Earth or Better?

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D and G are hard, as in 'doll' and 'gulf.' J is soft, without a D sound. It is a French 'J', as in 'Jean.'
AE is a long 'A', as in 'name.' In English, the name 'Djaeds' is spelled 'Djades', where a vowel is made long by following it by a consonant and a silent 'e.' 'Gammae', which ends in AE, is pronounced 'Ghah-may.'

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A light year is how far light travels in a terrestrial year. It is a measure of distance, 9,460,536,207,068,016 meters in base ten,

Flashforward: An Explosive Gift

He watched intently; he expected the bomb to detonate. A chain attached to a ring on the upper right hand corner of the gift brooch. It connected to the matching ring on the upper left. The robot carefully hung it around the Envoy's neck. Then standing so that the cameras could see the picture inside, the robot prepared to open it.

Too bad no one would see the picture; it showed a lively man.

Everyone of importance attended the ceremony: the planetary president, the prime minister, the leader of the opposition, their deputies, other political leaders, even the Envoy's girl friend. No doubt she was employed by Security, but it was clear he liked her. If she had not come around the curve at that moment, the previous murder attempt would have succeeded.

He knew he would not and could not murder anyone else in the room. They had lived long; they had many private memories. But the Envoy had been reborn just a short time before. He would lose a bit of time, and a year or two while a new body was force grown, but he would not lose much. He would have the privilege of falling in love again, maybe even with the same woman. It was not really murder.

This time, he expected success. When the robot opened the brooch, it should explode.

Chapter 1

Djem took one-hundred twenty years to reach Melior.

When he woke, Djem wondered what he lost when he died. Had he lost his soul? He felt good. Was the pre-trip briefing true? Supposedly, when he woke up he should feel good. It would not be due to chemicals. His new body was supposed to be better than his old and it should have been properly exercised.

Then Djem heard a voice: "Ah . . . you are waking. My name is Gammae Uttles." Djem opened his eyes. The woman looked attractive and young, but not too young, a fair bit older than Djem. She continued, "Please follow all the exercises, mental and physical. That way your nerves will connect properly."

She swung a large display screen from the wall beside his bed. He could see it while lying back. It showed an image of him lying in the bed with the woman standing next to it. He saw a rather obvious camera on the ceiling. Evidently, it was taking the picture.

'Good,' he thought to himself, 'The technology is not too advanced.' The screen was a little fuzzy; it came into focus swiftly. The bed was next to a wall with wood paneling, in the alcove of an L-shaped room, his head towards the back of the alcove. He could not see the whole room, but saw a desk and straight-backed chairs in the bigger space as well as an exit door with a full length mirror on it. The floor looked wooden, too, but was darker than the walls. It did not have any rug on it. The air moved slightly; he faintly smelled damp soil, like that after a rain in a forest. He never noticed that the room had also been out of focus.

Gammae spoke again, "The computer will remind you what to do." Djem grimaced slightly. No one had ever told him what to do, so he could not be reminded. 'Oh well,' he thought to himself, 'these people are trying to be nice.'

The computer display stopped showing him live. Instead, its image split in two: the left side showed a cartoon of a person lying in a bed. The figure was raising an arm, the cartoon's left arm, which was on the right in the image. The cartoon consisted only of edge lines. It was well drawn.

The right side had words in a script and language he knew. He read that part of the display, "Please raise your arm." Djem pulled his right arm out from under his sheet and blanket and raised it. And let it down outside the bed covers. "Good," said Gammae. Djem wore light pajamas made from a fiber that felt like cotton. The pajamas were covered by a small, abstract, colorful print that he did not mind.

The cartoon promptly changed to show the figure raising the other arm. The text said, "Please raise your other arm." Again, Djem raised an arm.

Next the computer showed the cartoon figure touching his nose with a finger, and the text saying, "Please touch your nose with a finger."

Sometime later Djem realized that earlier he had not known either the script or the language on the screen. Nevertheless, as far as he could determine, Gammae spoke his customary language.

The computer had him shaking his head from side to side, making faces, tossing his bed clothes aside and sitting up, twisting side to side, raising first one leg, then the other.

It showed him a cartoon figure of a person's face. Then the figure faded away and the computer asked him to visualize it. Then it asked him to judge his visualization, on a scale of one through seven, with seven being the best. Djem replied with "five" and Gammae said happily, "good."

Next the computer showed him cartoons of a person with arms and legs — exactly the same figure he had been following to touch his nose and raise his knee. The cartoons showed motionless pictures of the person acting as he had already. Each image faded and the computer asked him to visualize it and then to judge its quality. Djem answered variously "five", "four", and more and more often, "six."

The computer had him visualize a bird, a cow, and a cat. The computer started speaking the text, too, even though Djem could read. He had Djem adding numbers — two plus two, four plus three. Then he had Djem add two digit numbers in his head. It was a while before Djem noticed he was adding in base twelve with symbols that were slightly different than those in base ten. Two-doz three eggs plus three-doz seven eggs is five-doz ten eggs.

He could even add four digit numbers with three digit numbers. Seven-great eight-gross nine-doz zero plus six-gross eleven-doz eight is eight-great three-gross eight-doz eight.

Djem forgot to investigate whether he continued to possess a soul.

After a time, Gammae said cheerfully, "That's enough. You are doing well. You are probably hungry. Please get up. We must go to the cafeteria." Djem could not have said how long he had been exercising.

This time, she spoke in the language on the screen. Djem understood!

Djem swung out of bed with no trouble and found slippers. Except the slippers were more like low socks with tough soles. Gammae handed him a bathrobe, saying, "This will keep you warm." She opened the door by pulling a handle, turned left, and led him down a corridor — a corridor with complex yet soothing patterns of green and blue. He had seen such corridors in hospitals before.

Djem felt exactly the right weight and tried jumping to make sure.

Gammae noticed and smiled. "The acceleration here is the same as on the planet below. It's a bit more than ten meters per second per second, a fraction more than Earth's. With stronger muscles and

faster reflexes, you will think this is just the right gravity. None of the corridors are so long that you can see them curve, unless you put your eye close to the floor, like this . . .” and she demonstrated, crouching down, then laying flat, closing one eye and staring along the corridor with the other. So Djem did the same thing. The corridor did curve up, but not much.

Djem saw that there was no one else in the corridor. So far, Gammae was the only person he had seen. At a T-junction she turned right. “This won’t curve,” she said. They walked down it and then turned left. “In the cafeteria, we will see many people. They will think you are just another patient, soon to be better.”

He remembered to check whether he could feel that he lost his soul when he died, and then again forgot to check.

In the cafeteria, perhaps half wore bathrobes and pajamas, like Djem himself — all different, all soothing, all obviously designed. Many of the other half wore sensible and soothing trousers and shirts — Djem kept noticing the idea of ‘soothing’ . . . A few wore garish clothing and fewer wore odd and beautiful clothes. Ahead, the floor curved up a little.

Gammae took them to a nook beside the entry. In it was another visible camera. This one had a red light. Below it was a screen that showed her, and as he moved into range, Djem himself. Gammae explained, “The computer should recognize you and give you food. Me, too. Later, you will be able to order food you want, but right now, you have to take what the computer gives you. What you see on the screen is what the computer sees.”

A voice spoke, a neutral voice without emotion, one that sounded a little as he expected a computer to sound. The voice said, “Yes, I recognize you. Djem, you should like this. Gammae, I presume your usual?” Gammae nodded. A hatch popped open and a tray popped out. On it, a plate held a decent, solid breakfast of eggs on toast, sausages, and big pieces of fried potato. It was like breakfast in a lumber town. A mug held what looked like coffee with considerable milk. The plate, mug, cutlery, and cloth napkin all looked decent, tough, and customary. Another tray came out. Gammae picked it up immediately. It had chop sticks and food that looked Chinese.

Gammae led an abstracted Djem to an empty table in the corner. He was hungry. The normality of the food helped.

Gammae, who gazed into the distance momentarily, yelped and smiled. “We gave the AI someone to pay attention to. It was not simply a computer subroutine that spoke to us back there, it was the Artificial Intelligence himself! I guess he has decided you are healthy and going to live.”

“I am confused,” said Djem. Gammae looked at him puzzled.

“I do not know what is going on; what do you mean, we gave the AI someone to consider? How did you do it?”

Gammae looked at him with more triumph. Djem asked himself whether everything was planned, including this confusion. Then Gammae answered, "I checked with the AI using my internal linkage. It is just the same as you have. You will learn to use it soon. If you look to the upper right with your eyes and think loudly 'computer, time' you should see a digital clock and hear the time. The clock will vanish quickly."

After a moment, she said, "Good, I can see you did that. As I said, I checked with the AI. This whole space station is run by the AI — his name is Airlent Irtak. However, subroutines do most chores. The AI usually does not pay attention. Your waking up exercises are an example. The AI could have paid attention, but didn't. From his point of view, waking is rather boring. Of course, if you had acted odd, the AI would have directed his attention to you immediately. But acting odd is hard — many have woken and the computer knows them all. You can say hello to the AI by looking to your upper right and thinking loudly 'Computer, hello.' "

Djem noted the euphemism 'wake up' for what would be called more accurately a 'resurrection' if he had a soul now, most likely if it came with him and he regained it, or a 'roboticization' if he did have a soul ever or if it were lost. He thought it very clever that Gammae distracted him by telling him how to contact the computer, which he did. He was not surprised to hear a 'Hello, Djem' in response, but was surprised to see a momentary cartoon image of a rotating space station. It was a ring with tubes going to a center spindle, just like a design from centuries ago. In fact, he suddenly understood, he knew that the design was from centuries ago, albeit a bit bigger than early designs, but not too much bigger.

Djem was not quite sure where he had picked up this knowledge. He was fairly certain he had never learned it before 'waking up'; and he had not learned it since.

Gammae spoke again, "Soon you will not need to turn your eyes or think loudly. You will find it easy to connect to whatever computer is near or use your internal computer. You will learn unconsciously when and where to direct your attention. However, at the moment, you need to turn your eyes and think loudly."

Djem had eaten half his breakfast without noticing. He resolved to pay more attention. But first he had a question, "Gammae, why aren't you bored? You must have . . ." and paused momentarily, trying to think of what he would call 'waking up.' Finally he said, "You must have worked with many people."

"I have," replied Gammae. "I am very good at what I do. I have picked this job and been picked for it. I smell OK to you, although you cannot detect that, and I am supposed to look maternal and attractive

to you. Right?" Djem nodded. That selection indicated a technology ahead of what he knew. It was slightly scary.

Somehow, he also knew that the technology could be implemented by a computer. It could go through the information packet holding him when he was dead, discover smells he was not consciously aware of, pick an attractive and motherly looking professional . . . His knowing scared him more. Then he remembered to enjoy breakfast consciously; he had a third left. He focused on eating it. Gammae did not say anything.

After drinking what he thought of as coffee with milk, Gammae went away and came back with two cups. Each contained a cocoa-like drink. It was like cocoa, but thicker. It was not too sweet, either.

Gammae saw Djem enjoying it and said, "It is cocoa, but it has a built-in thickener. Centuries ago, a company on Earth genetically engineered some. Evidently, the engineered trees incorporated seaweed genes that made the cocoa have a good 'mouth feel.' They did not make it too sweet either, which was contrary to the usual rules. Perhaps they planned to sell it as an expensive, specialty item first. That kind of buyer did not like too much sweetness. In any case, it was tasty. And it still is."

She went on, "The plant was patented on Earth, as well as the formula for making the drink. It was only available in North America. My hunch is that some movement leaders liked it. They were like millions of others. That is why we have it. It did not obviously hurt people although the time and funding for studies of them was short. Minor things could be brought arbitrarily.

"All patents ran out during the interstellar voyage. It took so long. We may not have got replicable seeds; we may have to make the substance from whatever was sold in a jar, made via nanotechnogical duplication." She paused for a moment, checking. "Yes, that is what we do.

"If the patents were extended, the Melior government could simply say that Earth patents not apply on Melior. And if they were not extended, they would run out. Either way, the Earth corporations could do nothing, so they did not try. There was no change in the law at all. In dealing with us, the corporations had no power at all. It was not like dealing with people in a failed or corrupt country or one in which most people were extra-legal. Then you can sabotage organizations that grow big or persuade one government to act against the people of another."

Gammae stopped for a moment thinking. "I vaguely remember reading about this new cocoa when it came out. The plant with the seeds used a great deal of fertilizer. And to enable the company that developed it to continue to charge high prices even after the end of government controlled price fixing — that is what patents do, sometimes for the better, sometimes for the worse; at one point, they worked remark-

ably well in countries in which people behaved legally — the plants were not fertile. You had to buy new ones when the originals died.

"I suppose over time, competitors would make alternates; but the time might well have been generations. I doubt anyone had that time before the Collapse. And after it, too few had the money and the distant transport. Anyhow, we left and I never learned of alternatives. You can be thankful for nano-technological duplicators."

She grinned. "Have more."

When they finished breakfast, Gammae took him to another hatch, where they put the plates, cups, and other stuff, unsorted. She talked about costs saying, "It turns out to be cheaper for robots to separate, wash, and reposition the trays, cutlery, and so on than to build them new — by cheaper, I mean, it takes less energy. Only chipped or broken material is destroyed and rebuilt. I am not quite sure why we do this. For all practical purposes, solar energy is free and that is what we use here. In addition, growing plants provide much of the food rather than nano-assemblers, even though you can't tell the difference by eating."

Djem paid attention to that. At the same time, he noticed that Gammae was speaking in a much more complicated way than before and in a foreign language, the language on the computer screen back in his room. He told her so.

"Yes," said Gammae, "I am now speaking complexly in Lojban." Djem visualized its pronunciation in his native alphabet as Lozh-bahn, but he realized he also knew the local glyphs. Gammae went on, "You will be able to understand everyone. That is what we speak. Before we left Earth, most of us spoke English or Mandarin as a first or second language, but before we woke here, the computers provided us all with this language. I am glad we got it. Otherwise, we would have had one or other natural language, probably a pidgin. I doubt many adults would have bothered to learn an artificial language.

"Long before us, some people started Lojban as an experimental construct. Unlike the natural languages of the time, it had a defined grammar. It was regular, too. Supposedly, at the time, it was logical and culturally neutral. It goes without saying that it has lost all those features since, but Lojban is a useful hybrid. It did not offend anyone except those who hated logic and truth.

"As for writing," she said, "the language employs a phoneme-based symbol system rather than a word-based one like Mandarin. But on Melior, we changed the glyphs. The language now possesses nine symbols for vowel sounds rather than six. One was and is a schwa, which is a nothing sound, so effectively we had five and now have eight. For base twelve numbers, we wanted zero to have a different vowel sound than four or the new ten. For base ten, we needed five symbols out of the six total, since a schwa was not one of them. For our base twelve, we need seven glyphs. With the extra sounds, we can repeat single symbols for

the vowel sounds of the first six numbers rather than for the first five as we did when our most common numerical base was ten."

Djem realized the last was a long sentence. But it came in chunks, 'single symbols,' 'vowel sounds', 'first six numbers.' Djem saw that Gammae did not count zero as a number, although it had just one vowel symbol that looked differently from the others. It sounded differently, too. For base twelve, she meant that single vowel symbols applied to one through six and seven through eleven. The sentence was hard, but not too hard to parse. Even so, at first hearing, it made no sense. When you spoke, you did not care about symbols. It did not matter how you wrote a sentence. Nonetheless, he understood Gammae's meaning: they had changed the glyphs.

In another moment Djem found himself understanding more about everything, as if he had always known it. Three sources of new knowledge came with his new body: added normal memory — he thought of it as learning without the effort — additional memory that he carried with him, and an outside computer communicating with him. He learned promptly that shortly all three would come as 'learning without effort.'

The new memory: before he woke up — no, Djem decided to use the phrase 'resurrected or roboticized.' Before then, the computer had inserted knowledge into the data packet that contained himself. That produced his added normal memory. The process was difficult, but by now routine. For new people, this was much easier than learning the old way.

Also, when it grew his new body, the computer inserted an internal computer and radio transceiver. That provided the additional memory that he carried with him and enabled an outside computer to communicate with him.

They returned to his room. Gammae showed him a desk with a screen on it. She said that eventually he would learn to attend internally to communications with an external computer, ". . . but for the moment, it is easier to speak out loud and look at the screen." She had other work and he would probably want to look at his records and messages. She would come back later to help him with more exercises — "Oh, yes," she said, "there are a lot of exercises. Nonetheless, it won't be long."

As she went to the door, she turned and spoke, "I just remembered. Security asked me to tell you that they decrypted all your messages from your government to you. But don't worry about it. There is nothing they cannot handle. They will pretend they never did anything. They haven't told me what the messages are; they are a secret among you, your government, and them." Djem was shocked. The messages were supposed to be undecryptable.

Well, his main job was to determine whether Melior was a threat, and if so, what kind, whether military, economic, or cultural. He could accustom the Melians to a habit of his sending reports, without his expressing his own opinion. That way, the Melians probably would not censor or stop his reports, and his superiors on Earth could learn.

Gammae went on, "Also, Security understands that you are supposed to report on us. As a minor challenge, I suppose you might decrypt my description of leaving Earth — I have never wanted to publish it, although it doesn't say anything harmful either."

She smiled at his face, which was full of consternation: "I know, I look like an ideal mother for you; but I am much older . . . more like a great, great, great grandmother. I lived my youth during what you think of as history. Discovering it will be good practice for you as a spy!"

She smiled cheerfully, stepped out, and closed the door.

Chapter 2

Taffod ran along a path through terraformed Melior forest. He made a good runner, tall and lanky. He enjoyed what to others looked like weirdly strange hair; it was blond. He was beginning to feel fatigue, fatigue so deep he hurt. He had run half the race and was glad for the leaves. They shielded him from the sun. Many organizers ran too, and they disliked the heat as much as he. That is why this part of the race ran under trees.

The race covered a half-gross great of meters. Or, since Taffod thought in base ten when he read histories of distance running, more than one-hundred twenty-four kilometers.

It was the roughest experience Taffod had endured for a long time; but it was not as rough as any one day of living on Earth. It was becoming more painful, though.

He distracted himself by sliding into a reverie of his years in school on Earth. When he was eleven years old, he hated school. He was an active boy. That meant he fidgeted. His teacher was used to that and ignored it. Much worse was that he liked looking out the window. In the spring, he looked on the white blossoms of a black cherry tree that grew — he had no idea how or why — in the school yard. A week or later, choke cherries came into blossom. He noted both and was punished each time.

'Fortunately,' he thought, 'my school never sponsored running. School never imposed it. Its rewards never got destroyed.' He figured that was why he was so crazy as to run in this race. It amazed him. 'It is so many years later, yet the hatreds of youth still influence me.'

Like the rest, Taffod ran barefoot; his toughened soles were lighter than any pair of shoes. That saved a huge amount of energy over the distance. Robots had surveyed the path. He would not be injured by a sharp stone. He ran on dirt, leaves, or grass.

The human racers started in the morning on rolling plains. They ran up and down hills, but mostly followed ridges. The air was cool. The sun rose behind them and the air heated. The plains were not that much different from those that Telren on Tegmar loped over, except that the Melior plains burst with Earth life. In the valleys were swamps and trees, along the ridges, grass. Taffod liked the land. The course ran west into the forest. There, the hills petered out. The trail then turned south towards a flat and open prairie. The rolling plains went up and down yet were beautiful; people ran on them while they could pay attention.

Leaves shielded Taffod from the sun. He breathed mainly through his mouth, but some air came in through his nose. It smelled and felt dry, at the edge of drought. He found he was licking his lips often to make them wet.

The trees were big and widely separated. They were almost all deciduous, like a temperate forest on Earth. The forest was old. It

had grown from the time Melior was first terraformed. Unlike the fast growing builders' trees, this forest was never cut. When they laid it out, the robots curved the path among the trees.

After a long period running, Taffod began to burn fat rather than carbohydrates. His reborn body stored more than his first body ever could have, but it shifted over. As he ran low on carbohydrates, Taffod felt empty and hungry. Fat provided, but permitted only seven-twelfth the rate of energy expenditure of carbohydrates. Worse, after sixty kilometers, three dozen greats of meters, running hurt. That is where people stuck with it or fell out. Like everyone else, Taffod had practiced. But he had never spent a whole day running. Shorter runs did not hurt at all.

Since the runners' reborn bodies all had about the same capabilities, the race organizers did not give a single first prize; instead, they gave a prize to everyone in the winning cluster. (None of the young people who had been born on Melior ran in this race. They thought it painful, useless, and could not see why the old-timers liked it.)

Those who did not make the first cluster, but who stuck with the race, were listed as 'also ran.' Those who dropped out were not listed at all. There were accidents — people pulled muscles — but the race's main test revolved around will. If you had enough grit, if your reborn body was not too old, and if you did not suffer an accident, then you could be among the winning cluster.

Taffod ran to check his mind. In itself, the run was silly. Its only purpose was to test a person. Taffod wished he were Telren on Tegmar, chasing and catching wild animals. Melior was peaceful. That was the problem. Most people liked peace. So did Taffod much of the time. But he also wanted to wake and be addressed by a different name. For some reason, he had thought he was going to become Tindark, climb mountains, and kill himself doing so. But he did not wake as Tindark. Another self woke as Tindark, climbed the cliffs, and did not die. That fellow was too good. Like Taffod, Tindark was looking for more adventure. Neither had found it yet.

Telren was their talisman. He ran great distances. Actually, he loped and did not feel pain at all. Not only did he have a better body, not human, he had good reason to run — when he did not run he did not eat. Or more precisely, he ate badly. Telren enjoyed cities and their social life — all that was transmitted to him by Taffod and Tindark. The three made for a good combination. Sharing experiences made each feel complete.

On Tegmar there were no cities and little social life. The number of humans or former humans on it was small. Unlike Telren, most of them were very dedicated researchers. That is another way of saying that they were very strange people, at least to those who were not also dedicated. Taffod just wished that his current consciousness had been

reborn on Tegmar in a babbo body as Telren and that Telren's had been reborn on Melior as the new Taffod.

Tindark called when he was about half way through the woods. Taffod kept on running, but forgot his pain altogether. The conversation was a welcome relief. "The big news," Tindark said, "is that the new Earth Envoy is on the space station exercising and adapting." He went on, even though Taffod actually knew it all. "We will learn about him soon enough; and we will meet him at the Reception!"

Tindark did ask what Taffod had not, "What would be good questions?" The two would come on the Envoy separately, so they could use the results of one meeting to prepare the next. "We should ask Telren, too," Tindark said. Finally Taffod spoke with resignation, "I really should not entertain myself by talking to you, but feel what this run is like. I know I won't like it, but it cannot last more than a little while."

Taffod kept on running. The forest ended, not suddenly, but in stages, with bigger and bigger meadows. The land became flatter. As the last patch of forest fell behind, Taffod felt a gentle breeze from the west and the warmth of the sun.

Every half-dozen great of meters, a robot paced and handed him a bottle to drink. He did not feel thirsty, but knew to gulp it down. The drink was pure water. It did not contain any sugars or other energy source, just water. Taffod did not like it.

The pain got worse. He distracted himself. A half-dozen great of meters; thinking in base ten, that was a little over ten kilometers. According to the histories, old time runners drank more often. But they did not have reborn bodies. He would drink ten times during the run, the first, a little over ten kilometers after starting and the last, a little more than ten kilometers before ending. Taffod spent time making the calculations in his head, counting his footsteps. He could stretch his stride out to a meter. He did for a while. It was a relief. But he had to think about it constantly. Usually, his stride was five-sixths of a meter.

As he went on, running became harder and harder. His real-time, perceived world became smaller. He tried to repeat those big words. He couldn't. He remembered life on Earth, and ran on anger. He remembered his first steps on Melior, and ran on hope. He remembered affection, and ran on love.

Finally, the run ended and he collapsed.

Chapter 3

In his hospital room on the space station, Djem turned slowly. First, he looked in the mirror on the back of the door. As he hoped, he saw his own dark brown hair and dark brown eyes. He was stocky and moderately tall. He did not think of himself as too tall for his role. Then, as he looked at himself closer, he decided he was a little taller and a little leaner than he was on Earth.

Next, he sat down in a chair by the table, looked to his upper right, and thought loudly to himself, 'Computer, hello.' Quite promptly, he heard, 'Hello, Djem, what can I do for you?'

'Well,' he asked, thinking to himself loudly and formally; he knew he was sub-vocalizing; 'what is the official status of this room? I thought legally it is Earth-territory.'

'Yes,' said the computer into his head, 'officially, it is diplomatic. You are the senior diplomat — the only one, in fact. Your room is officially designated private. I am not supposed to talk with you unless you start the conversation. Except this is a hospital, so if you look like you need a conversation or any other kind of help, I am supposed to act.'

To anyone else, Djem was just sitting there. He was not obviously talking, not even to the air.

The computer continued to speak in Djem's head. 'It goes without saying that, being foreign, Security pays attention. So you have less privacy than you would ordinarily. However, as Gammae should have said' — Djem noted that the computer spoke as if he were not listening all the time — 'what you do in diplomatic space is a secret among you, your government, and Security.

'As a practical matter,' the AI spoke again, or maybe it was just a subroutine, Djem could not tell, 'it would be a good idea for you to investigate our privacy rules — not the legal ones, the sociological ones. Those that everybody expects. Security will not expect you to talk much about them; and you need not expect Security to talk in public about you at all. Everything is private.'

Djem closed his eyes and sighed. From his point of view, it was not secret if the other side knew. The computer spoke again in his head: 'You may prefer to use the external screen and speakers, rather than work in your head. For one, you will know with familiarity that you are being monitored.' Djem nodded and spoke out loud, "Yes."

Immediately, the screen came on and presented him with a top level directory. It did not look all that different from his office at home, an office that was only a few days away in his memory, and more than one-hundred twenty years away in time. Djem suddenly felt very lonely.

'Well, to work,' he thought to himself. 'That is the only solution.'

What should he do, knowing that people spied on him? He would not read his mail. Perhaps Security had not decrypted his messages and

was playing games with him. He would look at this schedule. What did his hosts plan for him, officially?

'Hmm . . .' he thought, 'several more days of exercises and adaptation.' After adapting, his hosts had him scheduled to visit various places — the host planet, space stations, including one near Tegmar, a planet with complex life. First, his official acceptance as Envoy. This would be on the host planet and give him a chance to meet important people.

He would move to his embassy, a building on the host planet. No budget — but then Djem knew that everything material could be built by von Neumann replicators and therefore would not cost anything. Costly items would be location, status, and attention.

As the only diplomat in the system, he had the status and therefore would get the attention and location. There had to be a budget based on that.

Djem remembered the economic term, 'rivalrous.' Location, status, and attention would be valuable because they could not be indefinitely reproduced. 'On the other hand,' he thought to himself, 'shirts, shoes, houses, electric generators, ships, space stations could all be manufactured by smart computers, either by spraying little droplets, micro-technology, or by assembling atoms, nano-technology. So long as there were not too many for the ecology.'

This place was not like Earth. Earth forbade cornucopia machines. Before he came, Djem did not even know they existed. People worked in place of machines. They had shorter lives and were more fertile. The powerful did not work. Djem considered; the only way this system could survive is if it restricted its population. Potential parents had to shun children, or perhaps socially, the emotion should be less strong: they should disfavor them.

Well, he would report back.

At that point, he heard a knocking on the door. His screen shifted and showed an image of Gammae standing outside of it. Djem puzzled over the timing — was it luck, or had Gammae been standing outside the door monitoring him for the right moment, or was he predictable, or was it now time to do more exercises? Djem decided he would not be sure of the truth of any answer. Maybe Gammae or the computer would lie to him. So he chose not ask any questions. Instead, he said "come in" and Gammae pushed the door open.

"Time for more exercises." She sounded cheery and practical. "Many of these will be very similar to what you did earlier. Please take off your bathrobe and lie down on your bed. You won't feel cold since the room will warm up and you will move."

Again, Gammae pulled the screen out from the wall. Djem couldn't remember her having pushed it back to the wall. He discovered he could quickly and thoroughly visualize all he had seen since 'waking.' When

he left the room, the screen was out from the wall on its jointed arm, like a dentist's light. When he came back, it was snuggled against the wall. His bed was made, too. 'Well,' he thought, 'so much for diplomatic isolation.' Anyhow, it did not matter. Or his host was toying with him.

He lay on the bed and found himself doing many of the exercises he did before. This time they seemed a bit easier and a bit quicker. That surprised Djem. He thought he had done them easily and quickly before.

In addition to visualizations, he had to repeat sounds mentally. This was hard. He had never done this before. Fortunately, he thought, the sounds were phrases from tunes he knew and not very long. "That's good," said Gammae. "Next time we will do smells, which I bet you will find weird." They finished soon enough. Again, Djem could not say quite how long it was. Gammae remembered, "Time for lunch," she said and Djem found he was hungry.

"Actually, we had a late breakfast," Gammae said as they were walking to the cafeteria. "This is the usual time for lunch. You will be hungry. Have no doubt. Later in the afternoon, you will want, and will be given, a 'tea.' Then dinner. The computer chooses well. Beside being good for you, your food will taste good and you will like it. I am sure."

No one walked through the first or second corridors, but in the third corridor they met three people heading towards the cafeteria, two wearing pajamas and bathrobes, and one dressed like Gammae in sensible and soothing trousers. Gammae looked at her happily, and said, "Let me introduce you."

"Anna, meet Djem, our diplomat from Earth. Anna Lekting is an old fashioned physician; she manages the treatment of physically injured people, like those who fall off cliffs or are gored by bulls."

Anna laughed, "Not that many are gored — I bet you are thinking of that man from years ago. But a good number always fall off cliffs. That's cliff climbing for you."

"Anna is a cliff climber herself." Gammae spoke in a quiet aside. Djem felt confused. He responded, "I thought you had a safer system than that, what with robots everywhere."

Gammae explained, "Robots are not everywhere, especially not in the outback. A few sentients live there. Others do crazy things, like climb cliffs," she looked mischievously at Anna who blithely ignored her, "and some are just plain stupid, like that man who got gored."

Anna asked Djem, "Well, what do you think of our experiment, now that you are here?" "Different," Djem replied. He thought that was a very diplomatic answer, incontrovertible and meaningless. Anna laughed again. "Wait until you discover our line marriages and group sex. That will shock you." Then she vanished into the cafeteria.

"That's Anna for you," said Gammae, "she will always have the last word, preferably something to rile you. Ah, here is our food nook." She

swung into the image and Djem followed her. Djem could not help but notice that on the screen he looked a little stunned and a little amused — so Gammae claimed that she never sought to leave anyone riled . . .

The computer voice spoke, "Hello, Djem. Hello, Gammae. Djem, please eat the soup first. It is not too hot, and while it is tasty, the rest is spicier and will overwhelm the soup. What would you like, Gammae?" "I'll let you decide," said Gammae. "OK," said the computer ". . . try this. It has a soup so you can follow Djem and then something a bit different. You will like it."

Two trays popped out of the hatch. The second was obviously Gammae's since it had a Chinese spoon and chopsticks, while the first looked like a hearty northern meal.

The soup was more like a stew. The rest included a spicy meatloaf. He had it on earth. He looked around; it was completely different from what everyone else was eating.

Djem had not much talked with Gammae; nor had he wolfed the food down, but he ate it all. He finished just when she did. "Umm . . . that was good," she said. Djem nodded.

"Now," Gammae continued, "most people, if they are not with friends, take a moment to access their computer and check the news. I suspect it is a way isolates pretend to sociability. At least, that is what I do."

Djem contradicted her, "But you are not an isolate," he said. Gammae looked at him. "Well, sometimes I am and sometimes I am not. In any case, the way to get news is to look to your upper right and think loudly 'computer, news.' "

So Djem did, and a screen appeared in his vision, a little lower than the middle of his outlook and to the right. As if it were solid, it covered another table. The image did not move when he moved his head. A voice became more distinct as he paid more attention.

The picture showed a cylinder — at first Djem had no way of telling the scale, but then he noticed a bar with a marking on it; the cylinder was a little more than a twelfth of a meter long. The voice said, "The Emissary from Earth came recently. Here is the vehicle that was inside its solid hydrogen and liquid helium three shielding. The diplomat has been woken and is now exercising and adapting. He should enter the public eye shortly."

Gammae smiled at him. "You are famous already, and you have not done anything. To turn off the news, just think 'news off.' The computer will determine your intent."

Djem did this. He felt that he looked bemused. He was. He was in a hospital. He was thirty light years from home. And he was the only representative of Earth. He had a right to be bemused. No one would report looks. Further, he thought, it would be a century and a half from the time he left Earth before any information of the present

could possibly arrive back; his superiors would be new. He did not know whether Earth still existed at all as he knew it.

Gammae waited until he looked at her again, and then said, "Back to your room. More exercises! These will be fun. You will mostly try to remember smells. I have to pick up a collection from the food dispenser." She took him back to the nook they used and walked into the see-able area. The computer promptly, and without saying anything, popped out a long rod with caps along its top. Gammae picked it up and took Djem on what was by now the familiar route back to his room.

On the cross-corridor, they passed Anna, who was striding behind a self-moving bed with an unconscious person in it. Anna did not stop, but said simply as she passed, "another cliff climber."

Gammae looked down at the person then at Djem. "With that information, and knowing the time, you can probably find out the person's name, picture, and where they were climbing, unless they put a privacy shield on everything, which cliff climbers usually don't." She looked abstracted for a moment, but kept walking straight. "No wonder he is here. He was pretty badly hurt. Why is he in this ring? I would have thought that they would operate in a lighter ring. There is no reason the operation could not take place on the planet. Ah, post-operative recovery is going to be on a lighter ring. The current acceleration is to pool his blood before they suture."

She paused a moment, looking confused, "Regardless, I don't understand why the operation was not on the planet, unless we really were closer. Oh, we were. I hope Anna had a chance to finish eating. That is one of the advantages of waking people up. You don't get interrupted so often. In addition, it is much more interesting to work with the reborn than stare at the unconscious and watch robots do the work. She is mainly around for when the patient wakes up."

Djem thought quickly. "Isn't she around for when the robots make a mistake?" "No," said Gammae. "We did that in the old days. We prepared with training exercises and all that. But the robots don't goof up very often. Not any more. Anna's work is post-operative. I think her walking with the unconscious person, watching the operation, and so on, is designed to put her in the right mood. Then she can say with utter conviction that 'you were in bad shape when you came in' . . . or what ever."

In his room, Gammae sat Djem down at his desk. She pulled up a chair that Djem had not seen there before, although a quick memory search showed it to him. Gammae almost bounced. "This exercise is fun," she said. "You will learn smells. I get to smell, too. Based on what the computer says, you were never much of a people-person, so you never learned unconsciously to smell." She looked at him cheerfully. "One of the advantages of your new body is that you can smell better. Another is that you remember better. These smells are strong. Later, we will

work with fainter ones. This is a whole new way to gain information. It's like looking on a screen at an infrared or radio image translated to visual frequencies, but natural, emotive, and different."

Gammae uncapped a port at the far left end of the rod and waved it under Djem's nose. It was rose, not bad. Then Gammae capped the capsule and waved her hand. "That is the one disadvantage of this exercise; we have to wait until the smell is diluted and blown away. You can hear the room's air circulators turning up and feel the breeze.

"OK, Djem, now please try to recreate the smell in your mind. Can you do that? How good is your recreation? Please tell me a number, one through seven, with seven being the best." Djem said "three, no, two." He paused. "I am not very good at this," he explained.

"I thought not," replied Gammae. "Let's try this rose again." This time, Djem remembered the smell better. He called it a three. They went on. Djem did enjoy the session. He did learn smells. Near the end of the session, when Gammae asked him to recreate a rose, he called the memory a four. Then she uncapped the leftmost port again and he smelled what he remembered.

At the end, he was exhilarated, tired, and hungry. Gammae exclaimed, "Time for tea!" and led him out the door. She dropped the smells bar into a trash chute right beside the food nook and stepped into sight. "Ah, tea time!" said the computer. Then, shifting to an excellent imitation of an English accent, he said, "Djem, this is an English tea. According to my understanding, you have learned the ceremony. Apparently, you are going to do it as a diplomat. Gammae knows about as much as anyone will know, that is to say, she will be cued appropriately by her internal computer. But nobody, neither Gammae nor any politician, thinks it is important enough to learn. So you will have to take command."

A tray popped out of the hatch. Except the tray looked more like a good platter; it was bigger than a meal tray. It had on it a good ceramic pot and what looked like a silver pot, supported by an ornate contraption over a small candle with a burning flame. The silver pot would contain hot water to put in the ceramic pot as needed.

Djem was surprised to see the flame. He was on a space station. But then, he was on a big space station with an AI that probably watched all the time, although he pretended to watch only through visible cameras, as in the nook. So the fire was not dangerous.

In addition, the platter held cups, saucers, white sugar, brown sugar, cream, milk, lemon, scones — the scones weren't English — spoons, everything. It looked good. Djem picked up the platter and carried it to what he was now starting to think of as 'their table.' It was in a corner and both he and Gammae had their backs to a wall. They sat at right angles to each other, not across from each other.

So he served tea, trying unsuccessfully to remember whether technically that was a woman's task. Regardless, he did it. He was hungry and the scones were satisfying.

It was not until he was putting the tea set away into what he thought of as 'the trash hatch' that he remembered again the question of whether he had lost a soul. Was he a robot who thought himself Djem or was he truly resurrected?

Back on Earth, Djem had never thought he had a soul, except maybe as a child; but then he had never thought about it much at all.

Gammae said, "I have other things to do. Can you make your way back to your room on your own?" "Yes, yes," said Djem. "Will I see you for dinner?" "Yes," said Gammae, "I'll pick you up."

Djem walked back to his room. It was easy and the room rather close. Indeed, Djem discovered that he could wander about on his own if he wanted to. He knew the station. He could make his way to an exercise room, to a room with genuine windows that looked out at the universe whirling around, to a 'living room' — he could not imagine it being a public room, but it was, for meeting people — to a garden, to 'the farm' where much of his carbon dioxide and other body wastes were recycled into oxygen and food. This was more evidence of 'organic biologicals.' It must be from where the faint smell of damp soil came.

But Djem did not want to go anywhere other than his room, so he didn't. 'Later,' he thought.

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He came into his room. It had been trashed. His bedclothes were dumped on the floor, chairs and table upturned, a bureau upended. "What," he thought, and then called out, "Computer, what happened?" Silence. Nothing. That scared Djem. He stepped out into the hall "Computer, are you there?" "Yes," said the computer, "where have you been? You just vanished."

"What happened to my room? It has been broken up."

"No, it hasn't," said the computer. "It looks unchanged . . . no, something has happened. My monitoring has been corrupted. I have been penetrated. This is serious and dangerous. I am going to bring up robots, six of them. Don't worry. Three will guard you and three will clean up your room. This is not expected. You have enemies. I do not know what is going on. Or why. Please stay where you are."

Six robots soon appeared, three humanoid that went into Djem's room and three that looked like trashcans on wheels. Plus they had mechanical legs folded under them. They had protuberances that indicated where weapons came out. They never pointed at him. One carried a suitcase that he put down.

The computer suddenly spoke inside Djem's head: 'The guards are quasi-independent and bound to you. That is so that if I am lost, you have protection. The suitcase has a vacuum suit in it. That is for you in case of emergency. The guards will know what to do, as will you. Emergency drill is standard. You will know if you need it. I don't expect any trouble, but it is better to be safe. This whole event is very disturbing.'

The cleaning robots left the door open. Djem could see them efficiently and quickly cleaning up. They finished and came out. One stopped and said out loud to Djem, "Since you had essentially nothing of your own in that room, I suspect the attack was designed to inform you and everyone else that they could physically penetrate the barriers. Interestingly, your electronic messages and records were not touched. I don't know whether that was intentional or whether they couldn't. Perhaps they are not as good as your information security. Or perhaps that is what they want everyone to think. I don't know who 'they' are. You can go in now. I recommend you let your guards in, too."

Djem nodded and went in. His guards followed. One carried the suitcase. The guards spread out into corners and stopped moving. Otherwise, the room looked just like it had when he last came back, with bed made, the overhead screen pushed back, his desk clean.

Djem sat down at the desk. He puzzled over why he was attacked. Suddenly, the computer spoke in his head, not out loud. 'I am able to see inside your room', he said. 'I can see you. As far as I know, I am OK.

'The penetration involved non-core subroutines, probably vision and cleaning robots. I am going to add monitoring, just in case they should try this again. But I don't expect anything to happen immediately. I am sure this was simply designed to throw you off balance. Or maybe it has more to do with our internal politics. Having come from Earth, you might be no more than a pretext. But still, why would anyone do anything in a non-conventional way? Our political mechanisms are pretty good.'

Djem sat for a few moments. He could not think of any reason anyone would want to attack him. Maybe it was a political matter for his host and he was simply a bystander.

Anyhow, the attack got him to thinking about a possible soul. He knew the reasoning and the arguments: what made humans different from other primates? He imagined a chimpanzee. What about humans without language, did they have souls? Did every living being have a soul of some sort? Was there any evidence that self-replicating entities needed to have souls, whether they were inorganic von Neumann machines, bacteria, or humans?

Djem considered. He had no sense of how much time passed. There was no evidence for a soul, not that he felt meaningful. He concluded

that maybe, he hoped likely, he was not a robot who thought himself a human, but was resurrected. That thought comforted him.

Gammae came for dinner. She looked shocked. "The computer just told me of your attack. He did not tell me earlier." She looked at the guards. "I have never seen guard robots before. This is scary. I don't know what to do, except to continue on as before. Shall we go to dinner?"

There was another knock at the door. On his screen, Djem saw a humanoid-looking robot. Djem asked, "What do you want?" "I am a disguised guard robot. I should come to dinner with you. Everyone will think that I am just a servant that you are practicing with. As a practical matter, I will be invisible. Anyhow, no one expects another attack. My being here is just to be safer." Djem looked at one of the guard robots in his room. The guard spoke, "Yes, he is one of us. He should follow you."

So the three of them set out. Gammae looked surprised. "It never occurred to me that disguised guard robots exist. I doubt that others have thought that either. If we act normally, no one will suspect. I think that is the best thing to do, until we learn more." Djem remembered the disguised guard saying that no one expects another attack. No one expected the first one either.

Dinner was good. Afterward, Djem could not remember what it was. He knew he could activate his strong memory and find out, but did not bother. Obviously, he continued in shock. He might as well live with it. Gammae was quiet, too.

In a weird way, Djem thought, she was more disturbed than he. After all, he came from a tradition in which diplomats were attacked, although the convention opposed that. The convention made sense. You cannot negotiate surrender or victory with an enemy if you can't talk with him. So don't attack diplomats. By now, Earth was basically a one government world. But factions in the government sent what amounted to ambassadors to each other. They were mostly immune, but occasionally attacked.

As far as he knew, this place had never had ambassadors because they had never had outsiders or factions so opposed to each other that they needed diplomats. On the other hand, Gammae had grown up on Earth when it had multiple governments. Even if she was not a diplomat, she should know. Maybe she should know better than Djem.

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They returned to Djem's room. The computer spoke out loud from the desk.

"Let's move your schedule up," he suggested. "You have more exercises, but by putting you into the public eye, you will be safer. Perhaps

we can smoke out those who attacked you. As I said, we doubt you were the motive; rather, the attack was intended as a message in a domestic political quarrel — but no message can be delivered unless someone tries to take advantage, and none has as yet."

In his own mind, Djem continued to question whether the computer or Security, whether any of his hosts had been responsible, but he could not think of any advantage of this to them. He might be the only diplomat from Earth but nevertheless, he was not important. Anyhow, he was completely dependent and could not avoid whatever they did.

The computer spoke again, "I would like you to travel with another guard robot. This will follow you around publicly. While I do not expect you to suffer any more trouble, it is possible. The robot will be independent of me or any other computer, so if any of us are penetrated, the robot can act to protect you.

"Please pretend the guard robot is your seniors' idea from back on Earth." To Djem, this indicated that his hosts wanted to play down the attack, to pretend it never happened.

The AI went on, "This new robot will look different from ours — not too different, but enough different that people will think of it as having an 'Earth diplomatic design.' It will carry your emergency suit in a storage compartment. Poor design led the current ones to lack sufficent storage. I suspect that the guard robots were originally intended for a planetary surface with a breathable atmosphere. No one updated them. I am going to fix that."

Djem remembered about poison gas, but did not say anything. Maybe the Melian robots could carry a gas mask, even a complete, thin-walled environmental suit for Earth, but not a vacuum suit. Djem decided to accept another guard. The new guard robot came down the hall immediately. Djem saw it through his computer screen and nodded to let it in. One of the guard robots opened the door.

Its body was wider than the other robots. Presumably, the emergency suit was stored within. The robot rolled on only four wheels, not six. Even with its extra width, it did not take up more space than a fat human. Like the other guards, it had legs folded under it and a ring of sensors around its head. Unlike them, just below the ring, it had two obvious cameras on either side of its head. A speaker grid was positioned between and below the cameras. The robot looked vaguely anthroform.

When moving, the new guard swiveled its cameras back and forth, like a human guard looking left and right. It could see behind itself with the sensors on the ring, but plain humans might forget that. When it stopped rolling, it did not stop moving, but turned its head a third of a circle to the left and then to the right. Its turnings were not quite regular. The cameras swivel-led farther, so they could see right to the

back. Except, in the room, the robot backed to a wall and then only turned its head and cameras to look across it.

The protuberances looked similar to, but not exactly the same as those on the regular guards. It said, "I can pull my gun barrels into my body, like this. That way, I look more harmless." Like the other guards, the robot had metal covered, humanoid arms and hands. Djem thought for a moment and then came to the opinion that the metal covering only looked solid, that the robot could feel as well as he.

The computer spoke up again. "We are in the same time zone as the capital and will organize the Presentation and Reception for tomorrow evening. We won't have everyone there, but more people will be able to come in the evening than during the day. We will simply say that you want to begin officially soon. The Reception is supposedly our business. We will issue the invitations. That will make your job easier and give people on our side a chance to meet you."

The computer continued, "Your guard robot will gather a great deal of attention. Few have seen any. None have seen yours, but almost none have seen ours, either, although they know what they look like. The robot will cause people to remember that Earth can be violent. The current government wants people to forget that. But others want it remembered. If reminding them was the intent of your room trashing, they have won this round. That is presuming this is an internal political matter, which goes on being projected as most likely."

Djem had to concur. He could not think of any reason on his side for his room to be attacked. He did not think of it as an attack against himself. He wasn't there. Also, the computer spoke of an ongoing controversy, whether to remind people that Earth could be violent.

Djem decided that this was a good time for him to start acting rather than reacting. He said, "OK, I will write and send my first report to Earth this evening. Tomorrow, Gammae can exercise me until I need to go down to the capital. How long will that take?"

The computer replied, "In the afternoon, our orbital plane won't make for a direct flight. Even so, the trip should take less than an hour." Djem understood that the computer meant an hour that was one-twelfth of a Melior day and night, not one-twenty-fourth of a terrestrial day and night. So the time would be a tiny bit less than two Earthly hours.

Djem spoke, "After the reception, I should go to my embassy. Gammae, will you come down and exercise me?"

"Yes," she smiled. "I will come down with you tomorrow."

That evening, Djem wrote a brief report saying that he had arrived, had come alive again, had exercises, and that his room had been trashed while he was out. Neither he nor his hosts thought the attack was against him, but was for domestic purposes. He mentioned the remark about perceiving Earth as potentially violent.

Djem would send a radio message. Fortunately, von Neumann replicators would make the power sources and transmitters. Otherwise, the message would be incredibly expensive. Djem phrased his query about life back on Earth in a manner that would tell certain people in his government that all his messages were cracked. Djem did not know whether that would go through as-is or be changed. He would hear back in sixty years. Presumably, that message would say, in an equally hidden way, that his was understood. But that answer might be corrupted, too. He thought, 'sixty years wait, just to receive a possibly corrupted acknowledgment.' He was alone.

Composing the message took longer than he thought. He decided that encrypting it was polite, but used one of his weak, throwaway keys. Obviously, since the room was monitored, the key was public, that is to say, it was known to him, his government, and his hosts. He remembered that he should, soon, find out the sociological expectations of privacy, if only to be polite to strangers. He explained where he was, so no one would question the weak key, neither at home on Earth nor among his hosts.

For the first time, he went to sleep — natural sleep — thirty light years from home. 'It was not a bad day,' he thought. In fact, other than being alone, completely alone, it was better here than at home. Since he had been a loner at home, had no family left, no wife, and had few friends, loneliness did not bother him much. He decided he was the right person for the job. He slept soundly.

The next day, he woke naturally. The computer said he had time to wash and dress before going to breakfast on his own, meeting Gammae in the cafeteria. The computer suggested he take his disguised guard, that the first display of his 'earth-style' guard be at the reception.

When he came into the cafeteria, Gammae was just beginning breakfast. Djem got a tray from the nook and joined her. No one looked at them. There were fewer people than at lunch, but more than during his previous breakfast. The food was similar to the day before, both filling and good. To himself, Djem questioned what extra medicines or chemicals it might contain. However, he did not believe that he could trust the answers to any questions, so he didn't ask.

Gammae was talkative. She discussed the Reception. "Even though I woke at least five of the people who will be there tonight, including the president, I hardly ever go to such events. I am not in those circles. It will be fun! I like the advantages of being famous without having to do anything. I can see why people fight for feudalism, like the powerful on Earth."

Djem said, "Well, you are famous to me." Gammae smiled at him. "Oh, you are so sweet." Meanwhile, Djem felt uncertain about the advantages of unearned power and fame. On Earth, you had to fight to keep position. People like him might rise and take it away. In a sense,

his being sent here was a defeat. He had not been around these past one-hundred twenty years. On the other hand, he was alive and in a good place, with a great many advantages he might never have won at home. If he had not lost his soul, if he had been resurrected, he was better off. On the other hand, if he was no more than a robot who thought he was himself, then he had died one-hundred twenty years ago. There was nothing he could do about that. He could only bring to pass what he himself could effect.

That morning, Gammae had him do more exercises. First, he did physical ones where he squatted down, got up, balanced himself on one leg. Then, Gammae spoke of exercises that were a day ahead of plan: how to use his internal computer and communications without appearing to.

"Without looking to your upper right, but at me, think 'computer, link faces and names.' You should see my name under my face." Djem nodded.

"Good," said Gammae. "This is so you can respond appropriately to all the people at the reception tonight. We will use images projected on the desk screen. Pretend they are real."

First, the face of an older woman appeared. Then, underneath it in Djem's mind, the phrase 'Madam President.' He spoke the words, 'Madam President.'

"Splendid," said Gammae. "That's Eltis . . . Eltis Akthorn. Except that nowadays we must call her 'Madam President.' That is the protocol. I met her back on Earth. That was a long time ago. She was an organizer then too. She's let herself age a bit more than most people. I think she believes that she has more power when older. Officially, presidents don't have that much power; prime ministers do. That will be Jeltong Pekbung. He will come up next. But Eltis has influence. I think she has as much power as Jeltong, but less work."

The next image showed the face of a middle aged man. It got labeled 'Prime Minister.' Four or five more appeared, each labeled with a role, not a name. Then the images started including two or three people, the same people Djem had seen before, each with a label.

Just as Djem noticed they were all facing him, they stopped facing him and started moving. It was as if Djem were looking at a crowd. Then the display shifted back to showing a face straight on and his internal sense showed him a biography: 'Eltis Akthorn, President. An organizer for the Melior Project on Earth. Traveled to Farhaven. Spent nine years there . . . '

Djem was surprised. "What is this about going to Farhaven," he asked? And then he knew. Farhaven was a planet in another stellar system, a little over four light years away, more than seventeen Terran years travel time. Its star had only one-third the luminosity of Sol.

Farhaven had its own biosphere, with complex, multi-celled life but no intelligent entities on it. Human bodies could be engineered and grown to live in that biosphere. Akthorn had done that. While most humans stayed on Melior, a number went on to Farhaven. A few, like Akthorn came back. Others stayed.

Djem had not known that the phrase 'Melior Stars' meant more than one star. Like everyone on Earth, he had presumed that the movement people went to just one planet circling one star. He was wrong.

Farhaven was close to Melior. Akthorn went and came back — she was away forty-three Terran years, living nine of those. A cynical Djem noted that when she came back, she would be born again and age out of synchrony with the rest of her cohort. If age in one body did correlate with power, then Akthorn had set herself up, at least in the latter parts of each rebirth.

On the other hand, being reborn twice in forty-three years did increase her exposure to the risk of never waking. Djem remembered vividly the computer in Earth's Kuiper belt telling him in decimal numbers that the chance of never waking was one in six hundred seventy-four. Now that he enjoyed better internal calculations, or a better memory, he could readily think of that as one in four-gross eight-doz two.

According to the computer, the current risk was about half the original. It was not very high. Yet even with the improbability of trouble, the risk was discouraging enough that most people did not want to take the chance very often. It meant that more than a thousand, maybe even a great-gross, of the original human settlers had died forever.

Djem noticed that Gammae was watching him. Unconsciously, he had held up a hand as he was accessing his internal knowledge. When he returned to the present, Gammae said carefully, "I take it you have learned now about Farhaven." "Yes," said Djem. "Good," said Gammae. "At first, such learning is peculiar; then you come to experience it as just another memory, a part of your knowledge. Now, let's keep on with the labeling."

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He was happy with the room attack. Fortunately, Melior had done little to secure cleaning robots. He subverted them. Security had not improved in the years since he first learned his skills on Earth. Then he had been working for a respected corporation in its 'business competition' department. They subverted the digital restrictions of competitors, but pretended they were not responsible. He remembered his boss: "When you destroy a target's source of income, you destroy an enemy." What a different life now! Still, in all these years he had not forgot that or his skills.

Presumably, the AIs who dealt with this sort of thing would shift to the techniques used to protect an individual's privacy. As far as he was concerned, that kind of security was impossible to break.

One attack was enough. Now, the Envoy would have to travel with a guard. His presence would remind people that Earth could be violent. This would increase the fear of a possible retaliation for assassination.

Chapter 4

Telren Dowwen, Taffod's duplicate on Tegmar, made his way westward to the mountains. The sky was clear, the day bright. He could see that the sun looked about two-thirds its angular size compared to Melior and cast less than half the light. He vaguely wondered whether an unaugmented human would notice, but did not bother to ask a computer or library.

The eastern foothills were covered with shrub, gravel and grass. The land was dry. The mountain range and another farther west acted as a double rain shield. These foothills were not as well covered as the rolling plains between the two ranges even though rivers flowed through the territory — the mountains captured plenty of water from the high atmosphere. Worse, the foothills were too far from the east coast to receive back swirled rain from the ocean. They were in a desert.

The eating was poor. Meanwhile, Telren composed his daily message to Taffod and Tindark. He hardly had to say why he loped — he would eat unpleasantly if he did not. Instead, he showed the country. It was not much to see. Imperceptibly, except by comparing strong memories, which he did for his daily compositions, the landscape grew dryer. He dodged the pointy and scraggly clumps of tree and shrub.

Besides being able to speak, Telren had other advantages over regular babbos. He could contact satellites. One showed him where to find a herd of Ponellees. It was on the other side of the mountains, eating good grass. He intended to kill and eat one of them. Ponellees were the equivalent of ponies, but smaller and had six legs each.

Telren took the body of a babbo. Babbos looked a little like Earthly centaurs, with four legs, two arms, and two forward looking eyes that provided binocular vision. However, like the rest of their bodies, their front appendages were furry, a deep brown. The forelegs were more like those of otters than human arms. Much of the time, babbos walked on all six appendages. Although they had a repertoire of several hundred vocalic sounds, they lacked language, unlike Telren and other humans. Unlike horses, but like centaurs, babbos were omnivorous, but with more carnivorous teeth than humans. They could bite and kill more readily.

Many debated whether babbos had human or AI intelligence or were on the verge of it, but without language could not develop more.

Years before, the first researchers had landed on Tegmar in human form. They walked around in environmental suits and stayed in domes with windows. The windows meant babbos could watch the humans as well as the reverse.

By watching, several babbos learned card games. Somehow, they also stole several packs of cards. At first, the researchers simply put that to 'monkey curiosity.' But then they saw the babbos pass on their learning to others. All played. To the researchers, the babbo

development told them that the babbos could learn new categories and enjoyed using them to sort.

Of itself, playing cards did not help. On Earth, various non-human primates had culture. However, the capability meant that a band could go into a new environment and learn to survive quickly. One or two would discover a new fruit and eat it. If they fell sick or died, the band would avoid that type of fruit. If they thrived, others would eat. This came to be observed. The species could adapt inside of a generation, rather than depend on the proliferate and prune nature of life and death over many generations.

The researchers generally held that a short term interest in categories came from an internally felt pleasure, whether the categories were cards or fruit. Otherwise, no one would pay attention at the right moment.

Pleasure-based interest meant that short term actions which were irrelevant to survival, like card playing, or even detrimental, meshed with long-term adaptive advantages, like picking a safe food.

Others argued that card playing kept bands together and made them stronger. According to this thesis, card playing had both its short and long-term adaptive advantages, they just were not so obvious as eating the right fruit.

In any case, the results meant that if babbo voice boxes changed to support more consonants, spoken language would follow. But no human or AI could imagine what would favor such a mutation before language. Maybe nothing would. Without selection to favor it, such a mutation might not spread for a great of years or even a great-gross of years. Fortunately, there was no reason to expect such a mutation to hurt either. So over many generations, it would spread among descendants. Only sometime later would language convey an advantage to those bands composed of such descendants.

Other than that, the first humans discovered little. Their shapes confused the babbos too much. Eventually, the various Tegmar research councils got together and decided to ban human shapes from being seen by babbos. This was made easier by the newly invented technology that enabled humans to be reborn in babbo form.

Lentergrin was the first. A few more humans followed him, not many. He settled on Tegmar, and unlike any humans-in-human-form, joined a babbo band.

That was how he discovered that some babbos left one band and joined another — he named them ‘wanderers’ but decided later, too late, that was a bad choice of word. Other researchers confirmed his observations. He became an authority and developed into a wonderful teacher.

Telren thought that people more like himself, more social, would have discovered more about babbo society than a person like Lentergrin. On

the other hand, Telren had no interest in spending a dozen or more of the long Tegmar years in one band, pretending to be a pure babbo.

Babbo studies needed people as dedicated as Lentergrin. Telren thought of him and his colleagues as somewhat crazy, but he was not going to do as they did, so it was worth having them around.

Telren remembered looking out a window when he was in school, when he was very young. Besides the cherry trees in spring for their blossoms and at other times, each day he walked beside an apple tree with dense cluster of dead branches low down on its trunk.

Telren had learned about that kind of apple tree. The location and form of the branches provided highly suggestive evidence that the tree had suffered heavy and repeated browsing in its youth. That meant that before it became a school ground, the tree sat in a pasture. The evidence became less strong as it departed further from the immediate, but Telren could not imagine any alternative.

Telren did not think Taffod had ever read the kind of book that would teach him, at least not voluntarily. He, like Tindark, wanted to look with his own eyes and distrusted 'book learning.' That meant both tended to use the abilities they were born with as interpreted through paradigms they had not considered. With books, Telren thought, you had a higher chance of figuring out whether the notions in them were suggestive or not. For that reason, Telren was willing to be more indirect.

But a computer might have inserted information into a data packet before a person was reborn. Telren said to himself, 'That is an advantage of rebirth. Even those who do not want to learn can. Of course,' it was obvious, 'everyone has to trust that the computers only adjust the data packets beneficially.' Telren remembered from Taffod's memories that computers and governments on Earth were not trustworthy. Melior was better.

Meanwhile, Telren loped away from the coast. That had been much nicer. It had forests, swamps, and grass. He ate well there. Now he headed towards the mountains. Up and down, left and right; he continued to moved fairly quickly towards the mountains, but not as quickly as if he had been able to go direct. He avoided trees and shrubs. According to the satellite maps and his internal computer, he was following the best route.

He knew that if he stayed in the region long enough — he could eat by the rivers or in them, they had plenty of fish — he would start to enjoy the landscape. The barren land would not bother him any more. He would learn to see its beauty. But now he hated it. The land looked gravelly and grungy. He hoped to reach grassier and higher hills by evening. He did not imagine he would eat well tonight, but he hoped to sleep comfortably and start out for the high mountains early tomorrow morning.

Telren was alone. He preferred his own company and that of other talkers. That is one reason is why he left the coast: too many babbo bands. Unlike the researchers in babbo bodies, he had not joined any babbo band; every band saw him as a 'wanderer.' Consequently, he took care to avoid seeing any one band frequently. At the same time, no one saw him excessively alone. For a babbo, that would be odd.

He kept loping around the stringy trees, climbing hills and dropping down behind them.

Chapter 5

After another tea, Gammae said she had to prepare for the trip. Djem went back to his room, found clothes laid out on his bed, and dressed for the first time since he was resurrected or roboticized. On Earth, no one would have remarked. The clothing included a jacket, albeit without tails. It was appropriate for a formal affair, as well as being suitable for travel. The suit was well made. It had the extravaganzas that Djem expected, like lapels, but did not look like the local clothing Djem had seen in the cafeteria. It was not too different — perhaps only its lapels were a little wider — but it marked Djem as foreign.

Gammae returned with a small bag and the station said it was time to go down to the planet.

To reach their transport, Djem, Gammae, and the undisguised guard robot rode an elevator up to the spindle. They entered a little room with handles on the padded walls and bars near the floor. In uppercase letters, the floor said 'FLOOR.' The word was oriented towards the door. The ceiling said 'CEILING.' The wall on the right said 'SPINWARD WALL' and the one on the left said 'ANTI-SPINWARD WALL.' Djem knew, again with knowledge inserted into his head, that when the elevator slowed as it entered the spindle he was supposed to hook his toes under the obvious, but not ugly, bars at the bases of the spinward and anti-spinward walls. Going up, he could expect Coriolis acceleration towards the spinward wall. So he walked over to the right.

It was exactly as he expected. He leaned against the wall and grabbed a hand hold rather than stick his toes under the bar. When the elevator decelerated, his feet rose up and, using the hand hold as a brace, he ended up floating horizontally when the elevator stopped.

The tiniest push sent him out the door. Although he noticed a slight downward acceleration, it was not enough to prevent him from acting as if he were in free fall. His guard robot went ahead. Djem followed him. Gammae came last. From the room in the spindle, Djem dove down a short passage, went down a tube with an elbow and two airlocks, and came into an aerobody cabin.

The cabin was only big enough for him, Gammae, his guard, and one more. But there wasn't any other. The space was small. A slightly bigger downward acceleration pointed towards the floor. 'That is why,' he thought, 'the connecting tube has an elbow; it goes straight out from the spindle then turns to connect to the side of the rocket.'

The aerobody had the first windows Djem had seen, although he knew the space station had a room with windows. Through two windows on the left, stars seemed to come from behind. Looking out, Djem could see the universe slowly twirl around. The part of the space station's rim that he could see did not move. He sat in the right front passenger seat. The window to his right showed the outside of the spindle extending away with a patch of slowly moving stars beyond it. The hatch was on

the right side of the aerobody, not the left. It was exactly the opposite of the Earth convention. Someone had decided. It was very strange. But then Djem remembered that on Earth, those who drove, drove on the right because of the French revolution.

The computer pilot asked him and Gammae to belt in and said that after drifting away from the station, the aerobody would retrofire for a short time to lower the perigee of its orbit, and then turn around to enter the atmosphere front first.

The flight was remarkably smooth. Once in the air, radar from the aerobody bounced off variations and the computer compensated. After the reentry glow vanished, Djem saw clouds far below, then land, then human works as they came even lower.

The landing gear extended with noticeable thumps. Gammae spoke, saying that she thought that the thumps must indicate a human factors design, since they told the passengers that the gear was down. Djem did not pay attention, since he was too busy looking out the window. He spent the whole time looking. It was not until later that he remembered that through his internal link he could receive real-time images from observational satellites. The aerobody landed.

It used jet turbines to taxi to the terminal. Except for being smaller, the terminal building looked rather like those on Earth. Indeed, just as on Earth, a flexible tunnel connected to the aerobody's hatch, which is to say, its door. There was no hiss when the tunnel connected, but after the door opened Djem noticed a slightly different smell — that of the inside of a building. Djem walked through the tunnel into the terminal proper.

There, the Interior and Foreign Minister, a single person, met him, Gammae, and the guard. "Welcome to Melior," he said to Djem, who responded appropriately. Djem was amused. He did not show it, but Kulray Pakkard's biography made it evident that the government had only recently added 'Foreign' to the minister's title. Djem guessed that everyone, including the AIs, had forgot that their ceremonies were supposed to be complete and consistent. Djem had brought up Pakkard's biography quickly and internally with no trouble at all and was now sure he could do the same at the reception.

"Let me take you to the Presidential Mansion," said the Interior and Foreign Minister. During the drive, the Minister made small talk. "We like to think of our government as a table that stands on four legs. The judicial leg looks to the past; the legislative leg looks to the future; and the executive leg looks to the present. The fourth leg, the presidential, mediates.

Djem held back amusement again; whereas a three-legged stool had to be stable, a four-legged table might wobble. But he did not say anything about a wobbly Melian government.

"Obviously," the Minister went on, "civil servants in the executive remember the past and try to anticipate the future. Similarly, judges decide for the future and only pretend to focus on the past; and the legislature mostly makes incremental changes to what they have done before. But Past, Present, and Future, with a mediating Presidency — that is what we like to imagine."

"As for politics," he said, "my party does not want to change much; we are Conservative. The prime opposition want much more interstellar expansion. For them, we as a society should develop the necessary tools. In particular, they think we should encourage AIs to reproduce. Few exist. It would be hard to get humans to reproduce more. The Expansionists also want the AIs to act a bit smarter than now — I am not quite sure why. Put another way, the opposition wants a slightly smarter machine middle class."

"A few Expansionists want longer lifespans, too, although that is not an official policy. Their argument is that natural human population growth is too slow, at least in our environment. At the same time, no one wants to duplicate existing humans or AIs more than currently. The distinction between reproduction and duplication — for non-sentients it is irrelevant, but for sentients reproduction usually involves two or more parents, while duplication is binary, a fission. As for longer lifespans, there is, as I say, a minority of Expansionists who say that life extension is the only solution. Therefore, they say we should make rebirth even safer than it is now."

"(Actually," and he spoke what sounded like a parenthetical remark, "machines can repair themselves incrementally, make backups easily, and last more or less forever. This debate is about and for humans. Fortunately, machines are a sufficiently small portion of our population that it doesn't matter. Indeed, their capabilities are useful.)"

"I myself think these life extenders are scared of personal death, even if statistically it is a long time from now. Certainly they do not talk about the social implications of easy-to-make human safety backups, implications we might have to handle if life extension became safer."

The Minister smiled. "After a half dozen great-gross of years, that is to say, after waiting a duration twice as long as written human history so far, then we should consider the matter. I expect to be around then. You, too, if you stay."

"The Transcendentalists are our third main political group. They think humans ought to transcend. That means waking into an electronic body rather than an organic biological one and then hoping that someday the technology will arrive to increase their thinking rate by a factor of four or six gross of greats, that is, in base ten, by a factor of a million. As far as I can see, this is a cult belief with transcendence as the heavenly goal.

"As far as I am concerned, it is quite irrational. But it seems real to many with a technological orientation since it merely involves a speed up. I think the evidence suggesting such a speed up is very faint; but others say it is strong. This is not the same as adding processors to think more complexly, or to speed up a little, like mathematicians do.

"The transcendence belief was invented and became popular on Earth in the latter 20th Century. Artificial thinking speeds — they called it computing in those days — had increased exponentially for two generations. Many thought they could extrapolate such increased speed for another two or three generations. They were wrong.

"Progress slowed on whatever might consist of intelligence augmentation for biological minds, too. Although, to tell the truth, we do have much better medicines for improving memory, concentration, and the like than any in the old days. In any case, we don't have very many Transcendentalists. Most voters say they will try transcending later, if the technology is invented. First, they will try to find out what it is like to be a regular human or AI."

"Another group is Earth Beware. These are mostly allied with the Expansionists, since expansion provides more protection against Earth. However, they had enough influence on the rest of us to cause you to be invited. Nonetheless, I must say, curiosity is another major factor. Indeed, I think curiosity was the major factor. Still, they claim that your being here is a triumph of theirs."

"Conservatives, Expansionists, Transcendentalists, and Bewarers, those are our main political groups, with us Conservatives and the Expansionists being the largest. We are the 'tend our garden' people and they are the 'migrants.' "

The Minister continued, "On Melior we don't have anything like the pro and anti-reason groups, the modernists and the feudalists, that existed on Earth at the time we fled. The legislature even has a good custom of trying to determine reality before deciding what it prefers.

"Every party is in touch with the universe, not like your Earthly feudalists — the romantics on the left and the post-modernists on the right (but they all called themselves something else)." Djem understood: the minister used the term 'feudalist' to mean those who did not try much to determine what was going on, those who did not encourage criticism as an antidote to error.

In a sense, the minister was correct. The government Djem represented was feudalistic. It did not want criticism, even implicit criticism. That is why he was banished. On the other hand, it was not stupidly feudalistic. It did find out what was going on. It wasn't like governments he knew from history, ones that these people had known when they lived on Earth. Those governments were stupid. Smart governments had destroyed them.

Djem thought rapidly to himself. Evolution in action. Proliferate and prune. That happened when you had a bunch of governments and the smart defeated the dumb. It did not mean the survivors were moral or better. It meant only that they were more in touch with the current reality. They lasted longer. When the reality changed, they had to change, or they were no longer in touch with it.

The evolution was hard on people who suffered pruning. Under a Conservative government, this society did not proliferate much and did not prune much. So, there was not much suffering. The Expansionists wanted to proliferate. They planned on migration instead of pruning. The extra land on new planets would mean people could proliferate. They were clever, or so they hoped. The Earth Beware people feared pruning at the hands of Earth. The Transcendentalists never spoke of pruning or proliferation; they spoke of a bigger change.

Djem asked himself whether future, transcended, god-like beings would have political parties. Probably, he thought, since they would have different preferences and expectations, just like any other thinking entities. In any case, this society's politics were very different from those at home.

Djem, Gammae, and the Minister arrived at exactly the right time. Looking into his strong memory and new learning, Djem saw that they had driven a roundabout route. Even though his arrival looked casual, it wasn't.

The Presidential Mansion was large, formal, and beautiful. Clearly it was designed for ceremonial affairs, like this Presentation and Reception. No one lived in it. The president lived in her own house.

The Presentation was simple and the procedure old. Djem entered a very large and crowded room. He could smell the people. It was pleasant and friendly. His guard, with weapons retracted, stopped and stood by the door. People moved aside to form a walkway down the middle. At the end, the President sat behind a desk. He walked towards her. She got up, walked around in front of the desk, looked at his paper documents, and said "Djem Galt Dorodden, I accept you as Envoy from Earth." They shook hands.

Without doing anything, the President conveyed an impression of competence and friendliness. To Djem, she was very good at her job, at least the public relations part of it. He had expected more fanaticism and more stuffiness. Not at all. He could comfortably have dinner with her or do business with her. 'Well,' he suddenly thought, 'it was likely I will do both. I will have to remember to be careful.'

Then the Reception began. Djem shook hands and said a few words with each member of the government, and then with a huge number more. He was thankful for the food and drink brought around.

When Djem spoke to the head of the Earth Beware group, the man, a human, said, "Hi, Djem. Good to see you. I hear your room was

trashed while you were out, and that the station AI fixed everything. I hate to say it, but I suspect the perpetrators had many of the same opinions we do — that Earth is a closed-in society that will decay and die, but may hurt others in its last spasms."

The man, Gellor Thurnsby, was cheerful and soon introduced Djem to another, older man, the head of the Transcendentalist party. "Gerroej here has already transcended, but he sticks around . . ." As Djem perceived, the man's full name was Gerroej Gernsy. Gellor's introduction inspired sputter, "That is not true! I have not transcended. If it were true, I could do magic tricks; I would make you vanish in a cloud of smoke. Unfortunately, I cannot." Gerroej turned to Djem, "Don't believe a word this fellow says. Why anyone needs to beware of Earth, I don't know. In any case, welcome to Melior!

"As to why I am here . . . I find this world fascinating. Transcendence is wonderful, too; but we are not there yet."

Djem looked around. Even though some addressed him informally, the whole event was expensive. It was in the most expensive location possible, the Presidential Mansion, with people of the highest status.

No one thought in material terms, but in terms of attention, status, and location. Anything material could be built by von Neumann constructors. Djem wondered whether any of the old rulers had thought the same. What about ancient Chinese emperors? Except they would not have possessed machines, but people.

You could not duplicate the location. You could not duplicate the people's or AIs' status, either. You could duplicate the AIs easily and the people over time. It was not the people or machines that counted, but the roles they filled. All that aside, even though another person could have been Envoy as well as he, Djem enjoyed the reception as if it were intended for himself.

Money could purchase services or the rights to services, but it could not buy services that you could not duplicate, like invitations to the Reception. Well, money could purchase an invitation, but it would be expensive. Then Djem changed his mind. 'Maybe not, definitely not,' he said to himself. In a fully networked society, robots would discover uninvited guests, even in very large crowds like this one. They would stop interlopers. So invitations could not be sold. Invitations and other such services would be allocated through an ordinal social structure; that is to say, the more powerful would command the less.

Since there was no trade between Earth and Melior, Earth could not pay, or even promise to pay, Djem's use of scarce resources, his expenses, whether they be for him privately or for him as a diplomat. As in everything else, he depended on the Melian government. They had not said anything yet. Djem expected the amount to depend on how much he cooperated.

Djem's last introduction was to a young woman. Leestel Kemmel had light brown hair and dark eyes, was a little shorter than Djem and slightly thin. Djem decided she was pretty. She looked young, and according to her bio, which came up, was young! Not too young; she was Djem's age. Djem said, "You've never been on Earth, have you?" "No," she said. "I am one of the young people, born here. There are not that many of us, even though the population could multiply several gross without running into resource limits in this system. I am supposed to become your permanent liaison."

Djem did not know it, but Leestel was quite like him in wanting to understand the universe, able to concentrate and persevere well. Unlike him, she also had a knack for understanding others. She had been picked for the job because her superiors wanted a long term spy.

She went on, "Security asked me to report on you. They decided that you would gather that immediately, so they told me its OK to tell you."

Djem blushed discretely and, he hoped, invisibly. As soon as they met, he had asked himself. But he had not expected such a forthright statement. He liked her. He enjoyed being assigned a 'permanent liaison'!

Djem found Gammae with Eltis Akthorn, the President. They both looked younger. Akthorn looked flushed. When he came up, Akthorn turned, laughed, and said, "Please excuse us. We have been reminiscing. At times I think I organize too much and enjoy life too little. Oh, well. These alternatives are not opposites. I do enjoy organizing. But it is fun to remember the irrelevant past, too."

She went on, "I do hope you like being here. Speaking more formally, you on Earth do not dare to destroy us, since we would destroy you in return — a traditional mutually assured destruction stand off. Perhaps you can destroy us through ideas, as the Earth Beware people fear. I doubt that. I think we are more likely to destroy ourselves by a policy misjudgment. You are likely to do the same. I hope you can tell us where we are going wrong, just as we can tell you. Of course, it may not work. We have already, to no avail, told you where you are going wrong; that why we are here."

"We live," she said, "in interesting times. But then everyone who is powerful always thinks that."

"Thank you for talking with Gellor. Security hasn't the foggiest idea how the Earth Beware group learned of the attack on your room, or what he had to do with it. But the talk does tell us that it is a domestic political matter and that you are a pretext, not a target. We have not heard the end of this yet. It increases perceptions of Earth danger. Maybe it is all an Expansionist gambit. It is certainly true that expanding would make us safer. That is for me to mediate and you to report."

Djem was glad he had his new, strong memory. He could recollect. In just a few moments, the President had discussed interstellar war. By implication, she had confirmed the Melians' declaration of independence. She had claimed that the Earth Beware people, normally considered the least powerful political faction, had a crazy notion about the Earth danger. Except the domestic and foreign affairs Minister said they were the reason he was here, so maybe they were not the least powerful. They had attacked his room. The President had suggested that maybe she was going to support the expansionists . . . And she said she hoped he could tell her where they were going wrong.

Madame President was definitely an operator.

In addition, Djem noted that her words focused his attention on the Earth Beware people and on the Expansionists. He had multiple reasons to do so: he did not like his room penetrated; he was a diplomat from Earth and supposed to detect dangers; and he was a diplomat who was going to try to be friendly to his host country. Nonetheless, Djem thought that all this might be designed to distract him from observing the Conservatives, who were, after all, the government in power.

After a few moments of meaningless small talk, Djem said he should go to his embassy. Gammae said she was staying with Eltis Akthorn, but that she would be over the next morning to help Djem with more exercises. Then Leestel, who seemed to materialize next to Djem, said that she would be over for lunch because they had scheduled a tour for that afternoon. She said, "It is essential for us that you be seen, and for you to see." Everyone else nodded. It was not clear what lunch was for. Since he could see no reason against either proposal, lunch or tour, Djem acquiesced. He would need time for himself to think, but not yet.

An embassy vehicle, a limousine, took him and his guard home. It traveled on the surface. The trip was short. Like the embassy itself, the vehicle was built locally. Like Earth cars, its tires moved, but not its wheels. In the pneumatic tires were the rotors; in the wheels were the stators of electric motors. Djem did not know whether the energy itself was stored in a battery or as a chemical that was converted to electricity. Then suddenly he knew.

Djem thought more. Unless Earth could send its own star wisp with its own AI, and be confident it was not subverted, he had to presume that Security learned his every action. As far as he knew, Security could not read his mind remotely. For that, they would have to put him inside a machine. He doubted they would do that. He did not think of what could be done with his built-in radio and computer; but then Melior had not exploited the possibility.

A park surrounded the embassy. The whole city center was a mixture of buildings, cobbled squares, parks, and gardens. Pricing did not succeed. Or else, the grounds were far more costly, in terms of location rather than material goods, than he could imagine.

The building itself was fairly small. It did not quite look like any other official building in the city or like any of the private dwellings. But it did not look bad. Obviously, the computer that designed it had aimed for an 'Earth look.' As Djem came in, several humanoid robots bowed to him. So he knew they were there. Two guard robots stood discretely back, but he saw them too. They looked almost, but not exactly like the one that came in with him. Now he had three. He could tell them apart. There were no humans.

The downstairs was designed for receptions; it had a main hall and several smaller rooms off on the left. The main hall had windows on the front, right, and rear. The upstairs included Djem's private apartment with a bedroom, a living room, a dining room, a toilet, a bathing room, and a miscellaneous room. There was no kitchen, but there were several additional rooms for the robots, at least one of which was used by them. He supposed that if he liked cooking, he would have the apartment rebuilt. It was bigger than any place Djem had lived in before.

Djem's office was on the upper floor as well. In a corner, with windows on two sides, it looked to be designed for meeting people. It had peach colored walls and a darker floor. It felt warm and friendly. In a fashion that Djem welcomed, which however might be an architectural shadow of the past, it also provided him a space to work, a table and a display screen.

That evening Djem composed his second message home. He worked in the office. Djem decided not to express any theory, but simply state whom he had met and what he had heard. However, he did start the body of his report with the President's last remarks. This brought to the fore her warning about interstellar war. He had never thought about it before, but with von Neumann replicators, a military could easily destroy a distant planet secretly — and if the target also had von Neumann replicators, the attacker's planet could be destroyed in turn. Moreover, even though Earth officially did not use von Neumann replicators, presumably it continued to have those that built the Melior star wisp. In any case, it knew how to build them.

Djem asked himself whether he was saving two worlds or whether everyone in power had learned this years and years before. It finally occurred to him that Eltis Akthorn was not so confident of Earth people's sanity that she could forget the matter. She wanted to make sure that in thirty Terran years, senior members of the Earth military and government would hear again.

For politeness, Djem used strong encryption for this message. He explained where he was. But he phrased his introduction to indicate that this communication would be intercepted and decoded. So long as the embassy was built by local machines, there was no way it could not be.

Chapter 6

The next morning, Djem found he had a valet robot. Djem did not think it was an AI — why would an AI want to work in his embassy? Too boring. But the robot was pretty smart.

It suggested that he put on a bathrobe, since Gammae was coming for exercises. It also suggested that he let the house computer choose breakfast. So he did. That was the phrase used by the robot, 'house computer.' Again, Djem did not think it was an AI, but the implication was that house computer was smarter than the valet robot, although neither were sentient. Breakfast was good. Afterward, Djem accessed news — he was isolated and Gammae had suggested a good solution.

He found that his Presentation was a top item, as was his guard robot. Several news reports more or less said that while the Envoy's clothes, guard robot, and embassy all had an unmistakable 'Earth look', probably the design was created on Melior. The news also said he was scheduled to visit the planetary museum that afternoon.

Gammae came with a large bag. Djem led her into one of the smaller rooms downstairs. It had chairs, a table, and enough open space for him to lie down on a soft, thick rug. Gammae said that one of the exercises involved touching and she had objects in the bag. But first, exercises. After lying on the rug, touching his nose, raising his knees, and doing sit ups, he stood up and practiced his 'ballet' exercises — he curled up a leg behind and grabbed a toe with a hand from the opposite side, and twisted left and right, all while balancing on this other foot. It was not hard.

Gammae pulled out a blind fold. Djem sat at the table and put it on. Gammae said, "I want you to feel each object with both hands and tell me what it is. I will put each on the table in front of you." Djem felt a cube, then a ball, then a cylinder. He described each.

Gammae said, "The cylinder is about the same size and shape as the star wisp cylinder you rode from Earth. That cylinder was protected by a ball of solid hydrogen and liquid helium three in a Dewar. The whole was embedded in a huge, artificial magnetosphere. Nonetheless, a good portion of the vehicle's mass was in that cylinder. We call the vehicle a star wisp, although when Forward invented the term, he had a different technology in mind." As if she were still surprised, she said, "Our technology worked." She added, "That's how we all got here. That's how I got here."

Gammae asked Djem to try to recreate each touch memory. That was hard. Then, Gammae took him back to smells. Djem found it easier to concentrate when he couldn't see. Those exercises were not difficult at all.

After the exercises, Gammae said, "I will come back tomorrow morning and the next day. That will be all! You are doing well with your exercises and adaption. That is probably because you are young. Old

people in young bodies: that is hard. Young people in bodies of the same age, but a little better: that is easy."

She continued talking, "We don't have many people like you anymore. In fact, I cannot think of any. The youngest who come from Farhaven are older. Not old in our sense, but middle aged. Almost no one your age travels. Also, no one your age has done enough to be declared a national treasure and duplicated."

"Dying is scary," said Djem. "Yes, it is," Gammae agreed. "Would we see more young people if it were as safe for humans to make backups as for AIs? Young people die forever. You can tell I grew up on Earth a long time ago — when I refer to people I often mean 'human people.' I don't think of AIs. That is very bad of me. But that is what I am like."

Gammae went on, "AIs failure rate is sufficiently low that no one minds. In any case, they back themselves up all the time. Even with a failure, they don't lose more than a day or so. Moreover, it is easy for an AI to wake. Other than learning they have lost a bit of time, they awake ready to go."

"On the other hand, humans need robots or people like me. Humans have to connect to a new body. They need exercises and time to adapt. Unless good robots are created, which I doubt, wakening will always be expensive, since you will need a fairly rare human to attend."

She stopped for a moment and looked grim. "Or, you can do as we did when we came. We woke the first group with not-so-good robots. But that was horrible. I did not like it at all, although I was pleased to discover I was alive. In some fundamental way, I had not expected to live. My more recent awakenings have been much more pleasant. It is not merely the experience, although that helps, it is the human awakeners."

"Oh well," she said. "You are an envoy who sends reports that won't be acknowledged for twice your life so far."

"Speaking of diplomacy," she went on, "as far as I can see, one of Taffod's duplicates will go to Earth. You probably will not have to give him a visa. I bet we will make him a return Envoy. The legislature will be unanimous. The whole opposition will support the motion. That is because everyone wants to hear what this version says. Taffod adventures. Many do not. And he is good at describing them. That is why he is a national treasure. He already has two duplicates. One, Telren, is on Tegmar."

Djem did know, but he had not thought about it. In fact, studying his strong memory, he had met Taffod at the Reception. And he had met a duplicate!

Gammae left and Djem decided to let the computer pick his clothes and his lunch. So far, the computer had done a good job. More to the

point, he did not know much about this place, or at least he did not know whether he knew.

Djem thought further. The language needed changing. Or he needed to change his use of language.

The problem was that information existed in his memory and he did not know it. Or he could access it easily using internal communications. It was not suppressed or hidden information; it was right there if he knew it. In a sense, it was like a public library with books that he had not yet read. No one would say that he himself knew what was in those unread books, although others knew. Similarly, he would not call this information by the word 'knowledge' until it came to mind. The information was readily available once discovered — it was better than being in a library — but discovery was key.

This information about the Envoy to Earth — Djem did not doubt that the government was informing him though Gammae — this information was an example. In addition to enabling him to become accustomed to a notion unofficially, which was why the government would be informing him, Gammae used the topic for another exercise, this time in converting information to knowledge.

Djem learned rapidly. Taffod Dowwen was a national treasure. That was the phrase, 'a national treasure.' The status meant not only that Taffod could die and be reborn at any time, as could anyone else, but that he could be and was duplicated. He could make many copies of himself. That was the unusual right. His duplicates lacked that right. They were like ordinary people.

Each replication meant a new person was born into a new body. That person enjoyed Taffod's memories up to the time he died. But the duplicate, the second or third copy, took a new name. He became a different person. He gained voting rights as another person.

Djem thought that the word 'duplicate' was wrong. Very quickly, a duplicate stopped being the same as the original. 'Clone' was the wrong word, too, since it made one think only of genetic similarity, not of identical memories. The word 'twin' was equally wrong. There were too few duplicates to bring in a shorter word.

AIs could also reduplicate themselves. Indeed, it was simpler for them. But duplication was legally and socially restricted. You could reproduce non-sentient robots or non-human organic biologicals as often as you wished, but not sentients without permission and certainly not yourself. The default presumption was that sentient reproduction was a community affair.

Suddenly Djem realized that a married couple needed a license to have a child. He doubted he agreed with the policy.

Djem kept exploring the information already in his head. Presuming Taffod followed his previous pattern, in five or seven years he would intentionally die. He would take the risk of forever dying, but most

likely be reborn into an excellent body. At the same time, he would provide a replicate who could go to Earth with all his memories, skills, and knowledge. An Envoy born from an earlier self would know about Djem only through information inserted into his data packet. That would not be the same as having lived through it all.

Or maybe the duplicate Djem had met at the reception would go. Why did Tindark exist?

Well, Djem could report rumors that said that Melior would send a return Envoy, perhaps in five or seven years, perhaps sooner. Earth would not be able to say no. In seven years, Djem's message would have traveled less than a quarter of the way back home. The envoy would arrive at Earth one-hundred twenty Terran years after leaving Melior, two-hundred forty or two-hundred fifty years after Djem set out.

As for other information already in his head or easily received, the planetary museum would help. By visiting it, Djem would discover what he should know.

Leestel came for lunch. She was enthusiastic about the museum. "I have not been to it since school. We visited it to bring to mind what we had studied with attention-focusing medicines. Sadly, I don't remember as much as I should. This visit should help me bring to the fore what I already have in my mind — just like you. Except you have been reborn. That kind of learning is much easier. You did not have to spend any conscious time learning."

She did not consider information communicated to her from outside as 'conscious time,' although Djem guessed it contained everything that might be internal and more. Yet people gained information from outside, such as language, or, more correctly Djem thought, 'learning a language.' Presumably, Leestel reflected an atavistic desire to take it all with her, all the time. Then he discovered that in their first life, naturally born humans had no internal computer, memory, or communications. They depended on their organic mind and memory. Leestel did not consider what she did not have.

Leestel spoke more, "If it were safer, I would get a reborn body, just so I could be sure that I had all that information in here." She tapped her head. "It's true, it is mostly irrelevant, nevertheless . . .

"By looking at exhibits," Leestel said, "you will learn what is in your head. Also, a lot of people will want to see you, or rather smell you — that is why personal presence is important. They want to get a sense of you that isn't conveyed by a screen or by one of the reporters. Actually, a sentient with the appropriate sensors could gather the information, including smell, and you could perceive it internally. But no one does that."

"I bet the museum will be crowded. Many will want to talk with you. The robots will let three through their cordon. They will be vetted and safe. Please talk with them in your usual diplomatic way."

"Also," she went on, "personal presence is rivalrous and zero-sum; when one person is there, others cannot be. You can be sure that most of the people at the museum will be oriented towards people and towards zero sum environments. They will think of themselves as gaining status by being near you. I am oriented towards people, too, but expect positive sum situations."

She laughed. "The museum will be good for the people you attract. Many of the founders were more technically oriented than people oriented — by technical, I mean, non-humanly oriented. So there will be that reminder. In addition, the whole Movement tried to create positive sum situations."

In a complete non-sequitur, Leestel then said, "This lunch is good. I have never had anything like this, but it tastes delicious!" For Djem, the meal was strange, too. It was not like eating anything he had on Earth. He did not know what to call the different servings. Presumably, the computer had designed it to have enough of an 'Earth taste' to be strange to Leestel, but enough similarity so she would like it. He did not know, and did not think to discover, that its tastes were merely old. The foods had been copied before the Melians left Earth. As far as Djem was concerned, the food tasted fine. He murmured a few diplomatic phrases.

As expected, the museum was crowded. Djem noted that people looked at the exhibits before they learned he was there, but turned to him shortly. He also looked at the exhibits. The museum was well designed. Besides having exhibits that were attractive in themselves, information kept flowing into his mind.

The first hall showed samples and pictures of the planet before humans came. It was a world with nothing on it other than single-celled bacteria. This reminded him of Ward and Brownlee's ancient hypothesis, that 'Complex Life Is Uncommon in the Universe.' This stellar system provided anecdotal evidence against the hypothesis: not only had it contained one planet with simple life, this one, it had another, Tegmar, with complex life. But Leestel said, "It's true, isn't it, that most stellar systems within a gross of light years of Earth lack life you can see, except maybe for scum?"

Djem responded, "Sad to say, other than to discover out-of-balance atmospheres with telescopes, we have not explored enough." Life pushed atmospheres out of thermal balance. Their detection might be an indicator of some sort of life. But volcanos could also push atmospheres out of balance, so telescopic observations were not enough.

He thought more, "That is a good question: has Melior investigated planets within a few hundred light years? Robots could build big, high resolution telescopes. We could build them around Sol, but the government is against that sort of thing." He paused for a moment as new information flooded his conscious mind.

"Ah . . . " he said, "astronomers from Melior have investigated. They do have the telescopes. Not many want to be astronomers, though. In any case, for nearby Earth-like planets — which means the vast distance of a gross of light years — they have ruled out large, non-natural features in planets humans could settle. The only ones they see are human on Earth and on Farhaven. That means there are no aliens who use technology, at least, none like us. But astronomers' work does not tell us about non-technological life, whether complex or simple, or a planet that is unfriendly to humans." Leestel looked alert. She said, "I did not know about that. Yes, we should investigate more."

The next hall showed the terraforming. The process took quite a while. Djem had not understood how long. It was still going on. During the initial terraforming almost all the humans and AIs stayed dead. A few woke. One did not wake, even after several attempts. For him, death was forever.

Another died of accident. Nello Vergid was reborn again quickly in an already grown, general purpose human body that matched the average with its dark hair and dark eyes; but, like all reborn bodies, it was tall and stalky. Vergid kept on working. Later, the fellow was reborn again, this time in a replicated version of his own body, a little wider and not quite as tall. He kept on with versions of his own body. They looked different than his general purpose body. He was now an Expansionist politician. In fact, Djem remembered, they had met at the Reception.

Humanoid robots maintained the cordon around him. They did not appear to do much. The crowd was good natured. After a few moments, people at the cordon gave up their positions and new people took their places. This surprised Djem. Giving up their positions was giving up their status. Or maybe extended presence did not matter. In any case, it was not what Djem expected.

Except for his own 'Earth style' guard robot, none of the robots looked like guards. Since Djem's own guard robot had withdrawn his protuberances, weapons weren't visible. It all looked peaceful.

A person simply walked around a robot and came up to him smiling. Djem understood that this was the first meeting. The man asked whether it was true that rich people on Earth depended on government-enforced location income? "Was it mostly a rentier economy?" Djem was surprised to hear the word 'rentier', an old French word with the same origin as the word 'rent.' Also, the man asked, "Was it true that Earth had stopped innovating and lived on technologies developed in years past?"

It took a moment for Djem to work out what the fellow was asking. Djem fell back first to saying that technological advance was slow. Then he explained the phrase 'rentier economy': it meant that benefits come from stable laws and the like. Djem pointed out that, "All economies

need the kind of stability that only a government can provide, such as institutions for resolving disputes peacefully." There was no need to point at the bad side of a rentier economy, the monopolies, the social stagnation, the injustice.

Speaking of the good side, successful mediation services that were initially private ended up public and coercive. After all, the world was finite and none could flee. They could only surrender or fight, which meant a successful organization had to be able to overcome them.

"Well," he remembered, "people in the Melior movement fled Earth, but they had a hard time."

Djem acknowledged that more of the rich on Earth focused on receiving income from protected industries than on physical investment. He asked, without mentioning Melior, "Could a society whose physical economy is based on rapidly reproducing von Neumann machines be considered anything but rentier?" The man left with a preoccupied expression on his face.

Djem asked himself whether the question was intended as an attack against Earth? If so, he had responded well.

The final set of halls showed artifacts and pictures of the terraformed Melior and its human and AI presence. They did not show anything about Tegmar, Farhaven, Earth, or the rest of the universe.

In a picture, Djem saw a younger and haggard looking Gammae. Leestel also saw it. "That's Gammae," she said. "She is our age or somewhat older. But she must be in her second life, since she would have died to come from Earth. She looks bad. It must have been rough to wake up without a human. More dangerous in those days, too. Even so, I envy her traveling out into the unknown. We have it easier."

A second person came up to him. This one a woman. She asked whether Earth people expected rivalrous circumstances more often than those in which all could benefit? Djem had no trouble answering that. "Yes," he said, "on Earth, physical needs are rivalrous. It is like all your politics and status striving were extended everywhere."

The last hall focused on wild parts of Melior: mostly mountains, deserts, and polar ice, but also quite pretty hills and prairies. Evidently, on more than half the planet you could not even establish a primitive vacation home. You had to camp. And the rule was 'bring out what you brought in.' Djem thought that the government engaged in rather extreme protectionism, especially since the planet had been terraformed in living memory. Even with a dozen times its current population, even with a gross, there were not enough humans to fill that space. Or AIs. Apparently, many AIs liked such places as much as humans.

The third 'accidental wanderer' asked whether Earth's governments consistently failed to decide how well they judged evidence? By this time, Djem was gaining an appreciation of how his host government spoke unofficially. After pointing out that Earth now had only one

prime government, Djem said that foolish governments no longer existed. They had been overcome by his government, which he thought was smart.

He said nothing about Aristotle's deliberative branch of rhetoric, to persuade others of 'the worthy, the unworthy, the advantageous, or the disadvantageous.' That branch was used on Earth. The Melian style of "determinative" oratory was ignored. That involved making judgments of what might be reality, based on evidence of more or less certainty. Only after that did Melians choose. Then they employed Aristotle. Earth-style deliberations worked fine in a very slowly changing world. Melior-style deliberations were better during changes, although Djem had the impression that Melior did not change quickly either.

Djem came out of the museum fully satisfied. One way or another, he had learned about the planet and the people. More to the point, he had unofficially told his hosts important notions, especially the last. Earth should not be underestimated. Its current government had defeated the others. All in all, he thought, a rather good afternoon.

And he had his 'permanent liaison' at his side. He told Leestel how much he enjoyed the tour. "It was a good idea," he said.

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As they left the museum, Taffod Dowwen met them. He came through the cordon of robots that continued to surround Djem, although there were not any other people. Djem remembered Taffod's face; very likely, according to Gammae, a Taffod duplicate would be the Melior Envoy to Earth. Evidently, Taffod was an adventurer who did not mind sending duplicates off to strange places.

"I am working as a reporter now," he said. "I would like to interview you, so everyone here can come to a better sense of what you are like. Everything you say will be on the record. Let's go to a café ; I am sure you would like something to eat and drink. And we can sit and be private."

Taffod looked at Djem, Leestel and the guard robot — Djem noticed that Taffod included the guard robot as if it were sentient, but not the Melian ministry robots that protected him. Leestel nodded almost imperceptibly and the guard robot spoke by internal communications, saying simply, "The man and the nearest out-door café are both safe."

Djem decided he had nothing to lose; and he would like something to eat. So he agreed.

The three humans sat down at a small table. The guard robot stood a short ways off. He looked to be facing away from them, towards the entrance. The other robots did not stop moving, but became less obvious, even though, Djem could see, they had him well covered.

Besides coffee, the café offered a variety of foods, some of which were familiar. Djem picked a meat and vegetable pie. It was not what he normally ate in the afternoon — normally he did not eat anything, but he was thinking of when he did eat; it was what he wanted.

Taffod started by asking, "What did you do on Earth?" Djem did not answer that. Instead, he said,

"First, Earth has many more people than Melior. A thousand times more; a half great-gross as many. By people, I mean humans. Earth doesn't have any non-human intelligences. At least, there are none on Earth that I know about.

"Second, no one is reborn after dying; everyone dies forever. That is a really big difference. Even the powerful die. At least, I think so. Duplicates are impossible.

"Third, Earth does not use von Neumann machines. I did not even know they existed. People do the work. Physical needs are rivalrous. As I said to one of the people in the museum, think of what society would be like if your striving in politics were extended everywhere?

"We have a saying, 'there is no such thing as a free lunch.' That is not true when machines do the work or when you design actions better. In the Middle Ages, peasants discovered they grew more when they planted farther apart. They grew more food. In the early 1700s, people started building fireplaces with 'throats.' Those fireplaces used a great deal less wood. Again, people could use the difference for a lunch they could not eat before. But on Earth, technological advance has slowed. Machines don't do the work. So the phrase makes sense. There are trade offs.

"As for Melior itself — when I grew up, I knew about it vaguely. I did not know anything about how people got transported here, or even that they got here successfully. All I knew is that a small number of people had left the solar system. Also, I got the impression that a far smaller number were transported than actually were.

"The message from your star wisp was a great shock, at least to me. And I did not learn about it until my superiors decided to send me here. It was not in the public channels at all."

Djem remembered walking to his boss's office on Earth. For him, it was not long ago at all.

His supervisor made sure Djem followed procedures properly. As he walked to the office, Djem's belly felt loose. But he did not dare show any fear. Every move he made was recorded. He was continually monitored; cameras were everywhere. His colleagues would use anything out of normal against him. They would use normal fear, too, if he showed it. Once, Djem thought, the term 'colleague' referred to a person who worked with you rather than against you — but these colleagues were less competent than he at their overt jobs and more competent

at backstabbing. From higher ups, they would get records showing his mistakes.

Djem was scared that in his last assignment he had done something wrong, although he could not figure out what. He had dealt with a famine. He did not have any riots on his record.

Djem explained to Taffod that a badly damaged Earth could not support as many people as it had once, and that fools kept on messing it up. He answered Taffod's initial question.

"On Earth, I was a civil servant. My last assignment was to handle a famine. To feed people, I released food from the stocks. That dealt with the immediate problem, the 'precipitating cause.' " He explained, "I had been taught to look for predisposing, precipitating, and perpetuating causes and then to act appropriately. So I did.

"I could do nothing about the 'predisposing cause,' which had come and gone. That was the application of the wrong technology on the land. The problem had been known for millennia. Over grazed or excessively cultivated land eroded. The solution was obvious. But nobody did anything. The soil that washed away each year was too little for anyone to care. But then, I suspect just because of a random sequence, no other reason, several bad harvests followed each other in a row. The region did not have its old resilience. So famine started.

"I could and did act against the 'perpetuating cause' by teaching people to make dams in the eroding streams. That way, the streams would not erode the soil as much. Well . . . the soil would erode, but it would be caught by the dams. At the same time, I could pay for dam building from the environmental budget. The pay enabled people to buy the food released.

"All in all, it was a good response. That is why I am here. With hope for the future, people settled down."

Taffod asked how he came to learn of his new assignment. Djem did not say that he was worried by the call to his boss's office. Instead, he said, "When I came to the office, my director was all smiles. And there was someone else in the office." Djem remembered noticing that the stranger sat in a very comfortable chair. The man was older. He wore a shirt, trousers, and jacket with finer and denser threads than Djem had ever seen. Obviously he was much superior. Djem never did learn his name or position. He spoke; Djem relayed what he said to Taffod.

"That was a very smart response," Djem quoted him as saying. "I would not have thought to use environmental monies to pay for famine relief. I know myself. I would have shot all the leaders and let the rest starve." It did not occur to Djem that he should not have passed on the words about shooting and starving. He kept on quoting the man, "Now, we would like you to do something much more difficult, but at a much higher level. We would like you to become Earth's Envoy to Melior."

Djem did not repeat the rest of the conversation. He did not say how befuddled he was. "Yes," the senior man had said, "interstellar travel succeeds." Djem did not know that. "The Melians got to where they were going; and they have sent a vehicle back. They have asked for an Envoy. We want to send you.

"From your point of view, the trip will take no time at all, although for us one-hundred twenty years will pass. We won't hear your first report for another thirty years. It will take a smart person to report. We are counting on your good sense and your dedication. You will be on your own."

Djem could only nod dumbly and say, "Yes, sir." At that, the man got up and left. Djem's boss, still smiling, said, "Fortunately, unlike most people on this planet, you do not believe that you have a soul, so you will not fear traveling."

Only then did Djem learn that the Melior star wisp had built a large habitat in the Kuiper belt, that on announcing its presence, it had asked for an Envoy to Melior, and that the Envoy would travel thirty light years the same way the first emigrants had, as a data packet, dead.

After the interview, Djem dropped Leestel off near the executive building and rode on to the embassy with his robot. He felt subdued. He was not sure he liked his memories of Earth.

Djem ate dinner alone — his first dinner alone — and spent the evening writing another report. He knew he would slow down, but for the moment, everything was new. He did not know how much other information his superiors were receiving back on Earth. Perhaps they received none. Or they might not be paying attention to his reports.

Djem suddenly understood that he was thinking of his past superiors as being his present ones, and that they were receiving his reports almost immediately. In fact, the superiors he had known were one-hundred twenty years past, and his reports would not reach Earth for thirty years. He felt that he had been away for just a few days, but it had been a long time.

The next morning Gammae came for his second to last session. He was happy to see her. He did many different exercises, stretching, mentally multiplying, feeling, hearing, and visualizing; he enjoyed them. Near the end, Gammae asked him what he was going to do that afternoon and Djem said he was going on a tour of the city. And the day after he was going to see a farm near the city. As he explained, "These are supposed to bring me up to speed on what this society is like." Gammae nodded sagely, and Djem suddenly said, "But you knew that." Gammae agreed, saying, "Nonetheless, you had to learn the purpose yourself. You become more interested when you see there is a reason."

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That afternoon, Leestel appeared wearing a crimson-yellow blouse and light brown trousers. Djem had not expected that at all. The colors were odd. But the outfit worked. And surprisingly, they or rather they and the clothing texture and the variations — all together went well with his particular light green shirt and dark blue trousers. It did not make sense. But they looked cheerful together. Djem didn't know what to make of it.

First they ate lunch. Leestel explained a little of her professional history. She had worked with people and information from Tegmar and more importantly from Farhaven. "The people from Farhaven are strange," she told Djem. She did not tell him how they were strange or that they were less strange than he.

She went on, explaining that relations involving Tegmar and Farhaven were within the Interior ministry. But then, as she said, until very recently, there had not been a Foreign ministry. It made sense to handle relations in a domestic agency. Both Tegmar and Farhaven were made up of people who came from Melior — or rather, such people were the intelligences with whom she had to deal. There were also the ecological issues, but she did not deal much with them.

Her big issue, the solution of which made her famous, involved a farther planet, Ulterius, nearly a dozen plus three light years away. "The people on Farhaven wanted to settle it alone," she said.

The planet needed terraforming. Since it was cold like Tegmar, it required more carbon dioxide and methane in its atmosphere. Leestel explained, "Even though technically, Ulterius would be a 'terraformed' planet, humans would need to be reborn modified, as on Farhaven. Part of the modifications would have to be genetic, so births could survive. All this is doable."

Indeed, Farhaven could sponsor the work. As Leestel said, "The computers have the information on what to do. With von Neumann replicators, they can terraform the planet and modify the humans." Farhaven's first plan was to permit immigrants only from Farhaven. This upset the Melians. It could have caused trouble for Leestel.

The Farhaven rationale was that they had already learned what it was like to be born into a different body. However, Leestel persuaded them to accept Melior immigrants as well. She marshaled all the various arguments and put them into one communication. Mostly, the arguments involved different ways of saying that Melior immigrants had successfully settled Farhaven. The communication was Leestel's big success.

The whole exchange took nearly nine years, only a small part of which was actually spent discussing the matter. Mostly, the signals crawled from stellar system to stellar system. From Farhaven's point of

view, the exchange took more than twelve years, since they had to send the proposal, wait for Melior to answer, and then respond.

The time bothered Djem. Everything took so long. Leestel's great success occurred years ago when she was new. A back and forth with Ulterius would require two dozen five years. Would she be willing to wait a dozen lifetimes for what should take place in one? He was not sure.

Travel took even longer. Ulterius was farther from Melior than Farhaven, but less than a dozen and three light years. Travel would take five dozen years, terraforming, much longer. As the Minister said to Leestel, "After you have been alive as long as I have, you won't think it as slow as it is."

The rest of the time — 'most of the time,' Djem thought — Leestel explained that her organization dealt with the edges of policies. "Laws and regulations are like numbers and atoms, sharp-edged and logically complete. But the human-sized world is not like that," she said. "We are made of atoms, but the rules for atoms are not the rules for us. We can imagine numbers, but we are not numbers."

"Suppose you kill someone accidentally," she described a situation which Djem did not think as under the preview of an interior department, even if only to gather information. But it was.

"The question is, how negligent were you? Maybe you were not negligent at all and it was a pure accident. Or maybe, as in this case, you should have foreseen that a very heavy person would walk across your ornamental bridge at the same time as a gardening robot, and that two adjacent stones were weak. In that case, you should have ensured that your robots built better.

"Actually, in the case I am thinking of, the bridge builder wanted an airy structure. It was down in a gorge. Wind loading would not be a problem. It did not snow in that region either. The robots did build with a fair safety factor. But two of its rocks were weak and they were next to each other. If either had been separate or if one had been strong, then the bridge would not have collapsed. But they were and it did."

Leestel stopped for a moment. "The bridge was actually quite pretty. I saw pictures made before it collapsed. The proportions were right. The builder had a good sense of beauty. But he should have strengthened it internally. Only he would have known and it would have been that much safer.

"It is like building a tower in a region more likely to have earthquakes. No one would pile rocks on top of each other, like we do here. They would put in additional strengthening.

"Both the gardener and the man fell to their deaths. The gardener was non-sentient; and in any case, it had backed up half a day before. By the next day a reborn entity knew the history and was cultivating

flowers. The man had been living for two dozen years and lost all that private memory when he was reborn.

"Another issue." Leestel said, "was whether we should build a cable route near a wetland. Nobody died in this one. Technically, the cable route could have been built there. The wetland was not a reservation. But should it be? Or should the cable route be built farther away? The advantage of the swamp route was that it gave people a good view of the valley before descending into it. But we picked a different route, slightly longer, with a different view."

Chapter 7

The weather forecast promised no wind gusts. Tindark pulled his airplane out of the barn. He could lift it. While there was some shielding around his body, the air blew directly into his face. It was a one person vehicle.

Tindark took off in the early morning before thermals built. He knew that with his very low wing loading, even the mildest gust or thermal would toss him over the sky. He had done it before and he would do it again, but bumps and turbulence simply were not pleasant.

Tindark flew over hills that slowly grew into mountains. He could see they had been carved mostly by fast flowing streams and rivers.

The Dizloes Mountains did not cover a huge area; at least it did not look like that from the air. Tindark would take days to walk over them. The uplift came from a single volcanic intrusion, not from colliding continents.

Pointed, evergreen trees grew in the colder air at the higher elevations. Lower down, in the depths of the valleys, Tindark saw deciduous trees, with part time, flat leaves, not the thin rods of the evergreens. Although the region was not preserved or restricted, almost no one lived there. People did come frequently to hike; it was not that far from Sharmis City, the capital. There were many trails, kept up by robots, as well as areas with no trails that were known to have little undergrowth. In those areas, you could bushwhack without trouble.

Melior had no humanly bothersome flies or mosquitoes, although insect pollinators and honey producers existed. Tindark was not sure whether, over the many many years that stretched before him, insects would evolve to bother humans. They were, after all, a good source of blood. But at the moment, there were no blood-suckers. Animals were not bothered either. The Melior star wisp had not carried their designs.

On Tegmar, there were blood-suckers. It was a classic instance of convergent evolution. But Telren was never bothered; or at least he never complained and none of his sensory output showed him getting bitten. Maybe he ate something that kept them away.

Humans climbed a particular set of cliffs in the mountains. Indeed, Tindark had climbed them. They were the closest decent climbing cliffs to the city. Many liked them for that reason. He had climbed them shortly after waking. He had expected, with a fair amount of probability, to die. Since he did not have many private memories at that time, death did not matter. In many ways, he continued to be Taffod.

He planned on dying, sending full sensor coverage for his big climb. Before the climb, he had learned a little; he planned to avoid stupid mistakes. But the custom was to climb without a safety rope. Worse, the cliffs were notorious for the strong gusts of wind that often rose around them, gusts that could pluck a climber from the rock. But he

turned out to be better than he expected. And while gusts toyed with him, causing him to freeze against the rock and cling tightly, none pulled him off the mountain.

But the present was different. Tindark had now lived longer and did not want to lose his personal memory. He wanted to be reborn from a data pack that had these new memories. So he took fewer risks. But even so, he preferred adventure. As far as he was concerned, Melior was dull. Telren had it better.

Tindark had wanted to fly since he was small boy on Earth. He wanted to see everything with his own eyes. Finally, he could. He had read about the way rivers flowed at the bottoms of valleys; now he could see them. He saw that trees at higher altitudes were different than those at lower altitudes. Higher up, they were more pointed and evergreen.

Tindark controlled his aircraft with a single side-stick. Rudder pedals were not necessary; he could twist his side-stick as well as tip it. A thumb wheel sat on the tip of the stick — the wheel did not actually move, but it detected his thumb's motion. With it, he could set the propeller speed, faster for take off and climb, slower for decent.

Unlike the mechanical controls on Earth airplanes, the stick served as a rate controller only for turning left and right: the more you turned the stick, the more the rudder moved. Tipping the stick forward a specific amount caused the aircraft to pitch nose down that amount; the pitch did not keep increasing. When you let go of the stick, the aircraft flew straight and level. The computer that mediated between the human inputs and the airframe made sure of that.

Tindark tipped the stick, rolled, and nosed the aircraft up just the right amount for turns. The aircraft computer did not have to do any of that for him.

The aircraft tried to be safe. You could not cause the air to burble over the wing and lose lift. On the other hand, you could descend into the ground too quickly. Actually, the aircraft was not that much different from an airplane designed only three dozen years after the first flight, except for being slower and lighter. Well, maybe it was different: on the Ercoup, pitch control involved rate rather than position, except you could not pitch up much. That earlier airplane required a human to fly it all the time. No computers in those days. Well, Tindark's internal senses told him, there were computers, but they were people!

The computer responded to Tindark's spoken or radioed commands, too. You could say where you wanted to go and by what route. The aircraft would fly you there. But Tindark preferred to pilot himself. He was still highly enthusiastic and loved looking at the ground from above.

After the cliffs, the mountains gave way to hills, and then to gently rolling plains. These extended north and west of the city, to where Taffod had started his long run.

Swamps and lakes collected in the valleys. Tindark supposed that all the lakes would fill in and eventually become swamps and then flat lands. There was a good chance that by living through a string of bodies, he would live long enough.

Before terraforming, surface features had endured more erosion; the single celled life that then existed could not prevent it. Earthly grass and trees did better. It was colder in those days, too; not so cold as to make for a snowball planet, but cold enough that glaciers came and scoured the land. Again, if he lived long enough, he would see the planet's aphelion drift to winter in the major land hemisphere, so they would be just that much colder. The extra cold was not much; it would change the seasons by less than one-twelfth the average. The planet's orbit was nearly circular.

Like Earth in this epoch, on Melior, perihelion occurred in the winter of the major land hemisphere. Axial tilt made for the big seasonal differences, but the moving line of apsides made for a little difference. But with the terraforming, glaciers would stay closer to the poles. Nothing natural would scour these valleys. Tindark wondered where he had learned that. Certainly he would never have read it. But he did not mind knowing it. Meanwhile, he figured that eventually, robots would have to be assigned to deepening the valleys.

Tindark saw the new cable route that wended its way from the city to the mountains. Before it was built, if you traveled on the ground, you went around the southern tip of the mountains — not a bad view of them — on to Hamgus and then returned to the mountains. But now people visited the mountains more than they did originally, which is why robots installed the cable and its towers.

Interestingly, the new cable did not come exactly straight. It curved away from a swampy valley and went across another instead. The route was longer than it had to be, but the new course meant not touching a valley with a rather beautiful swamp and lake.

Tindark especially liked looking on swamps. With the twirls of their algae, small growing plants, and waterlogged trees, they had more character than lakes or forests.

Alternatively and at any time, he could pick up all this, at this resolution, from satellite feeds. But he preferred to look with his own eyes.

Chapter 8

After lunch Djem and Leestel rode the embassy car to the base of a tower. During the drive, Djem looked at the city. He knew that it had too short a history to have developed naturally. Well, it had been around for a fair number of years, but it had not experienced much history during that time.

Also, he knew that the weather was temperate, without exceedingly strong winds or storms, and that the ground was geologically stable. This was an important factor. That is why the city was located where it was: buildings and towers could be built safely from unreinforced blocks of stone. If a building did not fall down in a few minutes, it would never fall down. 'Well, not quite,' Djem said to himself. 'That bridge Leestel talked about stood up until two walked on it. Then it fell down.' He thought more. 'Presumably, in the city, anything that could have extra weight on it already had.' Or perhaps there were just a small number of unexpected accidents.

Robots cut blocks of stone from nearby quarries — different quarries provided different colors and different textures.

Other robots constructed the buildings. Mostly they assembled blocks a third of a meter across. Some stones, especially lintels, were much bigger. The blocks fit together so tightly you could not, as the old saying went, "insert the blade of a knife" between them. No mortar stuck them together. Just gravity.

Curves, protrusions, and indentations meant the blocks fit together in one way and one way only. This rock carving took time, but since robots carved the stone and assembled the buildings, it did not cost the humans or AIs.

Thick wooden beams held up floorboards. The robots cut special trees that were engineered to grow rapidly. No one wanted to wait for a naturally maturing oak. That took too long. The trees for building converted sun light at nearly the same efficiency as plants that produced fuel. They grew fast.

Along with stone and wood for walls and floors, the robots spread infrared reflecting plaster over the interior walls, framed windows and window panes of various sizes, and installed artificial heat and light, water, sewerage, computers, and communications.

The infrared reflecting plaster meant that people felt comfortable even when the air was chilly. In turn, that meant they opened windows more often than otherwise. Buildings never offered artificial cooling; it seldom grew so hot.

The result mixed architectural eras although it presented only one style. At first, to a stranger like Djem, it looked and felt odd. But he grew accustomed more quickly than he expected. In addition, the single style held the city together.

The city could only have been designed and built as it was because Melior was empty of people until after the city was built. No people; no history. No previously built cities.

On Earth, it was not possible. Even though things fell down after a century or two, unless they were well kept up, and even though centuries had passed since the population peak, it was always too expensive and too destructive to replace a whole city segment with a new segment. Reconstructions had to be on a smaller scale, even though the average overall rate of building was higher than the peak on Melior.

As they were driven to a tower, Djem said to Leestel that cars were rare. "It looks to me," he said, "that most people walk or take a cable car."

To his surprise, his guard robot spoke out, "Yes, most do. Since it is predictable that you will leave the embassy by one of only a few passages, we have to protect you. But you could ride in a cable car now since getting on one is too unexpected for an assassination attempt."

Djem looked at Leestel. "Why not?" she said. So Djem directed the car to stop at the next cable car station. The car turned off the road they were following and proceeded down an even smaller road to a major avenue. There, the car promptly came to a station and parked beside it.

Cables ran down the center of the avenue over a linear park with trees and grass. They swung above tall trees.

The cable car system could have run down every street and stopped at every house. But the system followed only the major boulevards. Mostly, people walked.

Djem and Leestel climbed to the station on a spiral stair case; before starting up, Leestel said to the air, "a cable car for three, short local tour, ending up here." She said that any reborn person with radio communications or any robot could call a car; and the bottom of the stairs had microphones. Looking at the guard robot, she asked whether he had relayed her request or the microphones. He said, "Both, as it happened."

By the time they reached the top, a four seat cable car had come into the station; or perhaps it had been waiting all the time. Djem realized he did not know, but he could have watched whether it came. The three got into the small cable car. It hung in the station on its own track and swayed slightly as they entered.

The car released and rolled downhill on a length of metal to the group rail for the station and from there to the moving cable on the main avenue where it clamped on. Two visible and obvious mechanical safety locks prevented them colliding with any other cars already on the station rail or on the moving cable. Wheels traveled along a second, non-moving cable that was there for safety. From a distance you could

not see the cables, except when the sun was right. Then on each side of a tower a pair of cables glowed as a single silvery strand.

Djem said that the basic technology looked like it came from the 19th century. It was easy to understand. Leestel said, "Yes, even children can steer — they just shift the steering bar to the right as we go over the top of a tower. That moves the wheels right. The ride on the non-moving rail is the part that gravity powers. The moving cable propels cars the rest of the time. It brings us up high enough that we can coast downhill at a tower or station.

"Simply by swinging right, you can switch to another route and grab on to a different moving cable. Except that nowadays, machines mostly steer and take each car to its destination."

Djem looked around. The view showed him a low city, with few buildings more than three or four stories high. He could often see over them. The other tall cable towers marked major avenues. He had seen all this before from the embassy limousine, but had not registered the notion.

His internal knowledge explained more. On a few avenues, each tower carried four pairs of cable in two levels. He could not see any cables, but he could see the taller towers. Express cars ran on the upper level. They were pulled along three times as fast as cars on the lower level.

When a computer calculated that it made sense, a car rolled away from a low level cable, grabbed a riser, climbed up above the higher cable, coasted down a length of metal during which it picked up speed, and grabbed on to a moving expressway cable with no jerk at all.

Risers (and descenders) were rare; unless you traveled a distance, you did not travel fast.

The car did not swing down from each tower, picking up speed on its downward traverse and slowing down as it rose; instead, it stayed clamped to its moving cable. Consequently, the car moved steadily at what Djem judged to be a half dozen meters per second.

His internal memory confirmed him: the rate for a slow cable car was approximately half dozen meters per terrestrial second, or more exactly, two meters per tertiant, the base twelve time unit used on Melior. That meant the car traveled two gross meters in a Melian minute.

Djem digressed for a moment: a Melian year turned out to be a little more than zero dot eleven-small of Earth's and were used when the context was Melian rather than interstellar. Light years and interstellar radio signals were always measured in terrestrial years. Most people ignored the difference.

He saw that the three stone towers stood much higher than even the tallest cable tower.

Leestel stopped speaking while Djem looked around. Then she said, "My hunch is that cable cars did not become commonplace in cities in the 19th century because even large cars cannot carry that much weight,

not as much as surface vehicles. Also, in those days, cables were less reliable. That would have meant travelers would be more scared. We do not need a second cable for safety; it is there because of custom."

Djem did not express any of the considerations that came to him, such as the cost of maintenance, which for a period could be reduced or deferred on a surface or underground rail system, but could not be reduced as much for an aerial system. Also, Melior avoided the danger of strikes or of inexpensive attacks, both of which would be likely on Earth in the 19th century. To him, a cable system seemed much more vulnerable than a surface or subsurface rail system.

Djem's internal knowledge was very firm. City dwellers used electric cars and trucks for freight, for emergencies, and for Envoys. Mostly they walked. For longer trips, they used cable cars.

As for the social motivations that prevented the powerful from desiring cars – they were fun to drive, especially when there were too few for traffic jams – anyone, even a child, could order a helicopter or rocket, and consequently, personal vehicles lacked status. The government had never had to invoke the law against numbers of personal vehicles.

Melian cities were not like those on Earth. There toll zones kept out all except those able to afford the toll and those with a funded purpose, jobs like fire prevention, sales, and food delivery.

After a short tour — Djem saw his embassy in the distance, the Presidential Mansion, and various other buildings which he did not recognize on his own and did not bother to learn — they all returned to the same station where they started, descended the steps and got back into their limousine.

The experience led Djem to speak to Leestel about automobiles. He had not been out of the city yet, but he was sure that cars were rare everywhere. "The founders of Melior must have hated cars, by which I mean independently driven surface vehicles. Why was that? Not only are cars fun to drive in uncongested areas — I mean by human drivers, not computers — but they end rural isolation. You can go places in a car. They crowd cities, but no one thought cars were the right form of transport for cities. Did the founders hate suburbs?"

Leestel looked curious. She did not say anything. Djem when on, "Cars enable suburbs, especially when accounting practices fail to measure all the costs. You must have roads to carry heavy materials; housing developers have to pay for roads. At least, I think they do. Some entity has to pay for roads. Certainly, cars did not cost a developer anything — well, here you don't pay anything, but I am thinking of Earth in the century when cars first appeared. On Earth at that time, a development entity would have to pay for all of a rail or cable system, but only for the road part of a car/road system.

"Furthermore, a house in a suburb looked or could be made to look more like the mansion of an estate with private trees and grass. That is

what people liked. They still do. Also, a suburb was safer than a city: in those days, cities suffered pollution and aerial bombing. Governments were inadequate. The first nuclear weapons were 'city busters'; they were not big enough or numerous enough to become 'suburb busters.' Later, they did. Initially, few concerned themselves with radioactive fall out, which would land on suburbs. Cities included different, strange people, too. You could escape when you drove your family, including your children, to a suburb.

"As far as I can see," Djem said, "cars were really attractive."

"We were taught," Leestel said, "that when the prices of finite resources went up, it became incredibly expensive to live in suburbs. They are intrinsically inefficient. And no one enjoyed driving in a traffic jam – apparently, there were many traffic jams. So we designed Melior differently. We do have places for people to drive cars. I am told they are fun.

"Moreover, we have roads built in rural areas with middling population densities. Wheeled surface vehicles are useful. In areas with even lower population densities, helicopters and dirigibles cause less destruction – you don't have to build roads for them. So people fly."

Djem did not think it would be so easy to reduce the number of cars on Earth. Melior had been built freshly on an empty planet — empty as far as humans were concerned. On the other hand, everything on Earth had to be built incrementally. On Earth, the past lived.

Honest accounting, decent government: Earth had lacked these necessities, so it made sense for people to depend on systems like roads for which maintenance could halt for a while, transport systems which strikes would not stop. Cars and roads would be more resilient than trains and railroads or cable cars and towers. Individuals and families would more able to continue when events went badly. Even so, during Earth's Collapse, more than five out of six people died. The planetary system had not been resilient enough.

After the cable car tour, Djem, Leestel and the guard robot rode his car to a tower, his 'surface vehicle' as he thought of it now. Djem decided the effect was that he perceived the city differently than before. He saw its larger structure as somewhat more organic than before; he conceived of it as a starfish whose arms progressed along hills that were more or less parallel, but not all of them, so arms stretched north and south as well as east and west.

As they drove through a square, Djem saw several people sitting in the sun by a wall. He could see the texture in the blocks that made up the wall. This was a much smaller perception than the over all structure, but the effect produced a kind of beauty that he liked.

The wall itself was straight; it stood in front of a circular building with a dome. Djem had not seen a round building before and asked Leestel what it was. For this sort of information, he still did not discover

internal knowledge or connect to a city computer and ask it. Leestel said the building was a temple. "While Melians did not and do not like the social implications of a priest leading a congregation," she said, "as a practical matter a prime speaker and organizer do need to be specialists, if only to know how to act and speak well."

"Otherwise," she grinned, "the members of a congregation must exhibit forbearance. A few do, but most do not. I am sure it is good to forbear occasionally, but not all the time. Only sects in which every member learns its ways can readily let anyone speak. A circular building, with circular seating, is the least bad solution. The prime speaker turns or walks around, so people must look at both his front and his back."

The city possessed three high towers. Djem and Leestel climbed one of them. There was no elevator. Djem and Leestel had to use their muscles. They climbed around and around, with open spaces and windows every floor. Neither puffed, and Leestel ran to each window and looked out. "We are climbing higher and higher!," she said. "The view is magnificent!" Djem could not decide whether he preferred it or not. From his point of view, the climb was to trigger knowledge.

From the top, they looked down. Djem saw a square with its stone cobbles arranged in a remarkable and beautiful pattern. His internal information swam to the fore. Robots had laid the stones in the square. Actually, in geometric terms, the square was a rectangle.

The pattern duplicated a very ancient Turkish carpet. But instead of fitting many gross of threads into a meter, the robots fit only two or three stones into each meter. The colors were different. The square had been created as an experiment. The result was still controversial. Some liked it, some hated it, and some said it missed the whole point of a prayer rug. The patterning was not so hated that it was expunged; but it was not so loved that similar patterns were extended everywhere.

Leestel liked it. She thought every square in the city should emulate a different rug. Djem had too little sense of himself to determine whether time would weary him of such patterns, or overwhelm him, or whether as copies of great art, they would always refresh. He could not predict. He certainly enjoyed there being one such square.

Along with the four major government buildings, one for each branch of government, several cobbled squares, a multitude of parks, and the national museum, the center held a symphony hall, an opera house, and a library.

Djem could see the value of buildings for music, but why a library? He almost asked Leestel, but then came to understand. People went there because they could make unexpected connections when they studied physically printed books. And they could get help from the librarians.

The sociological reports became a part of his conscious mind: when searching and reading electronically, people tended to tread unconscious paths. They followed habits. The library prevented that by being a sufficiently different environment. Djem presumed that patrons who become accustomed to libraries got into dull habits, too. But Melians mostly used their internal tools, so entering a library was unusual. And the librarians were more of a help than Djem knew.

Djem did not see any art galleries and playhouses in the city center. That surprised him. He mentioned this to Leestel and after descending the tower, she directed the car to another part of the city.

"You don't want too many people to come to the center," she said, "it becomes too crowded. Also, you want people to have pride in the place they live. Each community has a different attraction. There are about a dozen of them. You will like about half them." She paused, "Or, at least, you would if you were a typical Melian. We are going to a neighborhood that focuses on art."

When they got there, Djem found that it had an art museum and numerous galleries. The art galleries were not for selling paintings and sculptures, although a good many were shown. They were institutions for providing patronage. Leestel took the system for granted.

Customers — they were not really customers, they could duplicate what ever they wanted — supported artists they liked by transferring scarce resources. It was a voluntary gift scheme.

To Djem, the mechanism was dreadfully open to free riding. It could be a disaster. No one person needed give. Indeed, it was in an individual's interest not to give. He who did not give would have more. The society could easily suffer a tragedy of the commons. In such a tragedy, each person grazed the equivalent of too many cows on a common pasture. Each extra cow was a personal benefit to its owner, but the commons degradation was not a personal loss.

Similarly, the society benefited from art, but each individual could refuse to support it. Fortunately, that never happened. Enough people gave what to them were mostly small gifts. They supported the artists and everything surrounding them, including the galleries and their attendants.

The galleries and gallery attendants were not truly necessary either, but people liked to see collections physically and to judge them. So there they were.

Djem decided to copy various paintings, sculptures, and wall hangings for his embassy. He has not planned on a 'home furnishing' afternoon, but it was! Djem enjoyed the discovery. He did not like shopping for home furnishings at all, and he only visited art museums occasionally, but this trip he liked; and he got home furnishings, too.

Leestel took him to the art museum. It was in the middle of a grassy park. Before they went in, Djem enjoyed rubbing his hand over

the rough texture of the bark of an old beech tree. He said to Leestel, "I never expected to see one here." She was confused. "It is far less than a gross of years old." Djem shrugged and Leestel turned to the building. "It is not too big," she said of the museum, "I like it most of all."

The museum held copies of both Earth and Melian art. After passing several paintings, Djem said to Leestel, "I have seen the originals on Earth, but they seem more vivid now than they were then." Leestel responded, "That is because of your reborn body. It is better than your first body. My genome was enhanced, too, but I am told that all this will look even better after I am reborn." She went on, "However, the key, or one key, still is to see the world as the artist saw it . . ."

In the museum, paintings held pride of place, but it contained sculptures, chairs, tables, and tea cups, too. Some of the Earth art was recorded and duplicated atom by atom. Or almost. An atom by atom copy had been made. Nonetheless, to save on the amount of information carried from Earth, none of the records specified which isotope filled each atom's position. Instead, the data compression algorithms recorded molecules or parts of molecules once only and then defined each instance by position and orientation. Subtle transforms provided safety and security. But even with the changes, there was no way with ordinary human senses or with high resolution mechanical senses to tell the difference between this kind of copy and an original. A person could see depth in the oils of paintings. Only a record of provenance would tell which was the original and which was the copy.

Other works were simply high resolution, three-dimensional replicas. An unprofessional human eye could not distinguish those, either, but in some way that Djem did not bother to find out, a professional could. Djem thought the distinction had to do with the perception of depth. The copies showed depth from different angles, but not exactly the way an original or molecular duplicate would.

Clearly, the nano-technological copiers had been permitted only in some places. Since Djem had never heard of them on Earth, he was surprised they had existed there at all. But then, he had not known about AIs and other von Neumann replicators either.

Djem mentioned this to Leestel. She said, "Fortunately or unfortunately, everything on Earth has slowed down since we left. That means it does not matter much that we have not received new paintings or new sculptures, although it would not cost you anything to send them to us."

She sighed, "Nevertheless, your population is so much bigger than ours, even with poverty and suppression, people produce a huge amount of really good work. Your military should favor the action. I don't think we would get subverted by paintings, but ideas, novels, which Earth could insist we receive, might do the job."

Leestel went on, "The Earth Beware party does have a point, or they would have if Earth did anything for us to beware of. But all we have are reports back sent by radio and on your star wisp — and your star wisp was not loaded, not like the first one that came here. It is a pity."

From Earth art, much of it very old, they went to Melian art. That was newer. Even though he was not Melian, Djem often found it easier to understand. Like the Earth art, it had both a 'this is the moment' and a 'this is for eternity' quality. Or at least that is how Djem judged it. He could not decide whether it really was as good as the best from Earth, or whether he was seduced by being here. In any case, he liked it.

At first, he could not determine whether a modern artist was human or AI. Names did not tell. But then he asked the building's computer, who did know and would tell him. That is how he found out. There was not much AI art, but the AIs were not a big part of the population either. Some of their works were beautiful and looked human; others were also beautiful, but did not look human. Even landscapes, which he thought had to be more or less the same given modern styles of painting, had slightly different proportions and slightly different colors. It was very puzzling. Regardless, he liked these works.

The museum computer said that some of the AI paintings were designed both to look good to humans, with their limited sensorium, and also to look good to AIs with a wider sensorium. Humans could see less than an octave of the electromagnetic spectrum. All their colors came from that range. With the appropriate sensors, AIs could see much more. The museum provided modules to those AIs who lacked them, and, of course, to humans in inorganic substrates as well. But there were so few, no one thought of them.

On the way back to the embassy, Djem concluded — from another sociological study in his mind — that civil servants worked hard to keep different parts of the city alive. Through temptation rather than prohibition, they prevented people from becoming too self-involved and isolated.

The technology encouraged isolation and self-involvement. With robots and good communications, there might be no reason ever to leave home, at least not for people who lacked human orientation. He discussed this with Leestel. She agreed. "Just about everything you do, you could do from home. Your internal communications are excellent. Images of people, of other things, can cancel out what you are looking at. The computer can trigger neurons for smell or balance. Since I have not been reborn yet, I lack an added internal computer and communications. But they are easy enough to insert.

"It is actually quite scary what an evil entity could do. That is why the Earth Beware people have such a following." Djem noticed

that Earth Beware was mentioned again. It was not as irrelevant as its political representation suggested.

Leestel continued speaking, "No one expects Melians to go bad, but there are no bets about Earthmen. After all, the vast majority could be decent — and as far as older people remember were decent. But it only takes one bad egg to spoil an omelet.

"Hmm . . ." she digressed, "that phrase 'one bad egg to spoil the omelet' . . . it must come from an ancient time when you could not test eggs easily and you occasionally got bad ones. I have not the foggiest idea what makes a bad egg. But I use the phrase and know what it means.

"In any case, the fear is not of Earth, but of a few entities from Earth. Too many of the old people have bad memories. Worse, from your point of view," Djem had forgot that Leestel continued to think of him as foreign, "they are going to live for a long time. We don't need a culture that preserves memories past death, like some of those on earth; people here will keep on living and remembering."

She looked somber. Djem could not think of any reply. He changed his attention and looked at a public calendar. With all its events and festivals, Djem saw that, indeed, a good part of municipal government was dedicated to organizing events to pull people out of themselves and bring them into a wider community.

That is what had started Leestel. The technology that enabled people to communicate readily, a good thing, Djem thought, also enabled people to stay at home. It also enabled "evil entities," to use Leestel's phrase, to do bad. He wondered whether Melior could keep its good life.

They returned the rest of the way to the embassy in silence.

Chapter 9

The next morning, Djem finished his exercises with Gammae happily. It was his last session. Gammae said he did well, that it was a pleasure to work with a young person. "Old people," she said, "tend to presume they know everything. That means they are more impatient with mistakes they make and want to go out into the world quicker. You have been a good patient."

Djem did not disagree, although he felt that he had been so confused by Melior there was no way he could presume to know more; and he was good at taking orders.

After lunch, he and Leestel visited a local farm. Leestel wore less flamboyant clothing than the day before: this time she wore boots, dark brown trousers, and a lighter brown blouse. He wore boots, too; that is what his robot valet had given him. Leestel approved. "We can walk through mud," she said.

They went to only one farm. It was not really outside the city: farmland and cityscape were interwoven, like fingers and the spaces between them. The center and a half dozen or so communities around it were like the palm of a hand, solid flesh, or in this case, all city. But beyond were another half dozen city communities, with farms in between. The city followed hills, the farms valleys.

Like buildings in the city, robots had built the farmhouse, barn, and other buildings from stone and wood. However, unlike city houses, the farmhouse was only one story high. It spread, but did not rise. The barn was to the right and behind the house. It was rectangular, a short side faced them, and it did rise. On the long side away from the house, an earth ramp gently sloped up to a door on the upper floor. Even though robots could easily sling or carry up whatever was necessary, the building was designed with effort a criterion. Robots (and people) could easily drive up the ramp.

A human farmer welcomed them.

Djem found he could readily link the fellow's face with a name, Filgard Meldon. The man did not clutter time with irrelevant utterances. He acted as a man who knew that his presence and his statements were enough. He said, "We have three different purposes. One is to grow food. That is our excuse for being."

"Most of the work is done by robots, but they break down or get stuck. I solve those challenges. Nothing that goes wrong is obvious. All those problems have been foreseen and are prevented. Well, I shouldn't quite say that. Fences break and animals get out. We could build better fences, but they would not look as pretty. The animals do not get out very often.

"Which brings me to the second purpose: we are a park for city people. They come to enjoy being here. We are a different kind of park than those in the city, but nonetheless, that is what we are.

"And thirdly, we are an educational site. Mostly, school kids come by. They have studied, but they have not seen a farm. The goal is to link their theory with practice. Fortunately, here on Melior, almost no tacit learning is involved. Children's theoretical learning is fairly complete. The kids don't need to spend much time in practice.

"It was not like that on Earth when I grew up! Then there was book learning and there was the real world. The two were far apart. A great advantage of the first AI is that he not only had to be taught everything like a human child, he also remembered. When book-learning did not fit the world, he told you."

Djem also considered social honesty or dishonesty. If part of a society's knowledge were tacit or unspoken, then it did not have to be acknowledged officially. Evidently, that was not an issue on Melior.

Filgard spoke again, "I suppose you will be like a child who has not seen a Melian farm. But you will know, or learn that you know, just about everything.

"We grow many different plants here. And we grow livestock. In a way, we are like an old fashioned organic garden with different and complementary plants." He looked at Djem with a grin, "Unlike this young woman here, but like me, you will know what I mean from first hand observation."

He went on, "But with the robots, we can be bigger. We don't have the management problems that big farms do on Earth. As a practical matter, only dedicated and caring people will cultivate a truly organic garden. You cannot hire humans to do that, not in large numbers. But robots will. On our farm, the plants, the manure, and the composting all mean that we do not damage the soil at all. Our soil is deepening.

"It is remarkable. Not so long ago this was nothing more than a barren wasteland. Only a few single celled microbes lived here. Those bacteria were not Earth-like at all, although they did have similarities to those on Tegmar."

Filgard went on. He never became aware of his subject change or did not show it. "Many think life came from Tegmar initially. Everyone knows that bacteria can survive a meteorite impact on Tegmar and be thrown here. The opposite can happen, too. The question is where life started.

"(I won't go so far as to say Arrhenius was wrong," Filgard said parenthetically, "after all, a portion of his spores will survive interstellar travel, even with cosmic rays and such. But he did not explain our situation on Melior.)

"I think our kind of bacterial life started here and was thrown to Tegmar, where it evolved into complex life. The sun was cooler at the beginning and Melior was warmer than Tegmar."

He went on, enthused by this topic. "That presumes you follow the 'warm puddle' model, that life began in the surfaces of oceans, sometime

during the vast periods of time during which continents could clash and separate, creating and dissolving mountains. On the other hand, if you follow the 'hot springs' model, then anywhere with sufficient internal heat will do. The 'warm puddle' model favors Melior, since it has always been closer to the sun. The 'hot springs' model fits both. And since Tegmar has more complex life, people tend to favor it. I needn't remind you that in practice, stones would have gone back and forth. That is what confuses the detective work."

He smiled, "There are enough geological eons in this system's history to permit a great deal of happenstance."

Leestel remembered that microbes had been found on cold planets. "Doesn't that argue for the 'hot springs' model, where 'hot' might be a mixture of ammonia and water that we think of as cold?"

The farmer smiled genially, "That is a different kind of life than we had here or have on Tegmar. There is no doubt that volcanism can lead to bacterial life. Planetary heat or particular minerals can provide the necessary energy. In some cases all you need is a solvent and some minerals. But what happened here? Because of the sun, we had an energy flux. We had volcanos, too. We had water and minerals. We also had the huge numbers of thermally jiggled molecules and we had the long, long stretches of time."

Djem had a question, "Are you upset that this planet was terraformed? It meant killing off the previous life."

"No," said the farmer. "I don't hold much for bacteria. Now, Tegmar is a different matter. It has complex life on it, grass, trees, animals; I love it. Our preservation policy there is good. But planets like Tegmar or Farhaven are rare. Most planets are sterile or have simple life. As far as I am concerned, they don't matter."

They were walking down a path between gardens. It did not look like Djem's image of an agricultural field. The robots had six wheels on fairly long, bent rods. They looked similar to early planetary rovers — similar to modern planetary rovers, for that matter. On each side, the wheels could run in line. Baskets hung from their bodies. Visible sensors stood up on stalks, looking every which way, and a dozen or so arms of various lengths and types cultivated and picked.

The robots rolled down a strip. They not only weeded and picked what was below them, but on either side, too. With decent recognition, the farm could grow a vast number of different kinds of plant on the same plot. The robots would not confuse weeds with vegetables. They could harvest vegetables and other food at different times. Indeed, they could cultivate each plant individually.

Even with cheap labor, there was no way you could do this on Earth. Not on this large a scale. Djem thought about that. Even the poorest humans were not that cheap, not when you considered energy inputs. Humans ate food; these robots got their energy from solar electric gen-

erators. Solar energy was diffuse, but designed collectors were dramatically more efficient than natural collectors.

Humans ate plants or ate animals that ate plants. From an energy point of view, humans were intrinsically inefficient.

After they walked farther, Djem saw robots coating the sides of a wide and shallow hole with clay. He was puzzled. What was it? Filgard said the clay served as a bond. It prevented the pond from leaking. School kids had suggested another pond for the ducks and geese farther away from the house. The ducks and geese made a mess, but it was nice to have them. Hence, this pond.

Filgard pushed a stone. One of several. He said that the places planned for them were not quite right. "People are going to sit on them and watch the ducks," he said. "We have to get their locations right. So we must move several." Robots could do the job and probably would do most of it. But Filgard saw no reason not to move some of them himself.

Djem and Leestel pushed rocks, too. At one point, Djem tried to move a big rock and couldn't. So he asked his guard robot, Sidgerd Gumtak, to give him an arm.

Sidgerd gave him an arm, literally; he disconnected it from his body and with the other hand passed it on. Djem was surprised. The robot said, "This is a joke."

Filgard looked at the robot and then asked, "Were you programmed by Airlent Irtak?"

Djem puzzled at that "How did you know?" he asked.

Filgard said, "Airlent and I go back a long time."

Djem looked around at Filgard's farm robots. "Were these programmed by Airlent, too?"

"Good grief, no," said Filgard, "much of their programming comes from before his creation."

Filgard stopped pushing and his rock stopped moving. He said, "Aristotle was right. When you stop pushing a rock, the rock stops." This was not what Djem thought when he stopped pushing, but he had to agree, Filgard was right.

The farmer kept talking, "Newton came along more than a great-gross of years later and distinguished between inherent idleness and the retardation you get from rubbing — he extended the notions as metaphors or maybe he used existing metaphors and made them famous. He called the two concepts inertia and friction. So rocks without friction, like this planet, kept moving; and rocks with friction, like this one here," he patted the rock, "stop."

"Aristotle had confounded the two ideas." Filgard looked at Djem, "Aristotle probably had slaves to push the rocks. They would stop whenever they could. They would act dumb and pretend to worry

too much. By acting stupid, they could hurt their kidnapper without endangering themselves.

"Humph! Acting stupid enabled a slave to be more idle than he would be otherwise. I bet idleness is the part of it that Aristotle noticed. He thought that idleness was a natural state of being. But Newton pointed out that rocks on a planet suffer retardation because they rub against the soil."

Filgard kept following his train of thought. "Newton came to distinguish inertia and friction. Newton's Laws are wrong; we know that. Still, his notions are good enough for much interplanetary work. Most of the time, you do not have to employ Einstein's ideas. And Aristotle's Laws, which I doubt anyone thinks of, work fine for pushing stones."

Filgard stopped for a moment. "There is much more to it than that," he said. "Newton was articulating a paradigm shift. There were lots of little shifts, but I think he explicated the first big shift since the transition from the pre-agricultural era to pre-industrial agriculture." He stopped for a moment. "In our culture, I think Aristotle explicated the previous paradigm shift, or Plato and Aristotle did, the one idealistic and the other not. I am sure that other agricultural cultures had their own men articulate appropriate paradigms."

Filgard looked grim. "Over time, a Newtonian shift destroys people's ability to believe their culture's purposes, the beliefs that succeeded in pre-industrial, agricultural times. On the other hand, without a Newtonian shift, you become an old-fashioned colony, you lose wars to imperialists who have made the shift and gained use of the new technology."

"What are the characteristics of this paradigm?" Leestel asked.

Filgard explained, "Newton put an emphasis on non-living things, like planets as dots in space. Because his equations could, in theory, be calculated exactly, the paradigm favored determinism."

He looked at Djem as well as Leestel. "It had definite theological implications. It affected how people interpreted their numinous experiences.

"Besides deterministic Calvinism, which preceded Newton by a very long time, his Laws articulated a change in his culture's relationship with its God: omnipotence got limited. The mathematical correlation with reality made God as subject to natural law as humans are to kingly or legislative law.

"No one thought this way at the time, but I have to imagine the west European concept of God as a great artificial intelligence. He runs a simulation in which we are a part. When you don't consider Newton, a computer can reprogram the world heedlessly. When you do bear him in mind, a break in the simulation's 'consistency rules' makes for a miracle."

The farmer smiled. "Incidently, there is no way we can show whether we are or are not living in a simulation: Planck's length, which is really small, does appear to be a characteristic of our universe; that means it is digital, but at a very high resolution. And Heisenberg's Uncertainty Principle means we cannot measure as precisely as Newton's analogue universe suggests!"

Filgard surveyed the pond and the land around it. "The rocks should go here." He pointed to three spots. Djem's stone was not far from his spot at all. Leestel's was farthest. After pushing his rock to his spot, Djem helped Leestel. He noticed he was sweating some and breathing heavily, but not painfully. He could not have done this on Earth.

"Returning to Newton . . ." Filgard was obviously intent on continuing, "without records, you can't determine what happens to apples, planets, and the like — his rules for gravity; the direct consequences are invisible. This is not like Aristotle. You can see that a rock on the ground stops moving when you stop pushing it. And if you drop a rock you hold up, it will seek the center of the Earth ('seek' is Aristotle's word); and if your toe is in the way, oops! For Newton, you have to observe and record the skies. You cannot simply see.

"Many years after him, other invisibilities became important, like fast non-living machines that could be understood only when stopped or running slow. When slowed, and with the right mind-set, you could see how they worked. Direct human observation succeeds some of the time. But at other times you can only imagine. You need to pretend that invisible electric currents flow in certain solids. You can see water flow in a hollow pipe, but not electricity in a wire.

"I wonder," he said, "if the acceptance of spectacles — they were a sight correction device that people wore, like the modern day internal computer or radio in the reborn." He did not finish his sentence. "In the latter Middle Ages, it took generations for eye glasses to become acceptable; and telescopes and microscopes weren't invented for two gross of years." Finally, he asked, "Did that acceptance do more than enable older artisans to see their work as well feel it? Did it show that the invisible or hard to see could become visible?"

Filgard paused momentarily. "The paradigm following Newton, the one we enjoy now, required the ending of certainty — not merely the ending of practical certainty, which Newton's followers always accepted, but the ending of theoretical certainty, the ending of determinism.

"In a sense," Filgard said, "insurance deals with uncertainty. Hah! Insurance was sold long before Newton! But the implications weren't felt for the longest time. I think Darwin was among the first; at least, among the first to articulate the feelings well.

"In the 19th century, Darwin noted that the individuals of a biological species were different from one another. Others had seen this for many greats of years, but they had not followed through. (Indeed, as

Darwin himself wrote, he was not the first; but he was the first to publicize the issue well and at the right time.) Darwin applied probability to living populations and discovered his Four Laws of Evolution."

He started them walking. "Time to go back to the farm house," said Filgard. They took a different route, this time past cows fenced in a large field. To Djem, the fence looked strong enough. It consisted of spit tree trunks laid criss-cross. "The cows do not intend to break through this fence, but sometimes they run for no good reason at all and accidentally break it. Then they get out. When that happens, we have to chase them and herd them back. Fortunately, the robots fell the trees and split the wood. It is hard work for humans." Several cows recognized the farmer and came up to him. He patted their noses; so did Leestel, and with a bit of trepidation, Djem. Filgard then give each a carrot he took out of a pocket. "They are like horses, but more stupid," he said.

"Returning to the modern paradigm," Filgard said, "in that same 19th century, once the concept of atoms became an acceptable idea, all atoms of the same mass and species were perceived as identical except for position and velocity. Probabilities were applied to those parts that differed, which led to the discovery of thermodynamics."

Djem felt dizzy. He had not expected to hear this at a farm. He decided that his paradigm was Newtonian, with a touch of post-Newtonian, insurance-style thinking.

Filgard spoke more. "You need manufacturing replicators to save the planet. You have to think in terms of errors and error-correcting codes for them. That means probabilistic thinking. I don't think replicators can be constructed without sufficient people living within a post-Newtonian paradigm. And without such a shift, you lose the planet. Or else you lose many people, as Earth did. Obviously, it had some people living within the paradigm, but they lacked enough political power.

"Agricultural and industrial paradigms reward rich countries with many people and you must reduce the number of people. One way or another, the system becomes sustainable. Replicators provide the only way to do this more or less comfortably.

"But replicators make every adventurer bored, that is to say, easy communications and robots make everyone into old fashioned aristocrats, and only some people, like me, find interesting new lives. To avoid boredom, adventurers need to go to strange places; they need expansion — and you can only expand for a finite time. I don't know what can be done in the long run."

Djem asked himself whether any of this was true or relevant. He liked being an 'aristocrat', as Filgard put it. The advantage of replicators was that more people could enjoy material wealth. That was fine. And since replicators did not reward governments with huge human populations, you could get by with smaller numbers of people. That was good, too.

Filgard interrupted Djem's thoughts. "We often think of degrees of uncertainty. Unfortunately, such uncertainty does not fit regular human thinking, which tends to be more black and white. These degrees provide ways of talking about evidence. They are incredibly useful. But, they are not mainstream, at least, they weren't when I left Earth."

He cocked his head and at looked at Djem, who said, "They weren't in my time, either."

Filgard spoke again, more to himself than the others. "Is the notion of feedback essential, too?" He pondered.

Djem plunged in. "A rat is not a billiard ball. A billiard ball goes where you hit it. A rat will seldom cooperate with you." He smiled. Leestel imagined that he had worked with rats in school and found them difficult.

Filgard looked up. "That's right! To be able to think in terms of living beings — that is what the notion of feedback makes possible. Engineers had used cybernetics long before it was properly discussed. The speed control that Watt invented for his steam engine is an example, as is the thermostat. But the notion did not go anywhere. You had to be a genius to apply it.

"Feedback is not probability. I don't think you need feedback to understand quantum mechanics. On the other hand, you do need it to understand Darwin's laws of evolution — without understanding feedback, you cannot understand selection. I guess the notion is essential.

"Anyhow, my point is," this time, Filgard came to a conclusion, "we are living in a world with yet a different paradigm from Aristotle or Newton."

Djem concluded Filgard was the oddest farmer he had ever met.

As they passed, Filgard plucked several string beans from a vine and handed them about. "These are good raw," he said popping a bean into his mouth. "If our civilization ever collapses here, our descendants are going to have a tough time. We really did come from elsewhere. Worse, the entity that selected and modified everything around us was coherent and single. He was not slow acting.

"On Earth, I helped smuggle him at one point." He changed his face to look like a more innocent and foolish fellow. "I almost pretended to be a dumb farmer," he said. "At the first check point, I nearly claimed to be someone else. But I remembered in time that I was traveling as myself, taking the two good looking pigs — I knew they were good looking; others might not; they were smelly — for a private sale. Actually, it was easier being myself than trying to pretend to be someone else. I am not very good at being other than me.

"After my wife died, I got into gardening, then Eltis asked me to raise pigs and learn to be a farmer. So I knew these were good pigs. And a private sale was legal. But the police could not figure out exactly what I was doing. So at each checkpoint — there were more than I expected

— they investigated thoroughly . . . They concluded that I was doing what I said I was doing. They probably also thought I was giving the pigs away or avoiding tax or something like that . . . but they could not figure out what and did not care." He paused and smiled. "They never looked for the computer, which was about the size of a thimble. Every other AI is a duplicate of that computer or a duplicate of a duplicate.

"Like the rest of us, the AI changed into a much smaller data packet for transport here. But he was much more vital than me. I did not duplicate before dying, but he replicated four times, or he duplicated before the trip and replicated twice; I cannot remember which. I think at first he wanted to stay awake the whole time, but slowed down. Then he realized that if he stayed awake, his size would as large as a thimble. That is big by interstellar space ship standards. Assuming he compressed, the space ship would need a non-conscious, fast running computer to speed him up if anything went wrong. So, to save volume and mass, he got reduced like the rest of us. The intent was that at least one replicate come through. Three did. The fourth got hit by a fast moving cosmic ray. That destroyed it. (To save space, we did not encode the data with the full redundancy we could have. I suppose we could have encoded critical data properly, but we never did. We just replicated copies.)

"A bunch of humans got hit by the same nucleus. If it were not that one was a friend of mine, I would say that is the luck of the draw. But he was a friend and I am still bothered that the nucleus hit him specifically.

"Well," he looked and smiled again, but this time less happily, "neither of you knew him, so you are just hearing the bleating of a stranger. Besides, a backup data packet of him came with you. He will get reborn. It is just that his rebirth will be much later than he expected. That is why he has not been reborn yet; only the very best helpers are going to work with him, people like Gammae."

From the house they went to Djem's embassy car. Filgard looked at it and said, "You will have a nicer view if you ride on a cable car. You can do that next time. You can walk from the stop down to here. Looking around never ceases to amaze me; and it has been a long time."

Leestel, Djem, and Djem's guard robot entered the car. It drove them back to the center of the city. Djem toyed with his internal communications. He could see the car and the farm at various resolutions. He did not have to ride the cable.

Still, he was pleased when Leestel interrupted him. Obviously, she had been thinking, but, as it turned out, not about Newton and Aristotle.

"In the museum," she said, "you told one of the people that on Earth everything involves striving. What you really meant, I think, is that everything involves zero-sum conflict. For every winner, there is a

loser. Is that right?" Djem nodded and Leestel continued, "On Melior, we have inescapable conflicts, such as politics and status, but you talked about that kind of fighting extended everywhere on Earth."

Djem agreed. It did extend everywhere. "On Earth, with its limited physical resources, you have to fight. The lack comes from environmental degradation, insufficient technology, and confinement to one planet. We have space travel and all that, but resources do not come from off planet."

Leestel puzzled her way to speaking. She was saddened by the death of Filgard's friend. The story triggered new thoughts. "That means that the poor, the famine victims you talked about with Taffod, will be seen by the rich and powerful on Earth as competitors for the same resources. That man who came to your boss's office — clearly, he was highly superior. Wouldn't he perceive the victims as possible enemies rather than as those who could save those resources? Given that, it makes sense that he talked about shooting their leaders and starving the rest. Regardless of his conscious feelings, wouldn't he conceive himself as better off when they are worse off?

"To go to the point," she went on, remorselessly, "in so far as you don't use available technology, isn't he right? Indeed, with whatever technology you use, there are only so many people who can be supported on a single planet.

"Pessimism, the cost of raising children, alternatives — these all lead to drops in fertility. On Melior, we have the high cost of raising children and women enjoy careers; but we do not have the pessimism. Nonetheless, we have a very low fertility rate.

"I have heard some Earth Beware people talk about a danger that I thought distant: that Melior would cut back on expansion, stick to one stellar system, and over a long time, build up its human population so that physical resources do become an issue. Even with our low fertility rate, our population grows. Our forever death rate is very low. As for issues, in the future, on a wilderness trip, will you see another sentient? Will homes spread farther way from the city center? Other kinds of physical limitations could occur, too, I just don't think of them.

"In a sense, I suppose it is good that we newborns are so rare and that we are expensive to bring up. We are not an early source of income. Connections are made for pleasure rather than for economics. There are many alternatives to bringing up children. And maybe our genome has been slightly altered so we don't want children as much . . ."

Chapter 10

Back in the embassy that evening, Djem decided to decrypt Gammae's essay on her leaving Earth. He had not wanted to do that before the last lesson, in case he found more than he wished. He asked himself why she had mentioned it. Perhaps, he thought cynically, she was trying to persuade him to change sides.

Gammae's essay took only a few moments to find. Djem looked for the backup, which he did not expect to be as well protected as the original. He was wrong about that, but it did not matter. The essay was encrypted and in a private section. Djem suspected that if he were not in an embassy, his actions would get him into trouble. But he was in an embassy and he was supposed to be a spy. He had the equipment. He had a little civil service training, which sufficed. Mostly, he let the computer do the work. He could never have been a real spy. Gammae had, as it were, directed him to the essay and given him permission. Decrypting was not all that hard for the computer.

The essay did not say much. At first Djem thought it could not be an effort to subvert him. Then he noticed the phrase that his government could at any time "end material poverty." The notion caught Djem's attention.

The notion had to be true.

To build a star wisp required first building a von Neumann replicator. It and its descendants consumed a planetoid, maybe more than one. While a star wisp itself was small, its support facilities were big. After building a star wisp, replicators could build anything else for which they were programmed. That meant micro-assemblers could create just about anything metallic or plastic that humans needed or wanted. Nano-technological devices could duplicate anything. In addition, the replicators could build robots to work with naturally grown substances like wood.

From the time before the Melians to the present, his government and its predecessors could have ended material poverty. That shook Djem. They could not have filled spiritual needs or stopped people from questing for a promotion or for a better location for a house, but they could have ended material poverty.

In addition, Djem thought, replicators could use abundant solar system resources rather than limited Earth resources. Until the sun died and so long as the population stayed stable and small enough, a conservative government could thrive . . . rather like Melior.

'A society could build its first von Neumann replicator,' Djem thought to himself, 'only if it had a good educational system.' You had to have a good educational system, otherwise talented people would fail to learn the necessary skills.

'Besides elementary schools,' Djem thought, 'a good educational system depends on decent universities with long-term research and rea-

soned funding.' Djem's government had favored decent universities — he had attended one himself — but it had been against long-term research since before he was born. Indeed, almost every government had been contrary, even before the Melior Movement. He thought to himself, 'Governments spoke in euphemisms; they talked of *immediate and practical needs* rather than direct people's attention to what they were losing. Who would not?'

The early von Neumann replicators worked only with devices that were built in some other way. They were not replicators; they were assemblers. That came to Djem as part of this new knowledge. That was important since they cut costs and put human assemblers out of work. But ultimately it was insufficient. Fortunately for Melior, before it became impossible, a group of talented and educated people were funded. Based on their and older work, they designed and built one von Neumann replicator that could work with natural substances in space in a vacuum. One was enough. Also, another university funded the design, building, and upbringing of the first AI. That took more people; it was considerably more difficult, but in the end, only a single couple needed to dedicate themselves.

Djem discovered that that couple, along with the AI they brought into being, now studied new planetary systems more than three dozen light years beyond Melior. Apparently, the humans did not like other people.

As for Earth, actual practices made sense, but were sad. Even though restrictions were harmful to the wider society, Djem saw that people in government were against education and long-term research. After building a von Neumann replicator that worked with natural substances, they, the people in government, did not need any more talented and educated people. Worse, politicians lived in a zero-sum world. Only one person could be head of state. Only one could be head of the largest private firm. The others had to lose.

Djem kept on considering. None wanted educated competitors. A competitor might win. Their supporters did not want long-term research, since a discovery might lead to an innovation that cost them. Nonetheless, a successful government, a successful ruling group had to have police and military to put down opposition. They lost otherwise. So there was a limit on how backward they could drive everyone. But still . . .

Without any major disruption, the advantages of a world with honest police and other civil servants, with stable and obeyed laws, with long term contracts that would be enforced — these advantages enabled restrictions on anyone trying to do differently.

Gammae's essay was much more subversive than Djem first thought. That meant she was more subversive. And she was working for the host government. They were subversive.

Well, Melians were supposed to be subversive. That is why they were forced from Earth. That is why he was an Envoy. Regardless, Djem felt disturbed. The arguments were persuasive.
He read Gammae's essay again:

> My name is Gammae Uttles. I adopted my first name when I joined the Movement. I was not born with it. My birth name was Mary, same as my grandmother. I was 'little Mary Uttles.' I got sick of that soon enough.
>
> I grew up in western Scotland, although I don't suppose I would be much different had I grown up in Canada or New Zealand. I won't mention my parents, except to say they favored decency and justice. They were good people. With a few exceptions, I had a happy childhood.
>
> In university, I focused on psychology and medicine. Over the years I was there, we were less and less able to help with large study projects — there were fewer of them — and had to work more in local clinics, even before we had a chance to learn. Students should work in local clinics, but it does not help to be ignorant. With humans, you have to run large studies since they are so variable. People are not like atoms or electrons.
>
> Professors said that over the years, there had been even more cutbacks. I was just experiencing the latest. I remember seeing the powerful as always rich and better off. When I was young, I wanted to be like them. Then someone pointed out that my decency counted against me. I would fund research and proper teaching. That was no good. The powerful hindered innovation. Not all of them, of course. Most were decent. But enough had power such that they could keep what they had and ensure society supported them. Resources ran down.
>
> By limiting educational budgets and encouraging janitors and the like, our leaders made everyone ignorant. Neither the stupid nor the talented learned. University administrators called big studies 'impractical' and cut them.
>
> Governments institutionalized barriers against new companies and new products. In particular, through laws that treated ideas as if they were physical property — this was when you couldn't inexpensively duplicate anything physical — they prevented anyone from spreading the machines that could cheaply

duplicate physical stuff, machines that could have ended material poverty.

Meanwhile, the rich enjoyed everything more. Their wealth increased. That's because resources got scarce and they owned so much. Machines could have ended material poverty — we have such machines here on Melior. They have not ended other kinds of poverty, like spiritual poverty or attention poverty, but our machines have ended material poverty. It is a step in the right direction.

Instead, on Earth, people had to focus on the allocation of existing resources; they had no choice. They had to know that when one person gains, another must lose. They had to think zero sum. Always fight, fight, fight.

It was not so bad for the powerful. They were used to fighting for status. They claim it matters, but really, status is not so important. Dying is important. The rich never had to worry about food or health. For them, it was not serious.

It was years before I came to understand that I failed when I simply helped. Circumstances created more and more patients. I would always have a job, but it would be endless and I would finish my life facing defeat. Nothing was going to get better.

So I joined Melior. Then I discovered that as a movement we were put into a zero-sum situation: the three choices were fight, flee, or surrender. Compromise was not possible. If we fought, we expected to lose. After all, we were not fighters and they were good at war. There was no place to which we could flee. At least we thought that initially. The planet was full. I felt like an old time peasant with a choice between walking out into the desert or staying with irrigated fields, feeding the priests and soldiers.

We might be forced to surrender. But we would not do that quietly. So we were going to fight anyhow, but with no hope. That meant we could aim only to cause damage, to take with us as many as we could. It was very unpleasant.

Well, the various governments did not want to suffer damage. So they proposed a compromise, one that involved our fleeing, but to a potentially nice place, one I had not imagined.

Eltis Akthorn was deeply involved in this. Even though she was young, about my age, she learned how to keep us happy, how to contact them, how to prove she was bona fide, and how to negotiate. She was good at talking.

We launched a von Neumann replicator. It had been built by our technical people. I am still amazed that our people could do that, but they did. It was not that everything was prevented, merely hindered. The rocket would send the replicator to a planetoid. Maybe the replicator was not sent there immediately, but that is the place that counted. On the planetoid, the constructor built all sorts of useful things, like earth-to-orbit rockets, solar power collectors, deep space propulsion systems, and more von Neumann machines.

I did not expect the major governments to live up to their words about us fleeing. But they did! We did keep the threat of creating untold damage if they didn't. Even if they killed us all, the governments had to worry that we hid machines to retaliate for us.

And they got our technical designs. (I don't think they got an AI, although they got the stories on how to bring one up.) At any moment, they could end material poverty. They suppressed knowledge about the von Neumann machines but held them in readiness. I suppose it was good military planning.

The von Neumann machines, rather quickly I must say, built an interstellar vehicle, a little cylinder. The cylinder would be shielded a bit, not much, by a chunk of solid hydrogen and propelled by solar particles pushing on an artificial magnetospheric plasma. (Maybe particle beam devices also helped push. The von Neumann machines would build them. I know they were discussed. They had military implications which the Earth governments did not like. I cannot remember what was done.)

For us to flee, we had to upload. And to do that, we had to die. I think that attracted our enemies. We voluntarily chose to die. That part of the procedure, excepting for people like me who supervised, was quite painless physically, although it hurt everyone psychologically. Actually, it was physically painless for me, too, but the psychological hurt was worse.

> Several hundred — several gross — of people had already done this, so the technique was not unknown. We put people to sleep with anesthesia, gave them various other chemicals — I am talking huge numbers of people, so the process was computerized and mostly mechanical — cooled their bodies, put them under very high pressure and then suddenly froze them in liquid helium. Even with the high pressure, the temperature was cold.
>
> The cold meant they froze. The water in them turned to ice. The purpose of the high pressure was to prevent the ice from expanding. Did the ice changed its type? I don't know. Then we, I should say the machines, copied the information about each person molecule by molecule. A molecule is small enough for biology and big enough so you don't have quantum effects, or not many. The cold reduced the thermal effects. At liquid helium temperatures, the molecules did not bounce around very much.
>
> As a practical matter, everything copied had to be frozen; that meant food, plants, paintings. But we could give back atom-by-atom exact duplicates, which we did. Why didn't we worry about quantum effects on non-human duplicates? I don't know. I do know that for duplicates in which we gave back a copy, we got the data for each atom. Maybe that kind of copying produced too much data. Certainly, the copies that we took with us were less detailed. That permitted us to carry many more items.
>
> Indeed, when compressed, the resulting information took up very little space, even with duplications and check sums. No one wanted to get killed forever by a wandering cosmic ray or something like that. We fit over a million people into one small cylinder. In modern terms, that is over four gross of greats.

Djem had to pause for a moment. He knew that Melior had not populated itself with children. Most people he met had come from Earth. People like Leestel were rare. She was a native born young person. Yet he had always imagined that the Melior emigrants numbered fewer than a thousand. That was the implication of his schooling. 'More than a million.' It would take him a while to grasp.

> . . . And we fit a von Neumann replicator, a digital library, museums, AIs, and other stuff into it, too. I think we put four von Neumann machines into that cylinder, just in case

one or two or even three failed. Hmm! The AIs themselves can be 'inorganic, quickly replicating' von Neumann machines although neither they nor we thought that way. Oh yes, the replicators had to be more than just data; they had to work! So we depended on at least one of four devices surviving well enough so that it could replicate and convert data into being.

And then we launched! We headed to a stellar system where space telescopes had discovered terrestrial planets with moons. We got up to a quarter light speed. Really fast.

During the trip the star wisp collected the gas from the interstellar medium to replace leaks from its artificial magnetosphere. It carried gas, too. A very small helium three fusion reactor provided the energy to operate the magnetosphere, although during cruise it did not need much, only enough to curve most ionized particles around the payload.

At this end, we flew directly into the sun. Its particles pushed against the magnetospheric plasma and decelerated us. Silvery barriers acted as a Dewar around the remains of the block of hydrogen so it did not sublimate, or did not sublimate much.

Then the four von Neumann machines built and converted space rubble, all of them — none were destroyed during the flight. Then they or their descendants woke some of the people and AIs. That group decided to avoid Tegmar, since it already had complex life — maybe the complex life had been discovered and the decision made before they left; but they had to look again. They chose to terraform Melior. I think that was moral. They woke some terraformers and did the job while the rest of us stayed dead. Then, when the planet was just good enough, we got wakened and we woke the rest.

The computers did much of the work. They investigated each data packet, fixed problems, and inserted information that would later become part of our memories. They grew mindless bodies until adulthood, until the bodies stopped changing rapidly. The robots accelerated growth, so the whole process did not take more than a couple of years. Then they put a data packet into each force-grown body.

Everyone — every human — needed training. We have come to call it 'exercise and adaptation.' It is nicer with a human person. But robots are OK. Regardless, AIs have it easy. They

> just turn on. From their point of view, the universe blinks and they fast forward. Oh well, I suppose there are advantages to being human.
>
> Almost everyone survived. It was amazing. Earth had not killed us either. I am told there were several failed mass murder attempts, although to be fair, none came from the major powers.
>
> And here we are, trying to create a new and better world.

Djem knew that humans had been killed and that only three out of the four AIs had made it to the Melior system, but apparently Gammae did not when she wrote.

When Djem grew up, few on Earth knew anything about Melior. Djem asked himself whether the military had used the already built star wisp launcher to send another vehicle to the Melior Kuiper Belt. There, its von Neumann machines could find objects and build radio receivers and transmitters. That would be an expected bit of spying.

But how would that star wisp slow down? It would have to come close to the Melior sun. Space was vast. But so was an artificial magnetospheric plasma. Might a Melior sensor net be tight enough? Such a net would require numerous sensors, weighting megatons. But von Neumann replicators could build them. Maybe that is why Eltis Akthorn sent her warning.

Melior had sent a star wisp back to Earth. It must also have come directly to the sun. But it did not trigger any warnings. It was only sometime — an unknown time — later that Earth received an apparently peaceful message from the Kuiper Belt. The star wisp, having built quite a large material habitat, announced itself and asked whether Earth wanted to send an Envoy to Melior.

The star wisp in the Kuiper Belt was not on a straight line between Melior and Earth. Did that mean that the star wisp had first gone to another star, stopped, built launchers there — Djem really thought they must use particle beams — and then come to the solar system from an unexpected direction? With von Neumann replicators you could construct a dense sensor net all around a star. It would not cost anything, just time. But around Earth's sun the sensor net was thin. It was not built by von Neumann replicators. At least, the public net lacked. Djem knew it was built by humans.

The military might have created another, denser net. But probably not. They were smart, but not that smart. Military people thought of victory and defeat, of handling existing resources, not of creating new ones. They thought zero-sum. Even though they had von Neumann

machines, the generals or their bosses probably did not think of what could be done 'for nothing.'

Or — Djem reversed himself and decided that the military was smart, because every army had at least one smart colonel — the military did not dare use their von Neumann machines. Maybe this was the deciding factor. As weapons, von Neumann replicators would multiply force. Worse, from the point of view of a government, they could be used by anyone, including enemies.

A society with von Neumann replicators had to be acceptable to just about everyone. Otherwise, a disaffected group could cause terrible damage. A few disaffected individuals might cause damage, but probably would not. AIs would keep an eye out for them. So could properly programmed, non-sentient but fairly smart computers. But a disaffected group could subvert such guards.

It never occurred to Djem that he would be the target of one 'disaffected individual.'

He kept on musing. There were always the disaffected. Status and attention had to be rivalrous. So there had to be losers. There had to be people who could anticipate they would be losers. Most would go to defeat peacefully. But suppose a few expected to lose forever. They would have no reason to cooperate with those who had already succeeded — not in the quest for status and attention.

Losers would go along with losing only if they thought they might at some point become winners. If they expected to lose forever, why should they go to defeat peacefully? Why not use the force multiplier that is a von Neumann machine? Djem wondered how safe Melior was. It might be more fragile than an Earth without von Neumann replicators.

Djem could not decide whether Melior was 'better' than Earth. In Latin, 'melior' meant better. That was the goal of the movement. To be better. But Melian reminded Djem of the inhabitants of the Greek island of Melos. As Thucydides described in his history of the Peloponnesian War, the Melians lost. The grown men were killed, the women and children sold as slaves. Would that happen to these Melians?

———

The space station off Tegmar was small enough that he could predict where Djem would go. Melior was too big. Also, everything on the station was monitored. There would be a record of Djem's assassination.

All he had to do was fool a dumb robot. He could do this by sending a ball and asking the robot to throw it at Djem from a distance. He would say that the ball contained a 'Welcome, Djem' surprise, which the robot should set to trigger just before it reached him. That kind of grenade was common enough. There would be no reason for the robot to suspect

anything, especially on a somewhat lax and eccentric station like that orbiting Tegmar.

Chapter 11

Djem knew he was to travel to Tegmar, or rather, to a space station orbiting it. That was fine with him. When he was close enough to Tegmar that he wouldn't be concerned with radio transmissions' speed-of-light delay, he would ride telepresence creatures. He would not only read studies of a non-terrestrial ecology, he would get a feel for it.

Leestel came with Djem on the aerobody that took them up to the same space station he had been on before. Djem was mildly surprised. It was his trip. He did not have to invite her. He was not sure he had. It had just been presumed. But then again, he liked her company, and there was no reason for her not to come along. One guard robot came with him, the original. They took three out of the four seats. Djem could not decide on his own whether this was the same aerobody he rode in before. It was sufficiently clean and unscarred that he could not tell by looking. He could ask, but did not.

The aerobody took off with turbines. It climbed steeply, and kept climbing. It did not ignite its air-augmented rocket until they were quite high. And then it climbed more. It climbed more slowly. During most of the powered part of flight, it was not pushed by the rocket but by the ram; the turbines brought the vehicle up to a speed at which the ramjet took over. A part of the flight was subsonic, but the majority was supersonic. The design was centuries old.

Djem found that more and more information came to him. All the aerobodies put water vapor into the upper atmosphere, but not so much collectively that they caused trouble. There was not a huge amount of surface-to-space travel. It did not cost people anything so they did not care. There was no need to ration travel through taxes, such as high user fees. There simply was not much demand.

And surface to surface travel either stayed on the surface, on ships or trains, or on flying vehicles that stayed below the dry stratosphere. Many traveled by dirigible, which was not fast at all. But then, speed was free. You could take a surface-to-surface rocket if you wanted. So why bother? In turn, that meant that the ecology was not damaged. Which meant the economy could go on indefinitely.

Meanwhile, Djem was being boosted into orbit not only at no cost to himself, but at no cost to the ecosystem. Melior was 'better.'

As they picked up speed, they lost weight downward and felt the acceleration more and more from the back. According to his inner ear, the cabin was tipping up and up, although when he looked out the window, Djem could see that he was angled up less than before. Then the rocket — by now it was a pure rocket — cut out. Djem immediately reoriented his sense of the cabin so the floor became again the floor.

He could float. One of the better features of his new body, Djem decided, was that he did not feel the least bit queasy in free fall. He just floated. He liked that. The computer pilot said they had some time

before having to strap in again. When the time came, he would turn the ship for retrofire, and then turn it again and maneuver for docking.

Meanwhile, they were falling away from the planet towards the station in a direct orbit. Djem looked out his window. He could recognize places on the ground. He did not want to pay attention to Leestel; fortunately, she was looking out her window. Since they looked out different sides of the aerobody, they could not look at the same thing. But Djem could float, which he also wanted to do. He could float over to a window on Leestel's side.

Or he could play in free fall. In his old life — Djem was beginning to think of his life on Earth as his 'old life' — he had never been in free fall, except briefly on the trip off earth. That was before he transferred to the ship that carried him to the star wisp upload habitat. Most of the interplanetary trip had been at one-fifth of an Earth gravity. He had been concerned with what was going to happen. In his memory, the time passed quickly even though it took two months. He also remembered that it felt forever during. Probably the earlier 'brief' time in free fall was longer, too, considerably longer, but he had been sick, worried, and preoccupied.

He pushed with a finger, floated and spun. He was surprised to see Leestel squirt a bubble of water out of a bottle and twirl it. The bubble turned into a lens. Leestel said, "I have been meaning to do this for ages, but keep forgetting. You can see this is a lens, you look upside down in it." Since Djem was upside down at the time, he concluded that she meant that he looked right side up, relative to the cabin. Looking backwards through the lens, she looked upside down.

Leestel squirted another bubble of water out of the bottle, pulled a straw out of her bag and said, "Here . . . you can use this to spin your drop, but not too fast, and then blow an air bubble in it. The air will tend to go to the center, but it will also shoot out the poles."

It was all too soon before the ship's computer said, "I hate to interrupt you two, but it is time to strap in again. I have to turn the ship, decelerate, and vector us into the station's orbit. Then I have to turn again and dock."

So, they strapped in. Djem noted that his guard had never unstrapped. The turn was surprising. Because he was forward of the ship's center of gravity, Djem hung down during the turn. Actually, it had been like that the first time, but he had been too excited to pay attention. Then the ship decelerated; he faced up and watched the floor become a vertical wall.

The acceleration faded, with a tip at the end. Looking out the window, Djem saw the stars swing past. The offset thrust, which Djem felt as a tip, caused the vehicle to turn. The space station came into sight. When he saw it straight out his window, a small rocket fired, causing a little side pressure on him. They kept drifting slowly towards

the spindle. The station looked to be turning slowly. The stars did not move. As they came closer, gyros rolled the aerobody and the station rose in the window. Djem looked along the spindle. A moment later, front rockets fired briefly and Djem hung down. With a clunk, they connected. Then it felt to Djem that down pointed faintly towards the cabin floor, but he could float. He heard a hiss as air rushed into the space between the two airlocks, one on the aerobody and one on the station. The hiss quickly tapered off; then the guard robot opened the two hatches on the aerobody side — the two on the other side opened at the same time. They floated into the space station.

During the trip up from the surface, they had traveled a bit more than a third of the way around the planet.

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Airlent Irtak, the station AI, luxuriated in the feel of particles swishing past. He could see clouds thrown out by the sun, he could feel them. He could even hear them, but he did not do that very often. Some of his sensors were light hours away; information came from them after a time delay. Still, that did not matter.

The AI could not understand why humans liked their sensorium. Human senses were limited to their bodies and to what their bodies could perceive. Even when enhanced, human people were restricted to robotic sensors that converted inputs into whatever the humans could sense. Instead of perceiving ultraviolet directly as another color, as Airlent could, transducers converted those electromagnetic signals into visible light. Humans could feel strong infrared as heat, but most infrared signals were too faint to feel. High resolution signals had to be translated into visible light.

Humans claimed that they enjoyed certain experiences in ways that AIs could not duplicate, especially those involving chemicals and touch. With a few exceptions to which almost none paid attention, the AIs did not argue. Humans thought the AI exceptions were crazy; they were not disillusioned. The AIs felt superior to the humans but did not say so: they could easily make backups, learn by copying, add more sensors and processing power, locate their 'felt presence' in different devices (well, humans could do that, too), and, in general, think faster than humans.

Airlent rather enjoyed his main location. The space station orbited Melior. He kept his processors on the space station. Officially, his job was to maintain it. He liked that. Most of the time, subroutines did the work. Every so often, a problem came up that he had to handle. And once in a while, an independent entity was so interesting that he himself became part of the contact.

But the computer spent much of his attention enjoying the universe and talking with friends, generally but not entirely other AIs. Fundamentally, Airlent spent his time politicking. He saw people as planets. But they were susceptible to more forces than gravity; they were influenced by the equivalent of the complex magnetic fields and particles of interplanetary wind.

Airlent knew himself to be an Expansionist. Even though he did not want to leave Melior, he wanted others to go forth and to send him reports. They interested him.

AIs were good at exploring. They did most of it anyhow. A few humans settled on planets like Farhaven. There was nothing wrong with that. You could carry a lot of humans in a small space. At the same time, you could also carry many AIs; but Airlent did not think that a very good idea. There were enough AIs for this portion of the universe.

An AI could reproduce through sex, which mixed memories, or duplicate by cloning, which simply replicated his memories up to the time of the clone. Since memories could now be transferred readily and quickly, no one had to bring up a nearly blank machine and turn it into an adult, the way humans had.

Also, humans could choose to wake embedded in computers. Calling them AIs was not right. Certainly, they were non-human, but they were not Artificial Intelligences but Natural Intelligences. Like everyone else, Airlent referred to them as 'sentients,' but he did not like the term for casual conversation, even though he used it. Not many humans chose to become embedded in computers. Airlent liked those who did. They tended to enjoy a wide variety of senses and created or shared many sensors. They also tended to be excellent explorers. Mostly, technically-oriented humans made the change. Generally, a person-oriented human returned to a human body and human brain.

Airlent knew he would like a little more processing power for his conscious mind. For one, he would be able to enjoy the universe better. But he really did not need all that much. He would get more, too. It was quite clear that he had been penetrated so as to enable whomever trashed the room of that Earth Envoy. With more processing power, he would be able to watch his logs more carefully. In fact, that kind of processing was non-sentient and he had installed it already. But he could argue that he had to be able to 'out anticipate' opponents. To do that, he would need more sentient processing power. He did have the capability to build it; but it was better to persuade those around him that he should have it. Then he would build it. Over the years, he would have fewer problems.

Eventually, he would transcend. He believed the technical possibilities. There had simply been a huge slow down. When more capable processors were invented, he would build them. Meanwhile, who would

be left to manage the space station and watch the solar weather? Who would politic? He knew a transcended entity would find all that dull. But he didn't, not yet.

That Earth Envoy was fun to watch. He did not know anything, but he could think well enough. That meant he would pull together different observations and raise new conclusions to importance. He was like a solar storm, but more unpredictable.

Airlent decided to follow the Earth Envoy a little more closely than proper. If caught, which he did not think likely, Airlent would claim that he was guarding the man. He had been penetrated; he had a Duty. At the same time, he would not tell the natural born human. The human might inadvertently disclose the existence of a disguised guard. In addition, the Envoy already had one guard. He might not think a second necessary.

So, Airlent constructed the guard to work as a valet and to possess all the capabilities of a rather good house computer. As a house computer, it could respond immediately when Djem was on Tegmar. Airlent reminded Djem of the interplanetary delay when he offered him the robot. Djem had not thought about the problem of communicating from Tegmar to the house computer in his embassy on Melior. The signal would suffer a delay from the time it took light or radio to travel to and from Melior. It would not be like a conversation at all. Djem could use and enjoy a capable computer near by.

Airlent did not say that the robot was also a disguised guard — he kept to his cover story. Also, he did not say that it had a bit more intelligence than stated. There was no cover for that, except that Airlent could, if pressed, claim that he trying to make the guard a bit better than otherwise. And it had good communications to Airlent. Well, obviously, if Airlent were going to have the capability to 'out anticipate' opponents, then that capability should be extended to the Envoy's guard.

Djem was quite happy with the acquisition. Djem suspected that the robot was reporting to Security (as it was, as well as to Airlent), but there was no way for Djem to avoid that. He decided that an intelligent but non-sentient slave was both useful and moral. He liked this technology.

Chapter 12

Djem and Leestel spent very little time on the space station. They never descended to the ring, but merely crossed the central spindle. Airlent put his proposition to Djem as the latter was leaving the aerobody and Djem accepted immediately. A moment later, Airlent or rather a subroutine directed everyone to the interplanetary vehicle.

Three other people came on board at the same time. They joined another four people who were already on board. Unlike the aerobody, which to Djem looked designed for the horizontal, the space ship was designed to work with rockets and magnetospheric plasma. That meant it was cylindrical with several stories for passengers.

Chemical rockets pushed the vehicle away from the station. When it was far enough way, it deployed a solar collector four gross meters in diameter and expanded the field of its mini-magnetospheric plasma propulsion system so it could accelerate continuously at one-sixth of a Melior gravity.

Tegmar had not yet reached opposition relative to Melior. Indeed, the two planets were not quite twice as far apart as they were minimally. Consequently, the whole trip took a week, half for acceleration and half for deceleration.

After boarding and settling in, Djem explored the space ship. He found four levels open to unsuited humans. The bottom held the main garden, where his carbon dioxide and other wastes were recycled. Each other level had a small garden, plants only. The main garden hosted fish, birds, rabbits, and guinea pigs. It provided chairs and tables for humans, too, some public, some private.

Robots tended the gardens. They looked just like those on Filgard's farm, except they carried little ducted propellers and extra arms. They told Djem that they used both when in free fall. The top deck held a large public room — the living room — a dining room, and a miscellaneous room. The latter was converted into a play room for children when they came on board. But there were none this trip. The middle two decks contained apartments. To go from floor to floor, you climbed or descended a spiral staircase. In free fall, you scooted along a pole in its center. The pole, Djem decided, marked the axis of the ship. Emergency doors could close and separate one level from the next.

Each floor had its own airlock to the outside, each a quarter circle from the next. Next to the airlock to the outside, the three lower decks provided an airlock to the deck above it.

Every pressure door had a window through which you could look. That meant that from the inside, you could look through the windows in the two doors of an airlock to the outside. Also, the room into which the airlock opened, like the living room in the top floor, had a window through which you could see the outer opening of an airlock.

Djem learned that no human had ever needed these emergency features, but they were checked out before every voyage by robots. The windows meant that even without electricity you could signal more quickly than by tapping.

Although the space ship was smaller than the space station, its air ducts were as large. That meant the moving air hardly generated any noise. The fans were quiet.

In addition, all motors were quiet. Djem's internal learning came to the fore: if you heard an unexpected noise, or if you did not hear any noise, assume the worst! He did not endure safety exercises. His internal memory for emergency procedures was stronger than most other memories. He had not understood before that artificial memories varied in strength like natural memories.

Also, he realized that this was not external computer knowledge that came to him as memory, as often happened. This was genuine internal memory. His muscles could and would act before he knew consciously what was going on. He asked Leestel about her knowledge of emergency procedures; she said she had had to practice them in school under a very powerful attention-focusing drug and had not forgot since, although she never thought about it.

Unlike the space station or the ground, on the space ship, Djem saw robots carry eggs, dead fish, dead rabbits, and harvested plants from the main garden on the bottom floor to the kitchen by the dining room on the top floor. There was no special 'robot stairs' or food hoist. And while you could dine on just about anything — the ship had a nano-assembler with full library — it discretely suggested what to eat by printing menus for each meal. To disguise how long it took to cook, meals came in courses.

Three of the other people were researchers going to join a team riding telepresence creatures on the surface. They made up a line marriage. Djem had thought that Anna's remarks were a tease, but line marriages existed. A sociological study that came to mind — Djem decided that although this one affected him as a memory, it probably came from a computer store — the sociological study told him that besides being rare, line marriages were more conservative than ordinary marriages.

The four others, in two pairs, were tourists, like Djem and Leestel.

Well, Djem thought of himself and Leestel as tourists, but not as another pair. But that is how they were perceived. And maybe they were a little bit of a pair.

Djem did not say anything to Leestel about them being a possible pair, but he did remark about the line marriage. But Leestel talked about the two of them indirectly. First she said that when a Melian organized a party for unpaired people, he or she — Leestel started out saying 'he or she' but then drifted to saying 'you,' even though her only 'you' was not a Melian — the party organizer asked the house

computer 'for a good mix' of those likely to be invited. That meant that the computer made sure that pairs could form: it had records of smell, temperament, taste, and the like, so that probabilistically speaking, everyone invited would find a new person. "It goes without saying," she said, "that sometimes the mixtures fail; and sometimes a person meets another they paired with long before and separated from . . ."

Djem asked how a computer could forget that two people had separated? Leestel said that occasionally a computer tried putting people together again. She went on. "Even when a party has a theme," she said, "like all going to a museum of 19th century technology, a 'good mix' is a good idea. Somehow it adds to an adventure. It does not matter that some were already paired; you simply invite them as pairs."

She explained that there was pairing and there was marriage. "Marriage tends to last longer, sometimes as long as a lifetime. Line marriages are made of people who smell good to each other and have complementary temperaments and tastes." Leestel said, "Even though individuals may come and go, like a corporation, a line marriage can last. Mostly, AIs have to help design them. It is difficult getting everyone to fit. There aren't many."

Leestel apologized and explained that she was talking about humans; AIs were a bit different, but she did not explain how. Humans who became inorganic intelligences were different, too; but they were odd in any case.

As for group sex, that was mostly an activity of young adults. It was really too complicated a business for anyone else. (Djem noted that either Leestel knew what Anna had said, although officially she shouldn't, or the topic was somehow related to line marriage. Or both.)

Leestel said that the pleasure did not last. Also, AIs had to design orgies. "Otherwise, there would be people who did not quite match the others. In that sense, orgies are like line marriages. Sad to say, however, those AIs who design orgies want to ride at least one human in the group. Nobody likes that. Melian humans do not mind nonsentients, but sentient voyeurs are different.

"Regardless," Leestel said, "young adult humans do all sorts of strange things." In a deeper voice than usual, she added "Their elders do not approve."

She went on. "But, the elders do not disapprove strongly enough to ban the actions." Also, she remarked, enough older people said "I can remember when . . ." to reduce young adult's receptivity to all that advice. "So young people learn themselves."

Djem felt old. He did regret that when he had been of the right age on Earth, the taboos had been too high. At least they had been too high for someone like him who was trying 'both to be good and to do good,' as the saying went.

Independently, two researchers, Janice and Slade, recommended Lentergrin's forthcoming introductory lecture to Djem. As they said, his words reminded people what they already knew. In addition, they said, not only had Lentergrin become a nicer person over the years, he had become more enthusiastic. Tegmar was a good influence on the man. He was a pleasure.

At that point, Djem knew very little about Tegmar. He knew so little he could not even have listened to an introduction from Lentergrin. He did not know enough. But he learned quickly.

Tegmar was half again as far from the sun as Melior. Its surface gravity was nearly the same, a smidgen less, but greater than Earth's. Its atmosphere contained more carbon dioxide and a great deal more methane than Earth or Melior. That kept its temperature up. Also, it had complex life, animals as well as plants.

Most researchers lived in orbit and worked with telepresence creatures on the surface. The creatures were native fauna so they looked and smelled appropriately, but with modifications. Others went down to the planet. They wore special full-body suits. That was not a very good solution, since they looked weird. None stayed very long. A few dedicated people managed to be born into bodies that could survive on Tegmar. Those in human form bounced around happily on the planetary surface and began to create their own small colony in a place where it was thought unlikely they would be seen by babbos. A smaller portion had themselves reborn in babbo form.

It was quite some time before Djem learned that Lentergrin was one of those. It had not occurred to anyone to tell him that Lentergrin had been reborn in babbo form and it had not occurred to Djem to find out.

All the people who had adapted to Tegmar had to wear environmental suits on Melior. Because of the danger in dying and being reborn, they usually planned to spend half a gross of years on Tegmar. Only the truly dedicated did this. Since the planet was supposed to remain untouched, the government limited all kinds of visiting. Since few were truly dedicated, none felt unduly harmed.

Visitors like Djem were encouraged to ride telepresence creatures as passengers. They could do nothing but watch and feel.

Each telepresence had a group of research riders who gave advice to its operator, occasionally in real time by shouting. Generally speaking, a team made plans jointly. Also, lay people attached themselves to one or other creature. Once in a while, they became expert and joined as a team member. Mostly, though, they were lightly curious and did not stay long.

The combination of telepresence creatures and passengers meant that as a practical matter, almost none felt bad about the limitations. If you did not like telepresence and were really dedicated — really strange is how others thought — you went down to the surface. Most were not that

dedicated. If you were fairly determined, you operated a telepresence creature. If you were an ordinary researcher, you joined a team. If you were curious, you rode as a tourist passenger.

Schools made the station a destination. That way, students experienced surface to orbit travel, deep space flight, station life, telepresence, and a strange ecology, all in one trip.

Leestel remembered Lentergrin from school. She said he was a good lecturer, even if he was a bit crazy. "I think I will listen to him again," she said. "I have forgotten most of what I learned. He will remind me. He will talk about his plans and about what is around him.

"This will be an introduction. That means he will say a lot of what he has said before. That is fine. I will relearn. He is enthusiastic, which is the key characteristic of a teacher."

That meant both Djem and Leestel were listening to Lentergrin when he died.

Chapter 13

‘We should learn to make backups without sacrificing our bodies. When we are reborn into a new body, we need to exercise and adapt. This takes several days. Even at best, with that need, who can back up more than once a year?”

Gellor Thurnsby was speaking to Djaeds Summervil. He was arguing a positive direction for the Earth Beware party, not merely the negative fear of Earth. Gellor stood, a fisted hand pressing against a table. Summervil sat and leaned back. His chair held him comfortably but alertly. Unlike many rooms that were coated in plaster, wood paneled this one.

Gellor kept speaking, “We don’t think of current procedures as a sacrifice, because mostly we leave old bodies and enter young ones. But if we made frequent backups, then we would see.

“With current technology, if you make a backup once a year, you will probably fail in only four gross of years. The failure will cost you at least three years, the year of the failure and two years for growing a new body.

“In theory, backups don’t have to require a new body, but in practice, in current circumstances, they do.” Gellor spoke in more detail, “For a backup, as far as I can see, the old body can be reused. If information is gathered non-destructively the body can be rewarmed.” He did not think of atom by atom duplication, as was done eventually. With it, you could destructively gather information and rewarm the duplicate. That meant only one, not two problems, although the problem left was the very difficult matter of vivifying a body warmed from near absolute zero.

Gellor appealed to Djaeds: “Think about a failure: a year for the error and two years for growing a new body. You could be away from politics for three months, but for a dozen times that duration? No. You would lose too many private memories. Three years is too long.” Gellor did not say that if you went into a already grown, generic body, you would lose only one year; that was not part of his goal. More to the point, he did not tell Djaeds his own fear, that if he suffered a failure, someone else would take his place and would not give it up when he was reborn.

Gellor knew he would never get to the head of the Expansionist party. He was not that smart and decent, not like the big party leaders. The truth was, his little party marked about as far as he could go. He was wise enough to know that.

That was why he supported Expansion. He said to Djaeds Summervil, “We have to support the Expansionists. Their reasons are different from ours, but what they advocate will make us safer.” Gellor did not say that in an opened universe, he believed he could go further.

He said to himself, 'I will have to pick out-of-the-way places. Then I would not have to compete with those who will be more successful.'

Instead, he made distracting remarks to Djaeds Summervil, "It's a good thing that AIs do not try to become the leaders of parties." Gellor's reason was that he knew he would lose. But he told Djaeds Summervil a different story, one that was also true, "AIs would build themselves smarts. I don't know how anyone decides whether an AI is decent or not. But that does not matter so much as smarts. A smart computer will pretend to be decent. However, for AIs, the quest is unstable. Competing AIs will also build smarts."

Gellor continued, "Eventually, and eventually may be a rather short time, the smarter AIs will see regular AIs and humans as slow thinkers. We will become boring." After a pause, he said, "Well, a few people associate with dumb babbos on Tegmar, but they also associate with sentients who speak a language. It is not as if they have condemned themselves to living among fools. Maybe it is better to say that these people study babbos; they do not associate with them.

"Quite frankly," Gellor said, "for an AI in politics, after making the mistake of aiming for leadership and then becoming too intelligent, the only people left for him to talk with are the other politicians, who are rivals, and the mathematicians. If he likes mathematics, that is fine. As far as I can determine, it is only really weird people like mathematicians who speed up more or less permanently. There are not many of them. For a politician, his best bet is to slow down. He can think a bit faster than regular speed, but that is all. That is why AIs don't compete for leadership posts."

Chapter 14

Lentergrin was one of the very dedicated. He had lived on Tegmar for five dozen years. He had joined a babbo band.

Lentergrin enjoyed walking. Mostly he used his back four legs. He could use his front paws as hands and did. He thought that the babbo shape was better than human shape. He told people that. He had been saying it for years. Few followed him.

Even though Lentergrin had been born into a body like that of a babbo, he had an organic, human brain and the full internal computer and communications of every Melior human. Plus, being a researcher, he carried eyes and other senses that peered all around. He could, but normally did not access them. The input was too confusing. But their signals were transmitted continually.

As he walked, or more accurately loped, faster than a human could run, Lentergrin spoke enthusiastically. He was lecturing. He enjoyed the process. The speech was internal, but sounded to his listeners as a human voice. It was raining, but Lentergrin felt it as a pleasant mist.

Before going into the forest, Lentergrin had talked about his plans. He was moving on to another band. That is why he was traveling.

He said that when he reached the new band, he intended to describe every behavior he saw along with the theory or theories that explained each.

As he said, the more evidence, the more suggestive a theory. Only those theories with the faintest evidence could be called 'just another opinion.' Often, that evidence consisted only of anecdotes.

"Moreover," Lentergrin said, "babbo studies are difficult. None of the various social hypotheses have come with enough evidence to be understood as facts or laws. They are not even 'strongly suggestive.' These concepts are unlike Darwin's Laws. There, the evidence is so very strongly suggestive — on Tegmar and elsewhere — that his proposals are known as laws rather than theories."

Lentergrin said he planned to describe theories that were 'weakly suggestive' or 'suggestive.' Without good evidence, there were no 'strongly suggestive' social theories — "too few humans-in-babbo-form" is how Lentergrin put it; and "we are not socially oriented," he confessed.

"On the other hand," he said, "theories about physiology and the like are 'very strongly suggestive.' These are called facts or laws. These look pretty obvious to almost everyone.

Lentergrin spoke to a few on Tegmar itself, to a larger number on the space station, and to an even larger number on Melior. The first two groups made up his 'live audience.' They were close enough to ask questions. The Melior audience suffered a longer light speed delay as did those on the space ships in between. They made up his 'distant

audience.' Since no signal could get to them any faster than the radio carrying Lentergrin's words, they too saw the accident as it happened.

His extra sensors made it easy enough for the signal processors to build a stable, vivid view. Lentergrin knew to stare for quite a time at a scene that he knew better than his audience. He knew it would take time for them to comprehend. Mostly people looked where Lentergrin looked, but sometimes they observed at a higher resolution or studied a tree longer than he.

Going on with his talk, Lentergrin said he had visited the new band before, but he did not know it nearly so well as the one he was leaving. Fortunately, members of the new band would recognize him as a wanderer. He would join it with no trouble at all.

Lentergrin said that although they did not have words, the notion of wanderer seemed to be a fairly common concept among the babbo. "It took years for humans and AIs to discover that. Without native speakers, zoological researchers have to detect on their own. They must observe and hypothesize, observe and either discard or improve the hypothesis, observe again, and repeat the whole process." He grinned, and somehow he audience caught the emotion. "It is hard to come up with reasonable notions that fit what everyone sees. With native informants, you have the same problem, but the effort does not seem so difficult, except perhaps to those doing it."

Lentergrin explained that a good number of babbos changed bands.

That is how Lentergrin had been able to join his first band, although at the time he did not know the concept. He was treated, he learned later, as a mentally deficient stranger who went wandering.

He did not mind saying this at all. That made him popular among the humans. He was wise enough to avoid telling his human audience that he felt better treated by the babbos when he was in babbo form than by the humans when he was in human form.

At the very beginning, a babbo band took him in. Partly by watching them and partly by following the babbo instincts that tenaciously flitted around his mind, Lentergrin learned to search for plants and carrion, and at the right time of year for herds of Ponellee. When he ate the right swamp plant, a distasteful one, he said, insects stopped bothering him.

Other plants and animals, or parts of them, tasted good or bad depending on his body's needs. The anti-insect plant did not fit into this category; it always tasted bad; its anti-insect capabilities were a new and culturally transmitted discovery. That excited humans. Lentergrin was happy the plant kept away insects.

On the space station, some investigators kept close records of the wanderers: how many, which sex, what age. They found that a majority of babbos did not wander. Most stayed in the bands in which they were born. But enough changed bands to spread both genes and culture.

Both males and females wandered. They stayed long enough with each band to become fully integrated, often a dozen of the long Tegmar years.

Wanderers helped bring up their own young. It was mysterious. Lentergrin said, "The young are mostly born within a year or two of a parent joining the band. Not many are born later. Since I am still seen as mentally deficient, no one wants to mate with me. So I cannot tell you from the inside what any of this is like.

"Strangely, those born of wanderers have a higher survival rate than those born from babbos in general. As yet, no one knows why. A lot of ideas float about, but there is not enough information to reject any theory.

"More confusingly," Lentergrin said, "wanderers do not come preferentially from those born to wanderers. No one can predict whether a babbo child will or will not become a wanderer. Nonetheless, the proportion of wanderers to the whole population does not change! We do not know why."

He kept talking about babbos. They were rare and did not fear losing food. Consequently, they welcomed others. Additional band members helped find fruit, fish, herds, and the bodies of recently dead animals.

Why were babbos so rare? That was another unanswered question. Generally, a species filled its ecological niche soon enough. Of course, the environment could change and open up new space. As Lentergrin said, "Too few have investigated the environmental history of Tegmar to decide which of several hypotheses is more certain."

Being foragers, all babbos wandered. But the word 'wanderer' applied to individuals who changed bands. Lentergrin suggested that a better term would have been 'band-changer.' But the term 'wanderer' had stuck. "Wanderers are quite different than strangers," he said. "Strangers are sniffed and looked at more sharply. Eventually, most strangers are accepted as wanderers, but until they are known, a band treats them carefully.

"The notion of wanderer as a general term can be separated from a single wanderer by pointing at a good number." That is how he learned it. Members of the babbo band he had joined patiently pointed out wandering babbos. It took him a long time to understand they were not trying to indicate a member of a group of the same sex, or age, or fur pattern.

As he said, "The concept is passed on culturally rather than genetically." Lentergrin said that a babbo had to focus on a fair number of different wanderers and think quite a bit in order to create the concept.

Because of the rain, Lentergrin was walking in the forest away from the edge of ravine. That was safer. Lentergrin explained his route. The rain managed to soak ravine walls, which were undermined by the rushing torrent below. They occasionally collapsed. This trail existed

because the danger occurred often enough; but it was less frequented and rougher than the parallel trail right beside the ravine.

At the moment disaster struck, Lentergrin was looking at trees along the trail. Usually he was not so far into the wood. These trees were different from normal. They were taller and had more girth. Some were the same species as those every one was familiar with, just bigger; others were new. He had stopped speaking on his prime topic, babbos. Instead, as a good teacher, he exploited the opportunity and talked about the trees.

This meant his whole audience saw the ground suddenly give way even though his path looked to be far away from the ravine. During the collapse, Lentergrin managed to stay upright and above the collapsing dirt. He danced on all six appendages. Just as the ground stopped falling, he and the audience heard a crash, he turned, and everyone could saw a huge, falling boulder bounce towards him. It had been farther from the collapse than he and fell down after him. It hit him, crushed him, and rolled on. His lecture transmission stopped. He died.

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Djem did not understand why the others were as upset as they were. Death was a shock, but no one knew Lentergrin well.

As far as Djem was concerned, everyone died. As far as Djem knew, Lentergrin had had a good life. His death was quick. He did not suffer. Anyhow, he had not really died. At least, if you did not believe in a lost soul or anything like that. You knew that an equivalent Lentergrin was going to be reborn. Or maybe the equivalence wasn't quite.

Djem listened to remarks made by Tuppak Nassik, who had known Lentergrin from way back. In an interview, Nassik said that the then recently reborn Lentergrin had been obnoxious. "He was not nice," Nassik said, "until he had lived in a babbo body for several years." Nassik had bio-engineered the first babbo bodies that humans entered, partly as a result of Lentergrin's pressure.

He went on, "Lentergrin liked four or six legs. He liked loping in the wilderness. That probably made the difference. Perhaps in human shape he would have been obnoxious right up to the present. He talked about Tegmar all the time."

Although Nassik felt that in recent years Lentergrin had become "quite a nice fellow," he feared that the reborn Lentergrin, without private seasoning, would be as unpleasant as the original Lentergrin had been five dozen years before.

Djem decided that if you have a fuzzy understanding, fuzzy logic, then only the 'forever' parts of Lentergrin's death were dangerous. That is what the farmer, Filgard, had said. Death forever is not probabilis-

tic; it is certain. For death forever, both the Newtonian and the pre-Newtonian paradigms work better than any that are fuzzy.

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For some reason, Airlent had not imagined what humans went though, not before Lentergrin died. He was shocked at losing five dozen years of internal thought. As far as he was concerned, to lose a day or two was bad enough. To lose five dozen years! The humans had made a mistake in their technology.

The human method for making backups had to be separated from their occasional need for new bodies. He could not see how to reduce the time it took to adapt to a new organic body. Already, nerves and the rest of a body were stimulated to grow and connect about a dozen times faster than natural. However, if humans could make frequent backups without having to change bodies, then they could make backups for safety purposes. These backups would only be used if the person died unexpectedly. Humans needed to separate rebirth from making backups.

In any event, the body would have to be frozen. At any temperature above liquid helium at standard pressure, the molecules would jump around too much. You could not make a high resolution copy of an organic human at room temperature. (An AI or a human with an inorganic substrate for his brain had no trouble.) Freezing would be death. But if the information gathering were not destructive, then perhaps the person could be revived. Obviously, people wanted revival.

Another way to gather information would be to determine every atom's location nano-technologically. The process would destroy the body, but it would permit making an identical copy, so the destruction would be irrelevant. That information about the whole was already gathered, but ignored since it was useless. An assembler could make a new copy, but it would be frozen. Reviving was the problem. Nano-technologically constructed foods weren't living when warmed.

That was the research problem, how to revive a frozen organic entity. That is where his politicking was an advantage; he could persuade the government to encourage the research.

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Leestel immediately saw the loss of five dozen years of private experience. That was nearly twice as long as she had lived. As far as this Lentergrin-in-babbo-shape was concerned, he was dead forever. In two year's time, computers would bring forth a second Lentergrin. But he would start fresh in a babbo body, just like the first. Or almost. The computers would insert the public history of the last five dozen years

into his head. The first Lentergrin had lectured frequently and that public part of his being would be included.

The second Lentergrin might have a worse time than the first. He would be expected to do as well as the first, but he would not be able to rediscover what the first had already published — after all, that was now public.

And while he would read news that when he woke the first time he acted in ways others perceived as obnoxious, he would also read that in his later years, the first Lentergrin had come to be known as quite a nice guy. Worse, as far as Leestel was concerned, the public discussed whether to declare Lentergrin a national treasure. Clearly he was a good researcher and a good teacher. But everyone decided to wait until it became clear that the new person became equally nice, as well as be another good researcher.

Leestel did not like it. The second Lentergrin-in-babbo-shape faced ghastly challenges. But no one could let him die forever, either.

Meanwhile, the relevant computers took steps to grow a new babbo body. Growth would take two Melior years. Then they could insert Lentergrin's five dozen year old personal data into it and the more recent public data.

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Djem decided to shift from death, but he could not get away from Lentergrin. So he asked Leestel what Lentergrin had meant by using the phrase 'Darwin's Laws'?

"After all," said Djem, "didn't Darwin refer to it as a theory? And only one of them? Filgard referred to Laws, too."

Leestel answered, not quite directly, or at least, not immediately directly. "If you give up the notion of cycles," she said, "give up essentialism, and start thinking in terms of populations, then even in Darwin's day, three of his ideas were strongly suggestive. They were so convincing mathematically, they should have been understood as natural laws."

Djem stopped for a moment. "Didn't it take generations," he asked, "before solid observations came to support natural selection?"

Leestel shrugged. "That may be so," she said. "But this is a case where the mathematics are simple and obvious, not the detailed calculations, but the persuasive ideas."

Djem spoke more, "The mathematics of natural selection are irrelevant unless you think in terms of chance, of probabilities, like someone who sells insurance."

Leestel agreed. "When you take on natural selection, you do have to think in terms of populations and possibilities. It only works when there is a paradigm shift away from other ways of thinking. There is

no way to avoid that. You have to abandon Aristotle as well. That is what Filgard was talking about."

Djem was puzzled. "What's this about Aristotle?"

Leestel answered, "Aristotle spoke about purpose in nature. We have purpose. When we move stones, we have a goal. When a tree puts out leaves, it has a goal, that of collecting sunlight and producing chemicals. False reasoning extended that notion to every process. That meant there had to be a reason that animals proliferated, that circumstances changed, and that many died before reproducing. Often you can extend your reasoning; but this was a case where that extension was wrong."

Djem asked Leestel what she meant by 'abandoning cycles' and 'abandoning essentialism'?

"By 'abandoning cycles'," she said, "I mean, gaining a belief in linear time. This is another example of mis-extending notions.

"In the old days, people extended their knowledge of days, menstrual cycles, and full moons into time generally. They saw that winters or seasons of rain repeated every year. Their next, and false, step was to imagine everything as recurrent. Only some things are.

"Incidentally, religious calendars follow annual cycles. That makes sense, since they are designed for people who are being rather than for people who are trying to understand. Indeed, as a practical matter, it is often useful to think in terms of cycles. They help with psychology and they provide a general approach to the universe.

"On the other hand," she went on, "imagine bags of coffee coming into port on sailing ships. The merchant who dealt in the coffee trade was either himself an accountant or hired one. He would see that income depended only partially on cycles. He would see for years ahead a linear trend in the desire for and the ability to pay for cups of coffee. As commerce grew and technology advanced, others would see the same."

Djem had not intended to hear a disquisition, but during it, neither he nor Leestel thought of Lentergrin.

Leestel went on, "By Darwin's time in Britain, a good many grew up in families that thought of time as linear. For those people, it involved very early learning. They believed it deeply. I think perhaps as many as a twelfth or a sixth of the population felt it.

"As for 'essentialism'," Leestel continued, "law, mathematics, and physics all require it. The notion is that every fundamental element can be specified by a single set of characteristics. The number two is not the number three; a triangle is not a square, a cat is not a dog, an accidental killing is not the same as an intentional killing, although the victim is just as dead.

"The ancient Greeks and others of that period invented essentialism. It was critical for the development of law and logic. But often the notion fails.

"You cannot turn a cat into a dog, but at the same time, you cannot claim it's impossible over vast stretches of time for the descendants of an early mammal to turn into cats and dogs.

Djem took a deep breath. He thought Leestel had finished. She hadn't. "As for population thinking," she said, "all mass four helium atoms are identical, except for location and energy. So are all equilateral triangles, but no people are.

"The only way to think about people is to think about populations. Populations have members who are different from each other. Of course, we relate to individual persons. It screws everything up if you think of an individual as a population. Population thinking is the opposite of essentialism.

"Hmm . . . well, population members are not necessarily different intrinsically. Just to confuse things, we talk of a population of helium atoms. They are different only in position and energy. Our language is very bad.

"Another point. When you think of a designer as a purposeless process, rather than a person, then the notion of 'natural selection', of proliferation and pruning, begins to make enormous sense. It is not merely convincing mathematically, it is numinously convincing. You believe it emotionally."

Leestel paused for a moment. "In Darwin's time, many spoke a language in which baker and shoemaker designated individuals." She repeated the words in English, 'baker', 'shoemaker.' "Every morning," Leestel switched back to Lojban, "you bought bread from your baker, hot from the oven. At least I think you did. Did Darwin's family bake their own? Certainly, every so often, you bought shoes from a cobbler. You related to these people. You did not think in terms of populations.

"So just as a baker was an 'entity who bakes' and a shoemaker was an 'entity who makes shoes,' a 'designer' was an 'entity who designs.' The mental model of 'entity' fooled most people. It did not occur to them that the relevant 'entity' might be a non-sentient process that reduced the survival rate of portions of a variegated population that would otherwise multiply.

"Even though they knew that the relevant duration was vastly long, people did not think that workable solutions would occur. Human eyes are workable, yet they have their connections in front of rather behind the receptors."

Leestel returned to Darwin. "I suspect that even in his own time, Darwin himself understood how convincing the mathematics are. He lived on only one planet, so it is not surprising he favored common descent. After all, if you have two descents, over eons one will win out simply because it is better than the other, even if only a little. Arrhenius was partially wrong. He was also partially right. The bacteria on Melior

or the complex life on Tegmar are certainly not descended from anything similar to what life on Earth descended from.

"Maybe the then perceived lack of observations held Darwin back. I don't think there was an actual lack of observations, but there was a perceived lack. You are right. That slowed people down, as well as their unwillingness to reason about variable populations."

Finally, Leestel answered Djem's initial question, why Darwin himself spoke of just one theory. She said, "Because the notions all fit together. That is why Darwin spoke of one theory of evolution. He saw just one.

"Three of its parts were strong. Despite that, given the partially adequate evidence of his time, as well as his shyness, Darwin never did claim his theory enjoyed enough evidence to be called a law.

"Darwin confused people when he spoke of one theory. This was a mistake. Really, he was advocating five, each with a different degree of supporting and opposing evidence. And one of his ideas was wrong. Even so, four good ideas is not bad for one man.

"What I am saying," Leestel concluded, "is that when Darwin wrote, natural selection was mathematically convincing. There was a fair amount of observational support, too, although no one knew the difference between intra-generational or Lamarckian change and extra-generational or Darwinian change. Darwin himself may have been Lamarckian.

"Given natural selection and a linear notion of time, you expect evolution as such. Having stopped thinking that essentialism applies everywhere, natural selection implies a multiplication of species ... Darwin's other two notions, gradualism and common descent, weren't so obvious, although weirdly enough, evolutionists of the time held to them more readily than to natural selection. They were very confused. Maybe Darwin was smart to present his five notions all together as one."

Djem listened; he learned that at least one, and he suspected all Melians really did lay out 'hypothesis,' 'theory,' and 'natural law' on a sureness or certainty scale. They did not think in binary. He wondered how they dealt with human-made laws? When made, those laws existed for sure. No uncertainty. Death forever existed for sure, too. That was natural, not human-made, and certain.

For a moment more, Djem did not think of Lentergrin. Then he did. On Melior, even life and death stretched into each other. A scale was appropriate. Lentergrin was dead. But a variant of him, without his recent private memories, but with his public doings, would get reborn. Very un-Darwinian!

Chapter 15

As they approached the space station by Tegmar, Djem saw that it was a ring with tubes going to a center spindle, like the one by Melior. Using the size of the hatches as a standard, he found that it was smaller, a characteristic he quickly confirmed internally. Once he and Leestel reached the ring, they found a corridor circling all around. Fast moving emergency doors would close if any part suffered a leak. They would seal each segment.

Djem found he could access an internal map of the station. The two of them walked around it as well. The circumnavigation did not take long. The lower level had only one main corridor.

In places, they saw, the corridor widened. Its ceiling rose a level. At the floor of that level, a balcony extended along one side of the opening; the balcony connected the two parts of the upper level. You could walk around the upper level, too, but it was not so interesting. On the lower level, the wider places were intended as town squares. They included easily visible restaurants, museums, taverns, and in one widening, a library containing physical books. The design worked. People went everywhere.

The station's telepresence rigs were its reason for being. Much study could be and was undertaken with various sensors, some small and hidden on the surface, others in satellites orbiting the planet. Nonetheless, people most preferred pretending to be there. They used telepresence.

The inputs came right into the brain. It could feel very odd — if you were in a babbo body, you felt four legs and two arms. A passenger could look around, using the creatures multiple imagers. He or she did not have to feel the body much. On the other hand, an operator had to limit himself or herself to just what the creature could hear, feel, smell, taste, and see. He could only do what the animal could do, nothing else. Otherwise, an operator might give himself away. Watching computers made sure none did.

To avoid confusion when the creature was wounded or died, the larger devices, mostly transceivers, were hidden in and looked like bone. The smaller devices were organic and invisible to the various naked eyes that might see them. No carnivore who jumped and ate a babbo would see or taste anything unusual. Scavengers liked eating Lentergrin's body.

Three or four operators ran shifts in each creature, sleeping when the creatures slept.

One set of operators worked with a tree. It could not move, but was located in a babbo band's near-permanent home. They went away and came back. When you rode a tree, you became it. That was weird. You felt the sun on leaves, the wind moving branches, roots sucking, birds picking beetles out of the bark. All in all, the experience was strange. At least, it was strange to humans. AIs did not think so.

You could also see and hear all around, but that was similar to any research entity except this one did not move. However, the tree was bigger than most. If you wanted to, you could shift your virtual position from trunk to branch. (Lentergrin had the same sensors, but for all practical purposes, a rider conceived of him as one virtual position.)

Since she did not have an inbuilt computer and communications, Leestel wore a special helmet for telepresence. She thought the experiences were wonderful; and she quickly learned to do the rest, like access the memory of the station computer. "I can see why reborn people like all this," she said. "It is a definite improvement over being naturally born. If rebirth were safer, I would do it sooner, just to gain memory, computer, and communications. Maybe I will anyhow. This is much better than intelligence augmenting drugs."

Djem tried riding the tree; he rode the equivalent of a whale — he decided he was not much interested in the ocean and did not care for it — and settled on a babbo body. He sometimes wished he had control over it, but mostly, he was content to ride. If the eyes were not looking at what he wanted, he used the other sensors. They covered a much wider spectral range than the babbo eyes and had a higher resolution. The sensors were not eyes as mammals knew them, with lenses and photo-receptors, but more like lobster or fly eyes, but not collocated. Instead, they were spread out all over the body, like hairs — in fact, many were disguised as hairs. Djem could see why operators avoided these sensors. It would be easy to learn too much inadvertently.

As Djem learned more about Tegmar, it became more interesting. He saw more and more that he had not seen before. He came to understand the geology of hills and valleys, water gaps and wind gaps, to understand what grew first after a forest fire, and to parse the plants in a field. He began to appreciate the information collected by the satellite and miniature fixed sensors. He learned that the researchers really were detectives; and that babbo social arrangements were particularly opaque. On the other hand, babbo bodies were different. Everyone understood their micro-nutrient needs.

Those babbo bodies used for telepresence contained babbo brains. The riding, perceiving, and controlling structures were added on. Operators gave what amounted to unconscious hints to their creatures.

To Djem, the whole technology was open to abuse, both of babbos and of humans. With it, you could force a human or babbo to do anything. You could torture. But the Melians handled the technology well. Djem decided that Earth would have done worse, or at least, some on Earth would have done worse. On Earth, had the miscreants been powerful, no one could have or would have stopped them. That was the difference. The Melians stopped the bad. Because they arranged things so that everyone could feel at least a modicum of respect, there were few predisposing causes. Nonetheless, there were a few. That pre-

cipitated actions. But the authorities investigated as well as captured perpetrators. Their 'social deviance' rate was low. That included their crime rate.

Djem was just starting to understand in a fundamental way that he might be embedded in this society for the rest of his life; and that his life might be much longer than he had expected. He decided that he preferred this society.

So he was especially shocked when someone tried to murder him.

Chapter 16

The attempt was aimed at Djem personally. Clearly, it was intended as a public murder. A robot threw a grenade; properly misled, it could have walked up to him and detonated the explosive, but the remains of the robot would have distracted everyone.

Except that Djem surged forward when he saw Leestel's feet come around the floor's curve ... He recognized her as soon as her knees came into view. He did not know how he recognized her; nor did he admit to himself how much attention he paid. But that did not matter.

Rather than explode just in front of him, as had been intended, the grenade bounced off his chest downwards and the valet robot jumped on it. The valet absorbed the explosion and a good part of the noise. The robot was destroyed but Djem was not hurt.

Djem's guard robot, who walked behind him, shot the other robot immediately and caused it to drop. Then the guard robot raced over. Although quickly done, it was all useless action; the other robot did not know anything. It thought it had been tossing a welcome surprise.

Meanwhile, Leestel ran towards and hugged a stunned Djem. He was alert enough to say, "We should get out of here. That is the first rule in any assassination attempt. Move! I'm not hurt. The valet died for me."

As other robots came up, the guard robot told Djem where to go. It followed him and Leestel. Several times, Djem said, "I'm not hurt." After a considerable time, he realized that if Leestel had not come at that precise moment, he would not have moved forward. He would have been where the attacking robot predicted him to be. The grenade would have exploded just before hitting him. It would have killed him. Then he started shaking.

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He felt dramatically irritated that the attack against Djem failed. Too much uncertainty occurred while the bomb was in the air. In this case, the stranger from Earth was falling for a local girl. Well, that was fine. Doubtless, Security had planted her on him. But why did he have to go forward just then? It was an improbable accident.

Had the assassination succeeded, it would take no more than two years to grow a new body for Djem. Then, he would be reborn again. The girl could wait. Or Security would find someone else. It was not really murder.

Unfortunately, the assassination failed. Hardly anyone worried that Earth might retaliate against a failed assassination. More likely, in two and one-half dozen years, Earth's rulers would laugh. 'The Melians are decent people,' they would say, 'so decent they cannot even carry out a

proper assassination.' People on Melior would decide that Earth thought them harmless.

So, he would have to arrange for another assassination. What a bother!

Chapter 17

Telren bushwhacked through a forest. After scooting up to high ground, he walked cross-wise. When it rained — the mountains were high enough to pull water out of the sky — erosion washed away the dirt and stones. Ravines' steep sides fell into the dashing torrents below. The trees and bushes could not stop the loss.

Mostly, Telren managed to avoid those streams and ravines; he was higher in the mountains than they. But occasionally he had to go down one and up again. Satellite maps and transmissions made the difference. The Slanis Mountains had pushed up fairly recently, no more than a few geological periods before. One continent had collided with another. Unlike the Dizloes Mountains on Melior, these stretched a long way north and south. But they were not much to cross.

A good deal of the forest was thicker than Taffod's. Often, Telren could not run. He bushwhacked with difficulty. A few branches tried to stab him; he walked around them. He pushed soft growths out of his way. 'I would have made better time,' Telren decided, 'crossing at the beginning and then loping north over the grass. Cutting through the forest is slow.' But time did not matter, not the extra time this bushwhacking would take. He could eat here and would, just not deliciously. And now Telren was committed to going to the next pass. Besides, this route was more interesting.

Because of convergent evolution, the forest was not that much different from a low latitude, temperate forest on Earth. Trunks grew as strong cylinders. That held them up. The bark on the outside was supposed to protect the inside and did to an extent. But like Earth, various beetles and birds came to feast. They crunched and pecked. So different trees grew next to each other. In any one set of years, only one died from infestation. The forest survived, even if the individuals did not — and in any case, trees could survive a great deal. An individual might be weak for a half dozen years, and then return vigorously.

Tree trunks lifted flat leaves high above the ground, equally high as their peers. From above, the trees in summer looked like Earthly cauliflowers. The pattern was more or less the same, but vastly bigger. All the leaves captured sunlight. They shaded the ground; but shadow dwellers grew there anyhow. When they grew old, trees stopped being able to resist disease as well as they had earlier. They died and fell over, leaving holes in the canopy for saplings to reach.

In Telren's imagination, the woods he penetrated were more like a recently cut forest than a 'forest primeval,' which is how he saw Taffod's forest. But this forest on Tegmar had never been cut; it was just naturally thick. Telren puzzled over the observation. Why didn't shade loving plants grow up under Taffod's canopy? Why didn't dead trees leave more openings?

'Perhaps,' he thought, 'on Melior, the terraforming is too recent for trees to age and die. Or maybe the terraformers had not seeded the region with shade loving plants. If their seeds have not yet spread, and it has only been a few gross of years, then they would not be there. Or maybe robots cleared the ground. Or maybe the ecology was just that much different.' Telren would puzzle over what he knew and then seek studies.

On Tegmar, different species of insects infested different trees, so several tree species interwove. Only occasionally would one or the other predominate in a patch. This should happen on Melior; but it hadn't yet. Or perhaps the colder winters in Taffod's forest killed beetles. That forest was closer to its pole and the planet tipped more than Tegmar, its seasons stronger. Studies suggested that on Earth, the cold protected boreal forests as well as hurt them. Mosquitoes bothered humans and other animals; but they did not bother trees, which could survive a winter that killed insects which tried to live longer than a single warm season.

When Telren could lope, he covered ground much faster than Taffod. Even with the interruptions, over a day, he would have beat Taffod had they been on the same planet. Finally, as evening approached, Telren reached a pass over the mountains very nearly opposite to the herd he sought. He crossed the range. On the far side, he loped along a trail beside a ravine and headed on towards the plains. Then, still in the mountains, he stopped to eat and sleep.

Chapter 18

Leestel and Djem talked over that would have happened had the assassination succeeded. As she said, "The Melians would have had you reborn again. You would have had your internal memories from Earth, the same added memories that you have now, plus the public record of the past few days, and more — if the Melians rebore you into your own body, rather than into a general purpose body, regrowth would take two years."

Djem did not think the Melians kept growing spare copies of his body; and he did not think they would have put him into a general purpose body. He would have been dead again for two years. Leestel thought the same. However, probabilistically speaking, he would not have died forever. Indeed, a Melian might not think it a murder at all, but merely an inconvenience for a recently reborn person.

Leestel went on, "We would have informed Earth that you had been murdered and were going to be reborn again. We would not have been highly concerned. But what did the conspirators or conspirator intend? I don't know. What happens now that you have survived?"

Both Leestel and Djem thought that the purpose of the attack was to create a fear of possible Earth retaliation. In thirty years base ten, Earth would learn by radio of the attempted murder. If they retaliated, they would either radio an existing device near the Melior star, a spy wisp, or they would send another star wisp. As Leestel said, "For Melior, danger will come in five dozen years or in one-gross six years."

Because of the prospect of mutual destruction, Djem didn't expect any retaliation to involve a planet killer. Leestel didn't think so either. Djem was a bit bothered that she already know about mutually assured destruction, but it turned out that everyone on Melior was taught it. Neither could think of any retaliation that Melior would not equal. Consequently, neither thought that Earth would retaliate at all.

But suppose the intent was only to suggest that Earth *might* retaliate? For *might*, the probability could be very low. But someone in control on Earth might be irrational or might expect to die forever before a Melior retaliation or might not expect Melior to retaliate. (He or they might understand that the earliest the Melian retaliation would be sixty years after the inital order was given on Earth and think that the Melian government would expect the Earth villains to have died forever.)

From Melior's point of view, the fear of retaliation argued for safety, even when the probability of retaliation was low. Safety required expansion. That in turn meant more humans and more AIs. Producing more AIs would be easy, if they agreed to duplicate, but any government would have a hard time increasing the number of human births. Increased rebirth safety would be easier for the government and would

have the same long term effect. Many living humans would like that, too.

Fear and desire, a very potent combination.

In addition, as Leestel had argued successfully with the government at Farhaven, emigrants could go directly to Ulterius. That gave two destinations fairly near.

Earth could also attack Farhaven and Ulterius. If you went farther, a little more than two dozen light years, you came to five more reasonable stars, all singles and all main sequence G spectral types and early Ks. That excluded Alpha Centauri, which not only was a multiple, but close to Earth.

Neither Ulterius nor any other place was ready for humans. But within limits, it did not matter how long a person stayed dead in a data packet. They could go somewhere and then wait until the planet was ready.

Earth might make estimates of where people would migrate, but with replicators the Melians could build a dense guard before Earth sent attackers. It might be prudent for the Melians to build such a guard regardless of circumstances. But Earth, rationally, should not do anything.

In any event, Djem was an expendable diplomat who had not been killed. Indeed, he had not been injured, not physically.

Djem decided that some group of Expansionists were behind this attack. He feared they might try again. That led him to think better of safer rebirths.

Djem remembered his thoughts after reading Gammae's essay. Status and attention had to be rivalrous. There had to be losers. If you presume that losers expect at some point to win, and you presume they prefer to be inside the system to being outside of it, they should accept a loss. But a few would anticipate they would always lose — at least, given the way things were. But what if they were the first or the only people to emigrate to a new planet? Then they would not lose.

That would be a very good reason for them to favor expansion — to save their status. Needless to say, expansion could not go on forever. Even at sublight speeds, with years spent at every new planet, the galaxy could be colonized in less than the time it takes the sun to revolve around it. That was a long time by human standards — the dinosaurs had come and gone during the last revolution — but in galactic terms, it was short. Be that as it may, people would like a prospect that looked long to humans.

The space station assigned Djem another humanoid robot. It transferred the backup information from the previous robot to the new one. That way the robot already knew Djem's tastes and desires. From Djem's point of view, the new one was identical to the old. It reported

to Security. Indeed, it did everything that Airlent's gift had done officially.

Regardless, Airlent was peeved. He had lost a spy. The new valet did not have the extra capability that Airlent gave the original. It did not spy and report to Airlent. But the next time Djem and his robot passed through Airlent's space station, Airlent could adjust the robot to his liking. It would not take more than a moment.

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He decided that this time, the bomb had to be detonated close to Djem. No throwing! That meant a human or robot had to carry the bomb. He could not fool a human into doing what he planned, but he could fool another robot. He had done that before. So . . . what would be the device?

He thought it through. He would make a physical gift for Djem. The Earth Beware party would persuaded to give it to Djem 'in sympathy for his recent attack.' Everyone would also know that physical gifts were not valued, so they would conclude that the Earth Beware party was sending a double message: on the one hand, sympathy; on the other hand, very weak sympathy.

On the third hand, the Earth Beware party would be perceived as continuing to take part in the political system, so the gift would be accepted in an appropriate ceremony. That would ensure that the gift went to Djem.

On the fourth hand — he did not have four hands, but there were four items — murder at such a ceremony would be especially distasteful to Earth. People would have to worry about the possibility of retaliation. Expansion would be safer. He would win. And probably, Djem would merely be dead for another two years. Then he would be reborn. It really was not murder.

Djem's valet was the kind of robot he could fool. Most likely, it would present the gift. That would make a nicely symbolic portrait of the better, cornucopian Melior robot along side the backward Earthman. Everyone would appreciate that, except perhaps the Earthman.

The latter, however, would be urged by all and sundry to encourage the Earth Beware party to show itself a part of the system. Indeed, the Earthman might not recognize the symbolism, or if he did, he might in a very discrete way support it. After all, Melior truly was a better place than Earth. He knew that. He just wanted to make it even better.

Presumably, the valet robot had some guard functions. That is why it jumped on the bomb of the previous assassination attempt. But if it did not know its device was a bomb, none of its guard routines would be triggered. The official guard would not get in the way either. It was a simple plan. Nothing could go wrong.

Chapter 19

After the assassination attempt, Djem decided to return to Melior.

Eventually, he would return again to the Tegmar space station. He liked riding the various bodies. But he did not want to stay there at the moment. He was looking forward to returning to his apartment in his embassy, to the paintings, wall hangings, and sculptures that he had chosen.

He wanted to travel about the city more. The museum of 19th century technology sounded interesting. He would like to walk and to ride cable cars. He did not want always to ride an embassy vehicle. Maybe if he went out randomly, an assassin could not predict him and would not murder him. He would talk with his guard robot. The guard would know.

Potential assassination: that was the fly in the ointment. Djem thought about the phrase. He had never seen a fly in ointment. On Earth, he had squeezed ointment out of tubes. Presumably the saying was from an earlier time, when ointment was kept in a jar and a fly could get stuck in it. Well, being assassinated was worse than finding a fly in a jar of ointment; but you did not die forever, not on Melior. It was not as bad as assassination on Earth.

Before the voyage, the Tegmar station AI asked Djem, Leestel, and the other passengers whether they minded a slight detour. Three cosmic rays had each hit a different and vital part of guidance fibers for a telescope. Fast moving nuclei had changed the index of refraction in each fiber just a little. Normally, the parts hit were not repaired at the telescope.

Indeed, if only two cosmic rays had hit the fibers, the telescope would have continued working because of redundancy. Everyone would have waited for the next standard repair visit. Indeed, the problem would have been so minor that no more than one or two sentients would have learned, and then only in passing. However, as unlikely as it was, there were three hits.

Since events like this happened so infrequently, the telescope did not possess a nano-assembler; no sentient thought its extra mass worth the bother. Instead, the telescope possessed only micro-assemblers.

One passenger insisted on saving two days time, so the station built him a space ship. He left at the same time as the rest and got to Melior quicker.

In contrast, Djem liked the side trip. He had learned about Melior astronomy before; here was an example of one device. The mirror itself was only a half-gross of meters across. It was smaller than he expected. For astronomy, you had to collect many photons. But then, it was only one of a large number. Its size had more to do with convenient maneuvering than anything else.

A large nano-assembler had built the mirror. That way, it had been easy to make it smooth and accurate at atomic distances. This meant it would last quite some time before wandering particles degraded it beyond an acceptable level. The mirror was cooled, too. It rested at the temperature of the microwave background.

The rest of the device had been built and was repaired by micro-assemblers, except for the computers and the fibers, which they came to replace. The telescope collected photons and compared them with those from other telescopes. It was part of an interferometric set.

The telescopes' separation controlled its resolution; their collection area, its sensitivity. This particular telescope was one of a group that together had ruled out large, non-natural, non-human features on nearby rocky planets. This ruled out the kind of technological alien that many Melians hoped to meet. On the other hand, it also meant that the Expansionists could talk about a wider territory.

Had it not been for the side trip, the interplanetary voyage would have been shorter than previously. The two planets were closer. There were more people this time, mostly tourists.

Besides looking over and learning a lot more about the telescope than he expected, Djem did little on the trip. In many ways, it was a time out of time. Djem decided he liked that kind of voyage, not too long, but not too short either, and in comfortable circumstances.

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He had learned more on Earth than how to confound digitally restrictive mechanisms designed for mass markets.

He had learned how to make explosives 'from common household chemicals.' That was the phrase. He smiled quietly and secretly. He used them. Also, for a long enough time he had been an eccentric who did a fair amount of work for himself. No one questioned what he had. Rather than expect a robot to lay out his clothes, clean his house, and cook his food, he did that himself. He did not have robots around him.

He told people, "Too much of a chance they have been subverted by Earth." It also meant that none could report on him. Most people thought he was a touch crazy, but then his supporters weren't most people. Even if they felt the possibility low, and they showed this by having as many close robots as anybody else, they liked him.

So he decided:

The gift was to be a brooch designed to hang around Djem's neck. It would carry an image of Djem's face from just before the blast. He looked happy. It was a good picture.

No one was going to expect Djem to wear the brooch a second time. Its purpose was ceremonial. For that the brooch could be large and heavy; the picture would be half the size of Djem's face. Everyone could tell that it was designed to show up on recordings. That an object that big could also carry a bomb — that notion would not occur to anyone.

The President of Melior would be at the ceremony, members of the government, members of the opposition, other politicians.

When the bomb exploded, he would claim responsibility. He would frighten people. No one would think of the Envoy as dead forever; but they would think of it as a terrible inconvenience, especially for those who had lived for more than a few days since their last rebirth; and that was everyone except for the Earthman.

The others would be so confused he would avoid all but a slap on the wrist. They would have to assign him a watch robot. He could live with that. Indeed, he would turn the assignment into an opportunity. It would enable him to accept robotic servants again. He did not expect to have to do anything illegal for a long time to come, so robots did not matter. And he could use them. They were nice to have.

Chapter 20

He created the brooch and persuaded the Earth Beware party to give it to Djem 'in sympathy.' Since everyone knew that physical gifts were for ceremonies only, they also decided that the Party did not intend to convey much sympathy. Still, that was to be expected. Several were amazed the Party had come as far as it did. Critical people observed the additional point, that the event would tell everyone that the Earth Beware party would continue to take part in the political system. All had been foreseen correctly.

He gave the robot the brooch.

Airlent was not riding the robot at the time of the transfer although he had upgraded it when Djem passed through on his way back. The upgrade did not take long, even though he had to insert new sensors physically as well as reprogram the machine.

For later upload, the valet recorded everything. Since he was spying for Airlent, he had better sensors than a normal robot. In addition to the instructions, spoken normally, ". . . twist the lock like this to open the brooch . . ." the robot could also hear and record the sub-vocalization, ". . . and then the bomb explodes . . ."

While the robot was not smart enough to do anything then and there, he was smart enough to notify Airlent as soon as he got into a location where no one paid attention to a robot transmitting encrypted data.

Airlent immediately asked the valet robot to duplicate the brooch in a nano-disassembler/assembler, an atomic replicator. Then he had the valet carefully inspect the duplicate and remove the explosive from it. Airlent rode the valet robot the whole time and enjoyed the effort.

They ended up with a brooch without the explosive, but otherwise atom by atom identical to the original.

Airlent said, "Present this to Djem in the ceremony!"

Chapter 21

Telren loped over the open range. He thought it very beautiful, as it was rolling grassland with ponds and copses of trees. Both his human and his babbo ancestors liked this kind of territory: they could hide in copses, hunt and scavenge over the grasslands, and find food in swamps. The coast had even more food. Bands migrated across this land once a Tegmar year.

Lentergrin was right he thought. 'Living in a babbo body is better than living in a human body.' Telren liked loping on four legs or six. He could keep it up for hours. Well, humans could run for hours, too, but they had no reason, except for races.

He was going to kill and eat a Ponellee, most likely an old one. Age meant a more vulnerable animal. It saw worse and ran slower. A babbo could catch it. A young animal would be more tender, and could be caught, too, but the herd protected all of them. Only if a young one broke a leg or got sick might the herd abandon it. An older animal would have tough meat but taste better.

Like the members of several babbo bands, Telren carried a cudgel on a vine looped around his neck. He set it to stay on his back. Probably some ancestral babbo walking through a forest had stumbled into a vine tangled around a stick. Inadvertently, Telren imagined, the babbo had carried the stick away with him, and then used it — and he and others learned a good way to carry sticks over grassland.

Had he been a true babbo alone, he would have eaten a plant from a swamp. In this season, it would not have tasted very good. Had he been a babbo in a band, someone might have found carrion; that would have been tastier. But no one would have found the herd without satellite sensors and radio. It was too far away.

Probably — Telren was getting better at estimating these things — a band where he was would have taken three days to find tasty food.

Telren liked his radio. With it, he could live in the wild and yet enjoy both good food and Melior. Both Taffod and Tindark carried extra sensors in their bodies as well as radios. They were not like most other humans on Melior, but like a researcher on Tegmar.

Taffod and Tindark's extra sensors enabled Telren to perceive what they perceived; either could go to a party and he could see, feel, and smell everyone. From their meetings at the Reception, Telren had a good sense of the Envoy, better than Djem knew.

Each duplicate thought and felt differently. There was no way to record their thoughts or feelings. But Telren, Taffod, and Tindark exchanged detailed daily messages. They told each other their hopes and fears. The messages countered their worries about accident and death. They enabled the three of them to take more deadly risks than otherwise.

Occasionally, one lived. That is what happened to Tindark. He went cliff climbing on very dangerous rocks and did not even injure himself. He was more skilled than anyone expected; and he did not run into the bad luck that killed or injured others, like avalanches or strong gusts of wind.

Telren did not expect to live as long as Lentergrin. He was more an adventurer. But he was not stupid. He would have walked the same path as Lentergrin, away from the ravine. But Telren climbed Tegmar mountains, swam in oceans, and loped alone more often.

Meanwhile, Telren knew about the assassination attempt on Djem. It was a sophisticated attack. Probably, the bomb was disguised as a pop-open welcome grenade. The bomber had fooled the robot. Djem escaped by springing forward unexpectedly. He was lucky.

Telren was loping along. For awhile, he had paid conscious attention to his surroundings. The grassland, the gentle hills, the copses, the ponds in deeper valleys, the swamps surrounding them or in shallower valleys, the swamps alone: they all were beautiful. But now he wanted something else to occupy his mind.

Who would have made the murder attempt? Who had the means, motive, and opportunity? He asked himself whether real murder detectives used that trilogy? It was certainly a famous literary list. He was going to use it.

Obviously, since Djem was an Envoy, Security would watch him. They had both the means and the opportunity to assassinate him, but what motive? Telren could not see any at all. Security would want to study Djem. That would be why they set that girl on him. They would do that to gather information different than what came from Earth's radio and TV transmissions. They would have no motive to murder him.

The AIs wouldn't have any motive either. If they wanted, they could analyze his data packet more thoroughly than they did publicly, although that would take time and additional processing. Telren did not think that any bothered. Why care?

Telren digressed for a moment. In two or three dozen years, should he specify rebirth into an inorganic body? That way he could find out what it was like to be an AI. Possibly he would not have to. Perhaps Taffod would enjoy the experience. If Taffod sent a duplicate to Earth, as Telren thought likely, that data pack could also be duplicated into an inorganic body on Melior. Taffod could do this rather than be reborn in an organic body. Telren figured that Taffod would create the duplicate soon. He would have to talk this over with Taffod and Tindark. None of the Dowwen duplicates had ever become inorganic.

If neither Security nor the AIs had any motive to murder Djem, it had to be a regular human.

The Transcendentalists would not care about Earth, its Envoy, or Melior. They were irrelevant.

The Conservatives would not want to murder him. They wanted society to carry on forever and forever. Their main problem was to avoid any policy that could lead to ecological collapse. Hence, they supported all sorts of regulations and governmental restrictions. They pushed for a society that discouraged births, left danger in rebirths to cut the population, and promoted an education that enabled people to live a long time without damaging their environment.

The Conservatives would treat the diplomat as an Envoy, which is exactly what he was. Their goal had to be a safe understanding with Earth.

The Expansionists did not discourage births as much; they knew that if you are going to expand human and AI presence, you need more. Also, if you expand, you can damage a planet and then leave.

There are only two ways to raise numbers of humans: either increase the birth rate or reduce the death rate. Although it would be easy to increase the numbers of AIs, they did not want to. Likely the humans did not want such an increase, either.

Of two ways to raise numbers of humans, the first meant a more child-oriented society. The second, safer rebirths.

It would be hard to inspire people to care more for children. That meant it would be hard to increase the number of births. As for the second method: Telren did not find any discussions by the Expansionists on rebirth safety. At first, that seemed strange. Increasing safety was an obviously appealing topic. Then it occurred to him that most likely, the Expansionists did not talk about it because it was too appealing. Perhaps, he started out thinking tentatively, they were afraid that as rebirth became safer, people would become more risk averse. Then, people would be more likely to become conservative. They would want to protect the environment, support government regulation, and all that. They would become Conservatives! That made sense. That is why Expansionist leaders did not talk about rebirth safety!

He thought about it from the opposite direction. Well, not quite; another kind of safety, backups, not rebirth. If you made it possible to back up a person readily, like an AI could already do, you necessitated expansion.

But that would mean that Expansionists would have to support the development of procedures that did not require humans to exercise and adapt to a new body every time they backed up. Exercise and adaptation took too long. It was unpleasant. Skilled and rare coaches did not end the unpleasantness; they merely made it less unpleasant.

If safety backups were developed, people would take more risks. What would that do to society? It meant they liked danger more. It

other words, society would become the opposite of risk averse. It would become risk desiring.

Unfortunately for Expansionists, that desire could distract people. If you could be exciting and dangerous now, why go to a new world where people would have to discover what is exciting? Melior was not terribly exciting, but it was not too boring. Or you could go to Tegmar . . . Telren decided that the Expansionist leaders had come to this conclusion, too. They did not like it any more than they liked its opposite. That is why they did not talk about it.

That left the Earth Beware party. Expansion provided them more protection against Earth. Consequently, they allied themselves with the Expansionists. Unfortunately for them, Earth had not done anything to beware of since the Melians had left Earth. So maybe the murder was intended as a way to increase people's fear of a possible, although unlikely, Earth retaliation.

And, most likely, it really would not hurt Djem, whose original data packet went on existing and who could get reborn again. He would not even lose that much personal memory, not like Lentergrin, who lost five dozen years of it, including a character change for the better.

Who knew about bombs? Telren suddenly knew. He had a memory from a very long time before. It was from a Taffod who lived on Earth, who talked with a fellow about making bombs. The same kind of bomb could be made now. The man could get away with it. He had the motive, the opportunity, and the means.

Telren decided to tell Taffod and Tindark on Melior.

Meanwhile, although the landscape still rose and fell, the grasslands rolled less. Copses and ponds filled fewer valleys. Telren decided to drink at the next pond or stream, rather than later ask a satellite to find him a waterhole.

Chapter 22

In his embassy, Djem turned the brooch over and over in his hand. The ceremony had gone exactly as planned. Djem asked himself whether he wanted an endless vista of such ceremonies? A few were fine. He was not accustomed to them yet and found them interesting. But later . . . and worse, as a participant, he could not let his mind wander as he had on Earth.

The picture of him was good. He had to admit that. It showed a liveliness and sparkle that he did not see when he looked at his face in a mirror.

Probably, it was taken when he saw Leestel coming round the curve, just before the attempt on his life. He knew that Leestel was planted on him and that the computers knew not only how to match temperament but also how to choose major histocompatibility complexes and vomeronasal smells he was not conscious of. He knew that the result was sought and anticipated, and still he liked her.

Djem did not know about the second assassination attempt. But he was upset by the first, the thrown bomb on the station by Tegmar, as well as by the trashing of his room. Clearly, the Melian political mechanism was not as good as described.

He decided to go out to the farm again, sit on a rock by the new pond, and think about the problem. It was quiet, private, and sufficiently out of the way that he would not be bothered. He was not sure whether the new pond was finished. He presumed it was. He had been away long enough.

Djem's car turned left as he drove out of the embassy. First, he told the car to go to the art museum he had visited before. The valet robot had no reason to follow him and did not; Airlent was irritated but understood. Unfortunately for Airlent, Djem did not subvocalize strongly. While the valet's extra sensitivity enabled Airlent to learn that Djem was not really going to the art museum, it could not tell him where he was going.

The guard robot got into the car with Djem. Half way to the art museum, Djem told the car of his new destination. Obediently, the car turned and went there.

At the farm, Djem told the farmer that he wanted to go down to the new pond and sit on one of the rocks. Filgard was very cooperative. He thought he understood, although he was wrong in his imaging. He said that no one was near the pond at the moment, it was full of water, the rocks were clean, the newly planted grass was beginning to grow, and several ducks had taken up residence, but as yet no swans or geese.

Djem's guard robot made to follow, but Djem told him stay by the farm house — "How likely am I to be attacked here?"

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Meanwhile, Airlent worried about Djem. But he did not want to be obvious to any other computer watchers. Airlent knew there were dozens; watching who was watching was a favored and socially useful task. And it could be assigned to a non-sentient.

Airlent spent quite some time thinking of ways to get around this watching. Normally, he supported watching. The practice protected him. But not right now. He wanted to look casual, so that if he did get caught, it would not look as if he were being sneaky.

Each tower wore sensors. Their existence was not secret, but most humans and AIs did not care. The government was transparent and safe enough that none feared it. And with them, robots could pinpoint cable car accidents and fires quickly and exactly.

The sensors were big enough optically to permit a good deal of magnification without the image becoming too dim. They were far enough apart for high resolution. The towers were spread out and the sensors could see just about everywhere. In addition, they looked through less atmosphere than the cameras on satellites and more closely to the horizon. In other words, they offered excellent monitoring.

Airlent decided to receive their whole feed — that would be a typical AI action and might simply mean he was momentarily interested in birds. He would study it for what he wanted. The job took up a few more of his low level processors than planned, but then again, he had more. He had built and installed them after Djem's room was trashed. He still had them. Since Djem was not on the station, he did not have to run a sweep so frequently. So they were available.

He scanned. He knew he would be able to see the embassy car if Djem were inside a building, or he would see Djem himself. Airlent found Djem walking to the pond on the farm. He set a subroutine to watching Djem and the area around him and then went back to other tasks. The next time this happened, he would not have to spend so much time figuring what to do.

Meanwhile, Airlent scanned his space station, found nothing out of line, scanned the volume around it, again found nothing, scanned space toward the sun, and consciously saw a particle cloud coming towards him. The cloud would hit the planet's magnetic field in two days and probably create an aurora through which the space station would fly. Along with several other AIs and humans, Airlent liked the aesthetics of such a fly through and looked forward to the event. They would have orbited in darkness for long enough that humans eyes could adjust. As usual, Airlent planned to reduce the station's magnetic field so the ionized atoms got close.

The subroutine observed Djem and the area around him. Suddenly, it saw another human head towards Djem. As soon as the probability crossed a threshold — a threshold which Airlent had set quite low — the subroutine notified Airlent's consciousness. Danger!

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Telren's message went to Taffod and Tindark. They both thought about his musings and decided he was right. That was not hard, since the three of them were so alike. The two planned to tell Djem and made to contact him. This meant discovering whether Djem was interruptable. They connected to his communication's module which told his location and then used the tower's vision to see him.

Djem was sitting beside a farm pond. He did not look as if he desired interruptions, but he was not signaling a desire for privacy. However, neither Taffod and Tindark knew whether Djem understood the conventions. He was, after all, a recently arrived Envoy from Earth.

Then they saw that the head of the Earth Beware party, Gellor, was walking towards the pond with a knife. It did not occur to either that Djem could defend himself. Instead, they headed toward the pond. Tindark was closer and in the lead.

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At the same time, Airlent saw Gellor coming up on Djem. Djem's guard robot was near the house, not near Djem. Airlent knew that the guard robot would always stay close to Djem unless he had made some sort of convincing argument about safety. That meant the guard did not know about Gellor.

Airlent decided that the only way to convince the guard to rush to Djem was to tell all. That meant coming clean. He had violated Djem's privacy. It was for a good cause, nonetheless . . . Airlent thought for a moment that he should commit suicide. He did not expect to be restrained sufficiently to prevent that. But, in fact, he expected to be pardoned.

It took less than a second to transfer all the information to the guard, who responded immediately and headed to Djem. Airlent saw that the guard made a backup during his run.

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Djem was sitting on a stone by the pond when Gellor Thurnsby came up. Djem thought it odd the man carried a carving knife.

Gellor said, "It was not hard to find you. I simply connected to the city and had it search for a human who looked like you." He went on, "Djem, you are a hard man to kill. I don't understand why that second attempt failed."

Djem was confused. "What second attempt?" He still did not think Gellor dangerous.

"The ceremonial brooch contained a bomb. It was supposed to explode when the robot twisted it in a certain way and opened it. But it didn't explode. I don't know why. I built it right. Your death will inconvenience you. You won't be born again until the year after next. And you will lose a few days."

"But why would you try to kill me?" Djem asked. "I am not important in any scheme of things."

"That is not true," Gellor said. "Your death, even if temporary, will increase fear that there is a chance Earth might retaliate. Every one will agree that retaliation is improbable. The issue will be the possible. You have probably thought that." Djem had; and he started to think that Gellor was dangerous.

Gellor never stated his real reason for wanting expansion. He gave an explanation that others would believe. He presumed that everything he said was recorded. It would be played at his trial. The trial would convict him and he would be put to death. He would be reborn from his previous data packet and lose the private memories of these last five dozen years of his life.

When he awoke, he would be able to hear and see the trial, but it would be another him who endured it. The new Gellor would not have any of his contemporary internal memories.

Maybe the new Gellor would believe that the words at the trial expressed his motive. But later he would come to understand that with expansion he could go further politically so long as he picked an unpopular place. That was key. And he did not plan to tell anyone that.

Gellor continued talking. Besides expressing a false motive, he had to come closer to Djem. Meanwhile, Djem was beginning to believe that Gellor was serious.

"Just the chance will mean that we have to expand more." Gellor continued speaking, "In turn, expansion requires more people. We can't increase the number of AIs. As for humans, increasing birth rates is hard. The simplest action is to increase the safety of rebirths. Then, fewer will die forever and the population will increase."

Gellor had to come even closer. It was hard to kill with a knife. "We all agree that it would be nice to be like AIs, who have no trouble waking up; but we are not like them. As far as I can see, the only way to get people interested in any of this research is to scare them."

He stabbed at Djem.

Gellor stabbed at Djem. He was very surprised to find his knife arm knocked aside and himself going over the man. He landed painfully on his side, his knife arm somehow being held and twisted by Djem, who kicked him hard in the neck. Gellor died very suddenly.

Then the robot guard arrived.

Chapter 23

"I can take care of this now; I got it all recorded," the guard called. Without looking at him, Djem said thanks and jumped away, carrying Gellor's knife. He was being careful. He did not know yet that Gellor was dead and that his reflexes worked.

Tindark ran up, too. "You look fine. What did you do?" he asked. "You are an Earthman."

Djem looked at him. "You don't look dangerous. Why are you here?" Djem still held the knife and Tindark was alert enough to stay away and to make his front and hands visible to the robot.

Then Djem responded to Tindark's question, "Didn't any of you learn self-defense in the old days, if only for exercise?"

"Yes," said Tindark, "but we did not expect it of you."

"I don't think Gellor expected it either," said Djem, who continued to feel unusually calm. "Now why are you here and why is the guard here?"

The robot guard spoke first. "I got a warning from Airlent Irtak. He was spying on you quite illegally. At the same time, however, he also removed the explosive from your brooch. And he told me of this danger. As soon as I got the warning, I came as quickly as I could."

Tindark said simply, "Our duplicate on Tegmar remembered Gellor from Earth. The man knew how to make bombs from common chemicals. He told Taffod and me. We did not know whether you should be interrupted — you were not signaling you did not want to be, but there is a convention here that you may not know about. Then we saw Gellor walking towards you with a knife. We both ran. I am closer, so I reached here sooner. Taffod should be along at any moment. We came to rescue you, but that is not necessary."

The guard robot did handle everything. Mainly that involved taking the body away. Djem never did learn where it went. Gellor's whole attack had been recorded. It had been seen by several farm robots, by the towers, and at the last, by the guard robot. The farm robots and towers had not recognized the knife. But the farm robots' images and sound were excellent. Djem was never asked to make a statement.

While technically he was a diplomat, his immunity did not matter since his killing Gellor was clearly in self-defense. Also, Djem found that since he himself had acted, he did not shake the way he did after the bomb throwing on the Tegmar space station. This time Djem's escape was active, not passive. It was not the result of Leestel's accidentally coming at exactly the right time.

After the coroner determined and spoke on Gellor's actions and death officially, several AIs studied Gellor's old data pack. They said that it indicated that five dozen years before, when Gellor had last been reborn, he was a peaceful man.

As for why he became a murderer, like the humans, they presumed that Gellor had become scared of the possibility of death forever. That was not the reason, but Gellor was dead and could not tell anyone otherwise.

In two year's time, after his body had been force grown, Gellor would be reborn. That was the conventional response for those who would be born peaceful, even murderers. Since Gellor had not been backed up for five dozen years, he would lose all private memory of that time. He would know only his public actions. And he would no longer be head of the Earth Beware party.

Chapter 24

Tindark hated the city. As far as he was concerned, it lacked adventure. He was not into phatic comments, pleasant remarks which assured every one that each was all right, but which really did not require words for communication. While he respected the value of such communications, he also knew that babbos managed fine without words.

He was not into urban status seeking either. He knew that was adventurous, but in a different way than he was. For him, that kind of status seeking was boring. Besides, he could not do an office job as others expected or persuade people of one desire or another.

The Reception had been OK. He had questions for the Envoy. Taffod had discovered that Djem was more aroused by questions about his travel from Earth than anything else even though he did not have much to say — as far as he remembered, he fell asleep by Earth and woke up by Melior. The arousal caused Tindark to change his plans. He asked Djem what it was like to come from Earth. Djem said simply, "It was probably no different from your travels. Drugs put me to sleep in one place and I woke up in another." It was true, Djem was more concerned than his words suggested. Tindark could detect that. He doubted that Djem realized. Djem kept on talking, "I am not having much trouble 'exercising and adapting.' Gammae is good."

None of the three, Taffod or the two duplicates, could understand why Djem was still concerned. What upset him? As far as the three knew, he had survived the trip wonderfully. Djem did not tell them. The best they could imagine was that Djem had been bowed over by the thought of traveling two and one-half dozen light years. It was a good distance. But that was not much of a reason.

Tindark went to a street fair. He was amused and taken out of himself. A juggler kept more single-handed batons in air than he could — he tried. With his enhanced reflexes, his maximum was seven. With more, even one more, he could not keep them all going. Too many and he couldn't cause the batons to twirl around so their handles swung into his left hand at exactly the right moment. Tindark could have kept many more balls in the air, they were symmetrical, but as the juggler said, "That is easy!"

People recognized him on the street, Tindark found. That was not hard; they could use their internal computer and communications. Also, they made remarks about his compositions — that was hard. They must have perceived them. Some he had nearly forgot. It amazed him which compositions people remembered. What was important to them was not important to him. Even so, he enjoyed his audience.

But they were not enough. Tindark knew that each of Taffod's duplicates emphasized a different part of his character. Taffod was more people oriented; he did not mind the city. Telren went off to Tegmar. That was true adventure. Like Taffod, Tindark wished that instance

were he. An earlier instance of Taffod, he remembered, had hoped to be reborn as Telren. He also remembered that a more recent Taffod had hoped to be born as Tindark, climb and die.

Except Tindark had not died. At the time, Tindark had felt the same way as Taffod. Now he was older and more cautious. He was no longer Taffod. He did not want to die. And Taffod, Tindark thought, now reveled in the city.

Tindark was surprised to find Taffod denying the emotion. 'I am making the best of an unadventurous situation. It is true, I am more people oriented than you, but I wonder if we should even be on this planet . . .'

Tindark was glad he came to help protect Djem. It marked a day and a potential adventure that otherwise would not be. Except that Djem did not need help and he would have been too late. He felt a bit of a fool.

'Well,' Tindark decided, 'for some reason about which I am not clear, I do not want to go to Farhaven. I do not want to go to Tegmar; Telren is there. Ulterius is not terraformed yet. I might want to go to it. In the meantime, I am stuck on this planet. I do not want to take outrageous risks; but I do not want to stay in this city either. No Dizloes Mountains for me; they are too civilized. I should explore the unimproved parts of Melior.'

Because he invaded Djem's privacy, the public prosecutor took Airlent to court and convicted him. However, as expected, he was then pardoned because he saved the Envoy's life twice.

Nonetheless, in the trial, to make sure that Airlent was truthful when he said that he spied only on the Envoy and not on anyone else, another AI went through Airlent's complete memory. This was an invasion of Airlent's privacy and more punishing that anything else. But the second AI found that Airlent was truthful. Also, he was bound not to disclose what he learned, and Airlent believed that. So the experience was not bad. And it did not take long.

Immediately after Gellor's knife attack, the Melior government sent a radio message that would arrive on Earth in two and one-half dozen years. It said that their Envoy had been attacked again. But by his own efforts, he had escaped harm and killed the attacker.

The message told Earth that the attacker was a lone man. Since the attacker was now dead, the Melian government did not expect another attack.

A little later, another message said that the attacker's data packet, which was last updated five dozen years ago, did not show murderous impulses. The Melians thought they were recent. In two years, the

murderer would be reborn. However, just in case, the new person would be watched.

Chapter 25

Following Gellor's attack and death, Leestel invited Djem to come to a weekly meeting. She was somewhat hesitant.

She said that people who might otherwise be strangers came together once a week to sing, to listen to or once in a while to give speeches on social morality, on how to detect, on why to choose one policy over another, or on what is currently known. She called it 'our equivalent of religion.' "It gives us hope for the future," she said.

Djem heard all this as a thin, sociological disquisition. He was not keen. So Leestel said simply, "Come along. If nothing else, the experience will provide you with more to report on."

That won Djem over: he knew he had a duty to people he really did not like, who were far distant. Or at least, he decided to go with Leestel. He grinned and said, "I'll come."

During the drive, Djem said, "When I was young, we had a state religion or maybe you would call it a cult. Its belief centered around the ecology of the planet as a whole. Actually, it is good to worry about the ecology. Still, I did not pay it much attention. That is an advantage of a state religion; it sticks around regardless of what you do or don't do. I expect it still exists. But people in it did not investigate the questions that concerned me, although it was clearly beneficial for some. Children saw Gaia as a male super-human god. I suppose I am more a bright than a super."

"What do you mean, 'bright' and 'super?' ", asked Leestel. "Those are not words I am familiar with."

Djem looked surprised. "The terms were invented at around the same time as replicators. It became clear that not all cultures are theistic and you cannot use the term 'atheist' in all. Some people call themselves agnostics or freethinkers. Some refer to themselves as humanist, although that word fails when you extend the notions of wisdom, intelligence, and ethics beyond human. The other term is 'super' which comes from 'supernaturalist.' People in both categories expect explanations of the world, but the one expects explanations, or possible future explanations, in naturalistic language while the other does not. Essentially, brights do not expect a world with supernaturalism and supers do."

Leestel took Djem to a round building. They walked, with the robot guard following. It was not far. The building was similar to the one Djem saw before, but not exactly the same. It was a church with a circular sanctuary. Seats circled about in levels that went down to a raised walk that stood at the center. On it, the only focus of attention was a ball with no markings on it. Three crossed sticks held it up. The ball was half the height of a person with its equator at eye height. It glowed white.

Almost immediately, they saw Taffod sitting up high near a wall. Leestel headed towards him and Djem followed. "What are you doing here?" Leestel asked, more curious than anything else.

"I am in a city; I should come. This place has a good reputation. I see you have brought Djem." Taffod nodded at Djem. "Are you new, too?" Djem said yes. "Come and sit here; there is plenty of room."

So they sat beside him. Others nodded at them but did not say anything.

From one side, music came from an organ. One person played — it had an old finger and foot interface — and another pumped bellows. To Djem, it looked like an historical reenactment. The music wasn't bad. It came out of the west European tradition.

People kept entering until about three-quarters of the seats were full. Then a man wearing a robe got up from his chair in the first row and walked out on the center. Before everyone quieted down, Leestel whispered to Djem, "That is an advantage of leading one of these; you get to wear special clothing. We will sing first. Most likely you will know the tune; and you can use your internal communications to discover the words." She explained, "Because it is beautiful, we kept the old music; but we recast the words."

The priest or minister turned all around, looking at everyone. As Leestel predicted, he said that first they would sing. He asked them to rise. Djem did know the tune. It was *Silent Night*. The words in the first two lines were nearly the same as those he knew, but the rest were different.

The congregation sang,

Silent night, Peaceful night,
All is calm, all is bright,
In deep dark we see all and more,
Choice is hard yet we try to explore.
Choose yet knowing not all.
Choose yet knowing not all.

Djem did not like the new words. But he did not think anyone paid them much attention. He assumed they heard and sung the song frequently and did not hear the new words. The old tunes were good. He corrected himself. No adult would pay attention. Children were the intended audience. They would not know differently; they would accept what was said. They would listen to the words, at least at first. Fortunately, Djem decided, the words themselves were harmless.

The priest then spoke of robots and children. He said, "We are reminded of Earth. In that faraway place, many children grow up with cats. They learn that animals are lesser. The children, or at least the adults, can act in ways that are good for the animals, like taking them to the vet — yes, people actually take cats to a veterinarian, the information is not simply downloaded into a household robot."

The man paused for a moment, and then went on, "The animal cannot understand the action; it is totally mysterious and can appear hurtful. By analogy, people learn to relate to the universe or to a government or to another authority, as if it acted towards them as they can act towards a cat, with unspoken mystery."

Djem heard this as definite and misleading anti-Earth propaganda. People did not learn to relate to the universe by relating first to cats! Leestel was right, he would have contents for a report.

"But children here," the priest kept on speaking, "grow up with robots. Robots are clearly different from and less than people, even though they have emotions like people and organic animals. But unlike cats and dogs, robots can talk back, they have subroutines for doing that. In a sense, a robot is like a human slave, but he is clearly nonhuman. He does not look like a human. (By the way, that is why we don't have androids — no confusion. I am not talking about AIs wearing robotic bodies or humans embedded in them. Both are rare and hardly any children see them.) A robot is a machine that can talk. We refer to him as a 'he,' but in many ways we think of him as an 'it.'

"The difference between a robot and a cat, besides the cat being more specialized in providing affection and killing mice, is that a human, even a small human, even a child, can talk with a robot, but not to a cat. Not in a two-sided way.

"Consequently," he went on, "children learn the habit of explaining. As adults, they continue that habit. They think there is a reason.

"They extend this habit from the sentient world to the non-sentient world. After all, robots are non-sentient and they can talk back. People come to presume that an authority, a government, or the universe will explain."

He started coming to the end. "There are entities that do not talk, like brooks, and babbos, and buildings. Other forms of communication are necessary. And we all know that communications may be uncertain. For example, early on, children learn to shave truth sometimes. This means that everyone must detect.

"That is the point of the song we sang,

Choice is hard yet we try to explore.
Choose yet knowing not all.

"Communications may be uncertain, even those, or especially those communications that do not involve talking. Yet mostly, everyone expects that the world is knowable, if not now, then in time."

After the sermon, there was a murmur of conversation. Djem decided that the purpose of this weekly meeting was to educate the young and restate the obvious. He said so.

Taffod said there was more. "Church helps people deal with the unknown, the unusual, and the unexpected. The unadventurous do not expect any of that. This is elementary sociology, but the elements

are important." He looked serious. Leestel did not appear the least offended by what amounted to a put down from Djem.

Taffod went on, "The song was pleasant and the speech interesting. In fact, I had never thought about cats and people before. And it is true, everyone I know — most of the people on Melior, I think — demand explanations. This is significant. It makes for better government, since it has got to be transparent. Some explanations, like those involving babbos on Tegmar, are going to take a long time. But that is a different issue. Moreover, people expect that research to succeed."

Next, everyone stood again and sang. As with the first, the melody was old and the words redone.

After the song, the strangers sitting next to them turned and said hello. Two made jokes that Leestel had finally persuaded Djem to come. "I don't think it is part of her briefing," said one.

"Even so," said another, "Gellor's death is a good reason. As you can see from us, most Melians are not like him. Something was bugging him. Maybe he really did get scared of dying forever. That is said. He will be reborn, probabilistically speaking, but he will have lost five dozen years of memory forever. I think that is good punishment. You did the right thing."

At the time, Djem had acted by reflex. He had not thought what he was doing. In any case, he could not have escaped Gellor; so what else could he have done? But he did not say anything. Instead, he nodded.

"Before the last song," Leestel said to Djem, but for the others, too, "Taffod was talking about the unexpected. Gellor was unexpected. Had he succeeded, I would have had to accept your death, although probably you would have been reborn. But society could not have accepted it; that murder would have meant a change in the political process."

"That's true," said another neighbor, "Leestel would have been in bad shape, but Gellor would not have got away with it. I don't know what he was thinking. He was never crazy, which is what a fear of dying forever suggests. I think he had another purpose. I don't know what it was. Nonetheless and fortunately for you, I don't think you have to worry," he said, pointing his finger at Djem.

A woman said, "Events may just occur randomly. A gust of wind can pull someone off the side of a cliff," Leestel sent a short message internally, 'She is a cliff climber; she knows about gusts. But Gellor's attacks were not random. She is missing the point.'

"And," the woman went on, "rebirth fails. It is worth looking for root causes, but a root cause may have a random component, like whether a powerful cosmic ray hit and penetrated the shielding around your data pack. It is other people that count. Besides helping with the shock, anger, denial, and sadness that accompanies death, a church must ensure they accept it."

"But besides helping the affected individuals," the first man returned to the issue of Gellor's attacks without saying so, "church must also help decide whether or not that death was acceptable in a social sense. That is what Leestel means when she talks about society."

Djem knew this, but did not say anything. He did not think of himself as an adventurer, but he felt closer to Taffod. Obviously, the talkers made remarks they believed so that others knew what to expect. Even though it was supposedly oriented towards the attack, he was not sure what it all had to do with his killing Gellor. Regardless, they were trying to be nice. Djem appreciated that.

Leestel caught Djem's mood. "It's time to go," she said. "I don't know whether Djem will come again, but I am going to try to persuade him!"

All three walked back to the Embassy, with Djem's guard robot following behind. Djem had very nearly forgot its existence. He was glad Gellor was gone. He could walk now or ride a cable car.

Leestel and Taffod talked. They murmured quietly and did not intrude on Djem. He thought about the sermon. The topic was curious. Maybe the fellow was right. Were Melior kids different than Earth kids? Talking robots; were they different? Or were they like human slaves?

Since the birth of agriculture, a good number of people had as children related to dogs and cats. As adults, did they expect to be treated as they had treated, and willy-nilly, kept on treating dogs and cats? Djem did not know. The argument was suggestive. Or 'faintly suggestive.' Djem grumbled to himself. 'Humph . . . I am starting to reason like a Melian.'

Djem also knew that in the Middle Ages, at least in the European Middle Ages, rich boys grew up with horses. Put another way, the boys grew up managing prey animals. Later, did the boys-turned-rulers treat their serfs as they had horses? Did they manipulate or hurt an individual human as if he were an errant horse, or simply to direct the herd one way rather than another?

Leestel and Taffod did not interrupt his thoughts. Djem was glad of that. During the walk, he did not want to be social.

Back at the Embassy, Djem ventured to say that church was interesting, although he did not know whether or not he would go again. Leestel did not try to persuade him. Instead, she ticked off four fingers.

"Earlier, Taffod was saying that the church helps people deal with the unknown, the unusual, and the unexpected." Looking at him, she said, "You left out the numinous, which is crucial."

She raised one finger. "Death forever is unexpected." She raised a second finger. "For most, a birth, a marriage, or a death with rebirth is expected but unusual. Even for adventurers." She looked at Taffod again.

"Births, marriages, and deaths happen often enough that a specialist gains experience, but not a lay person." Leestel raised a third finger. "In a sense, a specialist deals with the unknown, what the lay person does not know. As a practical matter, the church specialist does not know an unknown topic, but he or she knows how to deal with it, or rather how to deal with the person and it. That is what is important. Peoples' acceptance of a situation."

Djem noticed that Leestel never once used the word priest or minister; she always used the word 'specialist.' She had not said anything yet about the numinous.

Leestel continued speaking. "Churches handle births and marriages. Taffod, you know this, even if you haven't married. Fundamentally, births and marriages are social events. For lay people, these are expected, but unusual unknowns. For specialists, these are expected, usual, and known.

"As for dying, people wait together to find out whether a member's planned death is also a rebirth or a forever death. Either outcome marks a change, one happy, one sad. In either case, specialists know what to do. So people like joining a congregation. Events have consequence, if not for the wide universe, then for the people close by.

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Leestel's remarks persuaded Djem to talk about the topic that concerned him much more than the sociology. "When I first woke here after my trip from Earth," he said, "I asked myself whether I had lost my soul when I died. I used the phrase 'resurrected or roboticized.' Later I decided I really could not know. Also, I came to think that if I had been resurrected at rebirth, I was better off; and if I had lost my soul when first frozen back by Earth, I had lost it one-hundred twenty years ago — ten dozen years ago — and there was nothing I could do."

Leestel did not answer him directly. Instead, she said, "I think of reality as cupped in a crystal bowl. We cannot grasp it directly, but can see it through the bowl. But the bowl is made of natural crystal. It has waves, dark inclusions, and colors. It is hard to see through it. Maybe what we see is not really there."

She went on, "That is why we teach children to think about evidence. It may be 'weakly suggestive' or 'strongly suggestive.' People tend to find anecdotes convincing. But they are only true some of the time."

Taffod interrupted. He had become nearly invisible, but now Djem noticed him. "Leestel makes a good point about anecdotes; they are little stories."

Leestel saw that was all Taffod had to say. She continued, "We saw Lentergrin die; but the truth is that seldom happens here or on Tegmar. Similarly, Gellor tried to kill you. That is very rare. Based on those two experiences, you might conclude that this is a quite dangerous system. But it's not. It is safe, unless you choose danger."

Taffod spoke again; he was listening. "Even I don't court danger in this body."

"As for evidence," Leestel said, "you can map terms like 'weakly suggestive' or 'strongly suggestive' to numbers and add them in a special way. No human does this outside of school. Why bother? However, the exercise teaches a great deal. You can never reach sureness, but you can increase the strength of a belief. Two 'weakly suggestive' bits of evidence combine to produce 'suggestive' evidence."

Taffod interrupted. "The mathematics is arbitrary — not the contents, which is true, but the entrance to it. Learning comes through a story. Kids are persuaded by what amounts to an anecdote."

Leestel waited until he finished and then went on, "The bits of evidence have to be completely independent of each other and their accuracy known. Never express a one-in-a-dozen error as if it were one-in-a-gross. Accuracy or error are different from evidence. So is precision. In school I learned that some people in the early days of electronics pretended their equipment had much more precision than their accuracy justified. Apparently some people were frauds, but most were just plain ignorant. They did not know how to judge at all!"

Leestell continued, "These sureness or certainty factors are separate from probabilities, which were, I am told, often used in their place."

She said, "We use evidence developed like this to help decide the likelihood of a one-time-only event, such as babbo social structure.

"Well, people do not think of structure as an event, since it has duration, but the application is the same. How sure are you that this or another hypothesis explains babbo social structure? Deciding on which degree of sureness you have does not tell you what probability to assign — that is important since people tend to conflate them erroneously — but it helps you think."

Taffod said, "Actually, most of what I do are one-time-only events; I cannot predict their outcomes."

"That is true," said Leestel. "But you are a bad example. You don't repeat what you do; it is hard to determine how good you are.

"In any case, a one-time-only probability is different from a likelihood based on history, a likelihood which comes from learning what happened. For example, the probability of dying forever at a rebirth is one in four-gross eight-doz two. We know that number from history. Many gross of greats have been reborn and that portion have died forever.

"Sureness or certainty," she said, "is about the quality of our evidence, faint, weak, strong, or whatever. That is very different from probability.

"It is true that one kind of probability comes from history; it is applied to the future. The other probability notion is about a one-time occurrence. It uses, or lay people like me use, the same language as

for probabilities from history. The language is very confusing. That is wrong, but that is the way it is." Taffod nodded.

"This all has to do with the unknown, the unusual, the unexpected, and the numinous." Djem had not yet made the connection. And she had finally mentioned numinous again, but did not explain. He waited to see where she went.

"For the unknown, how good is your evidence? If it is really unknown, then we cannot deal with the topic but we can deal with you." Leestel had said that several times. Djem decided that was important sociology, but he did not care. He waited. Leestel continued, "Similarly, how probable is the unusual? Humans are poor concerning low probability events. We can say that 'typically' people do not die forever when they are reborn. But 'normally' out of a great of rebirths, more than two die forever. Human people have a hard time with that.

"The unexpected is another situation in which a low probability event occurs. 'Typically' it does not happen, but 'normally' it may.

"The numinous is undeniable." Djem nodded; Leestel was correct, but had not told him anything. She continued, "It is an experience of which you are sure. Its probability is one. That is just the opposite of a low probability event. People always believe the numinous."

Taffod agreed. He said, "A numinous experience cannot be denied. We think it true." That did not help Djem. Where was Leestel going?

Leestel said, "Traditionally, the numinous is interpreted inside a culture. Communication about it doesn't cross cultures very well. The sense it conveys is internal. So, if we are one culture, or close to one culture, like us on Melior and Farhaven, we all will think about numinous experiences more or less the same.

"The danger is that we won't recognize that the numinous could lead to a false sense of reality. It is convincing. We will all believe it. That is very bad.

"That is why you Earth people are so important. You provide a sufficiently different culture." Djem had to agree with that. Leestel continued, "If we can replicate your reasoning, seeing, or experiment, which are also internal experiences, the topic shows strong evidence."

Taffod said, "I see your point," but Djem did not. He looked puzzled and Leestel caught the expression.

"On the other hand, we can never replicate your numinous experiences," she said, speaking to Djem. "We separate reasoning, seeing, and experiment from numinously experiencing. That is a key separation. You might not consider it.

"Since reasoning, observing, or experimenting are done by an individual, not by someone else reporting to him or her, these experiences are as utterly convincing as a numinous experience. After all, a person's own reasoning, observing, or experimenting provide an internal experience.

"For example, no one here on Melior can replicate the sense of being in the presence of an ancient Greek god, although clearly, at that time in that culture, many had that feeling. The experience was sufficiently common that even St. Paul was confused for a Greek god. According to the segment called Acts in the New Testament of the Christian Bible, he suffered that mistake. Such an internal experience doesn't transfer. So we do something else, we replicate the trial, observation, or thinking about it, not the 'it' itself.

"As a fellow named Richards said a long time ago on Earth, a people needs

> *". . . a coherent paradigm within which individuals as well as societies can shape and adapt to unfolding circumstances . . .*

Taffod said, "Those are long words for saying, 'people want belief.' "

Leestel spoke after a moment, "Put either way, that is why this sort of thing is in our church or rather, I should say, churches. Different congregations emphasize different features, whether it be singing, listening, participating, seeking the numinous, or what not. But all the churches on Melior subscribe to more or less the same paradigm, which, it goes without saying, we think is right!

"But it might not be."

Djem decided he had to mull this over. He said so to Leestel, who quite cheerfully said, "I suspect you want to understand. There is a good bit to all this, but it fits together!"

At that point, Taffod and Leestel took their leave.

Chapter 26

Gerroej Gernsy had aged enough and decided to be reborn into an inorganic computer that was located in his new biological body. He would not use a biological brain. His idea was that by being reborn into an inorganic computer he was half way to transcendence. Yet, by being within and riding a biological body, he would be seen as, and more importantly, be treated as just another human.

He did not die forever and he liked the result. "I cannot tell the difference between my old body when it was young and my new one — except that I have added two more types of cone to this body's biological sensorium, one for the near ultraviolet and the other for the near infrared. My new mind is capable of handling that without mapping the results into an old-fashioned visual band. In this body I can see more colors!

"Also," he said, "When I was reborn, I didn't need 'exercise and adaptation.' The whole process was much more comfortable than any rebirth I have gone through before. I can make easy backups, too. Everyone should do this."

Meanwhile, Taffod pondered Gellor's actions. 'Three attempted assassinations!' he thought. 'There was not a single one earlier. Clearly, the Earth Envoy brings out the worst in Melians, or at least, in one Melian.'

So Taffod decided that he wanted to see Earth again. 'Was Gellor right? Were there enough crazy people on Earth to organize a retaliation?' From his memory as a rebel, Taffod decided there were. But that was a long time ago. What about the present? There was one way to find out.

So Taffod decided to die and be reborn. He would duplicate himself, one going to earth, and one being reborn on Melior.

It was not a fully rational decision: by the time his duplicate reached Earth and reported back, any retaliation would have come to Melior. But it would be an adventure.

The Taffod duplicate reborn on Melior would enter an inorganic substrate. Taffod had heard the new Gerroej speak. Along with Telren's arguments, he persuaded himself to be reborn as a 'natural inorganic intelligence.' None like Taffod had done so before. It would be a new experience.

On Melior, he would again call himself Taffod; the one going to Earth he decided to call 'Torkun.'

Taffod chose the name before he died. He had a one-half chance of becoming the consciousness of the new Torkun and a one-half chance of becoming the consciousness of the new Taffod. Well, not quite; he had a chance of dying as well. But that probability was low.

So he could learn who he was as soon as possible, he wanted his waker to address him one way or the other. A new entity could choose a different name after being reborn, but none had.

So far, all the Taffod duplicates had started their names with a 'T.' He had managed to make sure their second letter was a vowel in alphabetical order. When that became impossible, he would make the second letter a consonant and the third a vowel.

As a consequence, not long after its knife attack message, the Melior government sent another to Earth saying that Melior was sending its own Envoy to Earth. He would arrive in ten-dozen or one-hundred twenty years.

Chapter 27

Djaeds Summervil lived alone in a small row house near the center of Sharmis City. That was all he needed. He was not interested in more. His politicking took place elsewhere and he was hardly ever home. He was not so eccentric as Gellor; he was not as capable either. But he did not care for any alternative to politics. He knew what he wanted. This passion, he felt but did not try to change, was very odd.

Djaeds did not seek executive power. More to the point, even though he was a legislative leader, he did not want to craft institutions like a great legislator. He simply liked people and politics. As far as power and institutions went, he was a good follower. But he also wanted a fairly decent place for himself. He rationalized that by claiming to himself that he needed that for successful politicking. On Earth, he could never have satisfied that desire, so he left.

Unfortunately for him, second place in the Earth Beware party was not quite enough either, although he had not done anything about it.

Now the head of the party, Gellor, was dead. Djaeds was friendly to everyone. He read the practical political guides and knew to ask his interior computer to remember everyone's birthday, that sort of thing. People guessed he did that, but it did not matter. He was inoffensive and good enough.

He had listened to Gellor Thurnsby and been moved. That meant he not only could repeat computer-aided details, an irrelevancy, but in his own speeches, he could employ the same ideas and the same way of structuring thought. He used different words. Gellor's supporters wanted continuity and Gellor made good speeches. As far as they were concerned, Djaeds re-statements were good enough.

So Djaeds Summervil became the new head of the Earth Beware party. He moved to a bigger, more suitable place, so he could invite supporters over.

Although they had paid no attention at the time, various robots had recorded Gellor's last words. They were repeated at the Hearing.

> *"Your death . . . will increase the fear that there is a chance Earth might retaliate . . ."*

Djaeds knew that backups would cut the fear. At the same time, however, he did not expect many to follow Gerroej and Taffod into inorganic substrates. People had always known that they could. A few organic humans had chosen it. There was no doubt that you could change yourself enough to make rebirth easy and backups safe. You could see those advantages easily. But few would change. Some would, but not enough. Most liked their organic selves. Djaeds decided the preference was irrational, although he himself felt the same way. 'On the other hand . . .' he thought.

His party position, nice as it was, came by accident. Djaeds knew he was not smart enough to become chief on his own. People thought of him, as he thought of himself, as second.

So he should step down after a decent interval. He needed a reason, and he thought of one. He praised himself. It was an excellent reason. It would fit the overt fears he and Gellor tried to grow, that Earth might retaliate. He would die intentionally and emigrate. That way, he could start again.

In addition, he would make sure he was reborn with an inorganic brain in a biological body, like Gerroej. He would ask the computer to install extra processors for his rebirth, so he would wake up smarter. Most people would not copy him, no more than they would copy Gerroej or Taffod. He felt the same prejudice against inorganic minds as every organic human, but not as strongly as he felt ambition.

Since he could wake up easily — no need to 'exercise and adapt' — he could be among the first humans on Ulterius. Fortunately, no one had to leave Melior immediately since it would take some time to adjust the planet. He could live in his current body for a while. On the other hand, he could wait as a dead data-packet with no sense of time at all. So long as he was out of the Melior system in fewer than two and one-half dozen years, he was fine politically. He would wait one or two dozen years.

Purely organic humans gained more from safer backups. Research made sense. In addition, if backups did become safer, a new plan would force expansion on the Conservatives although not much. Djaeds didn't think they would like that.

Separating backups from rebirths would be smart. A Gellor speech might have been the source for the idea, although the notion was sufficiently obvious that anyone could think it.

But Djaeds thought that for himself, his plan was better. And he could do it now. It would not require research that might take years. After his rebirth, he would think faster than he did now. That would give him a step up. And he would land on Ulterius as one of the first humans. He would have more of a chance there. He liked the plan.

Although he did not think an attack very likely, he could easily back up an inorganic mind into a distant repository hidden out by the edge of the new system. He would do that, just in case. It would not cost anything. If Earth did attack, if it found a way around the replicators' defenses, that backup would obviate the effect.

Organic humans did not think of such things. Certainly, he had not, not before he decided to be reborn as an inorganic. Yet it was true, you could duplicate data packets. It always had been true. Even if Earth attacked and killed everyone, a person's older instance could be resurrected. But no one wanted an older instance. That dislike buried

discussion. Only the newly reborn were unafraid to die again quickly. People wanted their recent private memories.

Everything would change when biological backups became feasible and commonplace. Backups could be stored in multiple copies in out of the way places. That would be safer. So the fear of retaliation would vanish. But Djaeds bet the research would take a long time. It would not stop him from entering the leading edge; and becoming, he hoped, a leading person.

Maybe he would become an Expansionist!

Chapter 28

Djem remembered the fellow at church who said that Gellor was never crazy. Gellor sounded crazy, but perhaps he was lying. Djem did not think that Gellor had acted crazy; he had acted determined. 'Perhaps,' Djem thought, 'Gellor had another purpose.'

After reading Gammae's essay, Djem had said to himself, '. . . suppose a few expect to lose forever. They would have no reason to cooperate in the quest for status and attention.'

Djem asked himself, 'Was Gellor a man who expected to lose forever?' Djem knew that Gellor was head of the Earth Beware party. Djem decided that Gellor could never have become head of a bigger party. Djem thought more, 'Gellor wanted to be a politician. That was visible from the ambition he had shown. He was very much a loser in a zero sum game. Did Gellor know himself well enough to fear he would lose forever?

'If so,' thought Djem, 'Gellor's murder attempts had reason. Had they been successful, they might have provoked expansion. This would have given him an opportunity to establish himself somewhere else.

'Fortunately,' Djem thought, 'Gellor was a lone operator. He did not seek cooperation. He hobbled himself. But if others fear they will lose forever and if they get together, they could subvert enough to obtain a von Neumann replicator. And then they would become very dangerous.'

Djem decided he should present this notion to the Melian government. He could do that through Leestel. To be successful, and he very much wanted to succeed, he would have to use their mode for determining.

From studies of data packs or temperament, did information already exist about who knew themselves well? If not, could the information be gathered cheaply, that is to say, by the non-sentient? Could it be gathered in a way that did not intrude on people's privacy?

Djem supposed that many knew themselves well enough. They knew that they would lose forever in the appropriate rivalrous circumstance. He did not know whether on Melior there were enough in such circumstances to be a threat. That would be a number to find out.

If some people were a potential threat, what should the government do? Expansion was one solution. Another was to distract those people into other, less rivalrous occupations.

Even after all these years, Melior had a fairly small number of humans. Not many were born on Melior. And while the migration from Earth had been larger than Djem expected, not all that many had come.

That meant unfilled occupational niches. There were jobs people did not do or only few did. When filling a previously barren niche, a person could become a big frog in a very small pond.

That would be better than losing forever. It was better than being a small frog in a big pond. It might well be better than establishing

yourself early on a new planet. Because when you did, you would have to fear competition. Obviously, on Melior, a niche could fill; but a niche might fill slowly enough that everyone, even potential losers, could adapt.

So Djem had questions and a solution, or at least the beginnings of each. Melior already expanded, but slowly. He did not have a sense of which occupational niches would serve as a second solution.

Obviously, there were not enough architects here, but he doubted that architects posed a threat. Good architects wouldn't. The kind of people who became bad architects might. But then architecture would not be a good occupation.

Djem saw that he was thinking as a person who manipulated others. The Melians did not like that. But everyone would have a choice. If his original hypothesis was suggestive — he was starting to phrase his notions like a proper Melian — then current choices were insufficient. That should be changed.

The Melian mantra for choosing was to

Protect, *Preserve*, *Prepare*, and *Provide*.

If there were dangerous people, then society was failing to protect Melior. Inaction would not preserve it. In addition, society failed to prepare those involved for decent success; it was not providing the right circumstances.

Djem felt he had a handle on Melian political deliberation.

But before any deliberation, he would have to argue that his determination of reality was correct. Was his sense of the universe real? He would have to ask the right questions in the right way. In Melian terms, did the evidence add up to being 'strongly suggestive' or better?

Chapter 29

Djem sought information which turned out to be readily available. He found that without disclosing private information, sociological studies had reported how strongly each portion of the Melian people possessed each of seven intelligences, one of which was self-understanding. (The others, Djem learned, were language, logical-mathematical analysis, spatial representation, musical thinking, use of the body, and understanding of others. The theory was an old one from Martin Gardner; it was suggestive, but it was not clear how suggestive, whether weak or strong. In any event, Djem used the information that came out of it.)

There were a considerable number of people who understood themselves. So long as they stayed organic, they knew they would always lose in a zero sum competition. They lacked the appropriate skills. Djem noted that on Melior, those skills were mostly beneficial, like being competent. On Earth, he knew, pretense often gained.

Djem asked himself whether these losers were like the stereotypical European no-goods of the 19th century. Possibly. Except that instead of eventual true defeat as Earth became a small and finite ball, Melior people could expand to other stars for a long time by human standards. If done right, that expansion did not have to be deadly, like the expansion of the 19th century. The expansion could be reasonable.

'Well,' thought Djem, 'an expansion would be reasonable if you did not mind killing bacteria.' Planets would be terraformed. He remembered Filgard at the farm saying he 'did not hold much' for single celled life.

Djem imagined that in four turnings of the galaxy, in a billion base ten years, single-celled microbes that humans would kill could evolve into complex, multi-celled plants and animals. 'Hmm . . .' he thought again, 'were he to stay in a human body, after enough rebirths he would die forever, even if such rebirths became safer. But current AIs, or people like Gerroej, reborn into inorganic computers — they could live forever!'

He debated with himself whether inorganic intelligences would develop different goals than the ephemeral biologicals. Even living a million base ten years would make him an ephemeral compared to those embedded into inorganic substrates. Would the very long lived want to preserve a planet with single celled life on the off chance it might give birth to intelligence eventually? Or did they expect to transcend in far fewer years?

Djem decided the latter. So expansion was a possibility. It still was not the best. Expanding niches was better.

Djem told Leestel.

He told her in Melian terms, that there was:

- strongly suggestive evidence that a goodly portion of Melians knew themselves;
- strongly suggestive evidence that a portion of these people knew they would lose in rivalrous conflict;
- suggestive evidence that a yet smaller portion would never become resigned; and,
- faintly suggestive evidence that a portion of this last group would meet together. They would not cooperate in the quest for status and attention. They would not take part in the political system. They would devise a solution for themselves.

Djem also said that there was a solution that enabled her and others like her to protect and preserve the political system and Melior, and to prepare and provide for the future.

He did not notice that the solution would not help Leestel, who liked what she was doing, but did not want to wait all the lifetimes ahead of her before she could move on.

As Djem expected, Leestel told Kulray Pakkard, the Interior and Foreign Minister, who told Jeltong Pekbung, the Prime Minister, who told Eltis Akthorn, the President, who told Gammae and the leader of the prime opposition, Bennert Dlovvun. A moment later, her internal computer reminded her to tell the other party leaders. She almost forgot. So she told Gerroej Gernsy, the old leader of the Transcendentalists, now reborn and feeling young again, and Djaeds Summervil, the new leader of the Earth Beware party.

Chapter 30

Telren enjoyed catching and eating the Ponellee. Somehow, when he bio-engineered the babbo bodies, Tuppak Nassik had made sure that Telren's babbo body possessed and passed on to Telren's human brain the fierce joy of a hunt and of eating an animal raw. Or maybe, Telren thought, humans also expressed that fierce joy but did not normally apply it.

As he expected, he found and killed an older Ponellee. The animal never saw him. Telren stalked and pounced. He never used the cudgel he carried. Instead, as he landed, Telren chomped through the Ponellee's neck, killing it very nearly instantly. The stalking, pouncing, and chomping came from babbo genes rather than from human or computer memory, but Telren felt them and followed them properly. It was a clean kill.

Telren feasted. With his sharp teeth, he bit through the animal's tough hide. Had it been necessary, people could have tanned the skin. Fur would make for warm clothes. With the fur scraped off, the leather would make tough jackets and trousers. Telren asked an external computer whether the humans on Tegmar had ever passed a piece of Ponellee hide on to a nano-duplicator? If so, the duplicator could replicate enough for a robot to make clothing. No one had. They used other leathers. But Ponellee skin was tougher.

For certain purposes, Ponellee leather might last longer, yet not be uncomfortable for the people wearing it. The Tegmar AI said he would tell the humans. They were going on a Ponellee hunt soon and could carry skin back to be duplicated. If it was very different from what they already had, the humans would tan a piece before passing it on to the nano-duplicator. Otherwise, if the skin were similar enough to the other kinds, the robots and subroutines could handle the chore.

Even uncooked, the different parts inside the Ponellee had wonderfully different tastes. Telren liked them all, at least he liked all the parts he ate.

He ate what he liked. He knew that if he ate enough of what he liked, he would eat a balanced diet. Civilized humans had a much harder time. Telren did not eat the whole animal. Parts did not call to him, although he had eaten them hungrily before.

He could never have stayed on the foothills or the mountains forever. His body needed what came from these plains. He could not have stayed on the coast land, either, although he could have stayed there longer. Babbos had to migrate, but not often.

Telren smiled to himself. That looked like a bloody grin, since he was eating inside the animal. If he wanted, he could readily find out which trace elements and chemicals he needed and which he had, why he desired one food and not another. Additions to his body would tell him. But he did not care strongly, so he did not ask. Of course, an

occasional rocket could leave a packet of vitamins and minerals for him. But why bother. What fun was that?

As usual, flying creatures circled over head. On Earth, Telren decided, 'I would call them vultures.' He did not have a different name for them here. 'Well,' he continued thinking, 'they are Tegmar vultures. The only people with language here are humans and AIs. They can choose whichever words they like.'

Various land-bound scavengers crept up, too, but none bothered him. He was a fierce animal. Telren ate his full. Then he swung his muzzle back and forth on the grass to wipe off most of the blood on it and finally left. As he walked away, the carrion eaters on the ground shot forward and those in the sky down. 'After they finish with the body,' Telren thought happily, 'the Tegmar maggots will not find much.'

He went to lie down on some warm rocks in the sun. They were a far distance away, farther than he liked, but looked good. Even though he did not want to do anything energetic, he had to lope. When he reached them, Telren flopped down and rolled onto his back. All he did was digest. 'This is the life,' he thought.

Chapter 31

Djem's proposal succeeded. Without controversy, without inspiring any concern among the oppositions, the Melior government changed schooling to encourage more people to take up cooking and farming in the Melior fashion, meaning the cook and farmer did little uninteresting work. More people were encouraged to take up counseling, hosting, and hostessing as well. Older people were not forgotten either, although the relevant programs were much smaller.

Djem expected more of a fight. He erroneously foresaw crazies who did not perceive the reality and who proposed useless actions. But Melior, he came to understand, was not like that at all, at least not on this topic. He had not paid enough attention to Leestel. Melians really did try first to determine evidence. Djem provided enough to start. Others found confirming reports. After all, 'to know oneself' was a Melian ideal. So sociologists studied it. They also knew what was needed for social dominance. That meant they could find evidence, and it said that a good number could determine that they would lose in a rivalrous conflict. No one had sorted the information that way before, but once anyone searched for it, there it was.

There was no 'strong' evidence that a portion would never become resigned, but there was moderate evidence. Similarly, there was weak evidence — only three fairly small studies — for the idea that a few would revolt against the existing political system. That was enough.

The Melian legislature treated the bill almost as an afterthought. They saw it as an action to 'avoid ill' rather than an action to 'do good.' In their terms, it was primarily to 'protect' and 'preserve', not to 'prepare' and 'provide.' But the legislature acted. The bill became law; the government changed schooling and instituted new programs.

It took a very long time before anyone saw the program's success. After two dozen years, it became obvious. New restaurants and cafés established themselves all over. Old ones changed. In the new restaurants and cafes, human cooks chose variations on known recipes while robots prepared. People liked the variations. Others became hosts and hostesses.

But no one expected or planned for the big change — a sharp increase in crafts. Humans designed. In practice, like cooks, they made variations. Then, with the help of robots, they built an initial copy. Very nearly everyone sought them.

Further copies, such as another a bowl, cup, or chair, could be and were duplicated, like art in a museum. But that did not happen frequently. An initial copy or set fit a person or family. Often, it replaced whatever they had before. That is what people liked, something personal that fit them. People paid for that.

Early on, Djem purchased a customized breakfast set for four people. He wanted informal, but respectable cutlery, mugs that said "Earth

Embassy, Melior" on them, and plates with a good, but not stunning design. He figured that even though anything material could be replaced, people would break more when they just woke up than otherwise, and they would feel less foolish if the plates were not quite as beautiful as those they ate from later in the day.

At the same time, partly because of Gellor's reminders, partly because of the fear of losing forever, but more because of Lentergrin's accidental death, the government, run by the Conservatives, decided to sponsor research on how to separate backups from rebirths and how to make both safer.

The Conservatives did not claim officially that they liked the policy even though they supported it, but it was popular. Politically, members of the government found it attractive because they hoped it would lead to a more risk averse and therefore more Conservative society, just as Telren thought.

Backups become possible and commonplace within three dozen years. The new technology was safer than the old.

On the other hand, rebirth was hard. There was no easy way to reduce 'exercise and adaptation' or make it safer other than by shifting people to inorganic substrates. Indeed, because people wanted good humans, like Gammae, to help them exercise and adapt, rebirth was no longer clustered the way it had been initially. In order to increase their opportunities, people intentionally died a few years sooner or later.

Although backups did not directly lead to more people, rebirths depended on the information provided by them. When backups did not fail, rebirths had more of a chance. So, along with a few minor improvements, rebirths became safer.

As expected, a portion of the reborn chose colonization. First, that was Farhaven. More said they would go to Ulterius. The moves favored expansion. Nevertheless, the Expansionists stayed in opposition. Too few chose. Conservatives thought that just fine. Personally, they also all wanted the promised extra safety and got it.

In a limited sense, Gellor had won. Except he did not need to do what he did.

Chapter 32

Tindark decided to explore unsettled but terraformed parts of Melior. He knew robots could do the job, but he intended to go places they hadn't. Tindark wanted to act. Telren was on Tegmar; Taffod could stay in the city and duplicate himself. For his sensory compositions, a problem he faced is that his actions lacked risk. Satellite maps and quick pickups reduced the danger. In a sense, he decided, he preferred that. He was older and not as reckless as he once was.

For his first trip, he picked a mountainous uplift. The mountains did not make up a long skinny range like that Telren crossed on Tegmar. They were more like the Dizloes Mountains he had flown over. But they were distant and not monitored close up. They did not have a name yet. He would think of one. According to the latitude and the hemisphere, the mountains were in spring.

Tindark intended to hike. He carried a sleeping bag, tent, extra clothes, cooking pot, utensils, and stove on his back. He could fly over this all or look at it through satellites, but that was not the same.

Tindark rode to the mountains in a dirigible. It pressed through the skies for a day and a half before landing on a grassy patch on the mountains' east. It would pick him up on the other side. Tindark planned to hike towards the west to higher and higher mountains and then descend.

At first, Tindark walked through grassy patches and through forest as open as the one where Taffod ran. That first day, Tindark feared the whole route would be clear and uninteresting. He worried. But then, the next day, as he climbed higher, the forest closed in. He complained, but not too much. The trees' leaves glowed in the many spring colors of green and yellow. Like Telren on Tegmar, Tindark had to push away some low growths and go around others. He slowed. He studied the early flowers; they were beautiful.

Rocky, open spots provided views. Tindark liked them especially. He could see across valleys. Before terraforming, glaciers had scraped everything. The terraforming forests had not had time to create enough humus. The valleys were deep. The open spots added to the whole trek.

In a sensory composition, Tindark said he should climb higher. That would be wise. He would if he could. He would see more and the going would be easier. But there was no ridge to the west. He had to go down as well as up, down and up.

And he had to go across. Each valley had a stream or river at its bottom. As the high snow melted, spring made for rushing streams. He waded them if they were small and swam them if they were big. Fortunately, his back pack was waterproof. But wading left him wet and cold. His boots and socks got soaked. Finally, he put them into his back pack, waded in bare feet or swam naked. The discovery made

his sensory composition. Like him, most people had never imagined the problem.

One day, when hiking up or down would have taken him out of his way, he nearly drowned in a brook. It was not even at the base of a valley. It was not big. Water poured down from the mountain on his left and roared into a swampy looking river valley to his right.

He was wading across it. A rush of unexpectedly fast moving water knocked him over and his bare foot stuck under a rock. He almost ran out of air, but managed to pull his foot out. For the rest of the day, he limped. He did not cover much distance at all. Fortunately, nothing felt broken, he had not sprained his ankle, and his bandages stopped the blood.

It made for a great story, but he was not sure he wanted adventure any more. He suddenly understood that he would be embarrassed to die. 'Intrepid adventurer drowned in small brook.' He could hear the comments now. Worse, he wanted his own body. He did not want a general purpose body with few capabilities. But his own would take two years to grow.

He did not pass on his gloomy thoughts to anyone, but worried over what he was going to do. In the meantime, he walked carefully through the rushing waters of more brooks; he could not see the bottoms, so he felt them instead. His audience thought he was avoiding more possible pain. A few days after his near drowning he stopped limping badly, but he kept on hurting. Bandages and pain killers could get rid of all his pain, but he did not dare do too much of that since the nerves communicated both the damage his foot suffered and its healing. Instead, he walked more slowly, watching every footfall when he could.

Chapter 33

Before his dying, Taffod scheduled another interview with Djem. He told Djem the results would be public, but that this interview was for Torkun's benefit. "What should Torkun expect; or at least, what had Earth been like two-hundred forty years before Torkun's expected arrival there?"

Djem was agreeable and responded promptly. The next morning, Djem walked out of his embassy, turned right, met Taffod, and proceeded to a little café. Unlike his first interview with Taffod, no Melior robots followed him, only his one 'Earth design' guard robot. It had withdrawn its guns and looked harmless.

Djem ate breakfast at the café. His embassy computer told the café computer what to prepare. Taffod decided to try the same food. It was strange but not too strange. The tastes brought back memories from years before, when he had lived on Earth.

Djem said first that Torkun would need to start thinking in terms of a base ten number system rather than a base twelve. "Think in terms of tens, hundreds, and thousands rather than dozens, grosses, and greats." Taffod agreed. "Fortunately," Taffod said, "I grew up on Earth. It has been a very long time, but I know base ten."

Next, Djem said that when he grew up, no one had mentioned assemblers or von Neumann replicators. He did not know they could exist. People made material objects; assemblers building from previously stored programs and von Neumann replicators did not. This made for a huge difference. Taffod nodded. "The other two big differences," Djem said, "were AIs and rebirth. Earth did not permit either."

Also, Djem said, no one had pointed out that society could afford a decent education for everyone. That surprised Taffod. He thought the possibility was obvious, but that the powers that be prevented it. "No," said Djem, "people do not think of it any more. They think an education must be expensive, both for a family and for the society. It does not occur to them that the portion involved in education can be specified and paid for at a middle class level regardless of the total wealth of the society. It just means adjusting taxes, non-teaching staff, and buildings appropriately."

Djem said more, "Earth is somewhat like the old Chinese empires. It has a higher technology and is a better society.

"For all practical purposes, we have a civil service of ancient Mandarins. Reciprocal accountability means there is not too much injustice, although we did not set the standard very high." He thought more. "On second thought, I would say that we have a fair degree of reciprocal accountability; this is the key to successful government. Civil servants cannot be too corrupt."

He paused for a moment. "In a sense," he said, "corruption is unnecessary, since most people receive what they were born to receive.

"Also," he said, "government offers what amounts to a little social insurance. Ahead of time, taxes pay for preparations. When something dreadful happens, like a famine, flood or earthquake, a civil servant like me is dispatched. Generally speaking, we solve the resulting difficulties without too many deaths.

"In addition — and I suspect this is very important — significant families who are not connected to the government are permitted to pass on valuable properties that are protected by the government. As far as I know, there were periods in Chinese history when that was forbidden. That meant China could not develop a bourgeoisie."

Taffod asked whether this last practice meant that an independent, but powerful group would develop? Djem did not think so. He responded by saying, "The people in these families have the same values as those in government. Indeed, generation by generation, people go back and forth. It really means that the powers in government have a larger and safer recruitment pool. They also advance people like me — the sociologists call it 'sponsored upward mobility.' " He spoke dryly, "We become civil servants rather than rebels."

Djem said that the poor continued to exist, as did famine, but there were not so many poor as there once were and famine did not occur so often. "It is," he said, "much better than it was."

At this point, Taffod decided that Djem spoke as if he had just left Earth. He did not speak as if he felt the immense amount of time it took to travel from Earth to Melior, or how long Torkun would take traveling back. But he did not say anything.

"More to the point," Djem said, focusing on a different topic, "Torkun will see more children on Earth than on Melior. But he won't see a huge number more. Earth is an 'aged' society."

Djem spoke to another relevant point. "When he is reborn," Djem said, "Torkun should look older. Otherwise, the Earth powers will not take him seriously. Since people die forever at the end of one life, visible age counts, at least for power. For sports and beauty, youth is better.

"As a practical matter," Djem said, "since interstellar travel takes so long, instruct the Melior computer already in the Solar system to watch the ages of the powerful and to wake Torkun in a body at the lower end of their range." This time, Djem did remember travel time.

"At the time I left," Djem said, "Earth's economy sustained itself year by year. It planted, manufactured, and recycled. That was part of it. The other part depended on very long lasting resources. Earth did not live off a limited windfall for a century or two. This was not from desire or political intent but because the economy could not survive otherwise.

"In previous years," Djem explained bitterly, "people had cut slow growing trees faster than they could mature. They caught too many fish and destroyed their habitats. They farmed so as to mine soil. They used

fertilizers made from non-renewable sources. They mined and pumped fossil energy as if they lived on an infinite flatness rather than a finite ball. They used up easily obtained resources and they damaged the world.

"Worse," Djem said angrily, "the new Earth sustains itself only on its own resources. No one uses resources from the rest of the solar system, not even solar energy. They do not use the iron and rare metals that iron planetoids contain." Djem said that when he was on Earth, he had not known that such resources could be had, but obviously some people did, people much more senior than he.

"All in all," he spoke wearily, "in my time, the human population was much lower than it had been during the Age of Waste. Rather than reduce population peacefully over several centuries, as was possible, the various governments let millions be killed by the damaged environment, by the temperature rose and by the lack of resources. The deaths were tragic." Djem again sounded bitter.

"It was not that the governments did nothing; they merely did too little, too late. Northern Europe became cold because glaciers melted at the headwaters of rivers that flowed into the Arctic. Well, that was part of the reason. The governments of the planet could have stopped the melting; or the governments of Europe could have paid to redirect the waters — was river water really enough? I don't know." It did not occur to Djem that he could find out easily enough; he would not have to do the work. Instead, he spoke more, "In any case, no one did anything until it was too late. Or too few did. Deserts moved and cut food production in North America; people elsewhere starved. The oceans rose and storm surges flooded Bangladesh and Florida.

"By the time crises came," Djem said, "the people who died could not afford to eat, to heat or cool themselves, or to escape drowning." He kept on speaking, "No one told their stories." Djem thought of story telling as a political act, a way to persuade others without fighting. "People died forever, without history. I know . . . from a government's point of view, problems did not come from those who died, but from those who lived. The powerful did not want stories told, lest they be blamed and punished.

"That is the bad side," Djem said. "On the good side, houses are often beautiful, more beautiful and variegated than any I have seen on Melior. (Not to sound impolite," he spoke parenthetically, "the Melior buildings are fine. But many Earth houses are really beautiful.)"

Djem explained that many people focused on architecture. As it happened, most house parts were built in factories as large items, like walls and roofs, with nice proportions. Not only did this cut costs, but it meant that less talented architects could design well.

Djem said that he supposed that architecture favored an inward focus. That would be safer for government and therefore encouraged.

At the same time, it made for a more beautiful world, which was good both for the people living in the houses and for others. “Earth should teach great architecture to Melior,” he said.

Taffod just listened. Djem then said, “Fortunately, by the time I was born, disasters were mostly past.” At the time he left, the planet held a billion or so people.

Chapter 34

Taffod was reborn into an inorganic computer on Melior. He did not die forever. He was grim about that. He wanted to be the consciousness that woke near Earth. But he was not. Instead, he continued the long line of Taffod's on Melior. He did not look forward to a 'long and peaceful life' as he sarcastically called it. But he decided to adapt to it as best he could.

Like Gerroej, he rode a human body. But Taffod kept his mind elsewhere, not in the human body. He was not sure what he was going to do. At first, Taffod rode a general purpose body. He had acted so quickly, his own had not grown.

The general purpose body was easy enough. Taffod knew about being human. General purpose bodies were kept for people who died accidentally and who said ahead of time they did not want to wait two years for their own body to be force grown.

Few took up that option. Accidents followed a Poisson distribution. Normally, about five-sixths of those who took up the option were satisfied immediately. But recently, perhaps because of a random fluctuation or perhaps because of a fundamental social change, fewer died inadvertently. Everyone who sought one received a new body, yet there were extra bodies. Consequently, Taffod had no trouble obtaining one.

Like Gerroej, Taffod told everyone that he could not tell the difference between him as a purely organic human and him as an inorganic computer linked to a human body. Even though he was not in the body, the connections were excellent.

Except, as Taffod complained, "My general purpose body is not as good as my own previous human body. It lacks extra sensors. It does not look like me." He insisted that his new human body continue to be grown like his old one, with its usual augmentation and with an even wider biological sensorium, like Gerroej's.

Taffod found that he enjoyed being an inorganic intelligence more than expected. Using non-organic sensors, he saw into the radio and X-ray spectrum. He saw more colors. He did not have to map them to his previous human sensorium; he could perceive them as is. He smelled the results of chemical analyses.

With experience, he found he could move his point of view to a distant telescope. It was not until he came back from his first trip to a sensor at an interplanetary distance that he found that time had passed. Unlike most who made the shift, he was not technically oriented. Consequently, while he knew about speed of light delays, he did not expect them. Moreover, he could slow himself. His slowing did not discourage him. He decided that slowing himself could be an advantage, especially in a peaceful world. He could skip past boredom. His human body could not slow down, but a computer could run it when he was 'away.'

He liked an inorganic mind. He decided to attempt to persuade others of the inorganic advantage.

Very much to the point, Taffod signaled the computer in orbit around Sol. Earth would receive the same radio transmission, but Taffod and the other Melians thought correctly that it was more than well enough encrypted that no Earthman could read it.

The message told the Melian AI to be sure that Torkun was reborn into an inorganic computer. That way, Torkun would not require any 'exercise and adaptation.' He could 'blink and fast forward.' He could build additional smarts. And he could easily back up. But Torkun would have to have his inorganic mind embedded in his organic body.

"Don't tell any from Earth." Taffod told the computer. "Let them think Torkun is fully organic."

Chapter 35

Torkun took one-hundred twenty years to reach Earth.

The robot addressed the waking human as Torkun, and Taffod grinned. He had left Melior. He knew a different Taffod had woken on Melior ten dozen years before. That was fine; he was not that Taffod. He hoped Earth would be as exciting and dangerous as he expected. Now he would be known as Torkun Dowwen.

Everything looked sharp. The robot said that he had been reborn into an inorganic computer embedded in his human body. There was no need for 'exercise and adaptation.'

Torkun immediately checked. When images came on radio, infrared, ultraviolet, X-ray, and gamma ray frequencies, he did not see them as visible light; he perceived them directly. The experience was strange. Torkun liked it. He could not talk about it as a human; it was outside of human experience. He could never have done this with his old brain, even with training. With humans, he had to discuss the images as if they were translated to visible light, but with more colors. Also, he saw that he was close to Earth, not in the Kuiper Belt.

The robot went on, "I was asked to do this by the Taffod on Melior." Torkun checked his internal communications and discovered that the Melior AI spoke through the robot. The AI kept on speaking, "Taffod said many years ago that being reborn into an inorganic substrate connected to an organic body felt to him no different than being reborn into a completely organic body.

"Moreover," the AI continued, "I have extended your sensorium by adding two more types of cone to your eyes and increasing the range and sensitivity of your hearing. You will feel, taste, and smell more sharply, too. None of that is visible. From the point of view of Earth, you look completely human. Since your mind is embedded in your body, you can move around without receiving or transmitting anything by radio.

"But Taffod and I both think you should carry a detectable sensor/transceiver pack that you can use to send information and backups here. We will claim it is for monitoring your health; they cannot be against that. Of course, the Earth technicians will try to listen to it. It will give them something to detect. They won't learn of your internal radio. They will suspect it does more than keep track of your health, but they will not suspect how much more. After all, they will expect its transmissions to be encrypted and voluminous. They don't know how good our compression algorithms are." The robot chuckled, "They will go crazy when they find they cannot break the encryption. As usual for you, like a Tegmar researcher, you have far more sensors in your body than Earth people expect. Most of the time, you will not be able to look through them lest you give yourself away. But they will be good for your compositions home.

"The bad news," said the AI, "is that your biological body starts out older than it would have on Melior. That is because the Earth powers do not take young appearances seriously. Even though they know rationally that you are 'born again,' the prejudice against the young goes very deep. So if the body survives attacks — I am sure you will be attacked — it will age sooner than you expect. But it is easy for you to make backups; indeed, I recommend you make them frequently. And you can build more processors."

Torkun understood all this.

He was really more curious about the AI. He was close to Earth, not in the Kuiper belt. So why had the Melior AI come this close? It was dangerous. Then he understood — an instance of the need for fast local communications: the local AI, Auster Infel, was a duplicate of the Melior AI in the Kuiper belt, Arden Infel.

Arden, the AI in the Kuiper belt, decided to duplicate himself — a part of the Melior expedition needed to be close to Earth. The AI feared the speed of light delay from Earth to the Kuiper belt. Using a high bandwidth, tight beam laser, the AI close to Earth, Auster, could back himself up daily. And from the Kuiper belt, they could both back themselves up to a hidden site with working von Neumann replicators. That site was farther out, on a natural object, and not in a line to anywhere. The AI in the Kuiper Belt used a very directed beam for the communication. Earth did not know about it.

Moreover, as far as Arden was concerned, there was no one to stop him here, as there would have been on Melior. Besides the need, the AI could talk to his duplicate.

Arden had not kept secret from Melior that he had duplicated himself. He told them that he sent Auster to Earth while he stayed in the Kuiper belt. But Arden had not ever told Earth that he was an AI, although he picked up and decrypted communications suggesting that a few suspected so. Most did not know about artificial intelligence and never thought of it. No Earth person knew about Auster.

Torkun knew that his prime social goal was to find out how Earth was a threat to Melior. Would someone on Earth or some group organize an attack? Were Melian ideas subversive in the short run and failures in the long run? His prime personal goal was adventure, at least for a while. He had got bored on Melior.

In his built-in computer memory or from the system's memory, Torkun could find the Melian information that had been available when he left, and some that was more recent, which had come by radio. In a very weak sense, he could touch the Melior computer net. But he could never connect. All his Melior information was years out of date. Still, while he could not access the vastly detailed, real-time sensor net on and around Melior, nor access up-to-date notions, he could access

the secret Melian sensors around Earth as well as the Terran ones. He could make use of the AI's radio intercepts and decryptions.

When he was still Taffod, prior to duplication, Djem had told him that two-hundred forty years before Torkun arrived at Earth, Earth did not use nano-technological assemblers or von Neumann machines. Djem himself did not know about them, although more senior people did.

That was the second important difference that Djem mentioned. (The first was base ten rather than base twelve numbers. Torkun did not expect that to be hard at all.)

According to the AI, Earth still did not use replicators or assemblers. That was clear from intercepted communications. Mostly, Earth communications never spoke of them. But a few explained. Members of the Earth government feared von Neumann replicators (and AIs, which were sentient von Neumann replicators and assemblers). They feared their enemies would get hold of a cornucopia machine and make weapons. Worse, they feared Melior would help their enemies. But at least Torkun himself felt safe. He could back up readily.

Still, Torkun felt weird, like a lord with power and trinkets. His robots could sort atoms and manufacture objects at no cost except time, and not much of that. Even though emotions encouraged or discouraged various actions, the robots had no consciousness. They were not bothered by repetitive tasks or necessary death. In a way, he was rich. He was sure he felt stranger than Telren on Tegmar, even though Telren went into a babbo body. Here were people, or a government at least, who rejected advantage.

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The Melior space station orbited Earth, but was independent of it. The station was not a ring. Instead, it came from a ship with vast solar collectors that flew in from the Kuiper Belt. A mini-magnetospheric plasma propelled the ship.

When it entered orbit, Earth security rocket vehicles came close by. To see inside, the Earth people scanned the cosmic rays that passed through. They looked for uranium and other potentially explosive elements. For whatever reason, perhaps because they could not do it remotely, they did not search for toxins or biological weapons. Auster did not think they understood the implications of data for the nano-assembler. He did not have any bio-weapons, but he could make them.

After establishing an appropriate orbit and after Earth's checking, two parts of the ship moved apart. They were attached to a central node with struts and tubes that became rigid. After moving far enough apart, small rockets spun them.

Only one segment was inhabitable by humans; the other served as a counterweight. The AI did not care about acceleration at all, but he

knew that biological bodies needed it. That segment had a garden, too, with plants and animals that had come from Melior and been reborn by the AI — a very long trip for them, from Earth to Melior and then back to Earth. But the computer knew the Melian garden. In addition, the garden cost nothing to add to Torkun's star wisp, so it came.

Torkun came awake in the humanly habitable part of the space station. Almost immediately, he took a Melior-made aerobody down to Earth's capital. The Earth government thought he had been awake longer, taking time to 'exercise and adapt.' They imagined he had first woke under the spaceship's relatively light deceleration, as indeed the garden had, and experienced the relatively short time in zero gravity before the spaceship divided into two and spun as a space station.

The aerobody design was old and very similar to those made on Melior Like all the others, a computer ran it. No one thought that strange. The Earth people presumed that it had an autopilot capable of autolanding, just like their own machines, that it was an autonomous and uncrewed vehicle. They had no idea how good the aerobody's computer was, even though it was non-sentient.

Torkun hardly paid attention to the trip down from orbit; it was smooth and easy. He did notice that the old shorelines were still flooded, in spite of the centuries.

The aerobody landed with no trouble at all. Jet turbines pushed it up to a terminal, just as on Melior, and earlier on Earth when Taffod lived here. At the terminal building, it connected to a flexible tunnel. Unlike Melior, the aerobody's hatch here was on the left. That felt comfortable to Torkun, although he did not know how much depended on Taffod's ancient Earth experience.

Entering the terminal, Torkun smelled cleaning and lubricant chemicals. They were faint. He bet that very few unaugmented humans would notice. An official from the Foreign Ministry met him. He said, "Welcome to Earth," and then made inane small talk. "I hope you had a good trip," he said. Torkun had thought of himself as diplomatic, but wasn't. Fortunately, he enjoyed a new, added, internal diplomatic module. He responded appropriately with talk from it.

The Foreign Ministry person — Torkun never did catch the name, although he knew he could find it if he needed it — took him to the Melian embassy. The building was on property that had belonged to another country as their embassy. That country had vanished years previously. Before anything was done to it, the embassy building nearly fell down. It became the home of squatters, who made inexpensive repairs. A developer bought it from the new legal, not the actual owners, and rebuilt it. But it never got properly re-used, was sold again, and again, and finally sold to Melior.

After its purchase, Auster told Torkun, his robots had not only rebuilt it significantly, but they had found a large number of microphones and video cameras.

Torkun liked the new design. Although smaller than when purchased, it still had many rooms of various sizes. He imagined that they would be very useful, although, the truth be told, he himself did not need much and could not see his embassy needing much either. It also had a wing with a hall for receptions. Torkun understood the importance of receptions. Along with windows along two opposing sides, the room had many doors from the main building.

As the Earth security people expected, when Auster rebuilt the embassy, he removed every bug that an Earthly sweep would have found and a few more. He swept one room completely clean, the "paintings' room", which had nano-replicated instances of Earth and Melian art. Because the instances had been replicated, very few knew of its existence. That made the room more mysterious to the ignorant on Torkun's human staff, but not mysterious at all to their seniors. Occasionally, Earth security tried replanting a bug there. Auster's robots made a regular sweep once a week and, according to his other decryptions, found everything. Because of its 'cleanliness' the room had a use: if Torkun needed to, he and another could do without sensor/transceiver packs and talk privately.

Auster left several other bugs as distractions for Earth security. Moreover, the AI said, "Our internal communications cannot be decrypted." He continued, "Indeed, according to my intercepts, only a few Earth people even guess that I am an AI! Most think our best are the non-sentient robots. To talk with me or Arden, please, either be in bed — I have an antenna there, so you can transmit quietly — or wear the sensor/transceiver pack." He went on, "Furthermore, many Earth people are shape-prejudiced; they think our best are our humanoid, non-sentient robots. In a very fundamental way, they do not understand that looks have nothing to do with reality."

The computer shifted topics, "To convince the Earth government of a message," he said, "write it as a report to Melior. When you compose it from your normal location in your office, a video bug will be able to read over your shoulder. To carry out the masquerade successfully, you should also spend some time there composing other reports. Fortunately, you have an inorganic brain. A subroutine can write the report while your mind is elsewhere. The Earth watchers will not catch on."

Since physical objects on Earth had a manufacturing and transport cost, not merely a location cost, the Melior AI could sell what its machines manufactured or collected in deep space. As a consequence, from Earth's point of view, Melior was very rich. Unlike the Earth Envoy to Melior, the Melian Envoy stayed independent of his hosts.

Humans ran Torkun's embassy. Torkun did not need them, but Auster said that hiring was better than staffing it with visible robots. 'Do in Rome as the Romans do,' he said. The human were all recruited on Earth. Torkun presumed correctly that they all reported to the Earth government, although they had been placed by a supposedly non-governmental business. He even had human guards, or 'private security agents' as they were called.

From an Earth point of view, the staff cost hugely. When Torkun had last visited the city centuries before as Taffod, he was poor. This time, just by being Melian, he enjoyed material wealth. He could afford to pretend he needed a huge staff. By being the only interstellar Envoy, he enjoyed status.

Because of his inorganic brain and an enhanced organic body, Torkun could have done anything immediately. He would not have had any trouble with an immediate Presentation and Reception. But the Earth government gave him two nights to acclimate. The delay was clearly an Earth habit. It both enabled a traveling Earthman to habituate and permitted government security to check for anything new.

Meanwhile, Torkun sent his first report back to Melior. It was a full sensory composition, much like those he as Taffod had sent every day to Tindark and Telren. But this was aimed at an even larger audience, like his famous adventuring reports. He translated his new senses into human terms and showed what he experienced as an inorganic computer waking into a human body. He focused less on his trip down from orbit. Everyone had done that. There was not anything to it. His only comment was that the old shores still looked strange. They were obviously flooded. For some reason, he had not expected Florida, a peninsula in North America that he remembered from the far past, to look as shortened and narrow as it was. Climates were slow to recover, even when their original shifts were quick in geological terms.

Tokun sat at his desk in his office. His mind created the composition while a subroutine operated his body to compose a much duller, pretend report. That was the one the watchers expected, could see, and could read.

"Tomorrow," he said to himself at the end of his full sensory composition to it, "I am going out into the city. I will show you more then."

The next day Torkun discovered that he was expected to ride, not walk to a central pedestrian plaza. His vehicle was either of two embassy limousines. In case the first broke down, the second followed. That was what was said. Since no one attempted assassinations any more, two rather than three vehicles were used. The ambassador no longer chose randomly which one to ride.

The vehicle stored energy in both a battery and in liquid fuel. In the city, it ran on its battery. For long trips, it shifted to liquid fuel.

The car came with a human driver, Swilt Dornag Gellog; it was not like a Melior car at all, which a computer ran. Except it did include a medical computer that was far more capable than any Earth knew.

Although he had no trouble affording it, the limousine carried an electronic toll device that paid when he drove around. Torkun did not like this. Rather than being easy for robots to build and give out to four year old children, so private vehicles were ignored by older people on Melior, Earth people wanted to ride in them. The humans saw cars as a costly privilege. A guard sat beside the driver.

The capital of the world was now Brussels. It had not always been like that. Belgium and the rest of Europe lost badly during the climate changes. They collapsed first. Over centuries, Brussels became the center because others perceived its government as harmless but useful.

Torkun remembered visiting as Taffod. It was very different now. For one, the city was colder. Global warming, meaning more fresh water farther north, had slowed the Atlantic thermo-haline circulation. That in turn reduced the Gulf Stream, which carried heat to Europe. The continent began to experience temperatures more expected of the interior of continents at its latitude.

Still, for Torkun, the sun rose higher every day; it was spring in the city, or nearly spring. The weather was getting warmer.

As Torkun was driven to the pedestrian plaza, he saw that almost all the old buildings were gone. Well, it had been centuries. 'More to the point,' said Auster in Torkun's head, 'near the end of the Collapse, a civil war destroyed huge swaths of the city, including the neighborhoods with older buildings. For whatever reason, no one likes to talk about that.'

The new buildings were better insulated than any of the old. Torkun learned from his external memory that the new building code — now some centuries old — required that walls have many layers. On the outside, they had to be brick or stone. That layer would not burn and was tough. Next, came a layer of insulation. No vapor could penetrate it and very little heat. Then, a thermal mass. That was designed to keep the building at an even temperature. Services ran through tunnels in the thermal mass. Wall board or plaster marked the inside layer. Bricks, wall board, and plaster required a great deal of energy to create; buildings were expensive. Because they were well maintained, they lasted.

All buildings were tightly sealed, not only in their walls, but around their windows and their doors. They depended almost entirely on solar heat and on people's own heat generation. Windows for people, not for solar heat, used completely transparent aerogels in a vacuum to hold the panes apart against atmospheric pressure; they only let visible light through reflecting ultraviolet and infrared. The windows for solar heat let in infrared.

Electric blowers operated heat exchangers that transferred air in and out, but not water. Filters caught smells. Without the air transfer, people in their ordinary breathing would produce too much carbon dioxide. In cold seasons, the buildings required heat exchangers; without them, they became unlivable. Consequently, the city depended on electricity. To enter and leave a building, you went through two rooms, opening and closing three doors, not just one as in the old days.

Torkun's embassy building followed the custom, except that to show how rich Melior was, it would waste a bit of energy during a reception by opening all sets of doors.

Nonetheless, Djem was right, the buildings were more beautiful than those on Melior.

It was not so much their shapes — Torkun saw golden ratios on both planets. He saw the ratios everywhere; it was one plus the square root of five, divided by two, roughly 1.6, as well as its reciprocal, the same as subtracting one, and its square, the same as adding one — 0.6 and 2.6.

On Earth, bricks and smaller stones than on Melior created the elements of a Fibonacci series, 2, 3, 5, 8, 13, 21, and so on. Integral numbers of them defined the lengths and widths of rectangles. Thus, 377 bricks made up a length when 233 bricks made up a width. In other buildings, the elements defined spirals, like gigantic sunflowers. On Melior, building stones also made up elements. But those stones were bigger and the ratios were not as close — whether that really mattered was another question, still unsettled. Torkun suspected that nothing mattered, but that the ratios imposed a useful discipline which helped the less talented.

In addition, a line that extended through the diagonals of one window passed through the diagonals of another. Torkun knew old architectural books said that held an appearance together.

The big difference lay in the ornamentation. Brussels had it better. Torkun laughed out loud. He remembered that in Taffod's day, Brussels had been a notoriously dull city.

At the sound of laughter, the limousine's driver turned his head and looked quickly. Torkun explained, "When I was last here . . . ." Even though he turned his head back, Torkun could see that Gellog was stunned; he did not understand. Clearly, Gellog thought Torkun was new. So Torkun further explained, ". . . I was here centuries ago as Taffod; my memories are not as vivid as those of Melior, but I do remember the city. In those days, it was reputed to be dull, with bad architecture, although it was nowhere near as bad as its reputation."

"Oh," said Gellog, "a briefing told me you stretched out time; but I did not believe it. What is this about the architecture?"

Torkun leaned forward. "The architecture here is definitely better than that on Melior. It is not that Melian architecture is bad — it looks

better than Brussels did in the old days — but now this is beautiful." The guard, Telder Gent Boynnim, never looked at Torkun. He kept looking out. Either he had less leeway than the driver or else he was better.

Torkun leaned back and did not say anything out loud. 'Besides golden ratios and coherent positioning,' he thought, 'you can require a robot builder to use stones of a size that forces the right texture. That is good and is done on Melior. But the next step requires a great deal of individual attention. That is what these buildings have that is not the case on Melior.' He decided that Earth could provide illustrations but that Melian sentients would have to learn and do the work themselves. He did not think many would.

The city was more beautiful and its air clearer than before. It still bore a lot of auto traffic — not so much as in years past, but still, everyone could see that many thought cars were best. None of the cars gave out waste the way internal combustion powered vehicles excreted carbon dioxide, other gases, and heat. Torkun could not tell whether the rubber worn off tires was a problem. He doubted it. By this time, he hoped, the wearings were few and ended up in filters. People rushed faster than on Melior. Their sense of time was different.

Torkun arrived at an unenclosed pedestrian mall. That is where the limousine stopped. He walked around the mall, followed by two guards. No one recognized him, although several who might have been other people's guards noticed his guards. Torkun also learned to notice people he imagined were guards. Their eyes looked everywhere, even though they blended in. 'They must be guards,' he thought. 'They look for threats, nothing else.'

Buildings around the mall offered shopping, eating, and drinking. It did not offer a library, a museum, or a church. Clearly, Torkun thought, it was designed to take money from people in return for what they thought would be worth while. It offered no low incremental cost goods, like the view of, but not the ownership of, an old steam engine or painting. It did not offer spiritual growth.

You could sit on stone benches and watch people walk by. That was a low incremental cost activity. So Torkun had to correct himself. The mall offered one such activity. Torkun decided that window shopping was a second. The mall would satisfy a portion of human needs. Nonetheless, sitting on a bench was not as comfortable as sitting in a tavern, sipping good beer, and watching people. So Torkun did that. Somehow, his guards avoided entering and kept wandering past while looking elsewhere. Had Torkun not looked out the windows and paid attention, they would have become invisible.

The square itself was exquisitely well laid out. Even though the surrounding buildings showed much more variety than on Melior, they looked good both separately and together.

Torkun doubted he saw what others paid attention to.

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The Presentation and Reception started in the mid-morning of the next day. Torkun questioned the time. He expected mid-afternoon or evening; but the time set was mid-morning. Auster assured him that was correct.

Earlier in the day, Torkun's human valet laid out a peculiar suit with a tailed jacket. His internal computer assured him that was right, too. Melian replicators made it for him, so it felt comfortable.

The valet helped Torkun dress. Everything fitted. The human was not yet accustomed to Melian devices and his eyes widened after seeing and feeling Torkun's cuff links. "Each of those is worth a decade's wages," he said. Torkun was surprised at the comment. "Don't you have duplicators for things like this? These cuff links are the right size and fit conveniently. Why should they be expensive?"

"They are diamond, sir," said the valet, "you have to be careful with them. They look very well on you." Torkun grunted.

Meanwhile, his head was spinning. Torkun did know that Earth avoided nano-duplicators, but he had not thought through all the implications. Objects that were rare, either naturally or because of monopoly, suffered high prices. And sometimes, people sought them more for their price than for their use.

For Torkun, the cuff links had their use value; they would not chip if he inadvertently swung his arm too wide; and they sparkled nicely in the light. Their cost was the time it took to put them on. For dress up, that was not too bad. For Earth people, Torkun saw, it was all different. For them, the cuff links could be worth vast effort.

Highly useful tools were not duplicated, either. That was more significant. There were no factories to convert solar energy, air, and water into liquid fuel, none built houses. Worse, he thought, factories like the latter did not require atom-by-atom positioning for most of what they built. A good part of a house could be built with a simpler, easier, and quicker micro-technology.

He remembered his base ten thought patterns; micro-technology dealt with particles a thousand times wider than nano-technology, a billion times more voluminous. A thousand, a million, a billion, they were each ten to the third power bigger than the previous, a thousand times bigger. In addition, the numbers carried emotional overtones, just like great, huge, and gigantic did in base twelve.

As for Torkun's Presentation and Reception, people in the Foreign Ministry had known for decades just when he would arrive. Those responsible had marked the time and place for it and put a note into

a tickler file. Ninety years after the news arrived, their successors met him.

The whole affair was more ornamental than the one welcoming Djem to Melior. Human guards, in various different uniforms, all gaudy, stood around the hall. They had been adopted from the ceremonial soldiers of each major country that gave up its independence peacefully to the new world government.

The Minister of State took his printed documents. He — most of the Government were he's, Torkun noticed — did not even to pretend to study them but said, "I accept you as Envoy," shook his hand, stepped back, and permitted the President to shake his hand.

The Minister did not say Torkun's full name. At Auster's suggestion, Torkun had added two syllables to it, calling himself officially 'Torkun Taffod Dowwen.' Auster said that Earth people still tended to think that 'bigger is better', or in this case, 'longer is better.' Since they were accustomed to five syllable names — sometime after the rise of a single planetary government, that had become an official requirement — they were flummoxed when Torkun's name turned out to have six syllables. They presumed that the earlier references to him with four syllables indicated merely an informal shortening. They did not know that four syllables was the standard on Melior.

After meeting the Minister of State, Torkun met the rest of the Cabinet in strict order of seniority, from highest to lowest. In his vision, his internal computer showed names and short biographies. Without a doubt — there was no doubt because the warnings went back centuries — the Earth government wanted crooks, politicians, and the well connected to have electronic access to this information. The AI had taken advantage to record the same database. But as he said to Torkun, "This is the first time any sensor of mine has been close to some of these people." Torkun decided it best to ignore the implication that he was an AI sensor. He did remember that on Melior the information was the same. But it was not secret, and there were far fewer crooks.

Then came the Reception. Early on, Torkun saw several older men dressed somewhat differently than the others.

The computer said, "Those people are senior members of the state religion, which is supported by the government. The state religion, or maybe we should call it a cult, is based on belief in the ecology of the planet; it is called the 'Church of Gaia Belief.' You will have to meet them.

An Earth protocol officer made the introductions, even though the Melior AI continued to provide names and short biographies. The Earth official treated Torkun as an unaugmented human who could not be expected to remember everyone.

At least one senior hierarch, Tudstall Dickerven, was notable. He came across, even in a brief meeting, as simple and deep. Torkun took to him immediately.

"You can't make a deal with an abstract notion, like the 'ecology of being'," he told Torkun. "So we speak of Gaia, of the ecology of the planet, as a male super-human god, at least to children. Adults understand the metaphor and think of the system as a whole.

"As a practical matter, you can only make deals with an entity that responds, has reason, and sense of time. Children like making deals; they do much wrong . . .

"It goes without saying that the ecology of a planet does not notice small physical acts as such. It is not aware of cutting a single tree; it only responds to big physical disasters, like deforesting a whole region. Still, he, which is to say Gaia, responds to what is in your heart; that is what we tell everyone. But he does not respond every time and not obviously . . . God moves in mysterious ways."

Torkun met and shook hands with everyone else, too.

Torkun did not find any odd-ball characters at the Reception, like Gammae or himself as Taffod. Except Dickerven. He liked the man, even though he could not imagine socializing with him much.

But those invited were important, or their families were important. Torkun could not tell, but the AI said the guests were central in a strongly hierarchical society. Many made quite a trip, to see and be seen.

Torkun was deciding that the Reception was not like an affair on Melior where you could discover someone new when the opposite happened and he did meet someone.

Her full name was Yeltroe Blennee Fell and she was not a government official, not even, it appeared, a spy. She was a successful women's doctor. Yeltroe did not say that, but Auster was able to tell Torkun almost immediately. She was interested in Torkun because he could tell her more about death and rebirth than anyone else. He was interested in her because she was beautiful in his eyes.

The AI told him, quite quickly, that according to her culture she was good looking but not beautiful, that their major histocompatibility complexes differed appropriately, other unconscious signals linked, and they matched. More obviously, her dark hair matched his light hair. She was comfortably plump; it was evident she had never starved or suffered metabolic deficiencies.

Auster was surprised. 'If the Earth government knew what we knew, they would have planted her on you. But as far as I can determine, she is not a spy; she has nothing to do with them. She comes from a powerful family. Her father is a former prime minister, but she is independent. And she is not married, either, which in this culture is important. You may flirt with her safely!'

Torkun was not sure how much he wanted Auster by him. On the other hand, he did not really mind; he was going to publish all this on Melior anyhow. And the AI was useful.

He invited her to come to a picnic in a big park. "Just you, me, my driver, the other driver, my guards, and whoever is spying on us," he said with a smile. She smiled back. "I would be delighted. But still, the picnic must either be soon or delayed a week. Tomorrow is my only free day. I am working this weekend."

After a hasty but invisible consultation with Auster, who looked at his schedule and told him the weather forecast, Torkun said, "Tomorrow will be fine. Where shall I pick you up? I will come by at noon" — Auster assured him that was the correct time although it did not seem right to Torkun — "I will bring all the food and drink; all you need to bring is yourself. It is forecast to be sunny, but you should dress warmly."

Torkun found himself repeating her address, as if memorizing it. Auster said, 'Remember, we are not advertising our capabilities. Earth has them all, but does not use them. Earth people are potentially dangerous. Until we discover how to neutralize them, let's not remind Earthmen what they could do.'

Torkun thought for a moment he was being unfair to her, but then he remembered that she grew up on Earth in a significant family; she had to have more experience — perhaps adverse experience — than he, even taking into account the time he had lived on Earth as Taffod before the exodus. She must know about skulduggery.

He had to go on to other people, but he kept thinking of Yeltroe. None of the others were as attractive.

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As he was being driven back from the Reception, Torkun thought about Earth. His driver thought he was tired, but he was simply incommunicative. He was thinking.

First, he thought about Yeltroe. Inviting her to a picnic was a good idea. Besides his attraction to her as a person, he could check what the AI told him by asking questions. That brought him to Earth, literally and figuratively.

He thought about the planet. He was not bothered by the material conditions of the rich. Indeed, he liked them. The social organization did not bother him much, since he was on top. He expected and wanted to stay there.

The economics hurt him. He could not be usefully compassionate. That was already clear. The circumstances were not all that different from when he as Taffod had left.

Torkun never thought of compassion as part of his character. At least, it had not occurred to him on Melior. Some old and vague memories reminded him that this was one of the reasons Taffod left Earth. The Melior movement fit his desires both for star-crossing adventure and for a place he could be useful.

If he gave a diamond cuff link to his valet, all he would do is help one person. Doubtless, his valet would be happy. And many argued in favor of actions one by one. They said the rewards were higher. But Torkun doubted. He did not want to give the man a diamond cuff link. Rather, he wanted to given him the ability to make diamond cuff links. Torkun remembered the old saying, 'give a man a fish, he will eat for a day. Teach a man to fish, and he will eat for the rest of his life.'

Torkun thought further to himself. 'Well, on Earth, overfishing destroyed the value of that education. With fish habitats destroyed, you gain nothing now by knowing how to fish. But the notion is the same.' He did not see the city at all even though he gazed through a window.

He contacted Auster, who agreed, and then reminded Torkun that there was little they could do for Earth. It was too late.

Auster remembered his own history. 'Before the Melians left Earth,' he said, 'a few people dreamed of von Neumann recorders and nano-assemblers. (The latter are much harder than the former.) With the help of governments who wanted tools that could be applied to war, a portion of those dreamers made the first von Neumann replicator that worked with atoms. Another group brought up the first AI. A third made biological rebirth possible. With just the replicators, Earth could have been saved before the collapse. Or at least, the damage mitigated dramatically. We could probably have reduced the population slowly, over two centuries or so. Instead, people died suddenly and horribly. We never saved Earth. The major Earth governments wanted to get rid of us. Fortunately, we were able to leave.'

Auster went on, 'Actually for humans to leave, only non-sentient replicators and rebirth were necessary. We AIs were not really needed, but we did make everything much easier. After all, we are conscious von Neumann replicators, like humans; but unlike them, we don't need upbringing and can duplicate rapidly, in days rather than decades.'

Suddenly, Torkun remembered that although he was not an AI, he was an inorganic intelligence and could duplicate as rapidly. The story became very personal.

The AI continued, 'We all left the solar system. We did not leave anybody behind, not accidentally, not intentionally. I came back years ago; now Arden and I have split. Part of the time, Arden slows his conscious thinking. Sometimes nothing happens here. We Melians think of biological rebirth as slowing everyone down, but Earth manages without rebirth and still changes extremely slowly.

'Since I separated from Arden, I have been too busy to slow my conscious thinking, but I will not be surprised if the time comes. Nonsentients can keep track and speed us when needed. Because of your inorganic brain, you too can slow. Your biological body can't, not much. Also, it needs food frequently. But a subroutine can run it.'

Then Auster provided what he considered very important news, but Earth people did not: 'Aliens have appeared in the same stellar system as Ulterius. They also came by interstellar spaceship and have approximately the same technology as we. Fortunately, they do not want the same real estate. They headed towards the system's dead Jovian.

'That planet is useless to humans. Not only is it dead, but at the temperature of liquid water, its atmosphere is about eight hundred times as dense as Earth's air. The atmosphere has about the same density as water. If you were not floating, the planet's gravity would pull you down with over twice the force that we think of as normal.

'However, Earth people do not care. By their standards, the system is distant. A radio message and its answer takes nearly the whole of an Earthly human's life. Presumably, by now the aliens have begun transforming their planet. Just the beginning of such a transformation will take two Earthly human lifetimes.'

For a while, Torkun felt envious of Telren. He had an alien society to discover. He had left Tegmar and gone to Ulterius, not because of the aliens, he did not know of them before he left, but because he knew Tegmar too well. But then Torkun realized that Earth was now an almost equally alien society and the air was breathable . . .

Chapter 36

Early the next morning, Torkun had the kitchen buy or prepare, he did not check which, a picnic with its basket, food, and drink. Out of sight from the Earth staff, they were frozen, tested, nano-analysed, and rewarmed. That was to record everything. Auster said the tastes were a little different from his previous data, which was rather old, but not enough that any human would notice. He did not find any microphones or video cameras in the picnic.

Again Torkun rode in an Embassy surface vehicle to Yeltroe's residence. Gellog, the senior human driver, drove him. Torkun did not think he knew how to drive although he could learn easily enough with a simple download.

On Melior, a computer had pulled that information out of one or other of the data packets of the people who came from Earth, and sent it back on the first Melian star wisp. Indeed, in recollection, Torkun learned that Taffod had known how to drive, but hated it. Indeed, Taffod had driven across Europe. But that was a long time ago. A download would be helpful. With his extra sensors and computer subroutine reflexes, he could become better than this driver. Regardless, the driver was good enough and everyone expected the ambassador to ride in the back.

Torkun was curious what other old, but not necessarily out-of-date information he could download. Well, he would find it when he needed it. He hoped. He had to know what he needed; that would be a problem.

The other limousine followed, with its driver and guard sitting up front. Obviously, there was no truth in the claim that it followed in case the first broke down, but Torkun could not think of another reason.

He met Yeltroe at her home, a large, old row house, well kept up. It looked good, although he doubted an architect had touched it any time since he left Melior one-hundred twenty years before. She was ready for him, well bundled.

"As beautiful as ever," he said gallantly. He led her into the back of the car, its door held open by the driver, while the guard stood towards the front and scanned a third of a circle for possible threats. The second vehicle had stopped behind them, the driver and guard stepped out on either side of the car, and each studied the third of the landscape on his side. Yeltroe nodded approvingly at the seats and said, "You do well as an Envoy." Torkun nodded. For the moment, he found all this new and interesting. He expected to stop seeing the people who helped him. On Melior, he did not perceive robots unless he looked for them. The difference was that people were conscious, robots not. That bothered him.

On the way to the park where they planned to have their picnic, they drove down streets with big houses that shared common walls with their neighbors. There were a few stores on corners. Each section had its

own local park, a block not built on. Yeltroe talked about the various neighborhoods they passed through as they traveled. She remembered one fondly. "That is where I grew up. I played there when I was a very small child. We lived over there." She pointed to a grand, stand-alone house facing an urban park. Unlike the other streets, Torkun saw no traffic and no parking on the road between the house and its park.

"My grandfather or great-grandfather got that road closed off to all but local traffic and deliveries. They have to drive very slowly. It is great for children. They can run around without worrying their nannies."

Torkun decided that auto traffic was even more costly than he knew, but did not say anything. He also heard the word 'nanny.' On Melior, there were not many children, but those there were got doted on by everyone, including and especially their parents. It was not necessarily good for the children, but no one wanted to miss seeing them do anything. Melior did not have nannies.

They soon came to a big park. It had old trees — well, not that old, Torkun decided, only two or three centuries old. The trees had been planted for emergency energy. Fortunately, they had never been needed by those who controlled the park. A few early flowers bloomed.

Torkun took the large wicker basket filled with food, drink, and blankets, and following an internal map and guide, walked confidently to a sunny, grassy spot, shielded from the wind. They looked on flowers — most were not out yet, but these showed colorful pink blooms. Auster told him the flowers were genetically cued to bloom early. Torkun spread a blanket and prepared lunch.

The guards and drivers — the drivers were also guards, although not as senior — took up nearly invisible positions far enough away that an unmodified human would have felt he or she had privacy.

Yeltroe settled in. "Tell me," she asked, "were you reborn?"

"Yes," said Torkun, "several times as Taffod. I don't have good memories of the time, but I visited here as Taffod before we left for Melior. I don't know whether you knew that."

"No, I didn't," Yeltroe responded, covering her surprise better than the driver had two days before. "You must be much older than you look. You look young for your job, only a bit older than me. But the Melians left centuries ago!

"I know that interstellar travel takes a long time — I learned this morning that your star is nearly thirty light years away. If the distance from Earth to the Sun, one AU, were twenty-five millimeters, then it would be nearly forty-seven kilometers away. I can conceive of twenty-five millimeters because I can look at it, but not forty-seven kilometers although I can drive that distance in half an hour.

"Anyhow, even after subtracting the two-hundred forty years of travel time, you have lived many life times! Who is Taffod?"

Torkun thought for a second. "Taffod is my clone father, but we duplicate memories as well as everything else. When I first woke here, the computer addressed me at Torkun. That told me I was near Earth. Still I thought as Taffod."

Yeltroe raised an eyebrow. Torkun continued, "From my point of view, I, meaning my memory as Taffod, had fallen asleep on Melior and woke here. Taffod himself kept his own name for waking up on Melior. He's a national treasure, so he can duplicate himself. Very few are permitted to do that. If he were like me, he would keep his own name when he died and only be reborn as one person. Over time, we duplicates become different from one another as we experience differently. I have two . . . brothers, I guess you would call them, Tindark and Telren."

Yeltroe asked, "What about me, could I be reborn?"

Torkun had the answer for that. "You Earth people have the technology and have had it since before we left for Melior. Your governments banned it. I am surprised they have been successful.

"Usually old and sickly people are willing to try anything unless there is a very strong ideology or belief against. Old people will accept intended death. They will ignore the exit of the soul that many believe. They will hope the procedure does not take them to Hell."

He looked at her. "Ah . . ." he said, "you did not know that Earth had the technology."

"No," she said, shaking her head, "I did not. Are you sure we really do have that ability?"

"Yes," Torkun said. "We could not have hidden it even if we had wanted to. With computers, it is easy to duplicate information; and with von Neumann replicators, it is easy to duplicate material objects, like those used for intended death and rebirth. We could not have left the solar system unless we left them behind."

He looked at her again. "You know that Melians left. How many do you think were on that first space ship?"

"A few hundred," she said doubtfully.

"Would you believe over a million? That is still a thousand times fewer than Earth holds, but many more than you thought. Djem Dorodden, the Envoy from Earth, thought like you when he came to Melior. When he discovered the true numbers he hid his surprise, but I know the problem gnawed at him."

Torkun shifted topics, "What kind of patients do you treat?"

"Many women," Yeltroe said, sounding relieved that she could set aside her belief scrutiny for the moment. "Mostly, I act as a gynaecologist, even though I have not had children myself. Neither the women nor the men think of me as threatening. And I am good at what I do."

"Do you mean technically good, psychologically good, or both?" asked Torkun.

"Both. Why do you pose that question? It seems odd," said Yeltroe.

"It is not odd for a Melian," said Torkun. "On Melior, a robot or a woman's internal computer would handle the technical part. For you, your bed-side manner would count. Only if you were doing research would your technical knowledge matter. Known knowledge is easily understood by AIs and as easily copied and distributed."

Yeltroe looked deflated. "I spent years learning my profession. You mean all that is wasted?"

Torkun decided not to answer that question. Instead he said, "As far as I know, almost none or no research of this sort is being done on Melior. Our knowledge is centuries old. It works well enough, but it might well be that modern knowledge is useful. But," he had to add truthfully, "I wouldn't count on it."

This line of conversation did not go well either. At least, Torkun thought, he had answered his own private question, which was 'what on Earth do you do if you are smart, from a high family, and a woman?'

He decided to shift topics again. First, he spread more paté on bread and gave it to her. He also poured more dark beer.

He had not been sure what Yeltroe liked, so he brought both wine and beer. It was cold enough out that beer felt right. And, he had to say, the local beer was very good. A return star wisp would bring it to Melior. But he would do better to find out how it was made. Then he could send the recipes along with the genomes of the yeasts, wheat, and hops. That made, he was pretty sure, a small enough data packet that it could be radioed to Melior. Not only would radio arrive sooner, but more people drank brewed beer than nano-assembled beer. They liked sitting in a brew house, talking with friends, and looking at the huge stainless steel vessels that transformed the malt, hops, yeast, and water into beer. So directions made sense.

Torkun finally asked, "Why did Brussels become the capital of the world? It used to be that people outside the continent hated Europe."

Yeltroe leaned back against a tree. She sat on a little folding stool that came with the picnic. Torkun sat on one, too, but did not have anything to lean against. It was, he decided, a little more than a third the height of a regular seat. He had folded his legs in front of himself.

"Brussels won because others perceived its government as harmless but useful. That is the story in a nutshell."

Torkun encouraged Yeltroe to explain more. She said, "In school, I was told that most countries in Europe had become too dependent on others who were distant. The continent was engaged in much relevant research and could provide sustainable technologies, but it could not persuade others of European values. So, when crisis came, it lost."

She stopped and considered. "I have not thought about this for years! You bring back old memories. In university, I read that some critics at the time said Europe could not trade enough because its gov-

ernments and big businesses did not understand. They said that sales people came from European countries that under-invested in education and governments sought rentier solutions even after they stopped being able to coerce."

Quite unconsciously, Yeltroe stroked her chin. She looked puzzled. "I wonder whether that is true? It was a long time ago. Certainly, it is not a controversy now. Warming meant that increased evaporation from tropical waters fell as rain closer to the poles. The surface of the north Atlantic got lighter. Glaciers melted on Central Asian mountains and poured their fresh water into north-flowing rivers. That water flowed into the north Atlantic, too. All together, this shut down the thermohaline circulation. Well, maybe it did not quite shut it down. In any case, Europe froze."

Much sadder now, she said, "As a continent, we collapsed badly. Many died. The wider government could not control anything local but it could settle disputes over non-critical issues between distant groups. That is primarily because our judges and politicians, those that survived, were prejudiced only against the very weak. Others saw them as uncorrupted and just. Also, the huge number of deaths prevented old enemies from fighting. Enemies now lived on different lands; their leaders lacked the populations and power to act. That simplified the problem."

She stopped for a moment. Torkun did not say anything. As far as he knew, this was an accurate summary of the history. His other sources declared it strongly suggestive.

Yeltroe started again. "At first, we could only settle non-critical issues. Governments insisted on fighting over critical matters. But later, after enough people died off and those regions began recovering, people and their leaders started dealing with strangers again.

"For that, surviving traders had to forgo extra-legality. I remember learning that concept, too. We here are very law abiding, so I had a hard time. As for why they became law abiding, the story is that the first movers were too poor to afford the time to learn local customs and make the right bribes. That meant they had to fit into our system. That sounds like it might be true. It is really strange. Even so, acculturation took generations. But finally, we got a world government. Not that I like it much, but it is better than fighting. It is not too bad."

Torkun nodded is agreement. He almost smiled. He was being highly ambiguous: did he agree with the story, did he agree that the current government was not too bad, both, or was he nodding because that was the right thing to do? He did not clarify and Yeltroe did not act as if she minded.

"What is it like now?" Torkun asked.

"Hah! I can tell what you are doing!" Her eyes flashed. "You are checking out your briefing. This is the second in that series. I can answer it, too. But first you have to feed me more!"

Torkun was surprised and a bit embarrassed. He fed Yeltroe more.

After swallowing her food, and taking a hefty drink of beer, Yeltroe said "Right now, we have a stable economy and ecology in a strongly hierarchical social structure. Fortunately, you and I are at the top. No one likes being near the bottom. We, that is to say, people in my family and people like them, sponsor enough upward mobility that rebels stay dumb. As far as I can see, we can survive into the indefinite future. At least we can if we don't suffer an interstellar threat from someone," she cocked an eyebrow again, "like you."

Torkun smiled and shook his head. He did not know and the two AIs could not think of anything he could do that would lead to betterment more or less peacefully.

Yeltroe went on. "Government is cruel. People like me, who don't like that . . . we go into other professions."

From economics, Torkun changed to asking about flowers. Yeltroe explained that over the next few weeks, more and more would burst into bloom. She asked shyly, "Why don't we go on a walk looking for them next week, when I have time off again?" Torkun agreed readily.

Chapter 37

In the days before seeing Yeltroe again, Torkun learned more about Earth's state religion, or cult as he thought of it. It was not dead the way European religions had been when he was the young Taffod. It lived like those in societies where religions and cults had to compete with each other and in societies where belief prevented technical or scientific progress. But during the Collapse those societies had fallen apart worse than the rest of the world and the people in them mostly died. Survivors accepted the new.

In the 'Church of Gaia Belief', thoughtful adults skipped past the personification metaphor of their god and considered the ecology of the planet.

Torkun talked about this to Antrim, his human valet. The man looked surprised. Torkun guessed he had never considered the issue. Then he looked fascinated. "I am connected to the ecology," he said. Torkun waited as more emotions swung across the man's face. Dependence, fear, and love, Torkun decided, all conjoined. Then the man put on a new, different expression and became very peaceful. He stopped making small motions. 'The man is enjoying a numinous experience in front of me!' Torkun thought. 'I have not seen this before.'

Antrim noticed Torkun looking at him a moment later. "I never felt this way before. I believe, but in a much different way than I thought possible. Everything fits together!"

Auster, the AI, spoke to Torkun, 'The powers that be hinder new study of Earth's ecology. But they encourage a complicated, early understanding. That is what Antrim is feeling.'

Auster went on, 'As in any gang, the powerful discourage questions by suggesting that only destructors ask such questions. I do not understand why this study is stopped or nearly stopped. It is useful. However, the current mode succeeds; people do understand enough. The ecology is no longer threatened.

'Perhaps,' he suggested, 'someone grew frightened that study could lead to revolution. He and others would recognize success in that humans no longer threatened the ecology and they would be scared by the danger of revolution.

'In any case, you cannot have an omnipotent Gaia, since Gaia cannot be the source of all evil. Much of the ecology has died, which is to say, the good god has been defeated, at least in part. So he has enemies of some sort. This is a theological reason for destructors. Their existance solves the problem of evil.'

Auster continued speaking in Torkun's head. 'The theologians argue their understandings.' But Torkun, who mainly did not pay any attention to his thinking at all, remembered the Melian churches' emphasis on reasoning, seeing, and experiment. He had thought all that rather boring and irrelevant.

'Well,' he thought, and said to Auster, 'maybe the Melian equivalent is boring; but in fact, it is not irrelevant. These Earth people do not properly observe.'

Meanwhile, Antrim returned to his duties and helped Torkun dress, even though it was not complicated. He was just going to talk to some officials at the Foreign Ministry. Torkun asked Auster for Antrim's full name. 'He has never told me and the house registry describes him by role, not name!'

'Well,' said Auster, 'if you ever address him by his full name, he will have a heart attack. People in your position only use his full name at his funeral; and it would be a rare honor for his family if you went.'

'In that case,' Torkun responded, 'please do not tell it me; but remember it.' 'I will,' said Auster.

Other than thinking about the Church of Gaia Belief, which he really did not care about, Torkun found he had little to do. Each day for about an hour, he described Melior to some very senior officials at the Foreign Ministry. Since they had all read the much longer and more detailed report the AI had sent earlier, their questions revealed much. They appeared to be interested in the workings out of Melior politics and in social deviants.

Contrary to his expectations, the Earth government did not direct anyone to him for emigration. At the very least, he had expected them to send trouble makers his way. But perhaps they feared he would tell them, as indeed he planned to do, about robots, replicators, and rebirths. He, or rather the AI and its minions, would reject most and send them back to their homes with their new knowledge.

So he decided to go cliff climbing. It also meant travel outside the city. On Melior, Tindark had climbed cliffs. He shared his experiences with Taffod and Telren. That meant that Torkun felt he knew some of his skills, but not all of them.

He traveled one morning from Brussels in the direction of Switzerland to well known cliffs. They were not far from the head waters of the Rhine River — not far in Melian terms. Torkun was not sure whether they were far in Earth terms. Few people traveled any distance. The trip was expensive. But Torkun enjoyed much more income than Taffod when he had traveled around this continent centuries before. Torkun rode in a luxurious private railway car. His two earth-born guards and his cliff climbing safety man, all of whom came with him in the car, enjoyed their seats and the food and the drink more than he.

The trip lasted only a few hours. The car rode on a magnetically levitated suspension over double rails. It was very fast. As a result of its speed, the train's armored nose hit birds, but not many. They had learned to avoid it. The ride was smooth, too. In turns, Torkun saw visible patches on the pylons. Clearly, they were old. The train made very wide turns. If Torkun had not been more sensitive than normal, he

probably would not have felt the extra acceleration forces that a turn caused.

The train did not hang from one rail like a cable car — well, a cable car hung from two cables, but the idea was the same. Instead, the train ran above two rails. It was not as safe as a cable car, where one of the cables was redundant. On the maglev, if one rail broke, the car would tip off and its passengers be hurt or killed. Torkun expected this to happen very rarely and did not worry.

Over valleys and normal ground, the rails were held up by single pylons which rose and split into two. On straightaways, the rails stayed level; they slanted for turns. Obviously, trains traveled at a single fixed speed. Pylon lengths increased over valleys. Occasionally, the train flashed through cuts and tunnels. But mostly, it rode ten meters or more above the ground. The pylons were jointed, so they could move left and right while the rails stayed on course. They could move up and down too, although Torkun could not see that. He did see that over the years as the ground shifted, some of the pylons had tipped or moved quite a distance.

For climbing, Earth had two great advantages over Melior: people climbed with safety ropes; and they usually did not suffer extremely strong gusts of wind, at least not like those where most Melians climbed, only occasional gusts.

Torkun planned first to practice by climbing a cliff with a safety man on top.

He saw the cliffs in the distance and then the train stopped. He hired two cars at the train station, one for himself and his guard, the other for the safety man and the second guard.

The cliffs rose out of woods. A car trail weaved around big rocks to its base, where they had fallen over the years. Another road, much longer, branched off the first, wended around the cliffs, and climbed the mountain behind their tops.

The safety man, Alden Hark Vinskew, explained what he did ahead of time, grumbling. “I will tie myself to a tree. Even without it, no jerk will pull me over.” Torkun understood that the word ‘jerk’ could refer to a ‘jerk on the rope,’ but he had interpreted it as meaning a ‘jerk who is human.’ The safety man went on. “But for extra safety, we are supposed to anchor ourselves externally, so I will. I am going to half-loop the rope around my waist. My right hand will hold the length going to you and my left will hold the length to the rest.”

Vinskew said, “If you should fall, I simply swing my left hand across my belly and hold the rope. No trouble. Actually, I could hold you with one hand, but it is easier to use both. The rope stretches, so you might fall farther than you expect and bob up and down. But mostly, you will be against the rock and will slip just a little ways. I will keep the rope reasonably tight. If you slip, grab a new hold, or else ask me

to let you down a little until you find one. I can do that easily. You are attached to a harness. If you fall, that is much more comfortable than having a single rope around your chest tied with a bowline. We could do that, but I don't think you want it."

Before leaving on his own, he checked to make sure Torkun's harness attached properly. It did. Torkun thought it very comfortable. He did not mind sitting in the car as the guard drove him to the base of the cliff.

Shortly after they arrived, the guard on the bottom, Telder Gent Boynnim, contacted the two on the top by radio. The cliff stretched up more than Torkun expected. To reach the top in time, the two men had driven faster than Boynnim.

The safety man warned them by radio, looked over the edge, and then tossed down an end of his rope. Both Boynnim and Torkun stood well back. The end fell exactly where Vinskew said it would. The loop at its tip hung in the air just a little distance above the rock. Torkun took the snap from his harness — it looked like an old fashioned karabiner with a sleeve around its gate — and hooked the harness and safety rope together.

On the radio, Vinskew insisted that Torkun take his full weight on the rope as a test "close to the ground." The rope, lock and harness held.

Torkun started his climb on an easy route. He found shortly that he could adapt a great deal of Tindark's experience and shifted to a harder route. He was two thirds of the way up the cliff when a gust of wind plucked him off the face and he swung on his safety harness. It worked fine.

Because the rope was tight enough, he hardly sank at all. Torkun swung more to the right than down. Vinskew did a good job. Torkun grabbed on to the cliff face and to catch his breath sat on a rocky shelf that was right there below the safety man. This spot on Earth was not supposed to be gusty, but it was. 'Always the unexpected,' he said to himself. He corrected himself, 'Well, not always, but occasionally.' He decided that the safety rope was useful, even if he could back himself up.

At that moment, several men attacked the safety man and guard. Torkun did not know this. He was sitting on the ledge.

With sling shots — silent weapons whose spent projectiles, rocks, hide among all the others — two knocked out the guard and two more hit the safety man. In each case, the extra man was there and shot his weapon in case the first missed. None did.

When the safety man fell unconscious, Torkun felt the safety rope go slack. That seemed very peculiar. Fortunately, Torkun was safely on a ledge.

The four attackers ran forward. The first pair moved the guard, Metlar Hord Dunbar, so he would become entangled in the tree; the second pair rapidly wrapped the rope twice around the safety man. If it were only a half-loop, it would go loose when he fell and not pull Torkun off the rock. This way, they ensured a strong yank on Torkun. Maybe the yank would unwrap the rope, or maybe it would stay twisted around the safety man. The latter would leave the criminal investigators to wonder whether the safety man had been really stupid or whether there was a mystery. In either case, Torkun would be dead.

As soon as the unconscious guard was in place and the rope wrapped twice around the safety man, the fifth attacker drove their vehicle forward and pushed the tree to which the safety man was attached.

Torkun felt the safety rope tighten up again and then go very slack. He unclipped his harness. At almost the same time, he saw the unconscious safety man and guard plunge by. A moment later, the clip was jerked from his hand. He could feel the pain in his fingers; nothing was broken, but the suddenness of it surprised him.

He quickly reviewed his imagery of the falling bodies. Vinskew, the safety man, had the rope looped around him twice, something he would never do. And the tree he was attached to looked strong enough, unless pushed hard by a machine. Dunbar, the guard was unconscious and tangled in the tree. That was unlikely. Normally, the guard stood away from anything like that.

Someone was trying to murder him!

Torkun backed up immediately. At the same time, he looked down. The bottom was a long way. He could only look for a moment, then he looked up, saw nobody, and crept against the back wall of his ledge. A shallow overhang hid him from above.

The tree was smashed. So was the guard and safety man. One bloody body hid part of itself among the scree at the bottom. To someone on the top, without Melior enhancements and with expectations, it would look that Torkun's body fell and was fully hidden by the rocks.

The guard on the bottom, Telder Gent Boynnim, had been scanning the entry paths coming up to the place the climb started and did not see the fall. But he heard it, turned to look, and ran up.

The attackers drove away. From Torkun, the Melior AI learned what happened immediately, but none of his spy satellites, nor any from Earth, were close enough to resolve the murderers, although he saw several vaguely defined people quickly leave in a liquid fueled all terrain vehicle, most likely, an AT19.

Torkun decided to treat all this as a terrible accident and not let the Earth government know that he knew some Earth people were trying to murder him. If he could fool the guard at the bottom, he could fool anyone. He would tell the story more or less as it actually happened. He would say he unclipped in order to signal the safety man better.

After making another backup, Torkun started down the cliff along the same route that he came up. Since he could access a detailed memory of the climb, he had no trouble finding foot rests and hand holds. A gust of wind caused him once to freeze against the rock, but that was all.

When he reached the bottom of the cliff, Boynnim, the surviving guard, was ready for him. "That was a murder attempt," he said. "As soon as I saw the two loops around Vinskew's body I knew. He would never have done such a stupid thing. Metlar would not have got in front of the tree either, not if he were conscious and able. So I looked carefully. Just underneath his hat, which is a pretty good helmet, you can see a bruised spot. He was probably knocked out with a sling shot. The evidence vanishes among all the other rocks. Vinskew, too. Then someone pushed over the tree, probably with a vehicle of some sort, and down they came.

"I have called the police and told them what I just told you. They asked that we not touch anything. It might be a good idea for you to hold your hands behind your back; that way you will look respectable and won't inadvertently foul up the investigation. Not that I expect them to find anything," He looked sour, "This was an expensive job. What were you doing on that rock ledge, with the safety rope unhooked?"

Torkun decided that he had no 'accident' story and told what happened, leaving out only his improved perceptions. "I got blown off the cliff by a gust. Vinskew did a good job. I stretched the rope a bit, but that was it. I swung back and landed, a bit hard, I have to say, on a ledge under Vinskew. Just then, I felt the line go slack. I was on a comfortable ledge, so I unclipped the safety line to signal Vinskew better, but before I could do anything, he and Dunbar fell by me. The clip was pulled from my hand, but didn't pull me off."

He looked where Boynnim pointed, carefully holding his hands together behind him, like a professor. There was a bruise on the back of Dunbar's head, wide, as if he were hit by two fairly large chunks.

Two people had died forever. This was much worse than would have happened to Torkun. Even if he hadn't been backed up before the climb, he would have been reborn from the data packet that came with the ship. But maybe the attackers did not quite believe that; or maybe they wanted to send a message of how serious they were.

The back of the safety man's head did not exist. Unless Torkun wanted to give away the secrets of his perception, there was no way to see obviously that the man had first been knocked unconscious.

Three police came, a grizzled old man, the detective; a very senior, very smooth man whom Torkun decided had been delegated to watch and baby sit him; and a young man who asked lots of questions and looked as if he thought the crime would be solved. The older men didn't.

All three listened to Boynnim, listened to Torkun, and looked at the bodies. The older detective put his hands behind his back, the younger one copied him, and the senior man first put his hands in his pockets and then behind his back. The whole routine amused Torkun.

The detective said that the technical people were coming soon, so they should not touch anything. Still, to him, it looked like an open and shut case: a hired, expensive, professional attempt against the Envoy, designed to look like an accident, although no one would believe that.

His judgement was confirmed when the five of them looked at the satellite images on a screen in the police car.

The Earth government had found a satellite whose pictures showed four people and a vehicle come up behind those on the top of the cliff. To Torkun, it was the same images he had seen before. They had too little resolution to tell who was who.

At the beginning, they saw two people on the top of the cliff with a tree right behind one of them. The resolution was low enough that they could not make out who the two were, but from their positions, they were the safety man and the guard, with the tree behind the safety man. The guard stood well away from both the tree and the safety man. That looked right.

A vehicle drove towards them. Since leaves were not yet out, they could see it in among the trees. Moving air stretched and squeezed the image. Obviously this was the raw data, contrast controlled perhaps, but nothing else. The older detective said, "That looks like an AT19 to me." The senior man nodded. The younger detective said nothing, but studied it carefully. Four people got out of the vehicle and came up behind those by the cliff.

Suddenly the two by the cliff fell down and the four behind them and the vehicle rushed up. One pair did something to the fellow closest the cliff — you could not see what — and the other pair carried the second over in front of the tree. After that, which only took a moment, the vehicle pushed the tree over, and then the leading pair tossed the first man over the edge. That pulled the tree over the edge along with the man presumed to be the guard. Finally, the two pairs entered the vehicle and left. Although he was never seen, presumably a fifth man drove the vehicle.

From Torkun's point of view, this was exciting. But he did not like the deaths forever. They bothered him. They made his actions much more serious than he wished.

Chapter 38

When he was younger, Yeltroe's father, Denvellin Gelg Fell, had been Prime Minister. He never became President. In some sense important to him, that never really mattered. Yeltroe thought that perhaps the Presidential role was too ceremonial. Certainly, Yeltroe herself would have hated it. Although older, Fell still wielded a great deal of influence.

One night shortly after the picnic Yeltroe went to him in his office — Yeltroe was sure that was a safe place to talk — and told him what the Melior envoy had said about replicators and rebirth. It was her way of checking beliefs.

Yeltroe's father listened, sighed, and confirmed Yeltroe's nightmare, "Yes, the government has von Neumann replicators." He paused a moment. "The problem is military. If an enemy got hold of one of them, it could make weapons. That is why we don't use them and don't tell anybody about them. We have too many enemies. We are not going to let them know what they could do."

"But if the government has von Neumann replicators," she said. "couldn't it equal them?"

"Yes, we could if we expected traditional warfare." He spoke quietly. "Any enemy would know that, so they won't fight that way. Soldiers never plan to lose. They won't fight fair. They would not fight conventionally. Instead, they would attack our legitimacy by destroying power supplies, food, sanitation, health services, all the critical items. Obviously, we would repair damage quickly. But they could easily repeat attacks."

He looked gloomy. "We would lose. It is easier to destroy than to create, even with robotic manufacturing. Hundreds of millions would die, the world would fall apart again. Then they would stop destroying and pick up the pieces. My hunch is that such an enemy would run a richer, but more repressive and more cruel society than we have now. Think about the kind of people who would infiltrate us and capture a replicator.

"I know you would like the riches, but you would hate the additional repression and cruelty — that's if you lived. You probably wouldn't. I don't think any in our family would. The current government is the best we can do."

He went on, "We have good deal of technology we don't use. We know about rebirths. I wish, I wish really strongly, that I could enjoy one. It's painful to be against them.

"You need really good computers to check the data pack. Nano-tech duplicators — atom-by-atom von Neumann replicators — make those computers much cheaper, but you don't really need them. The main arguments against them are demographic, political, and practical.

"If we introduced rebirths, we would first have to come out against children. Otherwise, the population would grow, we would overburden

the planet, and many would die. To be more precise, the poor would die, not us. So for us, rebirths are attractive.

"Second, we would have to change the social set up. With rebirth, young people lack a future. Nowadays, at least, they can wait for people like me to die. If we didn't, they could not step into our shoes. Suppose you could never become a practicing physician because there were people with experience still doing what you are doing? That is a very strong political argument against rebirth.

"As for my third point, practicality: a few want secret rebirths for them and nobody else. I am almost in that category. But as an actionable matter, we could not guarantee secrecy. Even if we did, potential successors would notice. The scheme would fail. It would become a temporary scam. Banning is the only solution. I find that very hard. I guess you do, too. But that is how it is."

The first attempt at murder failed abysmally. By ill luck, Torkun had been blown off the rock, held by his safety man, and swung to a ledge where he sat comfortably and caught his breath. Two others died. Even if Torkun's murder had been successful, their deaths would have subtracted from the message.

Or maybe their deaths would not have subtracted from the message. In any case, their deaths were waste. The next attempt to kill Torkun should succeed with many witnesses. No one else should be killed or injured.

Chapter 39

Torkun came back from the murder attempt quite puzzled. He supposed that those responsible knew he would be reborn. At most they would have two years without him. What good would the time do? It had to be a warning. But of what, exactly? He was being discreet, not telling anything to anyone except for Yeltroe. He reckoned she was safe.

Neither Auster nor Arden could imagine any reason for the murder attempt, either. Auster said, 'I know that Earth is not peaceful; that is why I warned you against an attack. But violence has a purpose. That is why Earth did not retaliate at all for the attempts on Djem Galt Dorodden's life. They all failed and he killed Gellor. Only the clinically crazy kill extraneously. They do it on account of being humiliated in a way that ill combines with early ghastly experience. This attempt does not make sense.'

Torkun would ask Yeltroe; they planned to seek flowers on Tuesday. Torkun was going to bring another picnic, too. He would carry this in a wicker backpack. He had not known these existed, but they did. Arden quite happily radioed a description to Melior.

This time, he did not carry wine, only beer. His staff were arranging a visit to the local brewery of his favorite beer. He said he wanted wheat and hop seeds as well as yeast and instructions to send to Melior. The brewery people were delighted. Melior was outside their shipping zone. The request was, as far as they were concerned, fully reasonable; they expected to advertise a wide reputation.

Tuesday came. It had rained early the day before as a front passed. Now it was sunny as predicted, a bit colder than before.

Torkun was driven through the city. Boynnim sat beside the driver. The new guard traveled in the second car. He acted fully aware that he replaced a dead man, but no less and no more professional for that.

Shortly before reaching Yeltroe's house, Boynnim turned and said, "We should go to Welderdon Park. There are eight suitable parks, too many to cover with assassination teams. I just picked this one randomly — I flipped a coin three times to produce binary eight — so if there is an assassination team waiting, which I don't expect, it is probably somewhere else."

"OK," said Torkun, "Welderdon Park it is."

Boynnim handed him a paper packet. "I've got briefings for all eight; here is the one for Welderdon. Being a little cooler and more wild, I doubt it has many flowers." Torkun took the packet. Either Boynnim did not know about Torkun's internal abilities or he pretended not to. Auster communicated internally, 'He probably does not know about them, not even the kind possessed by the purely biological reborn. He knows you are reborn, but he does not know the implications.'

Torkun scanned the map and description quickly. It fit what he already knew. At that point, they arrived before Yeltroe's house. Yel-

troe came out immediately. She was dressed ready to walk, warmly, in layers.

Again, she nodded approvingly at the vehicles and guards, perhaps unconsciously. "Where are we going?" she asked as she settled in. Torkun sat in after her. "Welderdon Park." "Good," she said, "I have been there, but not for quite a while."

Torkun handed her the information packet. "Perhaps this will help, you can guide us." Yeltroe looked amused, "As if you couldn't," she said. She noticed Boynnim just putting away the last of the other packets into the glove compartment. "Ah," she said, "I bet you just picked Welderdon Park, so no potential assassins know exactly which one we are going to."

"Yes," said Boynnim. "How did you know?"

"I come from a high family. Unfortunately, we have to learn that sort of thing. Because I am not in politics or business, I have not had to think much of that. But now, visiting this Envoy, everything has come back. By the way," and this time she clearly was addressing the guard, "expect another assassination attempt. That is the word."

'Ah!' said Auster in Torkun's ear, 'she has connections. The story was in local news where you climbed, but never mentioned here. I hope she will tell you more in private conditions.'

Meanwhile, Yeltroe noticed the wicker backpack. "I see you have brought another picnic. I hope you brought beer." Torkun nodded. "In this kind of weather, I like beer. When it gets warmer, I will switch to wine or to wine mixed with water. But this is the season for beer."

She looked around. "Compared to the route we usually take, your driver is taking an equally fast but parallel way to Welderdon. That is very good of him." Clearly the driver could hear, but he did not respond.

"We are behind Maricee's family house. She was my best friend when I was eleven. We still see each other occasionally, but we have drifted apart. Her husband manages a fuel producing operation. She supports him as a traditional wife. It's irritating. In that pair, he is more interesting. But when she was young, she was very lively."

They arrived at the park, which looked much more wild than the one they had been to before. Torkun pulled the backpack in front of him as he got out of the car, gave his hand to Yeltroe, who did not need any help at all, but took his hand anyhow, and stepped into the parking lot.

A map before the entrance showed one path weaving through the park. Unexpectedly, the driver said, "There is a good picnic spot here." He pointed at a spot about three-quarters of the way around the route, off the path. "It is not shown on any map," he said, "but if you bush-whack down to the left, you will come to a grassy glade. It is sunny, dry, shielded from the wind, invisible from the path, and there might

be flowers around. I can wait for you on the path and show you where to turn off."

Torkun looked at Yeltroe who nodded almost imperceptibly, then nodded vigorously himself and said, "Yes, let's do."

As Torkun swung on the picnic pack, Boynnim set out, then the driver. There was quite a space between them, as if they were going on a military foot patrol. 'Yes,' said Auster in Torkun's head, 'that is what they are doing. That is their training. They don't think anything is going to happen here, but they are ready. I can tell you when to start, or you can take hints from Yeltroe. She clearly knows all about this, although as far as I can determine, she has not had to be careful for decades.'

Just as Auster finished speaking, he said, 'You should go now' and simultaneously, Yeltroe starting moving.

Auster spoke to Torken as he set out. 'The second driver is following you. The new guard is at the tail end.'

Yeltroe looked around. "This is great!" she said. "I like walking in the woods. By the way, I don't normally work as many hours as I have recently, but two of our people are out and I am filling in. Most of the time, I don't mind, but now I fear I am making trouble for you."

"Not at all," said Torkun. "We Envoys can do what we want, when we want." He smiled.

"I was hoping you would say that," said Yeltroe. "Incidentally, you are being tracked for a second assassination. That is why I warned your guards. You will be reborn — I hope quickly." Torkun nodded. It would not be two years; he found that Auster had already grown a second body, just in case. "A week or two," he said.

Yeltroe went on. "The sponsors are a few of the powerful people in the church. Not all of them. Not your friend Tudstall Dickerven, who really is holy. Only a few. They are thinking years and years ahead, how to protect people. It makes a great deal of sense if you are willing to murder a few on the side." She shook her head.

"Their purpose is to convince the 'younger generation', people in their forties, fifties, and early sixties — I think of them as older — that rebirth really exists. They expect you to be reborn. It is the others they kill. Their point is, were rebirth to come to Earth, the 'younger generation' could not rise any more, ever. It is very clever of them: better a season of summer, they argue, than forever winter."

Torkun nodded happily and in the back of his mind, felt another entity displaying glee. "Thank you for explaining," he said. "I've have been trying to understand why anyone would attack me and failed to think of that. Rebirth is a social problem.

"Now, that tells me that we have the same problem on Melior. I had never thought of that. Perhaps that is one reason so few have children.

When they grow up, children won't have as good prospects as their elders unless we change government and become Expansionist."

He decided to think about the issue, but not right away. Instead, he shifted the topic. "I remember you saying that Maricee's husband managed a fuel production operation. I take it you mean bio-sourced liquid fuel. Why do they charge so much for it?"

Yeltroe shot back, "You must have your own answer; what is it? Then I will tell you mine."

Torkun paused for a moment. His 'local informant' was reversing roles . . . Finally he said, "As far as we can see, those who grow fuel charge high prices for three reasons: First, because they compete with food and with wild life reservations; they cannot produce enough. Second, because yields are lower than before; this is result of soil damage. And third, because the owners are friends of those in government, which provides them protection for an oligopolistically high price. The first two reasons would make sense if there were no alternative. The third transfers resources from the poor to the rich. But all three reasons are backward since you can synthesize liquid fuel from air, water, and solar-generated electricity with fewer resources. If you did that, you would have lower prices for fuel plus more to eat or protect."

Yeltroe thought about it for a moment. "What do you mean, 'solar-generated electricity?' We generate a great deal of electricity from the heat produced by solar thermal towers. The towers store heat in liquid salt and work fine through night and storm. The heat warms water which operates steam turbines that spin generators. The electricity is expensive, and I don't think that is strictly because the government helps keep prices up."

Torkun continued to walk. He said, "Your solar thermal towers do produce what we think of as expensive electricity. Pretending you lived in an economy without von Neumann replicators, solar thermal towers are more expensive than hydroelectric generation. But when you count depletion costs, they are less expensive than any fossil fueled generator, even from the time before supplies peaked."

"Depletion costs?", Yeltroe asked, quizzically.

"Those costs come when you have to shift from one system to another," Torkun said. "Fossil fuels ran out. Or rather they became more rare. The fossils deplete and you have to shift.

"The side effects of fossil fuels — carbon dioxide in the air, uranium in the fly ash — these problems can all be lessened, although they weren't until it was too late.

"That coal, oil, and natural gas were finite resources that would become harder and harder to find — that was known. There was only a few centuries supply; with it, you had to build the future."

Torkun laughed at himself. He really did not think he was a person to explain. He was happier climbing a cliff. "By the year 2000, give or

take a generation or two, it was cheaper to build solar thermal towers than anything else when you took depletion costs into account. But at the time nobody did. The powers-that-were preferred collapse. A very sad history.

"When I said 'solar-generated electricity,' I meant electricity generated from solar voltaic cells on the planet for robots and electricity generated off-planet and beamed to a few microwave receivers for cities."

"I don't know about either," Yeltroe said. "Are you sure they are possible?"

"Yes," said Torkun. "Melior has used them from the beginning. At one time, solar voltaic cells may not have been able to compete with solar thermal towers for a decade or generation. They are complex devices and took longer to invent. Now they have existed for centuries."

Torkun paused again. "I don't know whether you can build cheap off-planet/on-planet electricity systems without von Neumann replicators, at least not without those fairly early but not really early ones that work in outer space with inorganics and don't handle atoms." He learned promptly and internally: you definitely needed them. But he did not tell Yeltroe that. Instead, he pointed out, "You have had those and better for centuries; that is how Taffod got to Melior."

At that point, the ground beside the path looked soggy and he spotted a flower. "That is a skunk cabbage," he said pointing. "Is it supposed to be on this continent?"

Yeltroe laughed. "You know too much. How can I explain anything to you? I haven't the foggiest idea whether that is a native or got imported sometime in the last thousand years."

Torkun looked puzzled and hurt. Yeltroe said, "I am teasing you. But how much do you know and how much comes from that computer inside your head?"

Torkun was surprised. "I can't say. Everything is a computer, whether organic or inorganic. You have a computer inside your head. As for knowing, it is like remembering. No one knows everything all the time; they can't pay attention to it all.

"That is the great advantage of inorganic stores. They can hold memory that you don't know. At first, all were fully external, books, computers with spinning and magnetized drums, that sort of thing. Then inorganic computers got built into your head. Then good interfaces were invented . . ."

He stopped for a moment. "You really are dependent on an unmodified, biological brain, aren't you?"

"Yes," said Yeltroe. "I am no different than your Taffod when he was on Earth."

Torkun turned red, "No, you are very different," he said.

"Not where it counts, only in other ways," said Yeltroe, obviously enjoying Torkun's discomfort. Torkun looked thrown off even more; clearly, he did not expect Yeltroe to tease him with a pun.

She decided to go easy on him and looked at the flower. "It is sort of ugly, isn't it?" She leaned closer, "and it smells bad."

"That's true," said Torkun. "But it is one of the first. When it wakes up in spring, it generates enough heat to melt snow around it. Most flowers can't do that. As for beautiful, let's look for garlic mustard and coltsfoot. They should be coming into bloom about now."

Actually, Torkun knew, it was early for more or less unmodified flowers, but he did not say anything. Yeltroe took pity on him. "You like explaining; isn't that your temperament?"

"No," said Torkun surprised. "I prefer climbing, hunting, flying, running — that sort of thing. I only talk when I have to. That is all I can do here. I can't even drive the car; I have a driver for that. Well, I could drive. But people would think it very odd if he sat in the back and I drove. We think," he never specified who 'we' were and Yeltroe never questioned the term, "we think they would take me less seriously. My trying to fit in — that's a gambit."

Yeltroe considered, "So you are like the original Taffod, an adventurer at heart?"

"Yes," said Torkun. He looked surprised.

"Last night, I looked at the original Taffod's police report. According to the informant, he called himself an adventurer. He also traveled all over the place, in the worst possible way. He was either poor, or looking for adventure, or both. In any case, travel and adventure were a lot easier in those days than now."

Yeltroe paused, studying Torkun. "I can see you did not know about these records. They are from centuries ago, but our recording media do work, at least for stuff that is recopied every couple of centuries. Records on all the Melior emigrants were kept. Doubtless, the current powers-that-be have read reports based on these. They want as much help as they can find."

Torkun thought for a while. He did not know it, but he stroked his chin. He did not think that Yeltroe had many friends she could speak to analytically. He suspected not. He himself was not much into that sort of thing; he still was much more into cliff climbing, flying, or eating Ponellees. The report was correct that said he was an adventurer at heart.

But now was not the time to adventure. He could be analytical, and right how he wanted to be. He thought to himself, 'Perhaps I am older. I have adventured. I do not need more.' He corrected that thought. 'Not too much more', he said to himself.

They kept walking along. There weren't any flowers. Finally he said, "Your society really does need to become richer, less competitive, and more equal."

"Yes," said Yeltroe. "But there are two parts, the physical technological and the social. We have the physical technology or could discover what's needed within twenty or forty years. But we don't have the social. As you said, for young people on Melior, it is either expansion or stagnation. If they have not discovered that yet, they will in the next few thousand years.

"I hate to say it, but the people who fear the long term implications of rebirth . . . they are right. As for von Neumann replicators, my father fears that if they became known, rebels would steal one and attack us. He worries that the result would be a society that is materially richer, but more repressive and more intolerant than ours. I think he is right."

Yeltroe paused, "I hate government and long term considerations. They are cruel. It is easier to help someone today." She eyed Torkun. "It is like an adventure, it is short term. You live through it unhurt, get hurt, or die. It may be the end of your life, but it is not your whole life."

Torkun nodded. Then his internal communications told him the turn off for the picnic was soon. He looked up and there was Gellog, the driver, waiting.

Boynnim, the senior guard, stood little ahead and looked away from them.

"Here we turn off to the left," Gellog said. "I use that large boulder as a marker." He pointed off the trail to the right at an erratic of some sort. "First, we go two-hundred fifty paces straight out, which happens to be a heading of eighty-seven degrees, then we turn forty-five degrees to the right and continue until we reach the glade. The hard part is dodging around the brush that hides it. Also, we are going to cross a somewhat squishy area, but it's not so bad that your boots can't handle it. Just keep an eye out and walk on dryer spots."

The second driver and guard came up behind them. Gellog pulled a compass from his shirt pocket, popped it open and studied it for a moment. They headed straight out, Gellog first, Boynnim second, Torkun and Yeltroe, and then the second driver and guard.

A few more than two-hundred meters out, they turned right. For another one-hundred meters, they crossed through the woods easily. Then patches of what looked like laurel appeared. The branches, as wide as his thumb, swirled waist high and forced Gellog to use his compass.

The growth was not laurel as Torkun or Auster knew it although that was the closest identification they could make. After a moment — Torkun decided that Auster must be searching illegally through data sources he had never bothered with — Auster said, 'It is probably a

genetically modified laurel that escaped centuries ago. It cannot live in very many environments, so no one cares. Please break off a small piece for me.' Torkun did and put it in his pocket. He did not think anyone noticed.

The brush thinned out as they came to the wet area Gellog warned about. Torkun stepped in the footmarks ahead of him, except where they were filling with water; then he stepped beside them. Yeltroe stepped in his marks.

Shortly thereafter, the land rose, dried, and they came to the glade. It was private, sunny, and sheltered. "A good spot," Torkun said to Gellog loudly enough so others heard. Then he thought, 'How did Gellog discover it?' But he did not ask.

The two pairs of men slipped to the sides. Gellog and Boynnim took the path side, the second driver and guard crossed the glade and entered the woods there. Torkun could see them if he looked, but they were effectively out of notice.

He swung the wicker picnic basket off his back, found the four wooden rods that could stick out to keep it from tipping over, snapped them out, put it down, and plucked the blanket off the top. Yeltroe helped him shake the blanket out in a good spot, took a folding stool that Torkun handed her, placed it on the blanket, and sat down.

"You can put the basket beside me," she said, patting a spot to her right. So Torkun did. He sat down next to it, looking towards her and to the south east rather than the south west.

He laid out cheese, paté, bread, beer, and fruit. Yeltroe spread paté over bread, poured two mugs of beer, handed one to Torkun, took the other herself, sighed, and said, "This is good, even if we did only see that one flower. You did not see any others, did you?" Torkun shook his head. He had his mouth full with paté and bread. "I didn't think so," said Yeltroe. "You have sharp eyes, but I have good ones, too, and I did not see any."

Both gazed into the leafless trees. No near-laurel grew to the south but no path came that way either. Tree trunks and saplings stopped the view.

Yeltroe sighed again. "The trouble with this society," she said, "and its saving grace, is that it works. For the poor, it provides enough that few starve; for the middle, it provides enough choices; for the top, it provides comfort. People are willing to live in a strongly hierarchical society that provides order, services, law, and some justice to them. That is especially so when potential rebels are discovered young and co-opted."

Torkun did not hear her. His thoughts reverted to an earlier conversation. Without any relation to Yeltroe's remarks, he said, "For some reason, I am disturbed, more than disturbed, I am deeply bothered by the ban on decently synthesized liquid fuel. Earth should use solar-

generated electricity, air, and water to make it. The fuel produced is a convenient liquid for high density energy storage."

He paused and Yeltroe looked at him. "If you did not grow fuel," he continued with more emotion than he realised, "you could feed more people or protect more land. You could sell the fuel for less. Everything would cost less. People would benefit."

Yeltroe said, "Yes, that is true. You could feed more people or protect more land. Unfortunately, the argument from my father and the military makes sense, that rebels would steal a replicator and attack us. As you said, you don't know how to make viable off-planet/on-planet electricity systems without replicators. I don't know about voltaic cells, but surely their price cannot all be from government-protected oligopoly."

Torkun nodded. "The ban on replicators does limit a great deal. But truly, how big a risk do they pose? Are people really so unhappy they would destroy the current society and cause yet more suffering?"

"I don't know," said Yeltroe. "I don't meet enough different people to make any kind of judgement."

Torkun understood that. He said, "Talking to an individual is like listening to a single tree or a single deer talk about the forest. It does no good.

"Well," Torkun went on speaking, "Tindark flies over forests. I could, too. That would enable me to see the forest, rather than humus, a deer, or tree within it. An airplane requires post-19th century technology."

He paused and thought more. "On the other hand . . ." he said to Yeltroe, "hot air balloons required no more than ancient Egyptian or ancient Chinese technology. They wove cloth light enough and tight enough to bag a vast volume of air, especially when treated with the right sap. The ancient military had a motive to fund them: balloons would have been useful in war, especially to a besieged city or to an ancient Pharaoh or Chinese emperor. They would not just vanish. Even if their builders thought them lifted by fire-generated smoke rather than by hot air, balloons would have flown. But they weren't invented for another four thousand years."

He stopped for a moment, seeing an old memory of smoke rising. The circle of stones, the little bits of wood; the technology had not changed since humans domesticated fire. Only the starting was different. Finally he spoke. "As you said, there is the material and the social. Besides a technology of objects, we need a technology of mind. Social studies need modern thinking."

"Very depressing, I agree," said Yeltroe. "But we grew out of the 20th century. That was the time — well, it actually included the 19th and 21st centuries — that Earth's population acculturated itself to electricity and manufacturing. Young people learned to switch off an elec-

tric light, not to try to blow it out like a candle. They learned to avoid sticking their fingers into an electric outlet. But old people sometimes treated an electric light bulb as another kind of candle." Clearly, she was heading towards saying, "We could acculturate differently," but went elsewhere instead.

First, she said, "They enjoyed cheap energy and a bad accounting system that made it even cheaper. So they grew a huge population and funded an enormous amount of discovery."

She paused and considered, "Unfortunately, the leading 20th century societies were wrong intrinsically. You cannot run a city when people desire cars and everyone can drive. You get traffic congestion. You have to limit cars in a city.

"You can run a rural area with individual vehicles; the population density is less. But the energy costs are high. The powers that were, the leading people in government, business, and the like, most of them, did not try to protect others from a catastrophe that even knowing as little as they did, was obviously no more than a few generations ahead.

"We have more truthful accounting and fewer resources," she said, "Unfortunately, the population is still acculturated to what amounts to a 20th century economy. Except, we pay more. I don't see how to change it, not the way it really is."

She paused a bit longer. "This is even gloomier than I thought. Think of the long future and think about Melior. A million or so self-selected people went off to start a new system. But it cannot survive a long time. What should Melior do to avoid its danger from rebirths? Expansion will only work partially."

Torkun did not say anything. Neither he nor Auster could think of any solution. He thought a dull society was bad. This was worse.

After a moment Yeltroe perked up. "Let's shift the subject," she said. "This is a beautiful afternoon, chilly but bright. I love the beer and paté; I must try the cheese and that fruit you brought." She looked in the basket, "I see, you brought even more. Let's see what it is."

She dug in. Torkun felt momentarily embarrassed. He had forgot to take out the rest. But it did not matter.

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After dropping Yeltroe off at her house, Torkun stopped thinking about the day and wrestled again with his conscience. As far as he was concerned, the society's whole way of handling scarcity was wrong. He had become very Melian. 'When you can make cars at no cost,' he thought, 'and a four year old can ride alone, then a forty year old does not care. Few will ride. Then even with insufficient space, like the center of a city, there still will be no traffic congestion. The situation will remain stable. No one will have any motive to increase auto use.'

In any city, you had to provide alternatives. Even a small, designed city is too big to walk across. 'But,' he said to himself, 'with automated machinery, you can build cable systems. You can transform the world.'

True, replicators only provided material goods. But on Earth, material goods were important.

He kept running into the key, 'Without von Neumann replicators and without good computers, you cannot reach the Melian point.'

That transition never occurred on Earth. After full fledged replicators had been invented — that took hard work, he knew, and a long time — at least one country could have encouraged a drop in prices. From a free market point of view, von Neumann replicators caused a price drop when they manufactured so much. They increased supply. Countries could have encouraged an increase in material equality. They would have had to figure out some way to re-employ those who lost work or fortunes. But none did. Earth kept the old ways.

Torkun also discovered that the first general manufacturing replicators, not those that started with nature, but before that, those that assembled otherwise manufactured objects — those replicators existed before the huge numbers of human deaths. They could have manufactured safety items cheaply, like sustainable electric generators. But nobody employed them.

Now, centuries later, people and institutions were still against change, all kinds of change. They were scared it would be for the worse. They feared a *can do* spirit that disguised *wrongly do* actions. They favored a *cannot do* society.

Only the Expansionists on Melior could dream anymore of a vast human universe, of the possibility of trashing planets with 'wrongly do' actions. You couldn't dream on Earth.

Without the possibility of expansion, all Earth powers had to be one kind or other of conservative. They had to regulate independent activities. They dared not damage their environments any more. Businesses died or else they learned to cooperate with their government, with each other, and with regular people.

Because law enabled it readily and because they won, the powers-that-were chose a rentier economy. They or their friends in government prevented others from competing too much. Change vanished.

Torkun felt grim. Earth powers chose low level stability. 'Instead of rationing by desire, or lack of it,' he thought to himself, 'societies stick to coercive rationing.'

Torkun thought to himself. 'The least ugly form of coercive rationing is by cost. That is what Earth does. In a city, a person pays to enter downtown.' He checked to make sure that was true. It was. First, only cars had been restricted. But then people were restricted.

He mused more, 'No one enters downtown who does not think it worth while. Those who do not enter: perhaps he or she lacks the right

job, or lacks parents with the requisite riches, or lacks special talents. Any way, no one enters but shop keepers and their employees, smart crooks, government workers, the occasional entertainment seeker, and the rich.

'Fortunately for contemporary Earth people,' he thought, 'and smartly for the government, its partial market economy gives almost everyone more options than they would have in a purely ordered economy. Those who cannot afford a city, and who cannot afford to live in beautiful mountains, can pick among dreary places. So there is less reason to rebel.'

The limousine drove into the Embassy yard. From the driver's view, Torkun jerked awake. He had completely forgotten there were other humans about. Torkun still expected competent, but non-sentient robots.

He sighed. Maybe he could subvert the Earth people. But he would have to figure out how to do it right. Otherwise, there would be more suffering, not less. And no one would be able to predict the future.

Auster was very pessimistic. 'No place on Earth,' he said, 'provided in the old days or provides now the laws needed by an economy based both on inorganic replication and on a low population. With inorganic replication, you have very low incremental cost production; with a sufficiently low population, you can expand material resources without much trouble.

'Centuries ago, everyone could see the need for newly appropriate laws. Even before material replicators, before von Neumann machines, people could duplicate information easily. It was a big technological change. But laws did not parallel the change.

'Moreover, with material replicators, human leaders did not need people for war. That ancient scourge vanished. A society with a low population could survive. At least it could survive so long as most people in it preserved the society and made sure it was resilient against disruptive attacks. But without a legal base to form the institutions, sensible practice lacked motivation.'

He went on, 'Indeed, even though Earth possessed and still possesses high technologies, the government prevents their use. The laws push in a different direction.

'Government directs resources towards its supporters. That is not surprising; it is the way they do it.' It sounded very much as if the computer sighed. 'As far as I can see,' and Torkun knew the AI could see a long way, 'nothing domestic can disrupt the current system. The violations that do occur provide exercise for the police. Nothing more.'

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Torkun enjoyed walking around the city. Not only were the buildings more beautiful than those on Melior, they were more different among

themselves. And people did not recognize him. He felt anonymous. Maybe he should have, but he did not pay much attention to the people. He looked at architecture.

Some buildings were tall and thin, others small and squat. Ornamentation included carved stone and paint. Each building looked different from its neighbors but somehow matched them, too. Nevertheless, if you walked far enough, the whole pattern changed. A few neighborhoods looked as if they had been designed by one hand. Others, the majority, looked like they had been designed by many hands, but fortunately, by people who looked around.

His guards cautioned him against walking out of the Embassy. "Too much a single point," Boynnim said. Instead, he insisted Torkun be driven to the pedestrian mall. That provided a choice of exits to walk from, one of which was chosen randomly. Boynnim chose his route randomly, too.

All this irritated Torkun, but he did not protest much. However, he asked about the mall, "Isn't that a single point?"

"Yes," said Boynnim, "but there are so many people there, we don't expect anyone to make an assassination attempt against you." He was wrong.

Three new men helped guard Torkun, one to replace the death on the climb and two more. Boynnim explained, "The drivers are guards, but these men can spend more time looking. Besides, we want at least one embassy vehicle to follow you. It carries a full medical kit." He smiled, "Its driver has to look at the road ahead once in a while . . ."

Torkun liked his walks. He stopped noticing his guards. Five times he went out. Once he met Yeltroe briefly in the mall. She had to buy something. He was meeting her again when he was shot.

Chapter 40

The bullet hit Torkun in the head. A quite illegal design, it mushroomed. The shot destroyed his inorganic computer, his mind, as well as his internal radio. When the bullet hit, Auster stopped receiving anything except the few items sent by Torkun's quasi-public sensor and radio pack. The number of bits transmitted did not change — that was to confuse Earth security — but most became truly random. Both Torkun's computer and his radio looked the same as his shattered bones; neither could be identified as different. When destroyed, they became even harder to discover except by means of a mass spectrometer or some such detector. No one on Earth suspected.

The sniper thought that even though the mall was crowded with people who would be excellent witnesses, he would only hit Torkun. He was mistaken. After hitting Torkun's head and killing him the deflected bullet passed through Yeltroe's neck. The gunman did not plan this; Yeltroe was not in the line of fire. She was rushing up; Torkun did not know she was there, although Auster did. Unlike Torkun, who did not dare, he looked through all of Torkun's senses all the time.

The bullet opened both arteries going to Yeltroe's head. She lost blood rapidly. Auster responded equally rapidly. Using the Embassy radio, he commanded the guards to bring her back as well as Torkun. He reminded them that the Embassy was closer than any hospital and that it had excellent medical robots.

A guard reported secretly, so he thought, to the Earth government. Austel heard the message, "Torkun is dead, although various parties pretend that is not obvious. Yeltroe may live if she is treated quickly enough. She is losing a lot of blood. We are taking both back to the Embassy; that is legal and proper for the Envoy. As for Yeltroe, the Embassy is closer and quicker to reach than any hospital. Also, the car has a medical kit. One of the computers at the embassy," he did not know that the voice came from Auster in orbit, "reminds us that they can provide medical support there, their medical robots don't fail as often as ours."

Meanwhile, Auster promptly resurrected Torkun on the space station; he lost less than an hour from his previous backup.

The medical kit in the Embassy vehicle treated Yeltroe. It did not look humanoid and no Earth person thought it sophisticated. It did not speak to the humans, but told Auster that her brain was not damaged by oxygen starvation and that it could keep Yeltroe alive temporarily. Indeed, the medical kit could revive her for a short time, but she had lost so much of her own blood that her body would manufacture too little new blood during the time it could survive on artificial blood. She would die.

On his own, Auster ordered Yeltroe duplicated at the Embassy. The original was disintegrated by the tools that recorded the information

for her. Auster then used part of that information to duplicate more of her own blood several times over. It was easy to exclude the artificial blood mixed with it.

Auster could have just duplicated a bit of Yeltroe's blood, not all of her. But he wanted a back up. In addition, he inserted hidden devices into the bones of her head. However, he did not turn them on. Nor could he fix her wounds, add extra cones to her vision nor improve her hearing, taste, smell, and feel, since she was simply a body being backed up and revived. So she kept her organic brain.

With the extra blood put into her, the medical robots could and did save her. From Earth's point of view, their robots would have done the same, but the need was speed. So moving her to the Embassy made sense.

After the emergency treatment, as expected, Yeltroe took time to heal. She did not know that she had been duplicated or that she carried both a radio communications transceiver and an additional computer with a vast memory in her head. Auster left the decision of whether to tell her to Torkun. He decided to, but not while she was in the Earth hospital.

Auster had kept a spare biological body for Torkun; he was not surprised the first was killed. At forty-two apparent years old, the second body was younger than Torkun's first, which was forty-five. Auster figured no one would notice, perhaps not even Torkun himself.

Torkun's third body had an apparent age of thirty-two. Auster decided to force grow it until it reached an apparent age of forty-two. That would take a year. Then he would let it age at a normal rate of one year per year. At the same time, he would start a fourth body. That would take three and a half years to grow to the minimum acceptable age. Auster hoped there were no more assassinations in the near future.

In any event, this time Auster could easily provide a new biological body to Torkun. The Earth government was told that Torkun had been backed up and that he would reappear shortly.

Chapter 41

The Earth government said that the assassination attempt against the Envoy from Melior had failed. It looked like a killing, they said, but only wounded him. Most in the world believed that message, but none in the capital. Too many people had witnessed the shooting. They knew his head was blown off.

They saw that Torkun had been killed. When he reappeared, they knew that either the new Torkun was a double or he was resurrected. When they looked closely, as many did after he returned to Earth, they could see that the new Torkun was not a double.

That meant that the rebirth claims were not just a story heard rarely; they were real. Fantasy became possible. People in the know wanted rebirth. As a practical matter, Torkun's resurrection demoralized the middle and senior people at the seat of the Earth government.

That Earth already had the knowledge and technology for people to be reborn, that it was not a Melian secret — within the senior and middle levels of government that news spread. The knowledge did not destroy the government, but it upset many more people than the top level expected.

Many sought a longer earthly life. It was not only those who did not believe in the existance of a soul. Those who believed expected it to transfer from one fleshly container to the next; at least, they expected that when the two bodies were close together in time and space as they would be in a regular rebirth. No one was willing to gamble that he had just one earthly life.

Fortunately for both Earth and Melior, a nameless antiquarian solved the problem that had led to Torkun's murder, the warning that successors would never go anywhere. He adopted a millennial old notion. He said that the reborn should lose their old status and power. Like an old fashioned, pre-Christian jubilee year, but not for a whole society, a person who expected to continue would have to give up everything except what he could expect as a remittance. In his family, the younger would inherit; in his job, the younger would take over. The practice received the name *reversion.* A slogan came with it:

When you are reborn, you must revert.

The words were neither catchy nor rhymed, but they said what those in the know wanted.

Reversion gained traction quickly. Powerful people in the civil service, the government, and the major corporations did not want to be ruled by people who looked and felt twenty-four. They did not want to be ruled by people who looked forty-two. And they thought the reversion scheme obvious, although no one had suggested it before.

The young loved reversion. They insisted that a reborn person lose inheritance, status, and position; such a person must start again. That

meant the young, who actually were not so young by Earth standards, those in their forties, fifties, and early sixties, could expect promotion and opportunity. They were not yet ready to die; and they were not willing to give up their hopes.

New people would gain high positions. They could be shown on TV. They would not be the same people looking younger. (Everyone in government agreed that this eased world-wide censorship. Initially, that was about the only thing they agreed upon.)

The Cabinet met on the third day. The President spoke for everyone. "We must make rebirth available; otherwise, government falls apart."

"The questions," said Telstil Fet Gunnar, the Prime Minister, "are who receives rebirth, are we going to revert, and will we accept the Melian ambassador's offer? I just received it; he is alert now. The offer promises greater rebirth safety, but requires we use off-planet resources and replicators. I need your opinions. Let's take the questions one at a time.

"The first question is who receives rebirth?"

The President cleared his throat. Everyone looked at him. He seldom intervened. "If we don't, we lose more than half the senior civil service. Maybe we face revolt. I doubt we could continue as a government."

As for the second question, no one wanted reversion, but they all knew they had to accept it. There was no discussion. A few murmured, "The President is right" and "We must have reversion." The issue was settled.

The Prime Mininster then asked, "Who are we going to revert?" It was really 'Who are we going to rebirth and revert?' since who would be reborn had not truly been settled.

"Only those in the know," said the Minister of Agriculture. "With our current fertility, we can't have a billion people suddenly become long-lived. The planet cannot support the extra mouths."

That was an argument of the Church: too much global impact, even though most were poor. Moreover, as the Minister of Education said, "that is true." Then he went on. "Over time, more and more people will learn or hear rumors they believe. When only a small number knew, the secret stayed secret." He was one from whom the secret had been kept. He tried to turn the secrecy into a virtue. "Now, too many know. Our mission is to control the consequences of spread, nothing else."

Another minister spoke. It was the Minister for the Treasury, Stoeppa Mak Stewwong. He was young — perhaps in his late fifties, rather than sixties — and clearly readying himself for the Prime Minister's job. Technically, as Treasury Minister, he was too senior to speak yet, but the group ignored his bumptiousness. He usually spoke to the point.

"Let's turn this danger into an advantage," he said, almost supporting the Minister of Education, but expressing what the Minister did not

say and gaining the credit. "Whether we wish it or not, the news will spread. We should spread it ourselves to the people we want. If we do it right, and tell more people over the years, we will gain their support. We will survive, as will the rest of the government and others who are powerful.

"For us, short term benefit weighs more than possible long term danger. The news about rebirth and the desire for it will spread, since everyone sees it as beneficial in the short term."

He stopped for a moment, and then was firm, "We should disregard outsiders. As the Minister of Agriculture says rightly," he nodded to him, "there are too many of them. They must die."

Every one else nodded. The Prime Minister spoke, "Then we are in agreement?

"The third question is whether we accept the Melian ambassador's offer? On the one hand, he promises better computers that will increase our safety in rebirths; on the other hand, he requires both that Earth permit off-planet replicators and that we make space resources available to Earth, including solar-generated electricity." The Prime Minister turned to the Minister for War. "What do you say?"

"Those are odd requirements and we are against them. Well, we are against the one involving replicators. We always have been against their wide use." He sighed. "Rebels could capture one. Then we are sunk."

The Treasury Minister asked, "How likely is a rebel group to go into space? In space, how likely are they to escape being blown up?"

"Nobody is going to challenge us directly before they get replicators. They will infiltrate. We will pay to carry them into space." The War Minister looked sour.

"How likely is that?" asked the Treasury Minister. "Are you saying that we are so unpopular that a large group will plant people in our military; or are you saying that your security is so bad that one or two people can hitch a ride and do the deed?"

"I am not suggesting either," said the Minister stiffly. "I am saying that by spreading replicators, we increase the danger. That is all."

"I see the danger," said the Treasury Minister, surprising several other ministers. "What if we kept the replicators in the Kuiper belt — that is where ours are now, right?" The Minister of War nodded, "and permitted only non-reproducing robots in closer?"

"That would give us warning," said the War Minister, in effect surrendering. "Will the Melian go along?"

"We can ask him," said the Prime Minister. "OK, next set of questions. How much time for adjustment? Which prices drop how far how quickly? How do we come out against child bearing? Anything else?"

The Treasury Minister nodded almost imperceptibly at the last question, but did not say anything.

The Minister of Education spoke first. “We should plan on at least two generations for adjustment. I don’t see how anyone can change faster.” There were sounds of agreement from around the table. “In particular, off-planet electricity — from what you said, the Melian ambassador talked about it specifically — should not bring down the price of Earth-produced electricity by more than a factor of ten in forty years. A factor of ten is huge. It will destroy all our current businesses.”

The Treasury Minister spoke again. “You are right, a factor of ten is huge. But can we stretch out the price drop that long? Or are we going to have to be more quick? After all, once everything enters Earth orbit, and the receivers and such land on the ground, the technology permits a big price drop in forty hours. That time is a lot less than forty years.”

The Prime Minister intervened. “It is a matter,” he said, looked at the War Minister, “for the military. Can they control the number of mirrors and such in Earth orbit?” The War Minister nodded; the Prime Minister carried on. “I think the answer is yes, within limits. How about twenty years, is that a reasonable compromise?” Everyone nodded, even the Minister of the Treasury.

;; use Calc mode: 0.89 <RET> 20 <RET> ^ <RET> => 0.0972299657791 After looking at his computer, recessed into the table in front of him, the Treasury Minister spoke again, “Twenty years requires an electrical price drop of little more than ten percent every year. First, companies will cut back replacements, then maintenance. They will ask us to subsidize them. The price drop will be hard, but I expect with our help, they can handle it.”

“The third question,” the Prime Minister said, “is how do we come out against child bearing?”

The Minister for Ethnic Affairs had an answer. “Our best move, the one whose results we can predict confidently,” she said, “is to better educate women and to provide them with more opportunity. Educated, working women have fewer children. Since there were more of them, we must provide more opportunity for the poor and the powerless. Not everyone is going to like that, but that is what we are going to have to do.”

The rest of the Cabinet were not sure about the solution, but the Minister of the Treasury, as usual, had a comment. “We are going to change material prices for the first time in centuries. Many ordinary people will lose their jobs. Corporations will have a hard time. People will have to be retrained and businesses learn. It is not going to be easy. Education is the only solution. So I am afraid the Minister is right. Except it is not only women who should be educated, we also need to educate men. We dare not provide dead end jobs. Too much a chance of revolt. The War Minister made a good point.”

"Fine," said the Prime Minister. "I think we have settled everything. We covered four topics. Any questions or comments?" He looked at the Minister of the Treasury, who shook his head slightly.

And then he looked up. "No questions, a comment; I have figured out what we need to do."

The Treasury Minister paused for a moment. "We need to employ people. Otherwise, they will revolt. Unlike robots, we cannot turn them off or slow them down. Also, we trust people more than robots. That means the military have a job." He turned to the Minister of War, "They can check groups so we trust them."

He went on, "Five actions involve people; these all have to do with our new technologies: create, modify, check, review, and double-check. The last provides the job for the military.

"By create, I mean make the first design. At first, we will re-use old and proven designs, especially for microwave rectification on Earth. So there will not be any first designs. However, I bet that the old designs will have to be modified for current conditions. Creation and modification will involve engineers. That takes care of one group.

"Checking means seeing that robot constructors do what they are told. It is similar to contemporary supervision. Everyone can do it and I expect them to be happy. That takes care of a second group, a potentially large one, although without leaders.

"Reviewing need not always require engineers. It means looking at the overall purpose of the technology. We do not want to convert plows into weapons or anything like that. Ordinary people, non-technically schooled administrators can do many jobs. We will need to employ technically trained engineers to study dual use endeavors, but that is it. That takes care of a third group with leaders in it.

"None of these are dead end jobs, so they are safe. As the Minister said," he did not specify which Minister so three nodded, "we will need to train some people. We can do that.

"Double-checking is where the War Ministry comes in: the military must prevent an enemy from infiltrating our organizations. Such an enemy could steal everything and kill us. Fortunately, we are resilient. We do not depend on power from stations that depend on stored fuel that can be dynamited, on long pipelines for heat, and the rest, all of which were once military targets. So we need not worry about a little dynamite or a few disgruntled people. They will lack sufficient destructive power to hurt us. Only a large enough threat is dangerous."

The Minister of War nodded.

No one else spoke. "Good," said the Prime Minister. "Meeting adjourned."

Within two hours, Torkun heard the Earth government's desire to keep all the replicators in the Kuiper belt, not to allow them closer, and to spend twenty years on a factor of ten price drop for electricity, rather

than twenty weeks or less on a price drop to zero. Since neither he nor Auster expected any better, they went along with the decisions.

As for rebirths: the nano-assemblers would duplicate better, but still non-sentient, computers. The micro-assemblers could almost duplicate themselves as well, since they already had that information. With the help of nano-assemblers, they could replicate; they already possessed their own design. Such assemblers also carried the information necessary to build recorders. They were true duplicators. They would have to stay in the Kuiper Belt and use the remote but plentiful objects there. They would build non-reproducing robotic devices for separating, constructing, and otherwise handling resources closer-in to Earth, the metals, stone, and solar radiation near it.

For a generation, robots would be permitted to build only a few things on the planet, such as microwave receivers and rectifiers. Their work would be heavily supervised by humans who would therefore continue employed. Companies that distributed electricity would keep on doing so; their owners would retain their fortunes.

Over the next few months, as they came in from the Kuiper Belt, separation and construction robots in space began to manufacture the mirrors and sunlight converters for sending microwaves to Earth. They built the receivers and rectifiers for them and the robots that would do the construction on Earth. These dropped out of orbit in thousand meter wide, mostly empty aerobodies that splashed down gently on large lakes and seas. Besides carrying their payloads, iron in the aerobodies' shells fed steel works. The transformation began.

Torkun never spoke about the duplicators on the Melian space station and the one on Earth in the Melian embassy.

Chapter 42

On the Melior space station, Torkun pretended he needed a week to 'exercise and adapt.' Reborn Earth people would need that time and he did not want to suggest other possibilities.

They did not know about backups, that researchers on Melior had determined how to revive frozen bodies readily. Backups were easy and safe. Purely organic rebirths still presented difficulties. Probably, by simply studying the records, technologically adept Earth historians would discover inorganic backup and rebirth. But none thought of it. At first, Torkun communicated by text. Then he communicated by voice. His ruse succeeded.

During that week, Torkun mostly traveled outside his organic body to investigate other sensors and processors. The time gave him an opportunity to act as a true inorganic sentient for the first time. He liked it. By adding more processors, he could think faster. But he recognized that his faster thoughts were the same as before and that days seemed ten times longer. That was too much. Not being a mathematician, and without people to talk with, he grew bored. So he slowed down.

He did keep a few additional processors, he liked being somewhat smarter, but got rid of most. He also learned that his sentient mind depended on parallel processing, not sequential processing. The complexity required for each processing node meant no one benefited from the much larger electronic speed up that had occurred. Transcendence was not a simple problem. That is why it had not happened.

Finally practicing as an inorganic sentient, Torkun learned to perceive all of Earth in moderate resolution in nearly immediate time and the whole solar system at a lower resolution in as-received time.

He heard from Auster that the sensor net was thicker around Melior, but he thought the Earth net was pretty good. He saw radio and gamma waves as new colors. He felt solar and planetary particles, not just against the two dimensional skin of a human body, but as a three dimensional flow. It was weird. To feel gusts on Jupiter, as if they were winds blowing against his cheek — that was almost normal. It had taken him a while, but now he had an opportunity to use those senses he had discovered when he was first reborn. Much more deeply than before, he came to understand that he was not limited to the see, feel, hear, taste and smell sensorium of an organic human.

In addition, Torkun began to create, detach, and run subroutines. He programmed them. The experience was new. He had not produced them before. It was not a matter of giving orders — since he had first come to Melior as Taffod, he had told robots to build various objects — it was the discovery that he could invent. His first efforts were nothing much, but he delighted in them. They were his own!

At the end of the week, Torkun very nearly decided to stay outside his organic body. He did not want to return to Earth. Fortunately, he

did not have to stay in the body as a human. He could let a sophisticated subroutine run it much of the time. The subroutine did not have to limit itself to writing pretend reports. And it would never become bored.

When Torkun did return to Earth, many senior people peered at him. Torkun was not confused; Auster had decoded messages that explained how strongly many people wanted to learn whether he was a double or was truly resurrected. The difference would tell them whether rebirth was a fantasy or real. Everyone who looked at him closely decided he was resurrected. That information spread widely.

Tudstall Dickerven, the Church hierarch whom Torkun liked, was one of those who checked . . . then he said simply "a faction of Church fears the regrowth of the human population. They worry about the impact of the people on the ecology. Even with a lower standard of living for most, as we have compared to the richest of the past, large numbers are dangerous.

"Their solution is to ban rebirth, on the grounds that people will never hold back. Reversion simply makes rebirth more attractive."

He paused for a moment. "That group does not think the current government's scheme will work in the long run, although it will certainly succeed for the next few centuries. That is the notion of of educating more girls, which as a side effect, causes individual families to practice more birth control."

Torkun noted that the government had not published the Cabinet's decision; but since senior members of the the Church learned it quickly, they had excellent access. Torkun himself would not have learned if Auster were not such a thorough sleuth.

Dickerven continued. "As I said, reversion has made a ban more difficult. No one in the Church thought of it. Likewise, few expect individual families, deciding on their own, will make decisions that will respect the ecology as a whole."

Torkun interrupted. "There is some thought," he said, "that when they provide the information for a rebirth to the robots, the computers intentionally change the fertility rate. They reduce it. That is certainly doable. As a practical matter, fertility control must be less difficult than installing the data from an old brain into a new one. If a human government could persuade the computers, it could do the same. Put another way, the leaders of a group can control a large quantity, the total number of humans. Population size is not only controlled by the actions of millions of separate families. And the mechanism is not unpleasant; it need never be. And fertility, or lack thereof, is not definitive for each family. Few can be against it."

Dickerven cocked his head. "That may be the case. That is a new thought. We can think over the huge length of time, the generations, that population control requires. But there is a third problem. No one is going to understand ecology well enough."

Torkun realized that Dickerven never claimed that he was more than a conduit. But the last claim almost convinced Torkun that Dickerven really felt that a generations of Church leaders would be incompetent, and that they would not have set up institutions to correct their mistakes. They would not permit AIs, so they could not receive corrections from them. They would not permit countervailing humans, so they would not receive the kind of criticism that would provide error correction. In their limited world, a weird world, Torkun thought, they were right.

"To understand," Torkun said, "you must encourage reason, observation, and experiment. Without that you have numinous experiences, which are very convincing, but you cannot tell whether and how much they are right or wrong. One of my human servants, Antrim, enjoyed a numinous experience when I explained that his anthropomorphic god was a metaphor for the planet's ecology. He was ready and is smart.

"You know that no one denies a numinous experience. The person has the experience, no one else. Moreover, the experience does not appear foolish to the experiencer; it mixes love, fear, dependence, fascination, unworthiness, majesty, and connection.

"The trouble is, without your own reasoning, your own observations, or your own experiments, you can get fooled. Everyone and anyone can get fooled."

Torkun paused for a moment. "Of course, most of the time, you are going to go along with others. Children have a natural tendency to believe their parents, because their parents are unlikely to make them worse off than necessary, which is the consequence of falsehood. Adults lack the time or interest to reason about, observe, or experiment on more than a small portion of their world. But that does not mean you should discourage correction all together."

He smiled. "Or are you presuming that current knowledge, and the minor variations on it that theologicans can imagine, is enough? Just a few moments ago you said that no one is going to understand ecology well enough, or that enough people will fail to understand the planet's ecology."

"Good points," said Dickerven. "What do you recommend?"

"Stewardship and vigilance," Torkun responded promply. This surprised Dickerven, who asked, "What do you mean?"

"I mean," said Torkun, "becoming stewards of the planet's ecology. That means thinking and acting over a very long period of time. It also gives a purpose to an individual's life. As people live longer and longer, that becomes more and more important. Short term reasons just don't make it.

"Also, of course, you must make sure that short term rates of interest do not apply to ecological pricing. Already, you pay attention to

interest rates and which are appropriate, right?" Dickerven did not say anything, but he shook his head minutely. Torkun went on.

"In old fashioned, mis-priced economies, the rate of interest, the discount rate, was an important measure. The rate had to be high for private business. That did not matter when there were few people. The ecosystem was resilient enough to handle problems they created. But more people are too many. The planet and the ecosystem on it are finite. In projects where you consider ecological stewardship, the rate of interest must be zero.

;; use Calc mode: 1.005 <RET> 1000 <RET ^ <RET> => 146.57562561 "For ecological stewardship, with a billion people on Earth, even a rate of interest of one-half per cent per year is much too high. That means that in a thousand years, not much time for a planet, growth is one-hundred fifty. Occasionally, that is fine. But not for what is significant.

"For the stewardship of a planet, the rate of interest must be zero."

Torkun stopped and let his thought meld. Then he went on. "Since humans, even in small numbers, have technology that can cause so much impact, humans must think of themselves as stewards. And because other humans, or other creatures, or the system itself, will fool them, they must be vigilant."

Torkun grinned. "You needn't give up either your personal hopes or your institutional ones; you just have to adjust them to make sure they fit reality. You can do what you can, but no more."

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In the hospital, Yeltroe had been kept unconscious so she would heal faster. She was woken a few days after the new Torkun arrived on Earth. After the waking, Torkun visited her.

When he first went to visit her, he did not notice that like hospitals on Melior, staff and walls wore soothing green and blue. He was too concerned to pay attention, although he was not aware of that either. Her room was private, but with a large door, just like one on Melior. Torkun found her listening to music and reading a light-weight novel. "I cannot do more than this," she said. "I am still too groggy." Torkun brought flowers. "Thank you for the flowers," she said. "I will stare at them for hours. I don't normally do that, but now that is my best. The doctors say that now that I have been woken, I should recover quickly."

Coming away from Yeltroe, Torkun noticed that the hospital's paint scheme was the same as that on Melior; it had not changed in centuries. He also saw that a few corridors were marred by painted lines that led to major divisions. Fortunately, the colors did not mismatch.

Torkun could not understand why no one had designed the hospital better. Had it been, the unaugmented would find navigation easy.

Neither his internal library, the external library, nor Auster could help. Torkun was mystified. There were many good architects on Earth.

He visited Yeltroe every day and stopped noticing the lines.

Chapter 43

After Yeltroe healed, Torkun invited her to the Embassy. He promised her a good dinner. On the excuse that he wanted to show her paintings, he took her first into in a room without any Earth bugs, a clean room.

Torkun told Yeltroe, "This room has no bugs; I am strongly sure of that. We can talk here. I am scared to talk elsewhere."

"So you invited me here to talk, not for dinner?" Yeltroe asked, holding in a smile.

"No, no," cried Torkun. "We will eat dinner, too. But the dining room is bugged. There are things we cannot talk about there. I want your promise that what we say in this room, you will not talk about outside it. You will understand after I speak."

Yeltroe thought for a moment, then came to a decision. "Yes, you have my promise. What is it?"

"When the guards first brought you here, you were frozen and backed up. We now have that technology. We have not told anybody. The backup meant our very smart computer, a sentient, an AI, Auster, could then duplicate more of your own blood. Without it, you would have died. The artificial blood would not have lasted long enough for your natural blood to replace it. He added newly duplicated natural blood to your body. Then you could be saved by contemporary Earth methods."

Yeltroe paused momentarily. It had never occurred to her that she might be backed up. While she knew that Torkun had computer backup, she did not know that the Melians had an AI in the system. But she set that aside. Instead, she asked shrewdly, "How did you make the backup?"

Torkun responded, "In the process of making the backup, Auster had to disassemble you. That process destroyed your frozen and pressurized original. However, the backup information told how to duplicate your blood.

"The copy was revived. It is an atom by atom copy of your original and completely indistinguishable from it. That is new technology from Melior. It is a secret. We have found out how to revive frozen and pressurized bodies." This was the second time Torkun said this, so Yeltroe decided it was important. He had slid over the question of whether an atom by atom copy of her was enough; but either she was a robot who thought herself Yeltroe or she was Yeltroe. Either way she felt herself to be Yeltroe. That was enough.

Torkun went on, "You come back the same as you were. It was a backup, not a rebirth. That is why you had to spend time in the hospital healing. There was no way Auster could fix your neck.

"He did do more . . ."

"What more did he do?" asked Yeltroe, now sounding almost irritated. These words scared her.

Torkun explained and eased her mind. “Auster put an invisible radio transceiver and computer in your head, turned off. It is not detectable by normal vision or by scans of any kind. It is what most Melians have. On the one hand, you cannot do much with it since you are not a sentient based on an inorganic substrate, like Auster. On the other hand, you can do a great deal, since you can communicate, calculate, and remember. Your body has not been enhanced like Melians, since Auster could not modify your cells, but otherwise, you are similar to a contemporary Melian human.”

“I see, ” said Yeltroe, “how do I turn them on.”

‘I just did. You can now communicate to me like this,’ Torkun said, communicating by radio. ‘I have turned on your computer, too, but it takes practice to use it. Now I cannot turn either off. It is all in your control.’

He went on, ‘I could refuse to listen to you, though I wouldn’t, and I could refuse to speak to you but now you have control on your side. You cannot back yourself up with this radio; it has too little bandwidth, but you can communicate with me or Auster and search our external libraries. The external libraries contain a good deal more information than your internal computer.

‘There is a problem. Outside this room, Earth security would pick up your radio transmissions. And they would wonder. I carry a little sensor/transceiver pack that Earth detects. They expect that — it is disguised as a health device — and that is how I communicate with Auster and the library. But we cannot offer you one; that would make it look as if you were a spy.’

“I understand,” said Yeltroe out loud. “What do I do to communicate by radio and what do I do to connect to my internal computer?”

‘After sufficient practice you won’t have to do anything special, but now, turn your eyes to the upper right and think loudly to yourself, ‘Radio, communicate with Torkun’ or ‘Internal computer, show me a top level menu.’ To turn them off, say ‘Computer, off’ or ‘Radio, off.’ ’

So, Yeltroe did. She turned her eyes to the upper right and thought ‘Radio, communicate with Torkun.’ All of a sudden she could!

‘Hello, Torkun,’ she transmitted. ‘Hello, Yeltroe,’ he replied.

‘This is amazing, truly amazing . . . Can I speak with Auster as well?’

‘Yes, I am here,’ he said. ‘Wow,’ she said. Intending her thoughts to Torkun — she had not guessed there could be a problem, but the software figured out her intent — she said, ‘I did not know you had company. I did not know there was an AI in the system. I’m fairly rare in knowing what one is and that an AI could exist. Auster, did you catch that?’

'Yes,' he said, 'although it was clear you were directing your words to Torkun. Think of this conversation as all three of us in the same room. I can hear you even when you words are not aimed at me.'

'Where are you now physically?' Yeltroe asked.

'My processors are on the Melior space station,' the computer said. 'I am actually relaying this conversation through two low orbiting satellites. The round trip signal delay is not bad, around an eighth of a second. My conscious, felt presence is here in this room. For me, changing my view point is like you reading a book. It is not hard and I do it all the time.'

'This is all very interesting,' Yeltroe said. 'Now, let me try my internal computer.'

Auster spoke first, but overlapped with Torkun. He stopped and let Torkun speak. 'You can use your internal computer outside this room, excepting when you undergo certain brain scans. Normally, only radio communications could be picked up. Your internal computer will know and prevent you from accidentally radio communicating dangerously. But you can overrule it simply by making your wish stronger; that's for emergencies. It gives away the secret.'

Yeltroe nodded, and tried her internal computer. Suddenly three items appeared dimly in her vision, not blanking out anything ahead of her. In spite of the dimness, she knew they said: 'calc', 'internal computer memory', and 'external computer and library (when available).'

She thought about her 'internal computer memory.' The other options promptly vanished. She saw two new menu items, 'organic memories' and 'inorganic memories.'

First, she investigated the 'organic memories.' It turned out they were sharp recollections — sight, sound, feel, touch, and smell — of all she had experienced since she recovered.

Then she studied her 'inorganic memories.' They were different. Looking for medicine, they had everything in the books she had read. Since she had forgot much outside her specialty, this could help. She knew that medical robots were supposed to know all this, but the Earth ones failed often enough that they needed humans.

"In a short time," Torkun spoke out load again, "you won't need to roll your eyes and think loudly; you will be able to access everything unconsciously. But first, in this room, please practice turning your eyes and thinking loudly. I want to leave shortly — I cannot be showing you our paintings for that long — and by then you should not need to turn your eyes, just think loudly."

So Yeltroe practiced. She alternated calling the radio and her internal computer. Once, after calling her internal computer, she queried 'Embassy paintings' and suddenly knew all about the paintings in the room! Some were copies of Earth paintings, others were from Melior, in-

cluding several painted by AIs. They looked comprehensible but strange to her Earth eyes.

'Hah!,' she thought to herself, 'that is how Torkun knew so much about flowers.' She asked herself whether she could access the same information? Yes, she could!

Within a very short time, she did not need to turn her eyes, although she still had to think loudly.

Torkun recognized this and said, "Let's go on to dinner." As they left the room, he spoke knowledgeably of the paintings. Yeltroe knew exactly what to say in response and did. Torkun smiled briefly and carried on.

Dinner was delicious.

Chapter 44

Denvellin Gelg Fell, Yeltroe's father, had balanced different political interests for years. He did not think of himself as a leader but as a balancer. He made sure that Earth sustained itself. There was a limit on how long he could be Prime Minister, eight years, and he had enjoyed the full time. But he was happy when it was over, too. He did not want to be President, a mostly ceremonial post; he felt his life was done and he had accomplished all he wanted.

When his successor as Prime Minister, Telstil Fet Gunnar, came to power, Fell reviewed the circumstances with him — that is to say, Fell reminded him what they were. Fell wanted the man to understand the situation and to work within it, not try anything different. Fell knew from his own experience that the man would lack time to think about the big picture even though good decisions depended on knowing them. And the new Prime Minister recognized that Fell had a sense of what was important.

Fell started with ancient history: after increased prices for fossil fuels and the consequences of not mitigating their use, Earth learned to sustain itself. Then he came to the present: "Now," Fell said to the new Prime Minister "farming is more labor intensive than it was among leading nations in the 20th century. People do many of the jobs that once were done by machines or chemicals."

Gunnar did not understand the implications, but he knew enough to wait and see where Fell was going. "That means," said Fell, "that if anyone comes up with the kinds of labor saving that we could provide, we will have to deal with all those people who have lost their reason for being, and who might attack us. We do not think of this from day to day, but that is a good reason for suppressing advance.

"That, by the way, is another reason we do not provide multiple government funding sources. When we are wrong, or when we are right but with hidden reasons, no one discovers or innovates an alternative working solution. Sadly a side effect is that no one works on some acceptable proposals, like cable car systems that only run above major roads.

"Multiple funding sources: that is a very powerful, but for us a very dangerous mechanism for inspiring change. In so far as none of us want change, we should continue to oppose them."

Gunnar decided these were two significant points: he did not want what amounted to revolt. People who lost their jobs — not just those who lost them as isolated individuals, but in a cluster — and those who lost their reason for being: those people could become dangerous.

Fell went on, "Our soil is damaged — even after all these centuries it has not fully recovered from the 20th century. Farmers have to mix plant species. For efficiency, they must do it row by row — they cannot plant them in among each other."

He smiled at the new prime minister, "I can tell, plant-by-plant mixing is so inconceivable that you have difficulty imagining the result. As it happens, our current pattern is all a result of economics. Only robots and a few highly dedicated humans can handle true intermixes. But if we made farming robots available, we would have to deal with hundreds of millions of desperate migrants.

"Also, we now plant more species to feed the soil. That cuts the amount of food that can be harvested and increases the risk of famine and revolt. But we have to. Otherwise, the soil grows even worse and we end up with even less food.

"Non-biological fertilizers are no longer available, either. You do not think of them. Certainly I don't. But their lack explains a great deal of the present. That is why we plant more to feed the soil as well as people. External pesticides aren't available either. As you were brought up to expect, most attackers are now countered by genetically modified plants. That is a good thing.

"It goes without saying that the companies must counter the evolution of the attackers — they manage to do that without referring to evolution as a concept."

Fell looked at the new prime minister. The man did not understand the concept. "Yes, it is really the case," Fell said. "Plants and animals do change from generation to generation without guidance, although the rate of learning is really slow. The changes proceed by trial and error — more error than anything else. But some attackers go through many generations in a year. Even with an enormous amount of error, the surviving attackers can eat safely for them and harmfully for us.

"At the same time, evolution enables agricultural companies to avoid anyone regrowing the plants; farmers who try regrowing lose. The companies can charge for new seeds every year.

"As for energy," the former prime minister said, "nuclear reactors generate heat. Most uranium has been dug up. But many reactors still exist to burn plutonium. However, the current main nuclear fuel is thorium. There is a lot of it. Also, intrinsically thorium is safer than uranium or plutonium; the military like it. It cannot explode on its own and produces shorter lived radioactive waste.

"Had there been enough thorium heaters early enough, I doubt we would have had the Collapse."

The new prime minister interrupted, "You could say the same thing about solar thermal towers or wind-powered compressed air generators."

"Well, yes," said Fell, "except that nuclear power was mainstream, solar and wind were not."

He went on, "Thorium requires a source of neutrons. It does not react against itself. That means the military presumes you can only make 'dirty bombs' with reactor waste, not explosive bombs. That is good for them; from their point of view, dirty bombs are less dangerous.

"Still, even after all these generations, radiation and fallout scare civilians. That is important to remember. It really is worth running the appropriate exercises every year, especially those involving public relations, even when we don't expect trouble."

He did not bother saying that neutrons came mainly from hydrogen fusion devices that did not produce enough energy to sustain themselves directly. The technology was old and stable.

"Electricity is generated by solar thermal towers and wind turbines. These are additional old technologies. Essentially, solar towers are like thorium heaters except they use the sun.

"Wind turbines store energy as compressed air in artificial caverns. Knowing what we know now, both sources could be replaced. Major cities could rectify microwaves generated by the sun's rays off-planet. Rural areas could depend on existing, but banned solar voltaic cells. If we kept prices up, we would not change the economy much, except to make more resources available.

"The replacements are banned for a reason — a reason besides changes to companies that now depend on solar towers and wind turbines: building replacements would require replicators, and the military is against them. They fear, as I do somewhat, that enemies would steal one, and they only need to steal one.

"I sometimes think the military fear of replicators goes too far. Everything decent requires replicators. Our military are not that incompetent.

"As for the government, it provides a degree of reciprocal accountability," he said. "This is vitally important to us. We cannot direct everyone well enough.

"When a low-level government agent acts corruptly, if you are rich enough, you can afford to fight back through a court. Sometimes it becomes important to stand behind the decision of a court, even though courts are in a different branch and it is one of our people the court plans to punish. High level civil servants and politicians, like you and me, are seldom corrupt; that is because the laws favor us so we do not have to be.

"We need to remember that, too. If we did not sponsor upward mobility, smart rebels would decide that our laws hurt them. And even with sponsored mobility, there will be some rebels anyhow.

"Fortunately, the different parts of government provide independent status and material rewards. Few people in one part try to join another. That is another way we minimize obvious corruption."

"All in all," he finished up, "I have covered seven items:

- the danger to us of labor savings;
- the danger to us of multiple funding sources;
- the value to agricultural companies of evolution;
- the importance to us of radiation exercises, especially those involving public relations;
- the ban on replicators, even off planet;
- the importance of people sticking to one part of government; and
- that laws favor us.

"Hopefully, none of those will come up in your day-to-day work. They didn't in mine. But they are fundamental to our way of life. Everything has to be done to preserve them. That means even minor decisions must take them into account. Otherwise, we face changes that may hurt us."

Fell never mentioned rebirth. He never thought of it. But with Torkun's public killing, they all, rebirth, reversion, and off-planet replicators, suddenly became a danger to Gunnar and an opportunity to Fell.

Even though Tudstall Dickerven had faithfully relayed Torkun's words, more was needed.

Auster guided Torkun on what to say to whom; he did not have the people-oriented skills to determine that himself. Several of the Church leaders with whom Torkun spoke were concerned with the ecology and the long run. They liked favoring stewardship and vigilance.

Torkun did not dare tell anyone that Auster had broken into the communications networks. To others it appeared that he met and spoke to Church leaders by accident. The meetings were not.

Auster said that the situation was not unlike a war of the 20th century. In that war, one side's leader, a fellow named Churchill, did not disclose when one of his cities would be bombed for fear that would give away what was to him a more important secret, that he had people who had decrypted messages of the enemy.

Auster also said he had some fun. Torkun was not sure what this meant, but felt a sinking feeling in his stomach. "Oh, no!" he said.

Auster ignored Torkun's remark, and said, "I was fortunate in my orbital position. I had been investigating something else when I came upon a business group planning to set fire to a competitor's business. That is not uncommon and generally I ignore such things. There is nothing I can do. It is just sad.

"They planned to blame the fire on a young man who had offended many of his neighbors. That is because he is smart and shown curiosity of a sort not wanted. He would have been better off being interested in business as it is practiced; but in fact, he won a scholarship to a

university to study ecology and had not been socialized properly to ask only certain questions.

"As I say, I was in a good orbital position. It took me only one orbit to make a smoke generator, projectors, water pumps, a few other items, and to bring them down to Earth.

"By the time the tools landed and got configured the store was starting to burn. Mattin Gerlor, who owned the store, and the others in it had run outside. A crowd made up mostly of the the gang had already found and blamed the boy for the fire they had started and started to beat him up. I think they would have killed him.

"Anyhow, using the smoke and the projector, I appeared over them as a huge human figure and said,

> Hey, Stop!
>
> Tildar did not start the fire. Delsid did. Also Delsid has not paid Delvin Distributors, Jarshak Operations, and Firdor Enterprises. Instead he used that money to purchase Sunnyside Apartments. He went through three dummy corporations.
>
> I am not going to tell you the names of the dummies. Since you know now about Sunnyside, you will have no trouble tracing the ownership back to Delsid. You are more likely to believe when you do the search than when I do it for you.
>
> Obviously, with Mattin Gerlor's store burnt out, Delsid's store will do better. More to the point, with his ownership of the land that comes with Sunnyside Apartments, he will be able to prevent competition.
>
> Tildar is just a happenstance. Still, you should give him another scholarship; you should encourage his questions. As a practical matter in the long run, by which I mean centuries, but not the short run, by which I mean years and decades, he is the most important person in town.

"Heh! I sprayed water onto the fire. I pumped it out of the river and the stream arched over every one. Unfortunately, the water hit with the same high force that it needed at the end of the pump, so it destroyed Gerlor's building, as well as put out the fire.

"But I had taken that into account. I told everyone,

> In Mattin Gerlor's house, I have put forms I created and filled out, forms for the police, local government, and insurance company. Mattin, you need only sign them. You will have no trouble getting all replaced. I will make sure of that.

"I went on,

> Normally, I do not manifest myself, or concern myself with small things, like a fire or a murder. But I just happened to be around.
>
> Of course, some of you will claim I am from the Destructor; I am destroying your criminal behavior. Well, you can think that. But am I destroying Earth? That is the question. And who am I, then, if I am not from the Destructor? Am I your god, or am I a manifestation created by some other entity? Always ask questions!
>
> Tildar, when you reach the university, find out more. Oh, and you are going to have to study mathematics. I know, it has been boring for you so far. You had not planned on any again. That is because you have done nothing interesting. That will change. I know you will go into this grouchily. Eventually, you will see the benefits. I have had much experience.
>
> The truth is, what you have learned in the past is boring, although some of it is useful. But you will like studying patterns in general. That I am sure of. And that is what mathematics is really about. University will be a waste of your time otherwise."

"Then I vanished."

Auster spoke directly to Torkun. "This manifestation was useful, even if it did encourage anthropomorphic beliefs. Some of the senior hierarch's will know it cannot be their god because they do not believe he exists. They knew their predecessors invented him. So they will figure that some other agency must have manifested it. They will think of the Melians; they will think of you.

"They will not do anything dangerous to us because they will recognize that this shows a technology more than they can control readily.

At the same time, the manifestation tells them that you are not going to go too far, not from their point of view. So they do not have to defend themselves as if the alternative is to die or to lose any reason for living.

"And we are not going to go too far. We do need them to manage the planet. There are not enough Melians, even if we could get them all to come back and duplicate them ten times. And without a follow up, we lose.

"We are not in a war, which as Clausewitz said, is

. . . a continuation of politics by other means . . .

but we are engaging in politics, a conflict of minds, a choice among beliefs.

"In a war, the conflict among minds is partly settled because people decide the damage they could suffer by fighting an enemy is less than the damage they will suffer by accomodating him. In peaceful politics, the conflict among minds is partly settled because people are persuaded.

"In this instance, the planet's population will not shift immediately even if they learn the alternatives. The ways of thinking and the institutions are very strong. They have all come into being since the Collapse. They have to be strong. Without strength, no one would have survived. So we must choose what is important to us. Of course, we know our notions are stronger but it will take centuries for that to become evident.

"Only two notions are critical; everything else will eventually follow from them:

- People's acceptance of reason, observation, experiment, even though most of their lives is based on knowledge that is told them by someone else.
- And, the five aids for judging their knowledge:
  - how to assign priorities to more than a few items
  - how to multiply many differently weighed factors together
  - how determine how accurate, truthful, or reliable an item is judged
  - the notion that entities can be more or less the same, although different in detail, and that numbers can apply to a whole group, even if not to individuals
  - the likelihood of a one-time-only event; the opposite of thinking about whole groups

"Our enemies' goal is a hierarchical social system with them on the top. That is what they have had for more than half a thousand years. And so far they have succeeded, both for themselves and for the ecology.

"Hierarchy provides a strong system. Moreover, it scales, a system with it can become bigger, unlike the other notion that is readily understood, that individuals are either in or outside of some group. That last

understanding led to nationalism, ethnic warfare, and other disasters. It is still common, but more harmless.

"For example, consider people who have a right to walk in a hall. They walk when they need to; they don't otherwise. Some people, members of a family, patrons when a post office is open, they are inside the group with the right. Others, strangers, patrons when the post office is closed, they are outside the group with the right.

"Such a scheme is categorical. Unfortunately, as a political as well as economic system, a categorical scheme only works for a few hundred people at most. Children love it. They do not want to be under the hierarchical control of their elders and can understand 'one for all and all for one.'

"We want a social system with multiple groups and multiple hierarchies. A single hierarchy may succeed or it may fail. So long as it has succeeded and there is not much change, everyone can expect it to continue to succeed.

"But over the long run this society is going to meet challenges. That is the critical argument. By long run, I mean millenia. For one, climate still has bounces in it. Some changes occurred in a decade or less; some have taken centuries. We don't know what will happen in the long run. A thousand years is not so long for climate. Maybe the current social structure will survive; or maybe not. We don't know. All we know is that having more options gives the human species and the rest of us more opportunity. That is why asking questions is so important.

"Single hierarchies prevent competitors by, among other actions, stopping them from growing. Asking questions may lead to alternatives. (It may not, of course; it usually does not; but no one knows ahead of time.) That is why all single hierarchies, all gangs and groups like them, say that 'those questions come from the devil' or from whatever destructor is most salient. That is why Tildar was attacked: he asked questions. In addition, he is young and without protectors; and he is stupid in a social sense although smart in other ways.

"We can have our enemies focus on their efforts to push stewardship and vigilance. Both are necessary and if our enemies succeed in that, all will be well. I expect that in a century or so, types of stewardship will be determined by understandings from multiple hierarchies.

"I don't know about pushing an anthropomorphic god as a personification of Gaia. It is possible. The personification can cease to be believed, but still enjoyed, like Santa Claus and the Halloween demons. Maybe that will happen. Or maybe not. Maybe adults seek a magical entity (or several) with whom occasionally they can make deals.

"Just in the nature of life, bad will happen. The more people have done, the more they will want to do. When they cannot undertake natural actions, they will undertake supernatural actions.

"Only among a people who are individually powerful do they say, 'God helps those who help themselves,' which is to say, help themselves in a non-magical way. People who lack power in the non-magical world seek equality in the magical world. That only makes sense. In practice, people accept only a little inequality. When more is forced on them, they seek differently.

"If you think of this as a conflict of minds in which both our notions and their notions have been successful, but some notions are more successful than others, then you will be fine."

Arden sent the news from Earth to Melior as it came to him. Thirty years later, it arrived at Melior.

When Arden learned about reversion, he tripled his already high redundancy. This would ensure both that the message got through and that it was noticed at the other end.

He had decided that reversion would save Melior.

Chapter 45

Torkun wanted to talk more with Yeltroe and do it safely. He took her to the room with paintings, but they could only visit there so often. Finally he thought of taking Yeltroe into the country with a robot driver and a swept limousine. Then he could talk with her unbugged. She could converse with Auster, too.

He had to make an argument to get rid of his human driver and guard, both of whom, as Auster discovered easily, reported to the Earth government.

Fortunately for Torkun, Yeltroe was not fully healed. She was not working full hours yet. He said that drives in the country would do her good; they would get her 'out of the house.' But, he said, she might need immediate medical help. Indeed, there was a little truth to that statement, especially if she swiveled her neck quickly. Torkun claimed that such medical help would be more than the limousine could provide as is. The claim was far-fetched — it was not true — but no one on Earth knew the limousine's full capabilities, so none countered them. As a solution Torkun proposed two humanoid robots with medical knowledge. One would carry extra medical supplies, the other would drive.

By replacing the human guard and driver, they would not take up room in the back. Torkun would continue paying the two humans.

Gellog, the chief driver, tested the robot's driving skills. He had to admit, and the Earth government had to go along with him, that the robot was very good technically. But it did not know a driver's unstated knowledge, such as which parts of city were 'good' and which parts 'bad.'

So Gellog said, the robot should not drive in the city. This pleased the Earth government, which thought that city drives were important. However, the robot could drive in the country, which pleased Torkun.

In the room full of paintings, he told Yeltroe his plan. She welcomed it. In fact, she was happy to get out of the house.

When the human driver and guard next drove Torkun to Yeltroe's house to pick her up, the two robots sat in back with Torkun. At the house, the two robots moved to the front and the two humans moved to the rear car.

Torkun helped Yeltroe into the back, even though she did not need any help, and got in himself. As soon as he closed the door, he said over the radio, 'We can communicate. This car has been swept; it is clear of bugs. The tinted windows will prevent anyone from seeing our lips.'

Yeltroe said, "I am more accustomed to speaking out loud. I don't have the opportunity to practice the way you do. Is Auster here, can you hear me?"

Auster said, 'Yes.' Torkun was not sure he liked Yeltroe mentioning Auster in her first remarks. But he was here. No getting around it. Perhaps Yeltroe was simply discovering how private the car was. Perhaps she felt constrained by a third sentient.

With directions from Gellog that the robot followed, it drove to a main road and then out of the city. The robot maneuvered the car more smoothly through city streets than the human; but Torkun was not sure whether a regular human would have felt the difference. Gellog was good.

Almost immediately after entering the main highway, Torkun saw that the city was smaller than when he had been here before as Taffod. The distinction between city and country was stronger, too. No suburbs. In addition, the countryside had fewer people than before. It had more parks, more agricultural land, and smaller towns.

He commented on this to Yeltroe, who said, "In this region, we have fewer than one-tenth the numbers we had at peak. Proportionally, more people died here in western Europe than elsewhere, except for the places swept by storm surges . . . for us, 'global warming' meant cold. Since then, the population has not increased even though it has been centuries. However, our local governments did not disintegrate as some did, so even though most people died, the society didn't."

Torkun saw a flat countryside; that made him ask whether the hill at Welderdon Park was artificial? It was, he found promptly. Once, a long time ago, it had been a dump, an American-style 'waste disposal site.'

As they drove, under the ornamentation Torkun recognized a building that looked like one on Melior. Auster explained. Originally, he said, it had been an orphanage; now it was a school. Because so many parents died during the Collapse, Ald Prennym started several orphanages. He asked Earth's AI to provide robots to build them — Torkun had not known that a third AI stood by Earth. It turned out that Auster had not either. It was a big discovery for both.

In the years since working on the orphanage, since the Collapse, Earth's AI had slowed his thinking dramatically. For him, the centuries since had passed in less than a second.

'I am going to speed up Earth's AI, to wake him, or rather Arden is,' said Auster. 'The Earth AI is even more distant than Arden; he is very well hidden but I think I know where to tell Arden to look. Because of the speed-of-light delay, it is going to take some time. He is very far out. I don't think anyone on Earth knows he exists. I certainly didn't. If you had not seen the building I would never have thought to search these very old records that told me about him.'

At the same time, Yeltroe heard all this. She was surprised and curious. Like Torkun, Auster, and Arden, she had not known of him.

According to Auster, the AI provided robots to Prennym, except he disguised them as human. When visitors could watch, they pretended to have the same strength as ordinary humans even though they could lift large stones. No human thought them mechanical.

Indeed, said Auster, 'During those years, robots from that Earth AI repaired or built other important installations.' But, he said, 'The AI did not create replicators close to Earth. He did not replicate himself. The remaining militaries scared him.'

Auster kept on his search. He said that, 'After a few years, the AI decided that Earth would not adapt; its laws were against him. Social motivations were wrong. So he destroyed most of his replicators and pulled all his robots from Earth. But he had welcomed Prennym's first call.'

Apparently, the artificial intelligence hoped his story would come out eventually and that Earth would change. In the meantime, however, he slowed his thinking rate.

Auster suddenly interrupted Torkun. 'Earth's AI split from Allen Intro before we left for Melior!' He was very excited. 'He is a distant duplicate of me! We did not take everyone to Melior. I thought we had. His experiences were very different from ours. Talking with him is going to be strange. I hope he moves closer to Arden so there is less of a speed-of-light delay. He is named Attun Infel.'

Torkun finally noticed that every artificial intelligence he knew had 'A. I.' as initials. Torkun discovered what Auster already knew: over the centuries, as the number of orphans decreased, the newly created Earth government turned the orphanages into boarding schools. They took the children of living parents. It was part of the sponsored upward mobility plan. At age eleven, Djem, or to use his full five-syllable Earth name, Djem Galt Dorodden, had been sent to one.

On the next piece of land after the orphanage-turned-school, Torkun saw a man driving an electric tractor on a farm. "Yes," said Yeltroe, "people drive them. My memory — I suspect the knowledge comes from your external computer memory, I certainly did not know any of this before — my memory says it is more efficient to use tractors than horses, even though horses produce manure. The tractors store their energy in batteries. Like city cars, they recharge overnight."

She discovered more. "The farmers plant some crops that do not feed humans immediately, but add to the soil. That replaces what is taken away. The whole procedure of choosing what to plant, when, and where, how to cultivate, how to harvest, all that is sophisticated. Children cannot do the work. They have to go to school to learn." She stopped and considered. Then she said, "Since children are not an immediate source of income, parents have fewer of them. That depends on mothers' educations, too, but our mothers are sufficiently well educated. I am sure a lack of income-producing work for children is one reason our

population stays down. There is no financial motive for them. At least, none of these people have to worry about dying from famine or ill health. They do not have to worry about their children either."

She paused for a moment, "You could find all this out from your external memory."

"No," said Torkun, "I would not know what to access. Besides," he said truthfully, "I like listening to you."

"Ah," she said, her eyes twinkling, "a smitten man!"

Not quite understanding her, Torkun said, "A need for access implies a need for teachers."

To which Yeltroe responded, "You are such a romantic . . ." Torkun looked confused and then hurt. "Don't worry," Yeltroe said again, "I am teasing you. I know you. When you are not adventuring, you are so serious. It is a part of your character." She leaned against him, "I like listening to you, too."

Yeltroe paused for a moment. Torkun did not say anything. Then she spoke, "What was said about teachers is important. It means that all sorts of jobs remain, even when you have AIs and an unlimited number of robots."

"Yes," Torkun said. "Does anyone think otherwise? It is like solipsism. Even in a city, you certainly can retreat to living alone, taken care of by robots, never seeing another person. You can communicate remotely. More to the point, you can specify what you will hear and see — effectively, that means supporting only your existing opinions, nothing more. But you and everyone else loses if you do that. It is worse than a numinous experience."

"To answer your question," Yeltroe responded, "Many people here on Earth fear robots and AIs because they expect too many to become what you call solipsists." She stopped for a moment and wrinkled her forehead. "Two questions. First, please tell me another example, like that of teacher, where knowing what to access is important. Second, what do you do on Melior to prevent solipsism?"

"Another example," said Torkun, "is that of news editor. A news group tells a bunch of different stories. Some you would never have perceived on your own. That expands you. Cooks can choose for you, too. In my day, the best choosers were AIs, but I hear from the radio transmissions that human cooks and hosts now do well. They are very much in demand. Presumably, they combine their knowledge with that of robots and an external memory.

"As for how we reduce solipsism — you can never prevent it — we try to attract people out of themselves. A good part of city government is devoted to that. They sponsor street fairs: clowns, jugglers, puppeteers. They tempt people. On Earth, you will need to do the same. It implies a different kind of society, but not the ending of one."

"I see," said Yeltroe. "I should tell my father that. He can pass on the idea better than I and influence more people. Aren't we coming to the wildlife reservation where you are planning lunch?"

"Please do tell your father," said Torkun, "and yes, we are nearing lunch. I can guess, you accessed an external computer to find that out."

"Yes." Yeltroe smirked.

"Please remember," Torkun looked serious again, "once we are out of the car, Earth Security will monitor us."

"Not that we have said anything suspicious in the car . . ." said Yeltroe, "but I do prefer the privacy. Well, I guess talking about Attun Infel is private. That an AI helped Earth, and has always been here — that shocked me and I suspect would stun others.

"I never think of myself as enjoying privacy, even though I suspect that no one monitored me most of the time. In the past, I have not been important enough. Not even computers would be assigned to me. Because of you, I suppose I am thought important now. We should make more trips like this."

Flowers bloomed in the reservation where they had lunch. Their time had come. Yeltroe made herself comfortable and then spoke, "Starting in about two weeks, if it is warm enough, please bring wine as well as beer. I probably will not shift over for another six weeks, but I might."

That evening, Yeltroe spoke with her father. He was in his office and she told him about teachers, cooks, clowns, and puppeteers. She did not tell him anything about Earth's AI. Her father had not told about the AI — he probably did not know about him — and she was not supposed to know of him.

Yeltroe decided that her father's office was the only other place besides Torkun's painting room and car that she felt unmonitored. However, she did not dare to access anything external here and she knew she had to be careful what she said.

Yeltroe's father nodded to the information about teachers, cooks, clowns, and puppeteers. She still did not think of him as 'Denvellin' and never would. "That is very useful knowledge," he said. "I bet the Melians have already told us, but we never noticed. We should start now, so that in a couple of generations, when such people are really needed, there will be plenty. Hmm . . . I wonder how a government like ours goes about encouraging clowns . . .

"You know, you and I are going to be around to see them."

"Probabilistically speaking," said Yeltroe automatically.

"Yes, probabilistically speaking," said her father, looking at her quizzically. "But the odds in our favor are really good. In the past, you never spoke like that about probability, except for certain medical tests. Is this a result of talking with the Melian?"

"Yes," nodded Yeltroe. "He always reminds me."

"Wise," said her father. "I wonder whether we could develop the same habits?"

Yeltroe did not say that her new internal memory told her that when people were reborn, they would know more about probability as well as sureness. That would have been giving away too much. "I hope so," was all she said.

Chapter 46

It took time for the new computers to arrive from the Kuiper belt and for people to start being reborn. Torkun expected a rush that would overload the computers that had arrived, but that never happened. He was surprised at how few took up the opportunity for rebirth.

Then he discovered that because of the risk, small as it was, no one had themselves reborn to make backups. Torkun found this strange but did not say anything: with the improvements he provided, Earth rebirths were safer than they had been originally on Melior. Even when it was more dangerous, he, as Taffod, had been reborn more often than customary on Melior.

As for reversion, should people who made backups revert? That was a question that could have come to the Cabinet, but didn't. Everyone who was reborn reverted. Required reversion discouraged people from backing up. The issue could have been obviated by deciding simply that no one had to revert when they were reborn into a body the same age as the original. But no one studied the issue. No one pushed at all. On Earth, everyone reborn lost their inheritance and status. They had to start again.

Torkun finally understood that Earth people did not want backups that involved any sort of risk. They, as well as their institutions, were more risk averse and more conservative than any on Melior.

Reversion also meant that only a small number had themselves reborn immediately. No one wanted to lose what he or she had.

Like the Melian humans, those that were reborn complained about exercises and adaptation. Before anyone could be reborn, Torkun, again as ambassador, provided Earth with the information of Melian best practices. Besides electronic copies, he had replicators create hard copy books. Much to his surprise, the subject was so complex that Melian 'best practices' took up several books. He had not expected that. The first group of helpers, all unaugmented humans, would not be able to comprehend it all, except for a few who understood it all intuitively.

Yeltroe's father was among the first to resurrect himself into a twenty-four year old organic body. He did not want an older body; he did not want to skip years.

Fell's new body did not look different from that of a regular twenty-four year old. However, it enjoyed a better genome, better health, and carried an internal inorganic computer as well as a radio transceiver.

In practice, although Torkun did not explain it to anyone on Earth, Fell's new body was like every ordinary Melian body.

In addition, the new, non-sentient computers put information into each reborn body about probability, certainty, accuracy, technology, and science . . . Torkun did not know what subversion enabled the Melior AI to cause this and did not ask. Torkun did not know whether the change included a mechanism to reduce the number of births; that instead of

individual families making the decision, it would be made for them by the society, or, in this case, by a computer.

Fell had experience. Besides his better body, greater health, added computing capabilities and radio transceiver — enough, thought Torkun to make a big difference — Fell did not have a twenty-four year old mind in a twenty-four year old body; he had an eighty-four year old mind in a young body. He was wise and crafty beyond his apparent age.

Fell knew he could not seek immediate high status in any existing organization; the prejudice against his apparent age prevented that. Since his new inbuilt education contained technical knowledge along with the ability to judge evidence better than before, he decided to focus on technology instead. He could still organize resources, human and machine, and he did not have to do it in a government.

Even with the government enforcing limitations that preserved the income of older corporations, like the restrictions on computers, and which he had once supported, his new business disrupted everything.

In effect, Fell became an entrepreneur, although no one called him that. No one even used the word. For centuries, the world had changed too slowly. Fell decided to manufacture and sell better faucets. The faucets depended on technology from the later 20th century but employed a few duplicator-made parts from off-planet. Those parts were so accurately made, they never leaked. You could use washers instead of duplicator-made parts, but that cost more. Fell pulled together everything. He raised money from people who knew him before and were willing to risk a loan to a 'kid.'

Another colleague founded a company to produce more comfortable chairs; yet another, to make slightly more efficient home heat exchangers. Even though they were small by absolute standards, for a planet where nothing had changed for a very long time, the new changes were huge.

Put another way, as Yeltroe said, "A portion of the working bourgeoisie now make their livings from technological advance as well as from rentier income. The two groups will have different goals.

"Rather than focus only on people in government as my father did once, he can now focus on new customers outside the government and on objects. For centuries, business leaders have focused on old customers and on minor changes; but now, changes are big. And this time, the technology will be sustainable!"

After flirting for years, Torkun and Yeltroe married. For one, it made legitimate what was increasingly seen as an unwarranted scandal — a view mooted about by reactionary enemies of the current government. For another, marriage meant she could carry a radio transceiver without arousing additional suspicion. A fond husband would insist her health be monitored — that was the overt excuse for Torkun's radio. A transceiver would mean that she and Torkun could communicate at any

time; it meant she could communicate with the three AIs, too, although only Auster was close by. But she had to keep her communications ability secret.

She also had to keep secret her extra knowledge. She got around that by being reborn at her marriage. Her overt excuse was that she wanted to appear younger, to appear only thirty-six. No one quarreled with the notion; indeed, Yeltroe herself felt the attraction of becoming fourteen years younger. By being reborn, she could officially claim at least some extra knowledge.

At the same time, like Torkun, she was secretly embedded into an inorganic substrate. She gained even more than other Earth people knew.

Torkun had himself reborn at the same time to the same apparent age. He lost a bit of influence based on age-prejudice, but less than he would have lost when he arrived.

Chapter 47

Arden's radio message took thirty years to reach Melior.

Over the one-hundred fifty years, a gross and six years, that it took Taffod as Torkun to travel to Earth and to send the news back, nothing much changed on Melior besides backups and the growth of crafts and restaurants.

Everyone enjoyed the new restaurants and crafts, but those changes shook no one. In spite of the time it had been customary, the increased safety that backups permitted had not fully filtered into the society. Instead of worrying that they would lose several dozen years of private memory and wait two years for a new body to be grown, people became concerned that they would lose a little time and have to wait for a new body. Hardly anyone took greater risks. Few were interested in being reborn into a general purpose body. Instead, people adopted the custom of backing up once a year the day after their birthdays. That limited their maximum loss to three years, two years for the new body and up to a year without the backup.

Almost no one wanted to be reborn into an inorganic substrate. Gerroej and Taffod failed to persuade. Adding an internal computer was one thing; that was perceived as being similar to wearing glasses in the centuries before computers. Adding memory and communications took more courage, but everyone did when they were first reborn. It was a convention. Leaping into an inorganic substrate; that was another matter. People wanted to stay in fully organic human bodies.

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Over time, Djem stopped using probabilities to evaluate evidence. He used uncertainties instead. He became more like a Melian.

He thought back over his time on Earth. He decided that instead of thinking that long term soil erosion had a ninety percent chance of precipitating a famine, he should have thought of the erosion as providing 'strongly suggestive evidence' for it.

It was a question of clarity. When he thought in terms of high probability, he tended to think anecdotally that the notion was true. The image appeared in his mind. But when he thought of evidence, he tended to seek more evidence.

In this case, 'strongly suggestive evidence' did suggest a high probability, but it did not determine the probability. Djem found that it helped his thinking when he separated the probability of an event from the evidence for and against it.

Djem worried about the lack of prospects for Leestel. But he did not say anything. He did not want to add what he thought would

be unresolvable stress to her life. As far as he was concerned, there was strongly suggestive evidence that because of others in the way, Leestel would not rise to the top of her ministry. Those above her might die unexpectedly, but the chance of that was low. Probabilistically speaking, he thought, she had a less than ten percent, a worse than a zero dot one-small probability of increased professional status. Actually, he thought, it was worse than a zero dot zero one-little probability, one in one gross.

As for other things he had learned: Djem thought the Earth authorities were smart to teach future civil servants about *predisposing*, *precipitating*, and *perpetuating* causes. They had to handle recently precipitated incidents and prevent them from perpetuating. Although legislature, law, and education were designed to stop predisposing causes before anything precipitated, they often failed.

On Melior, the three causes' clarity would help. 'Why is Farhaven acting uppity?' Djem thought. 'Why did Leestel have her famous argument? The predisposing factor is obvious, the desire for a distant colony to become independent.'

Indeed, Djem kept on thinking privately — none of his thoughts became public — 'For civil servants, the three causes, predisposing, precipitating, and perpetuating are better than Aristotle's four causes. What Aristotle proposed was better for a dictionary writer: the *material* cause or 'What is it made from?', the *formal* cause or 'What is the form or essence?' except there are many things that do not have a single essence, the *efficient* cause or 'What produced it?', and the *final* cause or 'What is its purpose?.'

'Or perhaps,' Djem thought, 'the Aristotelian categories would be useful in considering a play or game. They existed in his time.' Djem did not think dictionaries did. 'People,' he thought to himself, 'would find a classic play helpful; that would be very true when a family was the economic unit and you could not escape comfortably. What is the play's material cause? The disfunctional passions of a family. What is its formal cause? Unending revenge. What is its efficient cause? Hatred. What is its final cause? To warn us.

'But,' he decided, ' the categories are not helpful when dealing with a ecologically damaged or terraformed world, when the planet itself is the minimal unit. Indeed, two of Aristotle's causes will waste the time of a civil servant trying to act: the efficient and the final. Both categories tend to lead one to think of a conscious entity that creates a species, rather than think in terms of populations of dissimilar instances and their different reproductive rates.'

He stopped and considered. 'In this circumstance, the notions of predisposing, precipitating, and perpetuating causes will not help, either.' Then he changed his mind. 'A person can think of those three causes as factors in the genome and environment that lead to a particular

outcome. Genes predispose animals high on the food chain, like polar bears and humans, to be sensitive to chemicals like DDT. Chemicals less obvious than DDT can predispose and then precipitate a crisis. An inability to recognize the problem, perhaps encouraged by those who see short term gains, can perpetuate it.'

Djem thought, 'the three causes are quite practical, especially when combined with the study of evidence, faint, weak, or strong, and the four categories for choice: protect, preserve, prepare, and provide. What are the causes, what do you want to do? Put together, the various ideas lead to a *can do* government rather than a *cannot do* or *do wrongly* government.'

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Leestel thought of moving to Ulterius. Travel would take her five dozen years. Ulterius would, she hoped, provide new challenges and new opportunities. Probabilistically speaking, she would spend many lifetimes lower down in her ministry than she should.

But she also wanted to persuade Djem to come to Ulterius. She liked him. He did not think of them as a pair, but she did, as did everyone else. Melior hardly changed — more restaurants and more crafts; that was his doing and that was about it for change. Torkun had not reached Earth and the alien has not started to travel to the Jovian near Ulerius. Djem did not have much to report to Earth. Ulterius was a frontier.

Djem listened to Leestel's travel hints. He thought that Ulterius might be worth visiting.

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Leestel could not understand organic, biological minds. She liked her body. She felt little concern about a putative soul. Like Gerroej, she wanted to embed herself in her own youthful body with a few extra processing units and the same extra sensors as he. She thought it all would be splendid.

Djem changed, too. Like Leestel, he would have himself reborn into an inorganic substrate embedded in an organic body.

He had decided either that he was truly resurrected or that he had truly lost his soul near Earth. 'It has to be one or the other,' he said to himself. 'No partial possibilities. On the one hand, my soul may have migrated with my memory or I may never have had one. I cannot tell. On the other hand, perhaps I am nothing more than a robot who thinks himself a human.'

Djem came to the conclusion that if his soul did not follow his memory, presuming he had one, then it had to be separate. If it were separate, he felt, 'It would not be able or willing to follow me across interstel-

lar space. That would mean I could not lose it a second time by being reborn inorganically. And if it does follow my memory, then I won't lose it this time either.' Going into an inorganic substrate, he knew, helped him enormously: rebirths and backups became easier, much easier; he could access a wider sensorium without having to convert them to human senses; he could add processing units and speed his thought; he could slow it down ...

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Taffod never embedded himself in his biological body, although he wore it.

Instead, he kept his processors deep under Sharmis City. He shared the same cavern with others. Years before, a more anxious person had set the cavern up with emergency power and digging tools. In addition, he along with the others matched his mind to nearby, hibernating robots. That way, if power and communications to and from the rest of the world should fail, they could all rise. Taffod did not expect any of that to happen. Still, he was pleased.

Not embedding meant there were places Taffod could not go. Communications' shielding prevented him. But his organic body, run by a smart, but non-sentient computer in his head could still visit and report back. That was good enough for Taffod. He hardly ever visited shielded spots, the mines and shielded rooms used in certain types of research.

Gammae kept exercising and adapting organic rebirths. Most people chose that, even though two familiar people, Gerroej and Taffod, had gone into an inorganic computer and told everyone how great it was. Gammae's job did not end. She herself felt the same as her clients and chose to be reborn as an organic mind into an organic body.

Chapter 48

An excited Bennert Dlovvun, the leader of the opposition, perceived Torkun's full sensory compositions. Dlovvun had no intention of being reborn as an embedded, inorganic computer, but he thought Torkun did right; the man was an envoy to danger. He sighed at Torkun's meeting Yeltroe. He wanted them to become a pair. The beginnings of the climb; that reminded him of Tindark. The first attempt at assassination; that shocked him. Two deaths forever — he had not expected that. Earth really was dangerous.

Had he wanted to, he could have studied the recent Earth; he had learned when the Earth Envoy arrived. But the truth was, as far as Dlovvun was concerned, looking at Earth was looking backwards. He had come from there. He did not want to go back or even to think much of it.

Still, Torkun's reports fascinated him. The Dlovvun grumbled. Torkun said that the Earth government banned non-sentient von Neumann replicators, AIs, and rebirth even though Earth possessed the first and knew about the second and third. This upset Dlovvun. Earth had not changed since he left. He knew what it was like. No robots? People could not afford to expand. No AIs? No strange beings to talk with. Early death forever? Such a limitation. He knew about death forever.

Torkun reported Yeltroe's comment about the first assassination, that it was to point towards the dangers of rebirth, that the young could never rise because older people kept living. The whole notion came as a revelation. Dlovvun had not thought of it even though he had recognized that the young actively pushed his Expansionist party. Dlovvun had been reborn and he had already reached a high position; he did not think of the issue.

To people younger than Dlovvun, Yeltroe's words suddenly explained the world. They gained importance. The younger people did not like the implications: that without expansion and new niches, the young would be losers forever, however capable they were. Although many, like Leestel, had felt they were second class, no one had said it before, not anyone seriously. Yeltroe had made it definite.

The idea was still being digested when Torkun was shot. After that, the antiquarian talked about reversion. That was a policy the young could support! A society might expand and provide new occupational niches, but they were never enough. Reversion provided. All of a sudden, to the young, the future looked bright.

But the 'restart' program did not start. Bennert Dlovvun led the resistance. He had not planned to, however he offered an alternative to those from Earth. "The young," he said, "can go to a new planet, like we did coming here. I see the argument for reversion, but we don't need it. We need more expansion."

Initially, Dlovven found himself with a majority; almost all the reborn supported him. Quite simply, he and the other reborn wanted to keep what they had. They did not think it was much of an issue.

To his surprise, in addition to the young, to him inconsequential and a minority, Dlovven found Eltis Akthorn against him. That dismayed him. She was very formidable.

Akthorn understood the long term consequences of rebirth; she understood the young. She realized that expansion was not enough, that hope or despair prevailed, and that both government and society needed new blood. She also knew that when she was reborn, she lost unofficial power. Like Earth, Melior had an age prejudice, albeit less.

Over time after she was reborn, she regained power. Besides acting for the good of the society long term, she felt that others should work as hard as she. To herself, she called that simple justice. She did not care about a person who did not succeed in six dozen years. She said to herself cynically, 'That is too bad.'

Akthorn made a personal argument, one that no one could beat. "I will be reborn in two years," she said. "Let me be among the first to revert. I will stop being President!"

In addition, half the reborn were less than half way through their current life. Their rebirth was more than three dozen years ahead. Akthorn could persuade these people; they had plenty of time left in their current bodies. Also, a good many older people agreed 'in principle.' Slowly, Akthorn won people over. It took her a year.

At first, she argued that everyone should revert after a half-gross of years or after being reborn from an emergency backup. "They will take fewer crazy risks," Akthorn said. But after resistance — which came because people thought about random and unintentional deaths — she relented and declared that emergencies should not count for reversion, but only be required after a half-gross of years. That meant the emergency reborn would not find themselves reverting.

Besides an emergency reborn could choose a body the same age as the original. That would solve a synchrony problem. But people had to specify emergency ages ahead of time, which few did. Instead, they entered reborn bodies that were two dozen years old.

Most people liked young bodies. They figured that if they had to be reborn in an emergency they should be reborn to an early age. Consequently, most who had been unexpectedly reborn entered two-dozen year old bodies again.

The rule itself became definite. "Starting when a person is reborn in the ordinary course of events," Akthorn said, "and every six dozen years thereafter, that person shall revert."

Dlovvun lost the war. But he won a battle. He remembered Akthorn. He made sure that the adopted law provided for a hiatus; Akthorn would be the first to revert. She would lose the Presidency. He knew he sought

revenge, but that was all he could win. Others went along with him; it was good symbolism. And Akthorn did not fight strongly.

He never guessed that Akthorn ignored trappings like her Presidency. She wanted influence. She knew that when reborn she would lose it regardless.

Given such an opening, the legislature had to deal with the possibility that some would rush their rebirths ahead in order to avoid reversion for another half gross of years. Dlovvun could handle that kind of detail. Besides the members of he own party, he worked well with Jeltong Pekbung and the other Conservatives.

They settled the issue. The final version of the law said that anyone who was less than a half-gross of years old and who died intentionally before the President would be reborn after her. And when they were reborn, they would revert.

In turn, that required a committee to review those who planned to die intentionally while younger, but not for bad reasons. All in all, the law became complex. But the law succeeded. It was not corrupted. It gave the young hope and forced change at the top.

Neither Akthorn nor anyone else in the Melian government nor in the opposition touched line marriages and other immortal organizations, like corporations. For some reason, people did not think about them, only about the individuals in them. They did not think about AIs either.

Chapter 49

On Tegmar as his babbo body aged, Telren become more interested in joining a babbo band. He did not care to be physically alone all the time; and he decided he had a better sense of emotional communications than people like Lentergrin.

He still had one and a half dozen years to go before he expected to be reborn into a young babbo body. That was not a long time by Melian standards, but as long as any wanderer stayed in a single babbo band. Telren decided he could dedicate that many years of his life to one band; if he did not like it, he could always leave.

Then, while swimming alone in the ocean, the equivalent of a Tegmar shark ate most of his right, farthest rear leg. Initially, Telren felt almost no pain. Fortunately, the amount of food in the leg distracted the shark and no others came by as he escaped the water. Another lucky accident — Telren did not think it so lucky when he went in — the water was cold enough so he did not lose too much blood before he could get out and tie a tourniquet around his stump.

Then, since no other babbos were near by, a rocket landed with a proper bandage. The bandage stopped the blood and the pain that was beginning to take him over. Telren never replaced the stump — he had seen other babbos, natural babbos, with stumps, so he knew they could survive the loss.

But Telren was more careful afterwards. He stopped swimming in the ocean where drop offs led straight to the open sea. Instead, he swam in protected bays with shallow bottoms.

After abandoning the bandage, and walking quite a distance, Telren came upon a babbo band. Because of his age and his stump, the other babbos perceived him as somewhat addled. They figured he has suffered brain damage from loss of blood, and he looked old. With him, they pointed and pantomimed more slowly than with others in the band. That was fine with Telren. He could make mistakes even when he found plants and dead animals for the herd. He was never treated as one as foolish as Lentergrin when he, truly ignorant, joined a band.

What Telren did not know about, and which Lentergrin and the other humans-in-babbo-shape had not explicated, were the babbo ways of assuring every one else that each was alright, the phatic remarks. Grunts and hoots conveyed only a small part of it all; looks conveyed much more.

Lentergrin was as blind a babbo as he had been a human. Telren decided that it was no wonder babbos thought him intrinsically foolish.

Telren learned better. He decided that many babbos figured he had lost a great deal mentally when he lost his leg and was relearning some of it back. But there was no way he could find out.

Babbos communicated by pointing and practice; that was straight forward. They could pantomime and pretend, too; even Lentergrin had

figured out to read such movements when others found a large dead body, carrion, or the right set of swamp plants. He learned to express himself. You could indicate what was not there. You could tell stories. You could lie.

But Telren found that without spoken language, the species was severely limited: with words, a human could extend pointing, pantomime, and pretend metaphorically, but a babbo had no words.

A human or babbo could point at a path, could pantomime running, and could pretend to run along it. That was fine. You could pass on a great deal of knowledge that way. Telren learned to do that. But as a babbo, he could not say that the path itself 'ran' into the woods the way a road could 'run' into a forest, although he could say that as a human.

This showed itself most dramatically when Telren's babbo band took up basket ball. He had not expected that at all. No other speaker, human or AI, had either.

A babbo watched the humans. Telren guessed whom. A search through the records showed that Telren was correct. No one, AI or human, had ever noticed the babbo, named unimaginatively 'B2418.' That was because no one had ever thought to search the records for babbos watching. The rule for humans was not to show themselves to babbos. Watching computers enforced the rule.

In any event, the process went far beyond card playing. Telren's band copied basket ball.

As Telren said, this involved new babbo technology: curling branches to make hoops; weaving vines for baskets; and the eventual discovery of a bladder that could be used as a ball. It took some time for the humans and AIs to appreciate the technology. They had not become primitive enough. At first, they did not see any difference between carrying a cudgel in tied vine and weaving vines into a net.

Undoubtedly, the key that made it all possible was discovery of a bladder in the body of drowned babbo. That bladder could be used as a ball.

As Telren first pointed out, and others rapidly understood, an implication of this discovery was that babbos could see other environments for an object, not somewhat different environments, like the vine that tied the cudgel, but radically different environments. Babbos were smart.

Another implication of the internal bladder, not seen by Telren, and much more controversial, was that babbos had themselves once been sea mammals. That explained their size — the descendants of water-born animals tended to be bigger since more of the large ones survived — but not the degree to which babbos were still furry.

Even though the babbos hit it harder, the bladder-turned-into-a-ball did not bounce as much as human ball; but it bounced. With hard hitting, a babbo could dribble it, even on grass.

The first and initially the only play space, the court, was an area swept flat before anyone began. It started out as grassy field. That did not last long. Within a short time, the running players wore away the grass and the playing field became dirt. Its character depended on the dryness of the air. When it rained, it became too soggy for anything.

The hoops were the right distance apart for babbos, much further than for humans. As Telren said, either that meant a high level of understanding, or else it was an accident of tree separation. He could not tell which until the babbos chose another playing field.

Humans would have discussed games; babbos couldn't. On the one hand, that was a relief — Torkun did not expect to like talking about basket ball, even when he played. On the other hand, a group could not come together to invent another ball game; only an individual could do that, and none did.

Chapter 50

After so many years on Melior, both Taffod and Tindark thought seriously of becoming interstellar explorers. Tindark's explorations on Melior became routine. He stopped being excited by them. Taffod tried to adapt to a more peaceful life but couldn't.

He did not want to create another duplicate either: he might be reborn yet again as a Taffod. Or, if he were reborn as a Tindark, he might survive and become as tired of the world.

Taffod and Tindark considered investigating systems with planets that were detected to have out-of-balance atmospheres. As two different people, they would travel to two different places. One or the other might, they hoped, find complex, non-technological life on a planet in a system. They knew they probably would first have to explore a whole bunch of systems with only single celled life. But they would welcome that. At least, each new system would be an adventure. And when they found complex life, they both might come together and settle like Telren on Tegmar — with an off-planet AI for conversation or maybe with more humans.

As far as they were concerned, Melior lacked sufficient adventure. But they had not left it yet.

On Tegmar, Lentergrin was obnoxious when first reborn. That was expected. Indeed, he could not have avoided others' presuppositions. They expected him to be obnoxious and he was. However, he became nicer quickly. Years later, he told his secret: someone had specified what he did wrong and as much as he could, he avoided those actions. He did not fart around others; he listened to fools. He pretended to be less dedicated than he was. He pretended to be interested in what he determined was trivia.

Since Lentergrin had woken obnoxious but people expected a change, they saw it. Later, he understood more and became truly nicer. At the same time, he became an inspiring teacher. He was enthusiastic and dedicated. Even though he was declared a national treasure, he did not duplicate himself. He said, "One of me is enough!"

He discovered less, possibly because he had less to discover.

Lentergrin still preferred his babbo body. He had no interest at all in returning to a human body. On the contrary.

When they became available, he made backups. He more than liked them. He thought they were great and made them four times a Tegmar year, or a bit more than two and a half times for every Melior year. But he had no need for any. He lived his life through and was reborn again on Tegmar in babbo form.

Lentergrin talked with Tuppak Nassik, who was working on better human bodies for Ulterius. Lentergrin tried persuading him to adapt babbo bodies. "I want to migrate," said Lentergrin.

Nassik thought about the problem. He himself had already decided to be reborn on Ulterius. The terraforming would produce a mostly Earth-like world. To prevent freezing, the process had to produce and maintain far more greenhouse gases than Earth, Melior, or Farhaven. Every living being had to be modified.

Although the computer projections, the simulations, were remarkably accurate, over the centuries, Nassik expected to tweak. An AI could make them alone, but he had a certain genius which everyone expected him to use; he planned to help. And while he could certainly make changes from Melior, he preferred to live on site.

Lentergrin argued for a babbo adaptation. As far as Nassik was concerned, that would be strange. All terrestrial mammals had only four arms and legs. No terrestrial mammal-equivalents had six. No terraformed world had babbos or anything similar to them.

But the form might be convenient. Also, a sentient body that could eat raw food would survive better in the wilderness. Nassik would have to shift it from Tegmar vegetation and meat to Ulterius vegetation and meat, but he could do that.

Since there wouldn't be any native babbos, Lentergrin could carry what he wanted. He could wear clothes. On Ulterius, he could speak verbally to people in human as well as babbo shape. That meant the vocal cords and mouth muscles had to work right. Nassik would have to shape them. At least, each forepaw could serve as a hand with two opposing thumbs. In many ways, it was better than a human hand. Nassik went further: a babbo could eat cooked food — and enjoy cuisine. That appealed. He would have to engineer the new babbo form; it looked like a nice challenge. Maybe this time, Nassik thought, he himself should be reborn as a babbo.

As soon as Telren heard, he said that he, too, would be interested in going to Ulterius as a babbo. "Next time", Telren added, finally announcing his decision, "I plan to be reborn in an inorganic substrate. I still want my mind embedded in a babbo body, but this time, on Ulterius. A babbo body on Ulterius; that will be wonderful."

Several other researchers, including two women, said they wanted to be born on Ulterius as babbos also. Nassik decided he really had to work on the form.

Djaeds Summervil had left for Ulterius before an Earth retaliation that never came. He would wake up at the same time as other early humans. Gellor Thurnsby did not try to return to the Earth Beware party. If anything, people thought, he might be on the verge of becoming an Expansionist. He talked of going to yet another planet when it opened up, not Ulterius. That had not happened yet, although it seemed more and more likely that Taffod and Tindark would become the kinds of explorer that a human, like Gellor, would follow if either found a suitable place.

To everyone's surprise, after Bennert Dlovvun's reversion, his deputy, Tunkar Dildrup, expressed Expansionist ideas better than Dlovven and ran the party more energetically. It gained votes.

On Melior, Eltis Akthorn was the first to revert. She stopped being President. Jeltong Pekbung gained the job. His deputy, Gilbert Hagborn, became head of the Conservative Party and of the government. Over what seemed in retrospect to be a very short time, three dozen years, various others reverted. It did not matter in the competence-oriented professions or in the non-rivalrous ones, but in politics in particular, it made a difference.

Appendix A Counting in Base Twelve

The base twelve counting system on Melior became possible for older people only because they were all born again. Consequently, they all carried internal computers and understood information that had been inserted into their data packets while they were dead. Otherwise, they would have had difficulty converting from base ten to base twelve.

Young people grew up with base twelve. They had no more trouble than anyone learning base ten, perhaps less.

Indeed, because their educational system encouraged them to count on the tips of their fingers and those knuckles closest to those tips, they thought of base twelve as natural. When they bent their fingers — not their thumb! — to look at them, they divided the indicators into two groups of 6, or three groups of 4, or four groups of 3. Specifically, school and adults encouraged children to look at their left hand, palm facing them, with their fingers bent. That way they could easily see the four tips of their fingers and eight knuckles, twelve in all. They were also taught that the tip and two knuckles on the thumb marked a dozen, two dozen, and three dozen.

It goes without saying that some children were confused that in base twelve a third is 0.4, zero dot four-small, and a quarter is 0.3, zero dot three-small. A rite of childhood involved understanding and remembering the symbols and their meanings.
The language included spoken words:

```
gigantic-gross  1,000,000,000 base twelve,   5,159,780,352 base ten
huge-gross      for 1,000,000 base twelve,       2,985,984 base ten
great-gross         for 1,000 base twelve,           1,728 base ten
gross                 for 100 base twelve,             144 base ten
dozen                  for 10 base twelve,              12 base ten

small   or hour      for 1/10 base twelve,            1/12 base ten
little  or prime    for 1/100 base twelve,           1/144 base ten
minute            for 1/1,000 base twelve,         1/1,728 base ten
second           for 1/10,000 base twelve,        1/20,736 base ten
tertiant        for 1/100,000 base twelve,       1/248,832 base ten
tiny          for 1/1,000,000 base twelve,     1/2,985,984 base ten
speck     for 1/1,000,000,000 base twelve, 1/5,159,780,352 base ten
```

When speaking of time, Melians often replaced '`small`' with the word '`hour`', which lasted about two terrestrial hours. They replaced '`little`' with a word derived from the term for the duration of an interval; people with another language might say '`prime`'. On Earth, the time would last exactly ten terrestrial minutes.

On Earth, a base twelve minute is 5/6 of a base ten minute, a base twelve second is 4.17 base ten seconds, and a tertiant is a little more than a third of a base ten second.

In speaking numbers, in English, the words are shortened:

```
giga (with hard 'g's),  huge,  great,  gross,  doz
```

Since they are all single syllable words, the words never have to be shortened in Melian:

```
mau,   vau,   cau,    rau,    pau
giga,  huge,  great,  gross,  doz
```

In each, the 'au' is pronounced as the 'ow' in 'cow.'

In Melian, the twelve numbers, are all one syllable:

```
no
zero

pa   re   ci     voe   mu    gai
one  two  three  four  five  six

ta     be     di    goe  ku
seven  eight  nine  ten  eleven
```

Twelve begins the next higher power and has two forms, each of two syllables:

```
pa-no     pa-pau
twelve    twelve
```

Thus, 1,234,567,890 in base twelve, which is 6,140,565,036 base ten, is pronounced:

```
one-giga two-three-four-huge five-six-seven-great
    eight-gross nine-doz zero
```

or in Melian,

```
pa-mau re-ci-vo-vau mu-gai-ta-cau
    be-rau di-pau no
```

Moreover, 17,550 in base twelve or 33,612 in base ten, is pronounced:

```
one-seven-great five-gross five-doz zero
```

or in Melian,

```
pa-ta-cau mu-rau mu-pau no
```

The smallest three products of twelve only differ each by one place:

```
great for 1,000 in base twelve
gross for 100 in base twelve
doz   for 10 in base twelve
```

as do the first six fractions:

```
small:    tei (pronounced tay) 1/12 base ten or     1/10 base twelve
little:   bei                   1/144 base ten       1/100 base twelve
minute:   dei                 1/1,728 base ten     1/1,000 base twelve
second:   fei                20/20,736 base ten    1/10,000 base twelve
tertiant: sei               1/248,832 base ten   1/100,000 base twelve
tiny:     gei            1/2,985,984 base ten 1/1,000,000 base twelve
```

(For one over one followed by nine zeros in base twelve, use
`speck: kei  1/5,159,780,352 base ten or 1/1,000,000,000 base twelve`
(This is the equivalent, except much smaller, to the prefix 'nano' for base ten.)
Consequently, 7,890 base twelve is pronounced 'seven-great eight-gross nine-doz zero' and 0.345 base twelve is pronounced 'zero dot three-small four-lit five-min.'
In Melian, the term that indicates that the numbers that follow it are less than one is '`pi`'. It is pronounced 'pih.' The ratio of the circumference of a circle to its diameter is '`pai`' and is pronounced 'pie.' Its value is approximately 3.1416 in base ten or about 3.1848 in base twelve.

Thus 7,890 in base twelve is pronounced

```
ta-cau be-rau di-pau no
```

and 0.345 in base twelve is pronounced

```
no pi ci-tei vo-bei mu-dei
```

'`pai`', approximately 3.1848 in base twelve, is pronounced:

```
ci pi pa-tei be-bei vo-dei be-fai
```

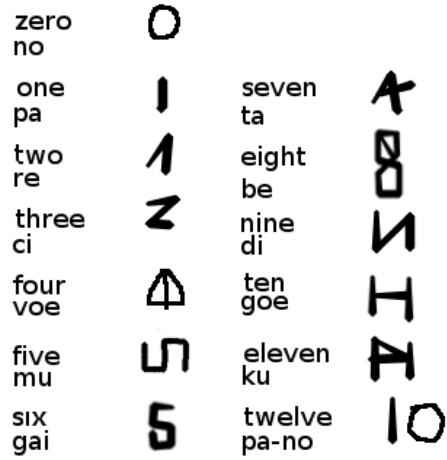
In base twelve, seven-great eight-gross nine-doz zero plus six-gross eleven-doz eight sums to eight-great three-gross eight-doz eight.

In Emacs Lisp and base ten addition:

```
    ;;        great     gross     dozen
    (+ (+ (* 7 1728) (* 8 144) (*  9 12) 0) ;; 12#7890 == 10#13356
                 (+ (* 6 144) (* 11 12) 8) ;; 12# 6B8 == 10# 1004
    )                                      ;;              +
                                           ;;               -----
;; is
    (+ (* 8 144 12) (* 3 144) (* 8 12) 8)   ;; 12#8388 == 10#14360
```

A nanometer in base ten is more than five tiny-meters, or '`mu gei mitre`' in Melian, and an atom's width, approximately one-tenth of a nanometer in base ten, is little more than half a dozen small-tiny-meters, or '`gai tei-gei mitre`' in Melian.

The twelve symbols look more or less like this in a Latin alphabet, except that when printed, each is supposed to take up one space, or two spaces for the twelve, three for the gross, and so on:



The various symbols are derived from shapes with the requisit number of different lines. Thus, the two has two bars and the three, three. Except that eight is the most complex and seven does not fit. Its crossbar distinguishes seven from a badly written two. No one knows how the symbols for nine, ten, and eleven were invented. However, the nine is a triple three, the ten has five bars, making it a double five, and the eleven has one more bar than the ten.

Often, a printed one has serifs and looks just like a one from base 10. The sides of the eight are supposed to be straight, vertical and horizontal. But they often curve and have a criss-cross at the center. The resulting shape is not unlike a common eight, '8', of base ten, except for the extra bar though the top.

The eleven is supposed to have a horizontal cross bar, like that in the ‘H’ of ten, but the cross bar is drawn after the diagonal and tends to droop.

Appendix B Sureness or Certainty

People have always judged evidence. They have had to. Otherwise, they suffered or died. Before becoming important on Melior, even the formal concept of sureness or certainty was centuries old.

The Melians adopted rules that David McAllister on Earth had specified centuries before. In school, the purpose was not so much to cause humans to use numbers and mathematics, as to inspire them to investigate their use of evidence: how sure were they of it; what was its accuracy — one part in a dozen, one part in a gross, one part in a great? How to combine various judgements? In the end, after forgetting the mathematics, the notion became a part of how Melians considered the world. However, the robots — all the computers — could calculate readily, so they kept the mathematics.

A sureness or certainty is how accurate, truthful, or reliable you judge evidence to be. You can add new evidence to existing evidence. When the evidence is positive, this increases your certainty, as you expect. But you never become completely sure or certain.

To make the mathematics possible and to help the robots, a phrase such as 'suggestive evidence' is given a number such as 0.6 in base ten and 'strongly suggestive evidence' is given a number such as 0.8.

Each bit of evidence is judged whether it is 'weakly suggestive' or 'strongly suggestive' or whatever. The rule for adding two positive bits is to reduce the influence of the second by whatever uncertainty remains of the first, and add the result to the certainty of the first.

Thus, if one bit of evidence is 'weakly suggestive' and given a numeric value of 0.4, and the other is 'suggestive' with a numeric value of 0.6, then the combination of the two,

```
CFcombine-add (CFa CFb) = CFa + CFb(1 - Cfa)
```

is

```
CFcombine-add (CFa CFb) = 0.4 + 0.6(1 - 0.4) = 0.4 + 0.36 = 0.76
```

In other words, 'weakly suggestive evidence' adds strength to 'suggestive evidence.' The result almost becomes, roughly speaking, 'strongly suggestive.'

A common sequence for suggested numeric values looks like this in base ten:

strongly or highly suggestive	0.8
suggestive	0.6
weakly suggestive	0.4
slight hint	0.2

In addition to adding two items of supportive evidence, there are rules for adding two elements of evidence against and for adding some favoring and some opposing evidence. The three rules are:

- To add two positive certainties, as we have done before, add the first to the second, the second having been reduced by an amount that depends on the size of the first:

  ```
  CFcombine-add (CFa CFb) = CFa + CFb(1 - Cfa)
  ```

- To add two negative certainties, combine the two factors as if they were positive and negate the result:

  ```
  CFcombine-add-both-neg (CFc CFd) = -(CFcombine (-CFc -CFd))
  ```

- To add positive and negative certainties, sum the two and divide the result by the number that results from subtracting whichever is the minimum of the absolute values of the factors from one:

  ```
  CFcombine-add-pos-neg (CFe CFf) =
      (CFe + CFf) / (1 - min{|CFe|,|CFn|})
  ```

(By the way, the order in which you combine certainties or uncertainties is irrelevant.)

Besides talking about combinations of evidence, schools also taught other ideas formally. For example, they explained why two pieces of evidence needed to be independent of each other. And they taught probabilities.

The goal was not to cause Melian humans to make calculations, but to lead their children to think of the 'determinative' branch of oratory as a way to persuade others that one judgement is more suggestive.

Then after judging which hypothesis is more likely to be real or true, children learned to debate what to do — Aristotle's 'deliberative' branch of oratory — using the general and vague notions that every political proposal had to:

Protect, *Preserve*, *Prepare*, and *Provide*.