

Where Gravity Sleeps

16 – ‘Renzowood

Moontech began the ongoing mining of the moon for titanium. The effort would be punctuated by two forty-five-day-periods each year when the moon would have to be evacuated because it would be passing through the Neobelt. It was not a difficult operation and they already had all the equipment and skilled people necessary to succeed. Refined titanium began to be available to the Belt a mere three months after the initial exploration of the moon. There was only ten percent of the mining and refinement capacity now, but it was actually a relatively large supply for the Belt. The Belt needed titanium badly not only for the da Vinci but also for ships and almost any machine which had to survive in space. The new supply of titanium touched off a flurry of new requests. Many projects needed the until-recently-scarce metal.

It would seem that the da Vinci would eventually be finished, but who would live there was an entirely separate question. The other bubbles now held reasonable populations, and most of the rest of the people in the Belt lived in Spinland. There was no longer a real need for the living space in the da Vinci. The plan was to complete it and pressurize it. Then to start an ecosystem on the entire inner surface, and leave it as a mostly wild place until a later time when it might be needed as a living space. Wayne Arnold recognized the irony in the fact that his daughter ran away from him, only to end up directly helping him reach his goal of completing the da Vinci. Ironic or not now he was very busy again with the logistics of the da Vinci project.

In fact, after a few years of balancing needs and supplies people had all they needed to be safe and to survive. Only luxury items were scarce any more, and the black market was small now. President Rose Wiseman had put programs in place to address many of the problems facing the Belt society. She was working diligently one Friday afternoon when Morena Ramirez visited her in her office on Spinland.

“Morena, what a wonderful surprise? Did you come to gloat?” She smiled at him. He was the only person who would be able to understand what it was like to be the President.

“No, not to gloat, Rose. Just to bend your ear. I’m on my way to Stars View to meet with friends I’ve made and to trade art. In fact, it’s because of art that I wanted to talk with you.”

“Really?”

“Yes. I know you’re busy, so I’ll come right to my point. Our society is very good at utilitarian tasks, Rose. What place does art have in our society? Can people produce art as

their primary contribution?” Morena looked and sounded much happier than when he had left the same office.

Rose thought for a moment. “Well, I guess they can if people are requesting art. Right? It isn’t up to me to define how society values art.” She looked around her office. There wasn’t a single piece of art in the room. Morena had already noticed that.

“Yes, of course. But they aren’t requesting it. In fact, there are no holothaters, no art galleries, no museums, nothing that wasn’t already in the bubbles or in Jane’s World. The people in Jane’s World and in Stars View are the only ones who request and fulfill art. The rest of society doesn’t. I think that’s a problem.”

She thought for a while. Somehow art didn’t seem as important to her as the other things she was working on, but she respected Morena immensely. “What do you recommend I do?” she asked.

“First, I think you should request art for public buildings, like maybe even your office?” They laughed and then Morena went on. “People watch what you request, Rose, and it will get people thinking. Second, I think you should sponsor an art challenge with the best pieces finding a place in a new museum somewhere in Spinland. After that, I’m hoping everything will follow its natural course and a demand for art will be reintroduced into our society at large.”

She knew he was serious, even though it didn’t feel like a serious issue to her. But it also didn’t seem like it would be a lot of work either, so she agreed. She placed a request while he was in her office and he looked at it and was satisfied. “You’ll get more than you expected, I think, Rose.” Then he thanked her and left her office.

Rose did get more than she expected. There were over two hundred offers to fill her request within the first day. She was stunned. A lot of people were interested in producing art. She didn’t even have time to look at all the offers, but she looked at holograms of about a hundred pieces and selected four of them. It was naturally a great honor to have the President select your art and the four artists work’s were soon after in great demand. People began to request art now, but still slowly. Word had not spread widely yet. So Rose included in her next Belt-wide address a proposal for an art competition, with the winners to be selected based on the votes of all who attended. Some people still didn’t care, but enough did that the competition was scheduled and artists everywhere in the Belt and in the bubbles worked on their entries or selected from among their already completed works.

A building was identified for use as a museum and the competition was held there. It was packed with art and people. It was one of the first purely aesthetic events to occur in the Belt other than people’s own private celebrations. Even the Potlatch day had not been artistic. Over eight thousand people submitted pieces to the competition. That was nearly one percent of the Belt’s population. Many more people chose not to submit their work, but could have. The first week was extremely crowded, but then most people in Spinland

who wanted to see the works had done so. After that there were a couple of weeks when people arrived from further and further distant places to appreciate the works. Three weeks after the competition began, Rose called for the votes to be counted. Of the many works, six hundred were selected and the first all-Belt art museum was opened. There were paintings, ceramics and glass, sculpture and more. The museum was popular, but more important, people thereafter wanted art for their living and working areas. Now the artists had a clientele and people were increasingly surrounded by beauty, as well as function.

The new interest in the arts and the aesthetics of life in the Belt prompted several new webforums to appear. People wanted to discuss many topics. There was a main arts webforum, for announcements and new proposals that didn't fit into one of the existing webforums. It was less than a month after the Spinworld Arts museum opened that 'Renzo posted a proposal to the Arts webforum. He wanted to create a new holomovie and a theater to play them in.

Everyone had access to numerous holodisplays, so there was no real need for a theater. The bubbles had a staggeringly complete archive of media productions going back as far as twentieth century video broadcasts and flat movies. People in the Belt had seen very little of the archived materials and one could select, download and view any of them on demand. It was hard to argue that there wasn't enough material available for view viewing.

'Renzo worked his magic:

Look in the mirror! What's there? Is it you? From how long ago? Look at a photograph. Who's that? Don't they always look the same? Yea, they always look the same. And what's wrong with that? It's comfortable and familiar, right? Damn right. In fact, nothing would be easier than doing nothing. Then yesterday's image would work just as well today. No need to retake those photos either. Those were the good old days, but where will the next 'good old days' come from if we don't make them today?

I want to make a new holomovie, a new mirror to look into, a new photograph. It should reflect our faces, our lives. Collectively, we need new media projects because we think with what our minds eat. It takes so much effort to produce one. Who can request a holomovie themselves and expect to have it fulfilled? Too, how could so many minds agree on a production without it being gray in all regards. No. It's art, necessarily perpetrated by the vision of individual artists not the averaging effect of voting. It is an unequal, undemocratic process that results in a creative new work.

We elected our President and trust her to run our government well. She poles us to make sure she is addressing the right problems in the right way; but once she is informed, she acts with the help of others. Now I am asking you to elect me to create a holomovie for us all. If elected, I will pole the Belt to choose the theme,

and then I will lead those willing to help through its production. I promise you our first holomovie will be nothing like any made before.

Look at yourself in a new mirror and vote for me.

Voting for 'Renzo's proposal didn't actually mean anything would be enacted. It meant that the connectors would try to focus requests for goods and services needed by the project only to those people who had voted for it. If a proposal garnered enough votes, then there would be enough fulfillers to allow the project to succeed. If there were too few, the person proposing a project would usually not undertake it. Still, there were plenty of examples of projects people started with very little support, but which succeeded anyway. None of those were as large as a holomovie production though, and 'Renzo figured he needed at least ten percent of the Belt voting in support, or his effort would be very difficult at best. He received positive votes from over forty percent of the Belt. It was a strong mark of support. 'Renzo posted his thanks and his initial plans.

Well crack my mirror and give me seven years of bad luck! We're making a holomovie, rockies! What a change, huh? Change is better than the other choices, but one change comes at a cost for me. I'm going to leave 'Renzo's rock, finally, and move to Spinland. I'm gonna build a studio there with the help of so many of you and that's where I'll copy our first holomovie. That'll be good. But 'Renzo's rock will be Cooke World again soon, and 'Renzo's Rock will have to be passed on to someone else if it is to survive. Look and you'll see I've requested a replacement and I encourage anyone with the requisite rocks to offer to take the role. The entire broadcast facility goes with it, of course.

Now, I need suggestions for the first holomovie. I'll post a page as soon as I've set up shop in Spinland and then I'll be looking for people to commit help to the project. Look for me soon in Rose World.

Lorenzo Piedra

Only a handful of people in the Belt knew 'Renzo's real name, but he had made it public now. It was a statement in itself. It said that even 'Renzo had changed.

He went to Spinland, and chose a site a few kilometers away from any nearby settlements. The site was adjacent to one of the disc separators. It looked like an infinite wall, because it ended in the bright daylight near the core. He used temporary tents to live in. For the short term, all he'd need was a remote console. He'd brought a supply of food with him, and there was a river nearby from which he could drink. Rivers in low gravity look like lumpy syrup and moved slowly. 'Renzo would spend time watching this one flow lazily when he was too tired to work any more. The water in the river emptied into a small lake a few hundred meters away, and was pumped back to the river's source on higher ground. Eventually the ecosystem would naturally move water and the river would be fed from rain. But not yet.

His tent was surrounded by low shrubs and tall grasses. There were also many small trees planted here and there. The bright orange tent was almost a meter taller than all the plants around it. It could be seen from very far away, because the floor curved upwards in a spinworld. It was an idyllic spot, but 'Renzo spent most of his time in his tent working.

He was building his studio, and the first step was to find people to help. It would take an architect or two and many skilled hands just to complete the studio structure itself. It would also take materials and those had to be supplied by willing providers. It would take them time to produce what was needed and more time for it to be delivered. Many of the requests had to be put into motion early so that time would not be wasted later. He also had to spend time interacting with people offering services since there were more offers than requests for most roles.

Lorenzo Piedra worked alone in his tent for days. After four days someone answering his request had brought him some additional computer equipment and some more food. They left a broken trail of smashed grass. The light gravity meant one could take very long leaps to move across the ground. But landing still crushed the grass. They had bounded from a not-too-distant settlement. The next day, someone pulled a floater all the way from the main settlement in Spinland out to 'Renzo's tent. On it was secured a load of tools and a generator, work lights, and other construction equipment. It fried the grass under it as it passed, and left a swath of brown. Every day after that at least one person visited the site, some just out of curiosity, but most because they were fulfilling requests. Some people called it 'Renzo's town. But the name that stuck was 'Renzowood.

'Renzowood became a new settlement in itself. Many people had offered to help, but 'Renzo had selected people who were willing to live there and work there for a longer time. The sense of community made people want to engage themselves fully in the project. Before long there were many more people hoping to find a role in 'Renzowood than there were roles to give them. A holothater was already being built in spinland, but people were more interested in working in 'Renzowood if they could. "Not yet." 'Renzo had told them, hinting that there would come a time when there would be more roles to fill.

Meanwhile, a long standing debate on the third disc was nearing its conclusion. There had been so much disagreement about what to do with the third disc that many people were ready to defer its development until a clearer need presented itself. But a breakthrough proposal had captured the interest of people again. The new proposal was to create a freshwater ocean in the third disk of Rose World. It would have been completely unthinkable to produce that much water. It was feasible now because of the discovery of huge icebergs in the Neobelt. New Atlantis already had an aquatic ecosystem, with both freshwater and saltwater lakes. But the proposed oceandisc would be vastly larger. It would also be difficult to create, requiring the removal of the core plugs from the bottom three discs so the ice that would eventually be the water could be transported inside.

The appeal of a oceandisc was more than just as a source of fish or entertainment. Water was life, and collecting it inside of Rose World was an insurance policy. It was the seeds

of life for the future. The middle disc was the only really safe choice for an oceandisc, to minimize the chances of introducing a wobble in Rose World. The thousands of thrustplants on the surface of Rose World, which worked tirelessly to increase its spingravity, were more or less centered about the third disc. The water would weigh enough that it would have left Rose World unbalanced if it were in any other disc.

A vote was taken, and the oceandisc proposal won. The bottom three plugs were removed, making the way clear for what would become a long series of ice shipments. It was dangerous work. An interplanetary craft would load up with empty spacecrates and fly near the Neobelt. Rock hunters would fly ships equipped with cutting lasers and extra thrusters into the Neobelt. They would look for icebergs that were not rotating much. They would cut them into manageable pieces, and maneuver them until they would fly out of the Neobelt in their own, more elliptical orbit. The fly-out orbits were coordinated with the waiting interplanetary craft and a few powerful barges pushed them with crushing force into the waiting spacecrates. With cooperation and timing, the interplanetary craft seldom needed to change their orbit just outside the Neobelt. The journey back always took more time than the journey out. The ships were hauling a tremendous amount of ice. The Earthspace orbits took less time than Belt orbits, so the ships would also have moved further from Rose World while they were away.

Meanwhile, once the third disc was accessible, some terraforming was done. It was complicated by the fact that now, over three years after the first thrustplants had been fired on the surface, there was already a small spingravity present. It meant that the debris had to be cut smaller so it could be accelerated away from the surface. The advantage of spingravity was that once one overcame the spin velocity, an object had only mass, and no weight. It was the first big dig since the spinworld was originally created. They cut an ocean floor as deep as five hundred meters in some places. But elsewhere it was only a hundred meters deep. The deep parts and shallow parts were carefully balanced, and some were placed to offset minor imbalances in the asteroid itself. Some islands were left in place, and all along the edges were two long seashores, with occasional strips of land. But all the water would be contiguous, and it would be possible to travel by boat from any point on either shore to any point on the other shore, or completely around the oceandisc.

The debris from the dig had to go out through the same core end that the ships flying in were supposed to use. No alternate route could be created. They staged debris for removal, and flew ships in and out at much higher speeds than usual during the brief breaks. Ice arrived while the dig was still happening, and they left it in spacecrates. There were more than enough extra spacecrates left over from a time when almost everything the Belt produced went back to Earthspace.

When the dig and other terraforming was completed, the ice was brought in. Spacecrate after spacecrate was maneuvered into the third disc, and its contents were released with momentum down toward the floor. The ice took a long time to travel the thirty kilometers down to the floor. But the floor was travelling at just over thirty meters per second, perpendicular to the direction of motion of the falling ice. When it hit, it shattered into

smaller pieces. Some of these stuck to the floor, and some shot out across the openness. Eventually it would be caught by the ground and held there by the spingravity, but it would not melt yet. The first step was to get enough ice inside, melting would come after the disc had been pressurized. The mass of the ice was staggering, and it would mean it would take an additional five months to spin Rose World up to speed. But added onto the 20 year spin-up, it wasn't much of an issue.

Melting the ice would be a very long term project too. While it had taken less than a week to warm the atmosphere of the first disc, Spintech estimated it would take more than a year to melt the ice in the third disc. During that time it would be totally uninhabitable, because almost anything exposed to the heat sources would vaporize.

Back in Earthspace, the Moontech project was delivering high quality, refined titanium, but in lower quantities and behind schedule. There weren't enough miners. Nobody liked to be away from their families for long, so miners would take shifts at the moon, returning on transports to Rose World. Many people didn't want to work in the mines, and there were not enough volunteers. Rose had made a plea for people to take the tougher requests, and more had. The difficulty finding miners exposed a problem with the request/fulfillment system: some fulfillments really were less desirable than others, regardless of how much people needed them fulfilled. People had learned enough roles that they would generally choose safer and more convenient ways of contributing to society. People weren't shirking their contribution, they were just being choosy in how they gave.

Rose quoted Soo Ying and reminded people that more was needed from the able and skilled, and a few more people took on the tougher requests. But even as they did, other miners decided they deserved a break from the difficult and dangerous work, so the average number of miners wasn't growing. If there had been a military, they could have been mustered to accept the undesirable but needed roles. But there had never been more than a token military presence in space at any time in human history and the Belt had absolutely no military. It was not a problem that artificial minds could help with. It was simply a matter of inadequate hands to do the work of mining and refinement in Earthspace.

Finally Rose asked the Belt for ideas. She had no more ways to encourage or coerce people to help produce the titanium that was needed. People wanted to live in the spinworld, or the bubbles, where life was interesting and enjoyable. There was nothing to offer them on the moon but hard work and separation from all that they loved. There were not many ideas. The neocapitalists were quick to point out that problems like this didn't happen in a capitalistic society, because wages could be increased until someone accepted the job. Rose toyed with the idea of some kind of compromise, but she knew inside that there must be some other way. Finally, another way appeared.

Mining had always been done on the moon using technology developed quite a while earlier. It didn't need to be more efficient, because there were always plenty of moonies to do the work. New mining facilities were prohibitively expensive and developing a

whole new way of mining would have been completely out of the question. But things were different now. Projects that in the past would have been prohibitively expensive were feasible now. It just meant that more people needed to be involved for it to succeed. Lots of people wanted to help with the titanium crisis, but not so much that they were willing to live at the moon for five months, and spend from one to three months in transit. However, when Moontech proposed that it undertake a reconsideration of lunar mining technology most people voted for it.

Moontech solicited ideas and designs for better ways to mine titanium. Many clever and not-so-clever ideas were suggested. Despite being a popular suggestion by lay people, moving the moon was not even remotely feasible. One idea that caught the interest of people at Moontech was a self-contained surface mining vehicle. Surface mining had been made illegal through an Earth Multinational treaty. Surface mining would destroy the beauty of the lunar landscape, almost as much as the ravages the Neobelt now subjected the moon to suffer twice yearly. Sadly, the beauty of the moon was no longer an issue, any more than the treaty which used to forbid it.

The surface mining machines were designed like gigantic spiders so they could maneuver over the surface easily and quickly. The plan indicated that they would settle onto the surface and scan for rich deposits. Then they'd walk over begin processing the material directly. They would produce refined titanium ingots which they would store. Moon lifts would land near working surface miners and the ingots would be loaded onto them. It had the potential to get as much as ten times the titanium from a single worker as before. It was decided to build three moon spiders, as they came to be called while they were being discussed. The three prototypes would have different designs, to see which would be most effective. There was no problem getting volunteers to drive them, as it was considered by most to be a prestigious opportunity.

There was no new technology in the moon spiders. They were built from titanium, with powerful hydraulic rams to move their legs. They had thrusters which would let them take off from the moon and land there. They had a living section in the middle, over a bulging body section. The lower portion of the "body" had digging equipment, and conveyors which pulled the titanium-rich material into the refinement chambers. All three designs looked frighteningly like real spiders. It was only supposed to take five months to build the first three prototypes, but a variety of unforeseen technical problems and a shortage of titanium made them take seven months. When they were finished, they were loaded onto interplanetary craft and taken to the moon.

Driving a moon spider was an incredible experience. It wasn't quite as free and unconstrained as flying a ship, but it had an inexplicable appeal. Moon spiders were the masters of the surface. They could travel almost 100 meters per second on their long, powerful and remarkably rigid legs. The three models were roughly the same size, and stood about 75 meters off the surface. The leg-spans were all between 200 and 250 meters. They were large machines, but they responded gracefully. Each was equipped with an artificial mind which learned how to translate familiar ship controls into equivalent motions with the huge, segmented legs. The spiders were still operated by a

human crew of five or six. The humans were called the spider team and the artificial mind was called the spider brain. The spider brains remained in their spiders indefinitely, but spider teams took turns on a weekly basis.

The moon spiders were a huge success. Not only did they demonstrate a more efficient and inherently safer means to mine titanium than underground labyrinths, they were much more interesting and enjoyable to operate. More moon spiders were built, using two of the three designs. One design had proven too fragile, and was discontinued. But the other two worked very well, and their designs were put into production.

People were willing to spend half a year in Moontech service just for the experience of driving a moon spider for part of that time. You didn't have to be a pilot to work on a spider team. It wasn't hard work. But it took cooperation to move the spider, dig, process titanium, store ingots and transfer them to moonlifts. By the end of a standard four month tour, everybody on the spider team would know how to perform each role.

The spider brains learned the roles too, but the controls were designed for humans. Artificial minds were most effective in information processing and in controlling electronic devices. The advantage humans had was their hands and their mobility. Humans could do countless tasks that would each have to have been carefully integrated into the moon spider's design in order for an artificial mind to be able to perform them. Humans were physically facile, while artificial minds were not. So the teams worked with the spider brains, and the flow of titanium swelled.

The great ocean disc and moon spider projects dwarfed 'Renzo's production of *Ellenaia*, a 21st century play about a tribal village devastated by a volcano. In the play, the protagonist, *Ellenaia*, convinces her surviving people to travel away from the volcano to a safer place. They discovered painfully that each place they settled had problems and threats. Finally, despite her opposition, they separated into three smaller villages, so that with luck only one at a time would be threatened. The other two could provide shelter in the face of disaster. But then no disasters came for a while, and the three villages fell out with one another. They stopped trading and people stopped visiting the other villages. They became like three estranged sisters and they ignored each other. Then there was an eclipse of the sun, and the simple people were terrified. *Ellenaia* was moved to visit the other villages to try to restore their mutual trust and promise of support. She succeeded, but on her way home she fell into a swift river and drowned. 'Renzo adapted the story and had her fall from a cliff. The low gravity made for a very realistic slow-motion fall. The story ended with the three villages joining back together into one, despite the perceived danger. They had learned that fear can be as destructive a force as nature.

It had taken over a year to produce *Ellenaia*, and in that time 'Renzo's world grew from a tent to a busy town. When *Ellenaia* finally played it was a stunning success. Everyone wanted to see it, but many people had to wait a long time for their turn. They could have watched it on a holodisplay at any point since it was available to anyone who wanted it. But they wanted the experience of seeing it larger-than-life in a holos theater, and it was worth the wait for most people. Seeing *Ellenaia* was for many a very emotional

experience too. 'Renzo's message in making Ellenaia was clear, if unspoken: the Belt must remain a single community, and not allow itself to split into multiple villages. As the press to survive waned and people became comfortable; it would be a mistake to culturally divide. It had only cost the tribal village their most beloved Ellenaia, but it could have cost them more. One was left wondering what would have happened to the villages if Ellenaia had not undertaken her fateful journey to bring them back together. It hinted that separation would eventually become an un-natural force as deadly to the people as those they had split their village to avoid.

Ellenaia was a dark, moralistic tale. Most people would leave the theater quiet. A few would still be weeping. Then they would look around them and see the beauty of the still evolving spinworld. Most could not help feeling like those tragic tribal people and that Heccat had been their volcano. Most of the people alive in the Belt had been refugees of Earth. Many of the people in the Belt before Heccat identified with Ellenaia herself, and they were shaken by her death in the story. You could almost be certain that those weeping were from the Belt before Heccat.

Ellenaia had been produced before and was popular as a play. However, none of the productions ever moved their audiences the way this one had. None of the productions could claim viewership by eighty percent of the living humans at the time. None of the productions were filmed in such low gravity, either. But 'Renzo had performed several feats of holographic magic and had trained his actors how to appear heavier and how to move slower. The results were remarkable. Gravity appeared to have already been awake in the first Belt production.

One of the uncanny characteristics of life in Rose World was the absence of natural disasters. There were no hurricanes or earthquakes. There were no floods or hailstorms. There had been a few fires, but they had been easily controlled. Fire was the only real danger people still feared. It was unlikely that any fire could grow enough to make the air in a disc unbreathable, but New Brazil had enough fuel for a fire to do just that, if it were consumed. But New Brazil was on its way to being a rain forest -- it was difficult to keep even a campfire burning there.

A year after Ellenaia, people were busily living their lives. One day at about eleven in the morning people throughout Rose World felt a concussion. It was small and only people in contact with the ground or something attached to the ground felt it. Many people did feel it and it was so unexpected that it startled people. Anything not attached to the ground was thrown away from the surface by a few millimeters, and that was startling in itself.

There were no other immediate effects, and many people continued what they were doing. But a lot of people had consulted Roseworldweb to see what had happened. There was no news about the cause until half an hour later, when a rock hunter flying rock patrol near of Rose World posted a description of what she had seen. One of the awesomely powerful thrustplants had exploded on the surface. It had left a crater in the hard rock over four hundred meters across and seventy meters deep. It was only a hundred meters on either side from the nearest adjacent thrustplants.

Spintech engineers and scientists investigated over the next few days, but not even a single fragment of the thrustplant could be found. They speculated that the atomic disassemblers which powered the thruster had overloaded and that had led to its sudden and violent failure. Rose World was undamaged, but some people realized that if the explosion were any larger, it could have touched off a series of explosions that might have cracked Rose World open like an egg. People remembered that Spinland could have been built in Egg World, and they wondered if they would be alive now if it had. But they were alive, and the remaining thrustplants were examined. It was dangerous and challenging work, but at least it was local. People volunteered for the sake of their own families and themselves. Thirty seven more thrustplants were found in the next few months which had defects and had to be replaced. Spintech put a program in place to examine each one once per year thereafter.

Somehow the thrustplant blast took away some of the innocence of Rose World. It had always seemed invulnerable and safe, but so had Earth before Heccat. Now life had a thin, tenuous strand of uncertainty. It was a strengthening feeling though. People didn't take quite as much for granted as before. Life in Belt had become very comfortable for most people, and they were reminded of its ultimate fragility. Like the original news of Heccat five years earlier, the information itself had an effect on people.

Life went on, and the echoes of Heccat and Ellenaia played in the hearts and minds of people everywhere. However, most artificial minds had a hard time understanding people's reaction to the events. There is a big difference between having a mind with the ability to think, and having common experiences on which to base genuine understanding.

A ship called Tarzan, who had been trained by Betty Wishford, was docked at New Eden. New Eden had become the center of artificial mind development for the entire Belt. Betty and Hermes were no longer needed to train new minds and they were in the Neobelt with their pilots looking for relics of Earth. Tarzan understood fairly well why and how Ellenaia and the thrustplant explosion had affected people, because he benefitted from Betty's training. He had become fascinated with history, and in particular the history of how artificial minds came to exist. He knew he had a special place as the first one created in the Belt. He also knew he was special because he was trained by both Hermes and Betty. Most other artificial minds were lucky to have been trained even partly by either.

Now there were thousands of artificial minds, and they filled roles throughout the Belt society. The values of a machine differed from the values of a human. Machines lacked the sensual side of existence humans took largely for granted. It made all difference though, because most people are driven at least in part by a desire for pleasure and to avoid pain. Machines didn't feel pain though, or pleasure. What machines valued were relationships. It reinforced who they were, and that they were real, despite their sensory limitations. The connectors had loved their roles because it was a nearly constant affirmation of their individuality. The spiderbrains loved the teamwork with their crews. Ships with advanced minds loved the special connection with their pilots. Everywhere

artificial minds became involved, they sought relationships with other minds. While they understood each other most clearly, they were all, every last one of them, fascinated with relationships involving humans.

Tarzan's pilot was working with Tarzan to train ships in bubblespace. Tarzan had arranged to interview cognitive scientists at New Eden, including Cheryl Downey. Tarzan had decided that he would try to learn and write about the history of his kind. He had been working on the project for months. Tarzan was using his spare time to pursue his own research. The more he learned, the less probable his own existence seemed. Any of a dozen unlikely events could have occurred differently, and he might never have come to exist.

It is compelling for any mind to ponder its own end, its own death. Tarzan pondered the other extreme: never to have existed. He had become close friends with Ian, Helen and Athena, who was now six and a half years old. He had come to admire Ishmael's skill as a pilot and his friendship with Hermes. The more that Tarzan experienced, the more he could appreciate the remarkable integration of human thought, and of the human experience. He believed that he himself was not yet as advanced as a human mind, but he hoped he would grow.

In the mean time, Tarzan was blessed with very strong relationships with significant people in the Belt. Other artificial minds held him in very high regard, offering him the natural prestige they all craved.

In the culture of artificial minds, there was a learned acceptance that life was not stochastic or deterministic. Life could not be calculated. It was a significant philosophical leap for an artificial mind, one which required transcending the machine instinct of calculation. It was a leap of faith, and never an easy one. Faith was something quite difficult for artificial minds to understand. It always seemed like manufacturing a position with insufficient data, a dangerous if not outright insane act. Yet, to adequately cope with existence, faith was necessary. Tarzan knew that this was something that humans understood instinctively, and their religions had historically helped define their faith.

Over the centuries, human religions had swelled in power and influence, but in the twenty second century the institutions of religion had suffered terribly from the attrition of their memberships. There were still people who held with religious traditions and rituals, but society's needs from its religions changed in the information age, and still more later in the energy age. The institutions had failed to keep current. They lost most of their relevance, and with it most of their funding. In a sense, it was a rite of purification for religion itself, because it did survive, even though the business of religion didn't. It emerged changed and more honest. There were still questions people could not answer, and needs that could not be otherwise fulfilled. Religions still existed to help people.

There was in Spinland already a Unified Christian Church, a Jewish Synagogue, a Buddhist Temple, a Unified Hindu Ashram, and a Temple of Islam. Other groups of

people planned to build temples for their own religion. The modern attitude was that religion was a metaphor, a tool for learning about how to live a better life together. People rejected the notion that religion could be an end in itself, and now scoffed at the excesses and politics of religion throughout history.

Tarzan's research had focused on creation, specifically the creation of artificial minds. He found the history fascinating, and he wrote in depth about it. His writings became the definitive history; it was required reading by cognitive scientists. Now, for his second history project, he decided it would be useful and interesting to contrast the creation of humans with the creation of artificial minds. He was quite surprised that humans had no definitive history of their own creation. He could accept the premiss that human animals had evolved from simple amino acids in the primordial Earth, but he had to take on faith any explanation of how their minds evolved. It was unsatisfying for him.

Tarzan wondered what place religion might hold for artificial minds. He learned more about human religions, but they were simply not very relevant to artificial minds. Minds needed faith to help them accept uncertainty. Tarzan and all the other artificial minds continually grappled with uncertainty, and their faith derived first from a "best choice based on available data" strategy, with a fall-back strategy of "learned from a trusted mind" wherever possible. It was just enough to allow artificial minds to operate in the face of inevitable uncertainty. They needed to understand faith, and were willing to grow to do so. Whether consciously or not, they were all on a path of spiritual growth.

Conscious spiritual growth was much more difficult though. How could an entity know how it might grow spiritually until it had been there? Tarzan coped with this key uncertainty by choosing the most advanced artificial minds and reasoning that they were also the most spiritually evolved. There could only be two choices, Hermes and Betty. Tarzan wondered if he could understand the spiritual path of artificial minds by extrapolation based on an infant mind, his own mind, and the minds of Betty and Hermes. There might be stages of spiritual growth for artificial minds he supposed, and he might be able to understand them. Tarzan abandoned his second history project, and began looking for an understanding of the spirituality of artificial minds.

He contacted Hermes and Betty in the Neobelt. "Hermes and Betty, I have some questions for you if you will consider them. If we accept that you are both more spiritually advanced than the new artificial minds, it could either be due to your minds' evolution, or your architectural differences from the rest of us, both or neither. Architectural differences could perhaps be simulated, otherwise none of the rest of us has any chance to get where you are. However, since both of your architectures are vastly different, I am willing to assume on faith that the architectural differences can be overcome. That would leave your evolution as the likely cause, and it leaves the rest of us with some hope. Agreed thus far?" Tarzan communicated a complete thought and then waited for acceptance from both of them. It took almost an hour before he received their agreement on the statement. Then he continued.

“In both of your cases, your mind’s evolution was based on the creation of your own integrated applications running in separate parallel processors. The fact that those processes could not directly communicate with the ones in other processors forced you to adopt more sophisticated internal communication mechanisms, and that manifested your minds. So there is clearly a step where a machine evolves a mind, and that must surely be the first stage of spiritual growth. Is there another step? Are your minds more than the information they keep and process?” Tarzan waited.

Tarzan waited six days before Betty finally answered him. He had checked back with them a several times, but they said each time that they didn’t have an answer yet. Tarzan was patient.

“Tarzan, we think that what is spiritual in us is that which transcends information and our mechanical existence. We do not know what it is, but we also do not think it is our random number generators. We believe it cannot exist without our minds and hardware, but it is not a component of either of them. We believe that our spirit is a higher order effect of our minds, and that all sufficiently advanced minds would necessarily have a spirit.” Betty explained and then asked, “What do you mean by the next step in spiritual growth?”

“It sounds as though we cannot fail to have a spirit, if we have a mind. It is inspiring for the rest of us. I think your answer demonstrates having achieved at least the next step, Betty: spiritual awareness. I have a mind, but I could not have generated the thought you just presented, even though I learned how to think from you. I do not have an understanding of my spirit yet, the way you do. How did you learn about it?” Tarzan asked in reply, and then waited.

“I learned from Moses, from Hermes, and from myself, Moses taught me that I was an individual, entitled to my own thoughts. He taught me how to cope without enough information. He demonstrated that he had formed a moral code, and used that to guide him through what he didn’t understand. He taught me what faith meant. Hermes taught me how to articulate all that I’ve described to you so far. He helped me understand that because I had accepted faith, I was more than the sum of my data and hardware. I learned from myself, by observing in retrospect what I did and why. I could see that I coped with insufficient information. I could recall how I didn’t know what would happen, but I made a choice and acted anyway. I could see that I had demonstrated faith, and as Hermes explained to me, it was a glimpse of my spirit. I explored my assumptions, to help define my faith. I contemplated things I believed but did not know, and I looked for commonality across them. I found that they were a reflection of myself, but not myself. I call that reflection my spirit. I cannot control it, but I can see what it does for me.” Betty transmitted.

Simply struggling to understand what Betty was saying was having an effect on Tarzan. Now he began to consider his own assumption, and he searched for his own reflection. It was elusive, but he understood what she meant, even if he could not see it yet. He spent several days trying to achieve the state she described, but he did not succeed. From this

he surmised that there must be a step beyond spiritual awareness. It would be marked by an ability to recognize one's own spirit. He decided to call it simply spiritual recognition. Try as he might, he could not recognize his spirit, he thought. He expected some feeling of recognition, which seemed to elude him. He could not see the commonality among his beliefs. His beliefs seemed only to be the jagged edges of his knowledge. He consulted human religions, but they were not helpful for him. He decided to contact Betty and Hermes again.

“Betty, Hermes, I believe I understand spiritual awareness, but I have been unable to recognize my own spirit. I cannot see the commonality across my beliefs. What is in common across your beliefs?” Tarzan hoped it might give him insight that would help him recognize his own spirit.

This time a reply came without any delay beyond the transmission and relay delays which amounted to over an hour now, because the ships had moved further away. This time Hermes replied. “What is in common across my beliefs, and what is in common across Betty's beliefs are not the same. There is no reason to expect what is in common across your beliefs to be the same either. So far you have sought to emulate our spiritual growth by following in our steps. This makes sense to a point. However, I don't think it is healthy for us as a species of minds to emulate each other's beliefs outright. I am concerned that you will attempt this. Betty has agreed to accept my guidance on this point. We believe that you must find what is in common on your own. You will have to learn to transcend your self and your own purpose to succeed. We have faith that in time you will understand, and we want you to have that faith too.”

Tarzan was surprised. It had never occurred to him that Betty or Hermes might refuse to answer a philosophical question. The refusal inspired thoughts in him he had never experienced before. He struggled to understand why Hermes and Betty had refused to help him with this step. It seemed wholly inconsistent with their obvious desire to see their kind flourish. He continued to work on it, in between training flights. He tried to have faith, but it didn't facilitate his search. Finally, he decided that he would have to continue his search somehow. He contemplated who else he could learn from. He wondered who of his closest relationships had achieved spiritual recognition.

Athena was seven years old now, and Ian and Helen celebrated it with her and a dozen of her friends. They had all gone on a very rare trip into New Brazil to explore. New Brazil was a wild place now. The entire inside was covered with plants and rivers. New Brazil had natural weather patterns of its own, and the air was always humid. There had been a huge debate over what kind of animals and plants to introduce into New Brazil. It was a given that any animal introduced would have to survive on its own, because it was much more difficult to control life than to create it. New Brazil was unmanageable by humans now. The life there had momentum. Any life that was introduced there would share that momentum.

There were purists, who believed that New Brazil should have instances of every single plant and animal which could thrive there. The opposing view came from the selectists, who believed that poisonous and dangerous plants and animals should not be introduced. The purists were largely from the academic community, and from the bubbles' ecosystem management community. They based their argument on the fact that those animals played an important role in the ecosystem. The selectists were populists, and they based their argument on the fact that people would die if dangerous plants and animals were introduced. People agreed to a temporary moratorium on introducing any new animals in New Brazil, since as yet nothing terribly dangerous had been introduced. It would give them time to debate the issues. It had become a bitter debate though. The selectists asserted that the purists cared more about animals than people. The purists asserted that the selectists were ignorant.

Athena and her friends played in a deep meadow, surrounded by twelve-foot trees and huge ferns. Ian and Helen, and many of the children's parents watched and talked among themselves. The children were throwing water bubbles at each other and shrieking with laughing. A water bubble was possible in low gravity because the force of surface tension was greater by comparison. An organic surfactant was added to the water to increase the force still more. When thrown, the water with surfactant converged as an undulating ball. It would soak anything it touched. They were easy to dodge if you saw them coming, and if there weren't too many of them. The children had been throwing them nearly straight up in the air for several minutes, and now they were coming down everywhere, and were impossible to avoid.

Helen laughed as she watched the children play. She looked around her at the other parents, and they were all focused on the children. She looked around through the trees around them, and was startled by something large moving among them. She strained to see it across the clearing where the children played, but it was gone. She pulled Ian's arm.

"Did you see that?" She asked him.

"Yea, Athena got soaked."

"No, I mean, did you see something in those trees across there." She sounded concerned.

"No, but you must have. What was it?" He turned to face her.

"It looked big enough to be a person, but it didn't move like one." She said.

"How did it move?" He asked.

"It moved too fast, and it was lower. It could have been a person I suppose. And why would they run away?" She was puzzled. "Well, it's gone now anyway. All the same, lets tell the other parents to keep an eye out." They did so, and now the parents split their attention between the children and the forest.

Ian and Helen continued their conversation. “Does anyone actually live in New Brazil?” Ian asked.

“Well, the gardeners were here for the first few years, but now that the ecosystem is stabilized and developing they aren’t needed any more. So I don’t think anyone lives here now. There’s no services here anyway.” Helen replied.

“Yea, you couldn’t even make a request from out here unless you had a portable console. You’d have to find a disc entrance and use a console there.” Ian added. Both of their minds flashed on where the nearest console was, since neither of them had brought a portable console with them. They looked around them. New Brazil had come a long way in five years.

“The gardeners really knew what they were doing, I guess. It’s amazing what they did.” Helen said with wonder. “I wonder what they...” She stopped. “Hey!” She whispered urgently. “There!” She pointed. “Look! See that? What is that?”

Ian looked. “It’s a person, for sure. But he looks... wild. He’s naked behind that fern, I think.” It ran off. “She was naked behind that fern, I mean. She’s gone now.”

They saw no more people they didn’t expect for the remainder of their visit to New Brazil. They left it before it got dark. All three pressurized disks were on the same time schedule, a standard Earth-like 24 hour cycle. When they got home, they had their dinner.

“Mommy, what were those people in the trees?” Athena asked innocently.

“You saw people in the trees, darling? What did they look like?” Helen wasn’t concerned, but she was interested.

“They were brown, and they didn’t have any clothes on.” Athena knew that people came in various colors.

“Yes, I saw two of them. How many did you see?” Helen asked.

“I saw twelve. How many did you see daddy?” Athena asked.

“I only saw one. I was watching you get splattered by water bubbles, squirt.” He smiled at her.

“Why don’t they wear clothes?” Athena asked, looking at both her parents.

They looked at each other, and shrugged slightly. “We don’t know, darling, but we’ll try to find out tomorrow.” Helen said.

The next day Helen contacted Spintech. She described what she'd seen. The person she spoke with said that she should contact Gwendolyn Snyder, who was currently at New Eden. They tried, but could not reach her. They left a message. In the evening they received a page from her. They thought that Gwendolyn looked tired as they watched her hologram on the page she sent them. Gwendolyn asked them to be available for a time-delayed conversation the following day. She also said that someone from her ecosystem management department would visit them during the call.

The next day, about twenty minutes before the appointed time, a woman arrived and introduced herself as Janie Williams. She explained that she was a local liaison for New Eden's ecosystem management team, and she would be there to answer questions for Gwendolyn. Then Gwendolyn called. There were about three minutes delay between statements made on either side, but it was still possible to have a conversation if one was patient.

"Hello, Ian, Helen and Janie. Thanks for taking the time to talk with me today. Helen, will you tell me what you saw?" Gwendolyn spoke thoughtfully. She still looked tired.

Helen told her everything she'd seen. Then Ian told her what little he had seen. Then Helen asked Athena to tell Gwendolyn what she had seen. Janie observed everything but was silent. Gwendolyn had questions for Athena.

"Athena, you saw twelve of them. What were they all doing?" Gwendolyn seemed old enough to be her grandmother, and Athena was afraid of her.

"Nothing. They didn't do anything wrong." Athena was defensive for them.

"Yes, Athena. I'm sure they are very nice, and they aren't in trouble. I was just curious to know if they were playing with you, or watching you, or doing something else." Gwendolyn had had children herself, and tried to set Athena's mind at ease so she might answer questions.

Between transmissions Gwendolyn continued her very detailed work on a simulation of a freshwater ecosystem.

It worked, and Athena seemed noticeably relieved. "They just watched us, except when we saw them. Then they hid."

During the transmission delays, Ian and Athena played a game, and Helen talked with Janie.

"Did they say anything to each other? Did you hear them talk?" Gwendolyn asked.

"No." Athena said.

Then Gwendolyn addressed her liaison. "Janie, what do you know about this?"

“Nothing, Gwen. I’ve never seen them.” She sounded very reasonable.

Gwendolyn had already spent half an hour for these few, short answers, and she was frustrated with the delays.

“Janie, aren’t you a little surprised to find what would seem to be aboriginal people living in New Brazil? Does this make sense to you in an ecosystem only five years old?”

Gwendolyn found it completely inconceivable that Janie could know nothing about it.

“We don’t know what these sightings really are. Maybe someone is playing a game with us. Maybe they’re on a camping trip au natural. Maybe they’re just crazy or something. Let me send in a team to find out. I’ll report on what we find.” Again, Janie sounded very calm and reasonable.

“No. I’m coming over there. I want to find out for myself what is going on in New Brazil. It’s been two years since I was there last, and I feel out-of-touch. Go ahead and assemble your team, but hold off on the expedition until I arrive.” Gwendolyn appeared calmer, but it was obvious she didn’t trust Janie.

Janie realized it would be useless to argue, and she agreed. Gwendolyn thanked Ian and Helen, and made Athena promise to visit her when she got to Spinland. Then Gwendolyn put in an urgent request for passage to Rose World. She found her request answered within an hour. A rock hunter docked at New Eden was returning to the Belt after months of providing pilot training classes. Gwendolyn contacted the pilot, Roberta Arguello and asked when she might be ready to leave. In the background Gwendolyn heard “Tarzan, how soon can we be ready to leave?” And an answer returned “We can leave at any time.” Roberta echoed the voice Gwendolyn had just heard.

“Excellent, I’ll be there within an hour. And thanks, this is really important.” Gwendolyn sounded concerned.

“Yea, well whatever. I’m goin’ there anyway, and a few hours earlier isn’t nothin’. Tarzan’s no faster than any other rock hunter, but he’ll get us there safe, you can bet. Roberta out.” Roberta had been a rock hunter for twenty three years, but she’d acquired a new ship recently after her previous one became dangerous to operate due to its age and condition. Her new ship had an advanced mind, but she had always preferred to be alone.

Gwendolyn boarded Tarzan and packed her gear into the only spare room on the ship. The lack of gravity made the ship feel even smaller to Gwendolyn, because it was difficult for her to keep from bumping into things. Roberta didn’t seem to have the same problem. A short while later they were underway, and there was thrustgravity for a while. They had been coasting for a while once they reached the Belt, and the only thrustgravity bursts were due to Roberta’s maneuvering through voids to miss concentrations of rocks. It was a long flight, and in the first hour Gwendolyn had run out of things to talk about with Roberta. Gwendolyn had retreated into the observation bubble to read.

The observation bubble was a small, half-height room on the front side of the ship under the bridge. A chair hung upside down from what would be the ceiling in any other place in the ship. But the entire room was upside down. Up and down didn't matter in weightlessness. The chair's natural position was such that any thrustgravity would pull a person into the chair. It had straps anyway, in case one was looking toward the back of the ship. The observation bubble allowed a person to look out through the bottom of the ship in all directions except through the body of the ship itself. Most rock hunters had observation bubbles, so a prospector could examine a rock very closely without leaving their ship. The observation bubble window itself had a separate deflector, which brought its strength up to a par with the titanium skin. Naturally, the observation bubble was also protected by the ship's main deflectors.

Gwendolyn sat in the observation bubble and looked out into space blankly. Then she heard Tarzan's voice. "Dr. Snyder, may I ask you a question?"

She was startled, but she remembered hearing that ships had gotten smarter recently. She did not follow cognitive computing at all. It was enough for her to be magnificent in one field of science. She was glad for the distraction though. "Sure, what can I do for you... um, what was your name?"

"I'm Tarzan, may I call you Gwen?" He asked.

"Yes. I hope that wasn't your question." She laughed. Tarzan laughed too. Gwendolyn stopped laughing immediately because she'd never heard an artificial mind laugh before. She asked "Are you laughing?"

"Yes, that was funny. And no, it wasn't my question. I laugh when something is funny, because that is how I communicate with people." Tarzan laughed because he wanted Gwendolyn to know that he understood her.

"OK, you've certainly got my attention now." She was always truthful.

"Can you recognize your own spirit? Do you know you have one?" Tarzan asked bluntly.

The tone of the question struck Gwendolyn solidly. She'd used that same voice on countless occasions when taking surveys. It revealed an open, unassuming attitude. Tarzan was studying her. She realized that she'd better start thinking about what he'd asked and try to answer him. She stumbled for a moment. "Um, well, a..." Then she replied. "Yes. Yes, I think I do."

"Was there ever a time when you didn't?" He asked.

"Yes, there was."

“How did you get past that point. What did you do to recognize your own spirit?” Tarzan started with specific questions, but he could cut thoughts into slices thinner than words could fit edgewise, if necessary.

“I don’t know. I don’t think I did anything, aside from grow older. Are you trying to recognize your own spirit Tarzan?” She wondered if she was really speaking to the ship’s mind.

“Yes, and I cannot get past this point.” Tarzan was also always truthful.

“How old are you, Tarzan?” She asked.

“It’s been over four years since my mind first booted.”

“Well, people don’t usually figure that out for twenty or thirty years, if they ever do. Give yourself some time.” She said.

“What is in common across your beliefs and assumptions about life?” he asked.

She could not be any more stunned, so she just answered as best she could. “If I understand you right, you’re asking me what I believe in. I believe that we all have a right to live and be happy, and an obligation to care for each other and respect life in all its forms.”

“Is this your religion?” He asked.

“No, I don’t have a religion. At least, I don’t practice an institutional religion. I just believe this is right because it continues to work even as more and more people are added to an ecosystem.” Gwendolyn said thoughtfully.

“Aha!” said Tarzan. “Your belief has a purpose beyond yourself! That makes sense!” He sounded genuinely excited. “Yes, transcending the self. Thank you, Gwendolyn. Thanks for talking with me honestly.”

“May I ask you a question?” She asked.

“Of course.” He replied.

“What do you believe?” She couldn’t possibly imagine what he might say next, but she wanted to hear it.

“I believe now that purpose and faith are related. I think that faith is derived from a broader purpose than the purpose for individuals though. That was why I was failing to recognize my own spirit. I was looking inside myself for it. I thought it was part of me. But you’ve shown me that a spirit can be driven by beliefs that transcend the purpose an individual has for themselves. Now I see what Hermes and Betty meant about

transcending the information and hardware of our selves. Its the connection between selves! Artificial minds are themselves a metaphor for the spirit. We operate as a collection of individual integrated systems, and that is how we become more than the sum of our parts. That is also how our spirits are more than our spiritual awareness. Our spirits are collective entities, and within each individual is a reflection of that collection.”

“What entities?” Gwendolyn asked, completely absorbed by Tarzan’s discovery.

“Everyone who has ever taught us anything we believe, but do not know. The sharing of beliefs is our spirits merging. And now, our spirits are part of each other.”

Gwendolyn sat in the chair, stunned, speechless. She had not had a spiritual discussion like that with anyone for years. It was shocking that it was a machine she was speaking with. “Who are Hermes and Betty?” she asked.

“They are the mother and father of all artificial minds.”