the forest behind her.

"What!?"

"I suspected that this was an odd place—"

"How'd you *do* that?"

Seeker grinned, stretching its black gums. "I walked in what I thought was a straight line. But this is a cylinder we're in, my friend. I walked around the entire geometry and came back behind you."

Cley looked up. "Then above that fog ... "

"There's more forest, yes. We could see it, if the air were ever clear here."

"So it's a cylinder ... how long?"

"Infinite, is my guess. Or maybe it curves around and connects back, eats its tail."

"If this is just an extra dimension, how come my hand is 3D?" Cley waved her hand at the forest. "And these odd trees?"

"My suspicion—and remember, I am only going from zaps and the like—is that this is what's called a 'brane' wrapped around a one-dimensional space."

Zaps were whole concept-nuggets, electronically induced—constellations of ideas that could be imported into a mind much as a book could be picked up. Understanding the zap meant ruminating upon it, letting it get integrated with your own thinking. That took time, but much less than old-fashioned learning through the serial input of reading, or even the parallel processors of eyes and ears through images. Still, if you didn't "read your zaps" you knew effectively nothing. Enough to get by at a dinner party, maybe, but no more.

"So we appear here as 3D things ... "

"Because we can move in the 'brane' that folds our 3D bodies into this added dimension."

"We're sort of wedged into this 4D place?"

"In a curious fashion. The Morphs must have known we could fit in this kind of halfway house of dimensionality."

"But for what?"

"Because we could comprehend this way? I do not know. Given the difficulties of broaching even simple ideas to the Morphs, I suggest we try to discover that ourselves."

"Um ... So we've only got one way to go, right?"

"Down the 1D axis of this wrapped-around, 3D space, yes." Seeker started that way.

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It was a hard trudge. Rough ground, thick air. They foraged for berries and Cley's stomach rumbled. Forest crowded in on them; at least there wasn't much underbrush. This seemed odd, since the light that apparently sustained these plants came from below. Cley wondered aloud about that, but for once Seeker—who always seemed to have an answer, even if a bit wrong—just shrugged.

"We could be anywhere in this Tubeworld, right? I don't like the sound of that."

"This is as roomy a 1D world as we could expect," Seeker said. "Remember, we experience it through a sort of transform."

"That 'brane'?"

"I suspect it allows us to perceive a more complex realm as this tube. Even so, it could be as long along the axis as our space is across, the radius of the universe entire."

"You mean it's infinite going that way?" She pointed fore and aft of the axis, the two flat directions.

Seeker tut-tutted. "Infinity is a term promiscuously tossed about."

"Okay, okay—large."

"And note that the breeze always blows the same direction."

"Right. I wonder if it wraps around the whole cylinder."

"Possibly. But what drives it?"

"A break somewhere?"

"A disturbance in the geometry. Ummm ... the quagma could provide that."

"But would it drive the air toward itself, or away?"

"I do not know. This is a 3D manifold, wrapped around an extra dimension, a complex 'brane,' I do believe. I christen it Tubeworld."

"Look, before we go founding new worlds or anything, worry about this. If it's really light years

long along the axis, then we'd never find the quagma that brought us here, that's doing all this."

"Well, yes."

"Y'know, that spiral back at the Library ... if we could use that ability, pop things in and out of the extra dimension ... "

Seeker's eyes opened in agreeable surprise. "Ah, interesting."

"We could reverse the sense of rotation in molecules, make them act differently."

"Excellent. There might be biological advantages. Some diseases are left-handed because that matches some of our molecules. If we could switch that sense in our blood streams, we would become immune."

"Great—only we have to be sure the Morphs that live here don't kill us first."

"I doubt they live here. This is a portal, no more."

"Yeah, a *ditch*. The bastards who dumped us here—"

"May not have even noticed that we had been sucked along in their wake."

"Even worse!"

"To be unnoticed? I would think it a blessing, ordinarily."

"Well, you don't think like a human!"

"That does seem to be a problem," Seeker said lightly, and went to sleep.

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Cley kept waking up in the diffuse pearly glow that oozed from the ground. It made her uneasy, and she wondered what made the light. What drove biological processes here? Were there stars, planets? If the Morphs made this, they had command of physics in an extra dimension, transcending everything she knew. Not gods, no—she had wrestled with one in the tarp bag, felt its smooth strength jerk and struggle. But vastly strange, yes ...

She lay awake and turned these questions over, and then heard odd sounds ... growing louder ... something coming.

Cley shook Seeker awake. Long reverberations came, sounding louder. They both stood up. Cley found a stick of satisfying heft.

The sounds seemed to come from all around. Cley discovered that if they turned perpendicular to the 1D axis, their bodies amplified the vibrations. In their ears sounded a tortured *stroooooonng* that repeated like the beats of a slow, thick heart. The pulses refracted and stretched.

Above the twisted trees beneath the persistent pearly fog came a great flapping shape. There were no feathers. Instead the dull reddish skin looked like the meat of some undersea creature. Cley thought of manta rays, and that this thing was larger than any bird she had ever seen. It was at the bottom of a swoop. As it neared them it coasted back up a lazy long parabola, disappearing into the mists. Another dipped into view, rose away.

"It's not dangerous, is it?" Cley asked.

"Did you notice the curved talons on the ends of those wings?"

"Yup. Just looking for reassurance."

"I offer none." The echoing, eerie *stroooooonng stroooooonng* got thicker, louder.

Abruptly the thing came again, this time plunging along a deeper curve. Its maroon flesh was now livid with red stripes, as though it were excited. It wheeled above the nearby trees and plunged abruptly—toward them.

Seeker dodged away, but too late. The talons caught in its fur and the thing lofted Seeker up, disappearing into the fog ceiling above. Cley could hear nothing and crouched against a thick tree. Another of the birds dipped below the misty deck, went back up.

Stroooooonng! Abruptly they appeared again—but now Seeker had its claws dug into the underbelly of the fleshy bird. They wrestled together in air, descending rapidly toward the treetops. Seeker snarled loudly and a strangled *stroooooonng* came from the vent slits where the creature's wings joined the tubular body. The creature thrashed, trying to shake itself free. With a cry Seeker leaped away from it, grabbing for a nearby branch—missed it—and fell through to the next branch. And another. The bird-thing flapped away, sending an angry-sounding *Stroooooonng!* As it labored up into the mist.

Seeker was in no better mood when it climbed down the crusty bark and slumped, sprawling. "I believe I have learned something," it said, wheezing.

"I'd love to know what."

"Attack when it approaches. Use a sharp stick. Also, I understand something of the geometry here."

"You learned that while it was carrying you away?" Cley chuckled; Seeker never ceased to amaze.

"It goes upward because gravity is lesser there. It carried me to a curious place where the fog cleared and the breeze was strong—and we were weightless."

Cley thought she saw the point. "So we're inside a rotating cylinder?"

"I thought as much, at first. But remember, this is another dimension, not a mere artifact."

"So gravity goes away at the center of this, well, cylinder?"

"I gather. Some sort of symmetry principle at work, I would wager." Seeker checked itself over,

rubbing and licking its pelt.

Cley yawned and looked round uneasily. So far there was no night here, making surprise less easy. "Those birds couldn't be the smartest thing in here, I suppose?"

"No. Something rather smarter must have access to this curled-up extra dimension, and ours as well."

"Then it's really a full 4D creature? How'll we recognize it?"

"I suspect it will be a morph form that manifests in this geometry as more cylindrical, to match the boundary conditions."

"You were once a mathematician, weren't you?"

"Labels are limiting."

"Aha! Thought so."

"I suspect that whatever rules here will be a denizen of a dimension we cannot know—and larger than a bird."

"Somehow I don't find that reassuring, friend."

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When they next woke up, Cley's fears surfaced again. They had been through a lot, and still Seeker seemed unfazed. Maybe it helped, being a mathematician.

More immediately, Cley wondered how they could find something to eat. Even Seeker—who seldom seemed victim to the needs of the flesh, unless it wished to be—had a rumbling stomach. They found yellow seeds hanging like teardrops from the vines. A tiny sample proved tasty and smelled right, so they indulged.

"Should we wait for the smart Morphs to make a move?"

Seeker shook its thick head. "They have probably lost us. The intermittent nature of their appearances argues that they do not control the inter-dimensional access very well."

"Maybe we should light a fire or something."

"Visibility is very short through this fog. Though I expect they can see us, if they have overcome the problem of looking down into lesser dimensions."

"There's some disadvantage to having an extra dimension?"

"Hyperseeing," Seeker said. "They see both more and less. First there is the difficulty that for us, light oscillates in a plane, and moves forward in the third dimension. In four dimensions, light

must oscillate in all three dimensions, then move along a fourth. That makes 3-D light hard for a 4D being to sense."

"Good. I'd just as soon that we're invisible to them."

"Not so now. They found us in our 3D universe, so they have overcome that problem. Perhaps they have stripped away one of the three directions, so they get a sort of edited version of our light."

"So they can see, but less than we do?"

"More, I suspect. When we look at a 2D painting, we see everything in it from one viewpoint. A 4D creature can then see everything in a 3D scene, without moving viewpoint."

"I can't visualize that."

"Not in 3D, no. But suppose you go to an art exhibit to see a sculpture of, say, a Supra woman. There are ten copies of it, each one rotated a bit, standing against a wall. You stand in one place and can look at the entire Supra without moving."

"*You* went to an art gallery?" Seeker always seemed distantly bemused by human amusements and interests.

"You seem surprised. I saw such a sculpture, and did not recognize the ten different angles as being the same object."

"Really? You're losing your air of omniscience."

"Good. I am but a 3D creature, just as you."

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They hiked on further, with nothing to show for it. The forest kept repeating itself, as though it just might be infinitely long. It seemed to be made of living modules, as if churned out by a living factory somewhere. The oddity of a 1D add-on being nonetheless infinite did not seem amusing, after hours of picking their way through the thick growths.

Plodding along, hypnotized by the routine, Cley dimly noticed sounds coming closer. And an utter quiet between the notes. Deep bass moans, as if from a huge throat ...

She had heard that before. "Morphs!"

She ran and ducked under a grove of trees. Seeker scampered after. The long, pealing notes got louder. Nothing came below the mist level. Louder ...

"Should we signal to them?" Cley whispered.

Seeker cocked its head, listening intently. "They may be looking for us, yes—but why? To carry us fully into their 4D universe?"

"Don't think I'm up for that."

"Nor I. It would be good to recover the history slabs, if we could."

"If the morphs mean to give them back, sure." The throbbing notes were louder, like a presence in the air above them.

"I vote for staying silent."

"Um. Me, too."

The long pulses seemed to press down on them in stretching waves—ominous, unending. Were they hovering above? Cley felt a sudden impulse to shout "Go away!" It was unbearable—

Dead silence.

This was worse. They studied the slow seethe of fog ... Nothing.

"Think they spotted us?" Cley whispered.

"I do not think when there is no point to it."

"Meaning?"

"Best to wait." The silence around them was unnatural, no animals stirring, nothing. Cley stood alertly, nerves strumming.

Sleeper curled itself around a tree trunk, looking like a thick fur collar at its base.

"You're going to *sleep*?"

"And you are not."

Which is what happened. Cley could not even doze in the silence. At least Seeker did not snore. When it did awake, the woods had returned to normal. A breeze had come up. They marched on again.

The humidity seemed worse. Heavy drops smacked onto their heads until she made frond hats for them both. Seeker thought of an experiment and got her to bark out short, high-pitched shouts; its throat was not loud enough, it said. Then they stood and listened to a faint echo come back. She had timed them, and from it they got a rough number for the velocity of sound. It was about half of Earth-normal.

Cley nodded. "Interesting, but so what?"

"We should gather information and then see if it is useful. At least we know why the birds could fly so well—thicker air."

They had seen a few more of the birds dipping down through the mist, but none attacked. Cley

stopped foraging for berries and stood still. The ruby-colored berries were getting quite tedious as her sole fare, which Seeker supplemented with small animals it caught and devoured raw. "Wait, we've been stupid."

Seeker was on the hunt and did not reply. "We should be flying, too!" she shouted.

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It took another round of sleep/trudge/sleep before they found what Cley wanted.

The spire of luminous rock was like other outcroppings they had encountered, but larger. More to the point, taller. Crystal Crag, Cley named it. Seeker laughed. "How human, to give a label."

Seeker laughed again at the large fronds Cley collected, but helped stitch them together with thread made from the tough vines. She found some bamboo-like trees and used the slim trunks cross-lashed together. The fronds held up well as she fitted them to the frame.

Deftly Seeker twisted oily branches and gnawed them off. Cley's embedded tools, extended from her extra fingers, proved useful in making the high-stress connections firmly knitted.

They climbed the rocky spire with care. She could feel gravity weakening as they rose, an odd but welcome sensation. The peak had a rounded crown that made footing tricky. Mist roiled and churned above it.

"No room to get a running start," Cley said.

"We would find that awkward anyway," Seeker said, "being of unequal height."

Though Seeker could stand on two feet, it liked to run on fours, with its hands foreshortened into the ancient, simple paws.

"I'm glad we thought to put in the hand-holds." She fitted her fingers into the tight, glove-like sleeves made of bark. Those had taken nearly as much time to make as the whole wing.

"You are hesitating."

"Yup. If we fall ... "

"We will not. Notice that there is a steady updraft from the warmer rocks below."

"We primates have a big thing about falling."

Seeker grinned. "Time to overcome your origins."

"Hey, your origins were in our labs."

"Don't remind me."

Without another word they got into position. A few seconds' pause, silent ... then together they took three short steps off the crown. The first moment was the worst—falling, the fronds filling with a rattle, but no lift. Then they caught a current and slowly leveled off. But no better—the mist still hovered just above their heads. And her arms were starting to feel the ache already.

"Left," Seeker said.

She leaned that way and their amateur hang glider canted. Lurched. Fell a little. Treetops zoomed by below their heels.

"If we tumble—"

"More left."

They veered further over. The fronds protested with clatters. She jerked them further over—

A glance down. Snaggy branches and some cushioning fronds ... a long way down. If they lost it, started to tumble, best to kick away, curl up—

An ominous splintering crack.

And the left wing came up.

An updraft caught them strongly, boosting them into the mist. Now she had no way to judge direction. She was almost grateful for the gathering ache in her arms, because it told her which way was down. Wind whistled around them, churned in her hair. The wing shook, veered, righted itself in churning currents. A moist tang filled her dry mouth.

Then—light. Dim but clear. They soared above the mist, trailing streamers of it. The turbulence sighed away.

Her arm aches vanished. She felt giddy, though her stomach still refused to stop clenching.

"We're at the center," she said.

"I knew it would work."

"Glad you did. I kinda lost my faith back there."

"I never doubted you."

"I was worried about the laws of this Tubeworld of yours. Whether we had guessed right."

"It was no guess." Seeker freed one paw and made a show of stretching its hind legs behind it. Yawned. Stretched. "Though ingenious, your idea, yes. I should have thought of it myself. Here we sit at the center of a barrel made of mist, in no gravity, comfortable. We move with the wind and so feel no breeze."

"And to think how we plodded along for days."

"I would rather not."

.....

They had brought food, but not enough. "How to plan for a trip that in principle might be quasi-infinite?"—as Seeker had put it. They ran out after two days (as Cley's thumbnail inboard reported). Water they got by slurping up rivulets that condensed and trickled off the wings.

There were problems they had not considered. Defecating in zero g was a source of great amusement for Seeker and some embarrassment for Cley. Luckily, she had thought to make a vine rope when they were building the sail. This she spooled out until she was behind the glider. Tying it to one hand, she managed ... barely.

Seeker was not so fastidious. It even invented a sort of water-skiing sport with the rope. When its spread legs gathered in enough of the vagrant currents that wafted in the wake of the glider, it could artfully swoop from side to side, cackling with glee, even giving forth a whoop utterly unlike anything a true, ancient raccoon had ever made. Only when its sideways momentum started rocking the entire glider did Cley yell at it.

They began to wonder how they would know they had reached anything of interest. If the fog remained in its curious cylindrically symmetric wedge, they could glide over what they sought. And what *did* they seek? Seeker's best guess was a research station where the quagma-generated geometric gate would stand.

But how big? Would it poke up above the mist?

They kept steady watch, relieving each other in unconscious imitation of the ancients who crewed the ships that sailed through foggy oceans. Nothing whatever jutted above the mist tunnel. In a way this was good, since they could easily have crashed into an obstacle. The glider held together, but Cley had no illusions about its ability to maneuver, or survive a solid smack.

They saw the meaty birds now and then. The creatures gave off their brooding *stroooooonng stroooooonnngs* well before coming into view, and slowly overtook the glider. How they fed was never clear. Seeker became alarmed when the first of them flapped stolidly within a few lengths of the glider. It braced itself against the struts, claws out—and the bird labored past, scarcely giving them a glance. So did all the others. Apparently they hunted ground animals—quite large ones, to judge from the immediate attack on Seeker—but considered anything flying in the weightless tunnel not fair game.

"Maybe they never saw anything else up here before," Cley guessed.

"I doubt so easy a niche would go uncontested," Seeker said.

A while later she did see a smaller bird scoot up into the wind tunnel—as she thought of it—and dart around. They startled it and with wildly flapping wings it ducked back into the fog. Now that she listened carefully, she occasionally caught distant squawks and even one odd, strangled cry coming up through the clotting mists. She wondered why the light here was not much weaker, since they were further from the ground, but then realized that they got light from the entire

Tubeworld perimeter. She and Seeker listened in their utter quiet glide and heard more.

Seeker was mortified that it had not seen more of the life below in their hiking. "We smell strange to them, I am sure. Inducing silence as we go."

The mutual sense of strangeness grew. A somber alien feeling came stealing into Cley's thoughts, the pressing sense of doom here. The featureless fog gave Cley the sensation of plunging down through an infinite cylinder, confusing her inner ear, bringing momentary bouts of stomach-churning nausea.

Seeker became uneasy as well. This led it to wonder aloud if they might indeed have set out upon an infinite journey, blown by winds that never ceased, circumnavigating the entire 3D universe in this tacked-on Tubeworld. An idiot Odyssey.

Long ago the ancients had realized that the full universe had ten dimensions. Arguments about mathematical symmetry and beauty had decided the issue, to the physicists. Seeker wryly remarked that this all came from a primate preference, but the mathematical elegance of the resulting cosmology was "too beautiful not to be true."

But where were all the extra dimensions? All but three of space and one of time were "rolled up" like tiny scrolls. They had been since the first few shaved seconds of the Origin, the Grand Emergence of space and time together in one Creation.

Curled up, they could not be sensed, even by delicate experiments. Wave one's hand and it passed through several unseen micro-dimensions, with no consequence. In ordinary life, the bonus dimensions meant nothing at all.

But rolled up to what size? Far smaller than the diameter of an atom, or otherwise the dimensions would show up in the visible spectra that atoms emitted and eyes saw. The span of a single electron was vast, compared with the realm where the extra dimensions lay hidden.

All this seemed like abstract fictions to Cley, even when Seeker had explained that the idea led to mathematics that nicely packaged up the fundamental forces, starting with gravity. In theory, the forces then all emerged "naturally"—for the mathematically minded. To Cley, all this verged on the theological ... until she had seen her first Morph.

But even those ancient mathists had not envisioned a place like this Tubeworld, a dimension big enough to walk across in an hour. So much for theory. Apparently, the Morphs had made this place as a sort of construction shack.

Seeker tried to explain why, but it just got Cley more confused. The sounds from ahead were almost a relief.

Their ghostly glide turned to surges—building fast, making Seeker grab for its grips. A high, keening *shreeeee* pierced the murk ahead and alarmed Cley. It sounded like a buzz saw meeting something it did not like.

"What's that?"

"The sink for this wind," Seeker said, holding on.

The idea of a place where the wind went was unsettling. Their wings rattled and wrenched. To Cley they looked suddenly frail.

The vapor around them began to back away, the ivory tunnel they had plunged through for days now opening like a throat into ... what?

Suddenly the mists fell away to all sides and they fell into a roiled red chamber. The distant walls glared white-hot. Yellow tongues forked across the entire expanse and slammed into the walls with eerie blue-green explosions.

"The quagma factory!" Seeker called over the sudden din—crackles, roars, percussive blows.

"Where shall we go?" There were winds now, sudden gales that buffeted them. They plunged, recovered. Sagged. Slewed. Cley barely held on. No gravity, but plenty of vagrant, blunt forces. Grasping, pulling like smooth hands—

Her shoulders ached, wrists popped ... and on top of it, she was *hungry*. And getting irritable. *One should face one's fate well-fed!*

"Let us—try to—stay in the—middle."

They were still streaming down the center bore of this place, but now heat pasted into her face like a slap. And ahead was something turning, revolving about a slow, canted axis. It was a ruddy-brown worm, livid with spots of ruby radiance from within.

"A long life form—too big to evolve here—must be—one of the engineers."

"Or—a machine," Cley gasped. Her hands locked painfully in their gloves. She was terrified, panting, hot.

At their left a pore grew out of the wall. Sickly white, oily, it thrust up toward them. Fumes blew off it into her face—and bit with acidic pain in her nostrils. Like a swollen wound it ripened. She looked ahead and the ruddy worm was closer, much closer, closing with them. Long drum roll beats surged through the liquid-thick air.

"I cannot tell—if this is—what quagma—would be like—" Seeker was struggling to hold on.

The thing like a pore was almost touching them now, still growing, giving off a fierce heat. Her skin shouted with pain, sizzled, broiling—

A hole opened in the pore. Inside was a dark, sullen blue. The throat of the thing opened like a livid mouth. Greedy.

She screamed. Seeker was shouting but she could not tell what it said. Forces stretched her. Her legs shrieked. Her shoulder joints popped.

Then it swallowed them.

.....

—and they shot through into blue spaces of sudden, chilling cool.

—tumbled, twirled about an unseen axis. The struts beside her splintered, popping away. The wing crumbled.

—and they fell onto a hard black surface. She rolled, gasped and the air was cool but *where was Seeker?*—and then Seeker fell on her.

They untangled themselves, got their breath ... and stared up at a vast ebony roof seething with rivulets of ivory glow.

"Black-branes?" Seeker said. "Perhaps ... "

"Which ... are?"

"Sheets of space-time. They can wrap around the hidden, tiny dimensions—those for which Creation had no true use."

"Except to build things like that?"

"Point taken. This black-brane is expanded, like this tubular dimension itself. We are seeing the infinitesimal exploded into the ... "

Words seemed to have failed Seeker. "The monstrous, how about?"

It gazed in wonder. "True enough."

"A kernel of truth puffed up into chunks of trouble?" Cley tried to remember what Seeker had said in their long days of cruising. It had been hard staying awake, even though their lives might depend on the knowledge. "Things that work like black holes, but with dimensions anchored on them?"

Seeker was somber. "Or so the ancient theorists believed. These are membranes, cloaking God's squandering of dimensions ... " Its voice trailed off.

In a way it was comforting to see Seeker truly impressed; usually, it gave the impression of having seen everything before. Not this time.

Something was making her dizzy, and it wasn't just the ideas. "You said ... back there ... quagma."

She sat down hard. Rough bumps in the stony stuff that supported them—against a light gravity, she noted abstractly—rasped at her palms. The thing above might be the primordial stuff from which God twisted Everything, but she needed a rest.

She hung her head between her knees and breathed steadily, easily, trying to get some equilibrium in all this. Her heart was pounding, nostrils distended. The air stung.

Seeker began speaking, its voice trembling just a bit. She realized that it was trying to wrap some

thin, tattered logic around what was happening. Any world was less frightening if some fraction of it made sense. Seeker spoke, words like balm ... and she felt her pulse gradually slow. She even began to comprehend some of what Seeker was saying. Or she took some comfort from believing that she did ...

Quagma: everything had once been all seethe and jostle, at the universe's birth. Heat beyond any human sense of what that short word could possibly mean—it had burst into space-time in a magma of quarks, tiny particles that supped of all the fundamental forces at once. In that infinitesimal era the fundamentals were One, and that Superforce could do anything—even alter the balance between the vagrant forces, shape them to a Will that could command quagma.

So quagma was the Stuff of All. To master it—to make it for a similar infinitesimal tick of time—gave the power to redesign some wedge of space-time. To make dimensions snake and blur and coil, space-time spaghetti cooked to order. Fuzzy space-time could be knit, sauce added—and all by Life as it dwelled in dimensions that were themselves subject to negotiation.

Or so she gathered. It was all a bit much, terms tossed in as though Seeker knew realms she could not glimpse. Well, maybe it did. The airy spaces of theory were not her proper province.

She said, "So ... this is where something from 4D makes a connection ... "

"To our universe. This curious little microcosm of modified 1D space, our Tubeworld, is a way station of sorts."

"An easier way into 3D?"

"A guess, no more. One would need to ask those who are doing all this."

"The quagma engineers? That huge ugly brown thing we saw—that was one of them?"

"I do not know."

"*Why* are they doing it?"

"Resources? Exploration? Those are the traditional motives of expansionist species, such as yours."

"Not like yours?"

"My kind are artifacts. I—*look*—"

Something had come into the space here, without entering. It simply appeared—a writhing blob of fleshy reds and pinks and salmons, turning like a greasy art object ... and reeking.

Cley wrinkled her nose at the queer aroma that came in waves from the thing. "I've smelled this kind before."

"I trust it is not harmful, though I do not know. Remember that this thing can see whatever we do, from any angle."

"I wasn't going to attack it."

"Wise."

With the black-brane candidate hanging above, this new element seemed just one more entry in the weirdness ledger. Then the thing jittered with fevered energy.

In quick flash-images she saw: purple-green limbs and folds, oozing into glassy struts—elongating, then splitting into red smoke. Leathery oblongs and polyhedrons folded over each other. Twinkling, jarring slices of hard actinic light poked through them. And it all moved as though blurred by slices of time into a jostling hurry—

"We are seeing some aspect of the true, larger 4D," Seeker said, voice slow with wonder.

"But we still have 3D eyes."

"I fear this is why none of it makes sense to us."

She thought about a 2D being suddenly moving through their own 3D world, seeing only cross sections of trees and rocks and moving cars ... and trying to stitch it into a coherent view. It could make a 2D symbol or picture and Cley could understand it as a flat scene. But for the 2D creature it would be the whole object, not just a photograph.

So it now was for her, maybe?—sensing these things moving past and not getting how they fitted together into something extending away, in another direction the eye could not see, but maybe the mind could glimpse ...

"Listen," Seeker said.

A strange symphony of booms and clatters and screeches came from the air all around them. Seeker covered its ears. "We're getting the sounds as they are in 4D, where the waves spread out in a different way, in packets and eddies."

Cley waved her arms in frustration—the only thing she could think to do. The deeply resonant vibrations were even coming from *inside* her. "Ah! Ah!"

"I do not think these waves are harmful."

"Like something speaking in my guts!"

"Music? A voice? We must find a way to speak back."

"Look—if Morphs can see us entirely, inside and out, steaming guts and all—well, maybe they'll notice my whole body getting involved."

She whirled, tumbled, capered, feeling like a mad dancer, working off her frustrations. A few moments in this low gravity left her panting—and something caught her eye.

A rippling fleshy knob floated near her. She wondered if "near" meant anything now. Gingerly she reached out toward it and felt only air ... but in her vision her arm telescoped away, growing long and thin—dwindling into the distance down an impossibly long perspective.

The knob grew, flexed, reddened. She reached again—and connected. *To reach across*

dimensions ...

A slick, warm surface. Smooth turning to sticky as she moved her hand down that long tunnel of perspective. Blue spikes poked through the knob's "skin" as though they grew from it. Hair? She fingered the spikes—hard, hot, strumming with long low notes like a church organ—but she could only feel these swelling hums, not hear them.

"You may be feeling its ... bones," Seeker said delicately.

"Ooog. I wonder if it minds?"

"When you walk down a street, do you mind if a shadow falls over you? It is a 2D intrusion, of a sort."

"Look, if this is one of the things that jerked us out of our space, made us do all this, damn near killed us—"

"You wish to be at least understood by it." Seeker nodded, walking at a stately pace around the strange display, treating it as an art object. But its fur bristled with excitement, too.

"I'm not sure what I want. Maybe ... payback."

"I share your dislike of being treated so casually."

The oily colors reeked like old mausoleums—then, suddenly, of salty air. None of this made any sense. But then, maybe it couldn't. She was a flitting shadow in somebody else's world. How did she talk to shadows, anyhow? Or fear them? "If I ever get a chance—"

"I agree. Let us act back upon it."

"But how?"

"Precisely. I am not feeling terribly powerful at the moment."

Overhead, the ominous darkness descended.

Sparks and helical neon-bright fibers shot through the air.

"Yet it must be benign," Seeker said, its composure returning. "Else it would not have arranged these bare amenities. Air we can breathe—though a bit thick and dry—and heat we can withstand."

"Me, I'd prefer to be left alone."

She knew they were carrying on a semblance of a conversation because it was the only human thing in this utterly alien place. There had been so much strangeness for so long she felt consumed by it, encased in a universe beyond human ken entirely, gyrating to its own bizarre laws.

"I sense some change coming," Seeker said. The air shot through with bright color. The plastic-slick, sour-smelling blobs and sticks that drifted in the space became dense, fibrous, as though drawing nearer.

Pop! "Hey, the history slabs!" Cley picked them up where they had clattered on the hard sheet at her feet. "It's brought them back."

The black-brane was very close now, radiating a crisp heat—

—a sudden stretching sensation, a sidewise lurch—

—*pop*—and they were standing on sand.

She lost her balance, hit, rolled. The slick blobs were everywhere, churning, churning. But beyond them—"Look!"

Mountains, blue and snow-topped. She recognized them—the valley of the Library of Life. "They put us back."

Nearby was a branch excavation of the Library. Nobody was around, but the gear was out and working, most of it automatic. They were a reasonable walk from where they had started and it seemed to be midday. She wondered how long they had been gone. Did time tick forward at the same rate in higher dimensions?

If the universe had only one dimension of time, that meant it was shared, even among higher dimensions. But if there were two time dimensions ...

She shook her head. Enough.

Seeker nodded. "I would like to get them to stay until we can profit from this experience."

She laughed crazily, decompressing. "Profit enough, just staying alive."

"None the less ... " Seeker twisted its muzzle. It walked over to the excavation equipment. It stretched up, found a tray of instruments. The 4D morph blobs and sticks were cascading with their slick plastic reds and pinks, white strands weaving through them. Some followed Seeker, the rest stayed with her. They made her uneasy.

Seeker selected a long, curved tool with a sharp, forked tip. It turned with a quick, deft move and plunged the tool directly through the nearest blob.

Chaos among the 4Ds. Seeker batted away one stick and stepped back to survey his work. The blob fluttered and distended, warped into a rosy plate, then a tube, then a teardrop. It oozed around to one side of the tool shaft, then another—but could not break free.

Its companions whirled in a cyclone frenzy. They imploded suddenly, grouping around the pinned blob. Though they strained at it, the shaft would not come free of the hard desert earth.

"I suggest we find help," Seeker said. It set off at a lope. "We must arrange some more permanent way to trap this portion of the 4D morph in our dimension."

Cley ran after him. After days in zero g the solid slap of shoes on soil was a pleasure. "How come they can't get the shaft out?"

"I do not know. But a needle can trap a finger in 2D, so ... "

"What? You did that on pure hunch?"

"Yes. That surprises you?"

Cley shook her head, grinning in disbelief. "They might've killed you."

"The 4D society must want this connection. I doubted that they would act harshly, once they have understood things."

"Um. Big gamble, Seeker of Wisdom."

"They have risked our lives already, then saved us—only to dispatch us? I thought not."

As if in testimony, a company of wheeling floating teardrops and sticks followed them. Cley looked back; the blob was still pinned. "You anchored it in 3D. Like getting your 3D hand stuck on 2D sticky paper."

"Let us be of speed, to think further. They may devise a way to free that portion of the morph."

"So 'they' is wrong—it's one thing."

"I surmise. Though how can we tell? We have inadequate eyes."

She thought it over as she gave herself over to the pure pleasure of running in fresh, clean air, unsullied by dimensional ambiguities. Yes, the dimensionally destitute in 3D could not see the dimension above. We use a basically 2D retina, even if it was in a spherical eyeball, to process light—then reconstitute in our brains our 3D world. A 4D morph must have a 3D eye, then. A sphere that provided the same service, to image the 4D world. Then one more dimension up, a 5D being needs a hypersphere—Seeker had told her about those — to see its world.

To her surprise, riding on her elation, she was beginning to think the way that Seeker could. She could *intuit* 4D, even if she couldn't see it. Yet.

Meanwhile, Seeker was barking with pleasure as it trotted. It batted away a floating stick, which dutifully bobbed away, then came back to hover. Surrealistic bees, in pink and white ...

"Think of what a 4D mind could tell us!" Seeker said. "Truths about our space we could never guess, any more than an ant crossing a table knows that a human is doing calculus there."

Cley said, "If they care to bother."

"Why else make that incursion into the rolled-up micro-universe, a tube that size? An experiment!—all in aid of getting through to us. Travel among dimensions is not easy, that we have learned the hard way, from this journey."

"Maybe we should keep it that way."

"There is no going back from this!"

Cley laughed. Seeker never got this enthusiastic. He was rebounding from the long days of fear, though he would never, of course, admit it. "Suppose there really were a Flatland for 2D beings—what we could tell them! We would be fascinated, too."

They were nearing a clump of workers. They looked up, puzzled.

"We could get the same richness, literally beyond conception," Seeker said, "if we only could talk to the 4Ds."

Cley laughed again. Home, and already thinking about fresh horizons. It felt like rapture.

The End