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*The Observers* takes place in the near future. Three categories of computer technology occur (mostly behind the scenes) in this story: near future human technology (weapons), alien technology shared with humans (virtual reality, sensors), and alien technology that sustains their civilization. I wanted all of this technology to have a solid foundation. The near future technology should be a reasonable projection of current research, the shared technology should be within the range of human achievement, and the sustaining technology should not violate the laws of physics. My special thanks to my UCSD, CSE colleague Larry Carter for reading this book and helping me with these issues.

Above all, I am indebted to my wife, Ann, who assisted me in all phases of writing this book.
Introduction

I started writing The Observers in 2002 as supplementary material for an undergraduate course in Computer Science and Engineering at the University of California San Diego (UCSD). The story was designed to stimulate classroom discussion concerning two future developments in computer science: ubiquitous sensors and sentient virtual reality. Ubiquitous sensors, sensors covering the entire earth, will be available to us in the near future while sentient virtual reality is a few hundred years off. I felt that a novel in which the characters wrestled with the implications of these technologies was the shortest route to student interest and participation.

Each generation of humans has had better technology for recording their family's history than their parents: cave drawings, writing and typography, portrait art, monochrome and color photography, 8 mm and 16 mm home movies, digital photography, camcorders and home DVDs. These increasingly sophisticated records of people will continue to improve until we are able to make living digital copies (sentient virtual copies) of our family and friends. When placed in virtual worlds of our design, these virtual beings will think, quite correctly, that they are alive. We, the biologically living, will be able to carry on conversations with virtual copies of our dead friends and relatives. Sentient virtual reality will be a part of our lives.

Of course, sentient virtual copies could be made of any living creature, not just humans. Sentient virtual reality would be the perfect tool for sophisticated natural historians to record life on earth or anywhere else in the universe. Such records would be compact, accurate, and easy to transport around the galaxy.

When the story begins, we learn that the earth has been wrapped in a web of ubiquitous sensors – sensors sophisticated enough to provide the data needed to create sentient virtual life forms. Moreover, humans are unaware of these sensors or of the society that has deployed them. This lack of awareness will soon change.

I retired from UCSD in 2004 and finished The Observers in 2006. Although never used for its original purpose, the story has resulted in many interesting discussions with readers. Some of these discussions are summarized in the Author’s Notes section at the end of the book.
Chapter One

Treatment Center: September 1

Twenty miles south of Gila Bend, Arizona, on Highway 85, the van made a left turn onto a dirt road. Its bouncing on the rough trail awakened Daryl’s friends, Ethan and Wilson.

“Ain’t going to be no treatment center out here,” Ethan said, rubbing his eyes and looking out at the starlit desert and desolate Sauceda Mountains.

The driver and his friend claimed to be drug counselors. Daryl had seen a lot of ‘em. These cold-blooded bastards were no drug counselors. They acted more like mafia types. The detox they promised was better than free: they promised a painless medical detox, an allowance while in treatment, and an easy job with benefits when done. Daryl and his friends agreed to the deal and were out of San Diego in record time.

“They said we didn’t need to bring anything. Better be right, cause our stash in Balboa Park has already been stolen,” Daryl said to his friends.

The other two addicts said nothing. They understood the problem.

The van slowed for a sharp turn, went straight ahead for forty feet, and stopped at a large rock face. The driver got out, walked to the front of the van, and waved his hand
at the rock wall. Moments later the wall began to open, with two large sections sliding in opposite directions.

Daryl stared up at the lone figure on the loading platform. “Check that skinny pale-faced sumbitch in the white coat,” he said, nudging Ethan with his elbow. “Must be the doc who runs this place.”

The guy on the platform spoke with authority, “Leave the van where it is; get everyone in here right away.”

The five of them, three patients and two counselors, climbed the stairs to the entrance. Inside the main building, Daryl’s eyes began to adjust to the dim lights. Large cages, barely visible, lined the walls. The room stunk. A loud grunting noise came from one of the cages, followed by a ferocious rattling of heavy iron bars. Daryl froze in fear.

The counselors, acting more and more like thugs, walked closely behind the three addicts, forcing the pace. They followed the doc farther into the building.

“Each of you will get a private waiting room,” he said. “In a couple of hours your regular bedrooms will be ready.”

Ethan got the first waiting room. About twelve feet square, it contained a single chair, small table, and wastebasket. The table held a bottle of water and a glass.

Daryl heard the door close and click as if being locked. Ethan, visible through the large view window on the door, sat exhausted in his small chair with his elbows on his knees and his head in his hands.

Next came Wilson’s turn, same kind of room. Daryl heard a soft hum of blowers, like air conditioners. Tubes about eighteen inches apart and four inches in diameter
protruded from the outside walls of Wilson’s room. Daryl wished he were back in Balboa Park. Even the middle of the desert would be better than this place.

The three of them should have made a break for it outside. Sick, tired, needing a fix, they’d had no plan of escape. The counselors led Daryl to his room, shoved him gently but firmly in, and closed the door. He tested the door; it was locked. On the ceiling, a row of eight video cameras pointed in different directions. Circular vents framed in stainless steel mounts punctuated the cream-colored walls. Dehydrated from the dry air, he began gulping down water from the bottle.

After twenty minutes in the uncomfortable chair, he thought of lying down on the floor, but the damned thing was concrete. He did his best to get comfortable. After awhile he needed to piss. Dumb shit to drink all of the water. He stood up, walked to the door, and gave the handle one more try.

Daryl caught some motion at the window of the door; the doc looked in it at him. At last, maybe he could get out of here. He pointed to his empty bottle, put his hand on his groin, and tried to shout through the door that he had to pee. The doc held up five fingers and motioned for Daryl to sit down. He obeyed and began to relax. Five more minutes in this dump.

The doc moved away from the window, and seconds later, the room brightened. The eight video cameras came to life. All of them pointed toward the large vent above and to the right of the door. After a few seconds, they shifted their focus to a point in the room about four feet above the floor where a small swarm of gnats circled and darted. Four of the cameras remained in that position. The others slowly turned until they pointed directly at Daryl.
Daryl sat transfixed by the ballet of video cameras. A sneeze coming on, he scratched his nose. He massaged his itching throat, just above his Adam’s apple. Not getting enough air. What’s wrong? His throat tightened. Then he couldn’t breathe at all. He stood up and tried to put his finger down his throat to make himself vomit. The room twisted and turned as he fell to the floor.

Dr. Jim Mathis looked at the score indicator on the control panel. Eight. More bad luck. He looked at his notes. The swarm’s training score had gone from zero to four with Ethan, to six with Wilson, and now only eight with Daryl. Mathis needed a score of at least nine. The detectives would have to locate another human test subject.
Chapter Two

Matthew Crigler: September 7

Small stones driven forward by a surprise rogue wave pounded against Matthew Crigler’s ankles. The retreating water from the same wave drove him in a series of forced jumps ten feet farther out to sea. He turned sideways, dug his shoes into the sand, and braced himself just in time to absorb the force of a second large wave that caught him squarely on the chest, soaking his clothes and leaving the gritty taste of sand and saltwater in his mouth. He shouted in anger, “Damned fool, I’ve forgotten everything I ever knew about the ocean.”

Matthew walked back to dry sand and bent over, hands on knees. On the beach in front of him, a gray rock about the size of a baseball lay half buried in the sand -- a common form of diorite, nothing special. But the more he stared at the rock, the more transfixed he became. He gently picked it up, brushed off the sand, and put it in his pocket. He then began the climb from the beach to his office at the top of the cliffs.

Halfway up the trail, comforted by the warmth of the midday sun, he stopped and looked back at the beach below. Large turbulent surf broke against a strong offshore wind. Translucent veils of spray arched seaward from the crests of the waves. He vowed to be back in shape in a month, never again to let this beach get the best of him.
In his office, he removed his wet shoes and socks and sat back to ponder his research in seismology. A job in San Diego at the Scripps Institution of Oceanography, long just a dream, had become a reality. He surveyed his unopened boxes of computer equipment. It would be publish or perish for sure at this place. It was Friday; he had survived his first week.

Overwhelmed by the multitude of tasks facing a beginning assistant professor, his mind wandered. He thought about Linda Nguyen, a young technician in charge of the mineralogy lab. His first attempt to strike up a conversation with her went nowhere; it would be nice to find another excuse to talk to her.

He examined the diorite sample more carefully. About one-fourth of the specimen was a dark gabbro, having no quartz. The remaining three-fourths was a gray diorite with flecks of quartz throughout. This close conjunction of gabbro and quartz diorite seemed odd to him. He placed the rock gently into the large, empty drawer of his desk. Maybe analyzing this rock was an appropriate task for Linda’s lab and a way for them to get better acquainted.

He looked up her number in the university directory. It took four rings.

“Mineralogy Lab, Linda Nguyen speaking.”

“Hello Linda, this is Matthew Crigler.” Silence came from the other end of the line. “We met yesterday. Remember?”

“Yes, I remember,” she replied, without much sign of enthusiasm.

“I have an unusual rock sample that I found this morning on the beach. It’s a strange mixture of gabbro and diorite. I’d like to get some thin-sections perpendicular to the diorite-gabbro boundary.”
“How big is it?”

“It’s small. I carried it up from the beach in my pocket. Can I bring the sample down to you in about twenty minutes?”

“Don’t bother. I’m about to go to the library to drop something off. I’ll come by your office on the way back -- see you in a few minutes.”

He had enough time to go to the restroom, brush the sand out of his damp shirt and pants, and wash up a bit. He got back to his office shortly before Linda arrived.

“Nice office,” she said, standing at the open door and surveying the mess of boxes. “Have you found a house big enough for you and your family? I hope you don’t have pets. That makes it almost impossible to find a place around here.”

“I’m single, and I don’t have pets,” Matthew said. “I rented a nice apartment, walking distance from the beach.” Short on friends, he wanted to learn more about Linda. But she had other ideas.

“So where’s the sample? I’m very busy today.”

“Right. I think you’ll find it most unusual.”

He reached into the partly open desk drawer, felt for the rock, paused, opened the drawer wider, and looked in. Lying on its side at the bottom of the drawer, where the rock had been before, was a large ceramic mug. He lifted it from the drawer, placed it on his desk, and stared at it.

“It’s certainly unusual,” Linda said, with a smile. “It looks like a mug!”

Matthew sat with a puzzled expression. He’d never seen the mug before. It had no handle and had thick, sturdy sides – designed more for pencils than coffee.
Linda grew restless as Matthew searched frantically for his missing diorite. “It’s all right -- you’ll find it,” she said, as she backed out of his office. Her tone was that of a psychiatric nurse consoling a patient.

Tired of the search for the diorite, which continued long after Linda’s departure, Matthew locked the door and put his head down on the desk to rest. He awoke some time later with a splitting headache.

The mug was gone. Before him, on the desk where the mug had been, lay the diorite. Next to it, a small glowing rectangle displayed text:

_Sorry about the mug, Professor Crigler. We couldn’t allow ourselves to be thin-sectioned. We are sure you will understand. If you have questions, just speak in your normal voice. We will reply with text._

Matthew shook his head to make sure he was awake. Was this another Caltech prank? He’d been a victim of far too many of those during his brief stint as a TA for Geology 106. He tried to place himself in the mindset of his tormentors. They would be recording everything he said, to play it back at the most embarrassing moment. He looked nervously around the room for a hidden video recorder, but the room was a mess. There were hundreds of possibilities.

He gently pushed the diorite with his finger. It moved slightly, but the words displayed on the desk remained fixed. He’d expected a shock or some such additional insult when he touched the rock, but none occurred. Emboldened, he picked it up. The text disappeared.

He put the diorite back on the desk, upside down from its previous orientation. The text reappeared as before. Then, looking carefully at the rock for the first time since
awakening, he noticed that it was all diorite -- the small zone of darker gabbro was gone.

What was going on? Had someone entered his office, taken the mug, and replaced it with a different rock? *Sorry about the mug, Professor Crigler,* the first sentence read. The meaning of that apology hit him full force. The original rock, the mug, and the new rock, changed slightly from the first, were possibly transformations of the same object.

Caltech undergrads were clever but not that clever.

Feeling he had nothing to lose, he whispered, “Who are you?”

The words on the display shimmered slightly and reformed.

*Natural History Colony 8945UM53. We are microrobotic life forms, originally from a region near the Sagittarius Arm of this galaxy.*

“Welcome to earth,” he said, speaking a little louder this time. It sounded corny, but he had run out of ideas and was rapidly losing his self-confidence.

*Thanks, but you are a bit late. We have been here over 160,000,000 years. Let us have the privilege of welcoming you to earth.*

Somehow, this reply had a note of disarming sincerity to it. Matthew’s instinct was to continue the discussion and to resolve the “we” part first. By asking good questions, he would show off his knowledge even if his tormentors were recording him.

“What do you mean by *we*?” he asked.

*This object you refer to as your rock sample is a complex colony of microrobotic life forms. About five thousand of us are permanently on duty here. We average about one hundred microns in height. You may refer to us as “microbots.”*
He tried to digest this information. One hundred microns was one tenth of a millimeter, about the thickness of printer paper. Five thousand of them wouldn’t come close to filling the interior of the diorite sample.

“What else is in there with you?”

_We have machinery, structural materials, computing and communication resources of all sorts. The surface of the “diorite” is shielding material. We can change the shape of it in many ways. We specialize in nanoengineering._

Matthew did some quick calculations. A nanomachine, such as a Stewart platform, would compare in size to one of these robots as a peppercorn would compare to Matthew’s size. His curiosity over technical matters began to come to the forefront, excluding all other concerns, even the possibility that the whole interaction was some sort of hoax.

“How many colonies like yours are there?” he asked.

_Over fifty billion Natural History Colonies are now on the earth. Working together, we control a large number of deployed sensors of all sizes. Some are mobile and some are fixed._

In concocting the usual exaggerated nonsense associated with grant writing, he had recently computed that the earth’s surface area is about two hundred million square miles. These colonies had tremendous coverage, averaging several hundred colonies per square mile. If necessary, the mobile colonies could move around, greatly increasing their concentration in certain areas.

“Why are you here?”
We are observers, recording in detail the natural history of the earth, including biology, geology, and anthropology. Our records include sentient virtual copies of all species and virtual simulations of their habitats and interactions. Our culture has been engaged in this type of activity throughout this and nearby galaxies for the last two billion years. It is our mission.

That explained why they knew English and likely every other human language. All good anthropologists learn the languages of the cultures they study. They started monitoring the earth one hundred sixty million years ago. That would be near the middle of the Jurassic period of the Mesozoic era. They were not here at the start of life on earth, but they must have some fascinating information. The virtual reality simulations sounded particularly interesting. He assumed they would be like the holodeck in his collection of old science fiction movies. What fun it would be to participate in them!

“Could I see these virtual simulations?”

The answer to his question was evasive.

Two summers ago, when you were in the hospital, one of our colonies made a sentient virtual copy of you. We periodically update this virtual Matthew with your life experiences. The most recent update was when you slept in your office after Ms. Nguyen’s departure. A headache sometimes results from the procedure. Virtual Matthew will be able to participate in the simulations.

The hospital part was accurate enough. While installing sensors in the Los Padres National Forest, north of Santa Barbara, he volunteered to help fight a fire. One evening, flames in a steep canyon trapped him and some other volunteers. The professional fire
crews rescued them by helicopter. He spent one day in intensive care and three more
days recovering from smoke inhalation and minor burns.

The rest of the displayed statement was unclear, to say the least. What did they
mean by “sentient virtual copy”? That was the second time they had used that phrase.

“You refer to my virtual copy as ‘sentient.’ What do you mean by that?”

You, Matthew, are a creature of information. All of the reality you perceive about
you is captured by your senses and interpreted in your brain. We can simulate the
function of your senses and brain completely. The simulated entity is what we call virtual Matthew. Virtual Matthew is a fully conscious, reasoning, self-aware individual. He
shares all of your memories of childhood, family, and friends.

This was too much. He had thought about such things and looked at some
scientific papers that showed that such detailed simulations were theoretically possible.
But to actually do such things on a grand scale? The colony’s computational skills must
be close to the limits allowed by the laws of physics. His mother had kept computer-
based multimedia records of their family vacations and important life experiences.
Images of family and friends would talk, sing, smile, and wave when displayed on the
computer monitor. But with the technology of the microbots, the “images” recorded by
his mother would be so rich in detail that they would themselves be alive. This
technology opened up endless possibilities.

“You say I will be updated periodically. How periodically?”

We will update virtual Matthew frequently during your natural life. After your
biological existence is over, virtual Matthew will be able to become you at any stage of
your life. He will also have his own worlds to experience long after you are dead.
Matthew realized that he’d already begun to refer to his virtual copy in the first person. The diorite robots seemed to regard his virtual self and real self as one in the same. What nonsense! That little imposter wasn’t the same as him. He needed to set that matter straight.

“I myself, the real Matthew, would like to see the simulations of species,” he said. “It doesn’t help me if a virtual Matthew is going to see them.”

*What you call the virtual Matthew is the aspect of you that will live with us. He (you) will stay with us on our missions as long as time exists. You will have, for all purposes, eternal life.*

Matthew had sometimes made fun of the religious notions of eternal life. How ironic that eternal life was now his. It seemed a bit disappointing. The being he had thought of as himself would expire by one of the usual methods while the little imposter in the diorite would have endless adventures. Clearly, he would get no sympathy from the diorite robots over such jealousies.

“If you are what you say, what’s to keep me from informing others about you and your mission on earth?”

*If you attempt to inform others, no harm will come to you other than a certain loss of face. We will erase all memories of your contacts with us from your mind, making it impossible for anyone to quiz you further about our presence.*

This threat now seemed real to Matthew. The power of this strange alien civilization began to sink in.

“Why are you copying me and communicating with me?
Since our arrival on earth, we have not made our presence known. But ongoing advances in human technology will soon force us to take a more active role in human affairs. You will be a consultant to us in this process. What we need from you is your intuition. You will understand all of this later. To start with, we ask that you contact Ms. Laura Stever. She is a graduate student who works afternoons in the library. She finishes work at 4 p.m. Laura was an undergraduate at Berkeley with you. Virtual Matthew informs us that you had a class with her.

Could virtual Matthew have a better memory than he did? Laura, the dark haired girl in Introduction to Philosophy, on the tennis team? He’d hated that class, screwed up on every assignment.

Matthew stared at the diorite rock, now with its display retracted. This robotic civilization had pushed the holodeck concept far beyond what he had imagined it to be. A sentient virtual copy was a complete re-creation, from the point of view of information, of the original organism. It thinks, feels, remembers, reacts to situations, and learns new experiences exactly as its biological counterpart. But so what? Would he ever encounter his virtual self? He tried to imagine what he would say to someone who already knew everything about him. How’s the weather wherever you are? The microbots could simulate the weather to be whatever they wished. He grew more confused.

The natural history colony, he decided, was no prank. He would phone Laura to see if they could meet at the campus coffee shop when she got off work. How could he explain his contact with the aliens to her without sounding insane?
Chapter Three

Laura: September 7

At Café Roma, Matthew ordered a large house coffee. He sat down at an empty table outside on the patio, shaded from the September afternoon sun. Staring at his cup, he thought about the strange events of the day. Halfway through his coffee, he saw someone approaching. Laura Stever smiled at him.

“I do remember you, Matthew,” she said, as she sat down. "It was Introduction to Philosophy, like you said on the phone. You were the atheist. Or was it agnostic?”

“That wasn’t my favorite class,” Matthew said.

“What brings you to campus?” she asked.

“I’m an Assistant Professor of Geophysics, just started this week. My office is at SIO.”

“What a beautiful place to have an office. You were on the swim team at Berkeley. Do you still swim?”

“I like to surf, especially bodysurfing, but I’m out of shape now.”

“What have you been doing since Berkeley? It’s been, what, five years?”
“I’ve been in graduate school at Caltech. Remote sensors, geophysics, seismology, lots of sedentary stuff.”

“Geophysics sounds fascinating. I thought studying earthquakes would have you traveling the world.”

“There’s some of that, placing sensors at various parts of the earth. What about you, Laura? What have you been up to?”

“I did my Junior Year Abroad program in Delhi, then traveled in India and Southeast Asia after graduating. Got interested in the history of religion and ended up here. My Ph.D. dissertation is on the Gnostic Christians, second and third centuries.”

“I don’t know much about agnostics, but I didn’t think they were Christians. If they are, then I’m not an agnostic.”

“Not agnostic, G-N-O-S-T-I-C, the G is silent,” Laura said, with a sigh.

“Matthew, what’s this all about? Why did you ask to see me?”

He had no idea of the extent of her knowledge about the aliens, but she must know something or they wouldn’t have sent him to her. Best to be cautious.

“Has anything … strange happened to you recently?” he asked. “I mean really strange?”

Laura looked down at the table. She seemed to be searching for words.

“I suppose you wouldn’t ask that if something strange hadn’t happened to you. You brought it up, you go first.”

Laura excused herself to get some coffee, giving Matthew a few minutes to compose his thoughts. When she returned, he told her about discovering the rock and about what had happened in his office.
“That’s an amazing story,” Laura said. “My first assumption should be that you’ve lost your mind. You say these … aliens sent you to me?” Silent for a moment, she finally said, “Something strange has happened to me recently. But … it’s not the same sort of thing.”

“Tell me about it, and let me be the judge,” Matthew said.

“I often work in the library on my research. This summer an older man, well dressed, nice looking, often sat at one of the tables. He had stacks of books but rarely looked at any of them. I thought he was troubled, so I tried to talk with him. He’s strange -- remarkable even -- but nothing as strange as your diorite.”

From Matthew’s point of view, something could be very strange indeed and still be less strange than his diorite.

“I want to know all about him,” he said. “This guy may be the reason the microbots sent me to you.”

“He’s a genius at history. Seems to know everything in great detail. Too great. I can’t verify most of the things he says, but I can’t disprove them either. He’s helped me with my dissertation.”

“Does he tell you how he knows these things?”

“He says -- this is crazy -- he says that he has access to detailed records of everything that happened, but he’s just kidding of course.”

“The natural history colony -- the rock in my office -- claims to have been around during all of human history. They must know a lot about history also.”

Laura looked toward the library, deep in thought.
“Sometimes, he sits very still for long periods, almost motionless like a cat waiting for a gopher, like he’s dreaming it all up.”

Matthew had read that a cat’s hearing is amazing. They live in a rich world of sounds unavailable to humans.

“Like he’s listening to something, something you can’t hear?” he asked.

“Maybe. But other times he’s talkative. When I asked him for his name, he gave me several and said I could choose one. Weird.”

Weird was an understatement, Matthew thought. “Which name did you choose?”

“Valentinus. There’s a man named Valentinus that I write about in my dissertation, an important guy. He almost became the Bishop of Rome.”

Matthew noted that Laura wore a Christian medallion with an inscription “Mark 13” on it. He remembered she wore a similar medallion at Berkeley. He’d never read more than a few lines of the Bible. It made no sense to him.

“The aliens reminded me that we’d had a class together at Berkeley,” he said. “They learned it from my virtual copy. Does Valentinus know things about you, surprising things?”

“He does seem to know things about me that I’ve never told him. But he wouldn’t need a virtual copy. He could ask around.”

“For such a strange guy, asking around might be awkward. He could have a device that allows him to remain in contact with the natural history colonies. Maybe it’s embedded in his ear or brain.”

“That’s a real stretch,” Laura said.
“This guy,” Matthew said, “may be under the control of the natural history colonies. A human captive or slave to do their bidding.”

Laura frowned. “I’m getting frightened about this, Matthew. Your imagination’s running amuck.”

He had to check himself. Yes, he did have an overactive imagination, made worse by the day’s events -- events that stripped away the usual constraints imposed by reality. He downed the last of his coffee and took a couple of deep breaths.

“I hope I’m wrong, but we must assume I’m right and think through the implications. A worst-case scenario.”

“We should tell someone about this,” Laura said. “We may need help.”

Matthew lowered his voice. “I don’t think we should tell anyone. It’s the brain-erasing bit. Have you told someone other than me about Valentinus and how strange he is?”

“I’ve mentioned him a few times. Said I’d met a strange, slightly crazy man in the library who knew a lot of history. But no one was interested in that.”

“So that’s why the aliens haven’t threatened you with brain erasure yet. You didn’t know enough to be a threat to them. They’ll threaten you now that we’ve talked.”

“That’s serious for me,” Laura said. “The history I’ve learned from Valentinus might be erased too.”

When Hollywood depicts an invasion from outer space, things blow up, monsters destroy people, and aliens want the earth for extra territory. Matthew felt that nothing violent like that was in store for the human race. These aliens have kept careful, detailed
records of every aspect of life on earth. Their primary interest, at least until now, seemed to be academic.

“Do you see what’s strange about this situation?” Matthew said. “This is the opposite of what you see in the movies. These aliens have wrapped the world in a web of information. They’ve been content with that for millions of years.”

“The phrase ‘web of information’ gives me the creeps,” Laura said. “It’s like the earth has been captured by some sort of giant spider. Why would they be here recording everything?”

“I’m not sure,” Matthew replied. “They’re not after territory or extra resources. At such a small size, the microbots certainly get their energy from light, chemicals, or atomic power on a tiny scale. They’re completely self-sufficient autotrophs.”

“I think Valentinus has a … religion,” Laura said. “Perhaps it’s religion that motivates him to cooperate with the aliens.”

Matthew felt very uncomfortable with the idea of religion playing a role.

“I don’t believe that religion has a role. Valentinus seems interested in the facts of history. Religions avoid real knowledge. I think these microbots, for some mysterious reason, enjoy observing natural evolution in progress. If that’s true, the human race may be in trouble.”

“Why in trouble, if the aliens just want to observe?” Laura asked.

“They may see the human race destroying the natural world, the world they’re dedicated to watching evolve. To get the biosphere back on track, they destroy the human race, reset the clock in evolutionary terms, and continue entertaining themselves with the fantastic and complex struggle of life to survive.”
Laura shook her head in disagreement.

“Oh do you think they’re playing a game, taking bets among themselves on where evolution will end up? I don’t think so. If your microbots have chosen a spiritual man like Valentinus as a confidant, then they have a deeper purpose.”

“All right, tell me about Valentinus’s religion and why it suits the microbots,” he said, with a tone of disgust.

Laura shrugged. “I’m afraid that would be to cast pearls before swine.”

The insult angered him. “At least I’m one of the swine with enough brains to see that this ramp we’re on leads to the end of the human race.”

Laura sighed and then smiled.

“You need to learn more about religion, Matthew. You say the aliens need your intuition, maybe mine also, in their evil project. Why do they need any humans, Valentinus included, if they only want to destroy us? They could just introduce a new virus and watch as everyone dies. They wouldn’t need us to help with that.”

Matthew could see that she wasn’t going to put up with trivial conjectures. He needed more information.

“Laura, can I meet Valentinus and talk to him? I think it’s necessary if we’re to get to the bottom of this.”

She appeared reluctant as she considered the options but finally said, “I suppose so. Meet me on Monday, just after four on the fifth floor of the library, near the elevator.”

Matthew stood, suddenly eager to be somewhere else. He would brave the Friday afternoon traffic and drive to San Clemente to visit his parents in their new condo, watch
some football with his dad, and pick up on the south swell at San Clemente pier -- normal stuff, not this alien invasion nightmare.

“You know, nobody likes to be spied on,” he said. “If this alien civilization is about to come out of the closet, you can be sure people will be furious about losing their privacy. Violence may occur.”

Laura shrugged. “If the powers you attribute to the aliens are true, then retaliatory violence will be futile.”
Chapter Four

Valentinus: September 10

The Geisel Library sits like a large spaceship in the middle of the campus of the University of California, San Diego. Matthew stood by the elevators on the fifth floor waiting for Laura. He didn’t have long to wait.

“Follow me, Matthew,” she said. “He knows we’re coming. I hope you know what you’re doing.”

They walked to the northeast corner of the library where she stopped and pointed to a small room with a beautiful view of the inland mountains. A man sat at a table with his back to the open door. Laura knocked gently and, getting no response, entered with Matthew following.

“Valentinus, this is Matthew,” she said, almost in a whisper. “I told you about him earlier.”

Valentinus slowly extended his right hand.

“Pleased to meet you,” he said, in a steady baritone voice. His powerful grip tested Matthew’s strength. He had the unflinching gaze of an infant and short gray hair that was uniform in color.
“Matthew knows a lot about mathematics,” Laura announced, with mock pride.

“He proved in our undergrad philosophy class that there is no God.”

“Really,” Valentinus said. “We would like to see the proof someday. We have never had success with that.”

“Actually, sir,” Matthew said, “Laura is just kidding.” It was coming back to him now; he’d tried to show that there was no way of proving that God exists. Big difference but still bullshit. That Valentinus had even considered the existence of God worried him.

“How is your friend Clement?” Laura asked. She was just making small talk.

“We are not in communication at present,” Valentinus said. “He is on a special mission.”

Clement? Laura hadn’t mentioned him. What sort of special mission? Matthew, who had carefully rehearsed his questions, felt threatened by this surprise tangent.

“Well,” Laura said, “I’ve got some historical references to look up. I’ll leave and let you two get acquainted.”

“Goodbye Laura,” Valentinus said, still looking at Matthew. “Bring the references to me when you have them. I will tell you what actually happened.”

Laura seemed hesitant to leave them alone. Was she afraid Matthew would be too blunt, too paranoid? Had she kept other things about Valentinus secret from him?

Matthew sat down opposite Valentinus.

“I suppose you know a lot about me, sir,” he said. “But I know almost nothing about you.”

“We have access to the most recent copy of you,” Valentinus said.

“Then you know about the colony in my office and can get information from it?”
“Yes. We can exchange information with any of the colonies.”

The consistent use of “we” supported Matthew’s theory about the nature of Valentinus: a human accomplice in direct communication with the microbots. He was apparently not the only such accomplice.

“I suspect that you have a special relationship to the microbots and are in constant communication. Is that so?”

“We know from virtual Matthew that you have made that conjecture. You are on the right track. The truth is that what you and Laura call ‘Valentinus’ is a natural history colony just like your diorite. Our task in simulating a human is complex, but we have had plenty of time to practice. Over ten thousand years in our case.”

Of course! The microbots could build a shape-changing machine to simulate a rock or a mug. Why couldn’t they also learn to simulate animals, including humans? Another segment of his rehearsed line of questions had become irrelevant. Valentinus had been using virtual Matthew to prepare for this meeting. Matthew realized that the microbots had scanned his brain at least once since the first time in his office. They were using him to update virtual Matthew. He had no privacy, but that was the least of his worries.

“So I’ve been addressing you as Valentinus, as a single entity, but you are a machine controlled by millions of microbots. It’s these microbots that I need to understand.”

Valentinus sat motionless and silent for an uncomfortably long time. The frozen expression on his face gave no indication that he would ever speak again. But he did.
“These microbots are the citizens that comprise our society. Each is a separate individual, highly intelligent by your standards. Our more primitive robotic ancestors were invented by a carbon-based life form that evolved over two billion earth years ago near a star at the edge of the Sagittarius Arm of this galaxy. Do you know …” his voice trailed off.

Valentinus sat still, his head turned to the side as if he’d heard a noise.

“We have just been informed by virtual Matthew that you are familiar with the structure of our galaxy.”

Valentinus once again preferred to go to virtual Matthew for basic information. Why? Maybe it was easier than quizzing Matthew himself. The sun was at the inner edge of the Orion Arm and probably somewhat farther from the galactic center than the microbots’ home star system. Matthew knew that much. Virtual Matthew, of course, knew the same.

Valentinus continued.

“Our robotic ancestors were designed to assemble and control nanoweapons. They fought many battles. They and their nanoweapons began to coevolve at a rapid rate compared to biological evolution. The wars became increasingly destructive.”

Matthew was suspicious. The microbots started as warriors and were now passive observers of natural history. But were they really so passive? Warriors don’t change that easily.

“Are you still at war with someone?”

Valentinus ignored the question and continued his story.
“Our microbot ancestors were programmed to produce an environmental impact report after every battle. These reports became ever more complex and detailed. At one point, a cultural transition took place. The reports and the study of natural history they entailed became the all-consuming reason for our existence.”

Ironically, Matthew’s father had complained to him about time-consuming environmental impact reports in San Clemente. Here was a civilization of microbots devoted to carrying out such reports for the entire galaxy and beyond.

“You’ve taken on a considerable challenge,” Matthew said, aware of the understatement.

“The greatness of the challenge, with its many dangers, has caused us to evolve into a complex and advanced society. The study and recording of natural history has become for us what you would call a ‘labor of love.’ The events we have recorded are truly amazing. You will find them so as you learn about them.”

Matthew understood that virtual Matthew, not he, would learn about natural history from the microbots. That distinction was of little concern to Valentinus, but it was important to him. He wondered why the microbots would go to the trouble of simulating a biological human.

“Why are some of the colonies in human form?”

“To study humans we need to have mobility, proximity, and high bandwidth communications at short range. We must mingle with them. An inconspicuous human form works best for our purposes.”

This answer made sense to Matthew on a technical level; otherwise, it begged the question. His curiosity about Clement returned. Clement, to be on a mission of concern
to Valentinus, must also be a colony. Matthew decided to make this assumption and see if Valentinus contradicted him.

“Can you tell me about the Clement colony and why he is not in communication with you?”

“Since early this morning he has been on an emergency mission to an underground laboratory in the Sauceda Mountains of Arizona.”

Matthew mistook the silence that followed for the end of the explanation. But not so.

“In general, we don’t interfere with biological or cultural evolution. But if an intelligent life form threatens the destruction of a planet’s biosphere then the non-interference rule must be dropped.”

Finally, Matthew was getting information that fit into his preconceived notions of what concerned the microbots.

“Is that sort of thing happening in the Sauceda Mountains?”

Valentinus’s gaze looked eastward, through the windows of the room toward Arizona.

“Yes. A project to make weapons of primitive swarms of microrobots has been going on there for five years. Security at the lab is advanced. We have gotten small natural history units into the lab but cannot communicate with them at the high bandwidths we prefer. An opportunity arose to put a humanoid colony into the lab. Clement is now there and will remain for another day. He will introduce new sensor units and set up communication links that will give us higher bandwidths.”
Matthew was surprised and pleased that Valentinus would confide so much in him.

“Will Clement stop the project?” he asked.

“The current project has already failed, but the principal engineer plans to redesign the project by training his microrobots to control self-replicating swarms of nanoweapons. This is the same disastrous approach taken by our creators. We will stop him. But once someone has thought of this idea, many others will also. We must change the way we relate to the human race.”

“And Laura and I are to help?”

“It will not be difficult for you. All you have to do is meet with us regularly so that you understand our goals. We in turn will benefit from your intuition concerning your fellow humans.”

Matthew had never thought of himself as well endowed when it came to intuition.

“Laura’s intuition seems pretty good,” he said. “But mine’s nothing special.”

Valentinus was reassuring.

“Do not worry. We have chosen you both carefully. Your roles will be crucial.”

Matthew thought about how Valentinus had preferred to go to virtual Matthew for basic information.

“Will it be Laura and I who help you, or virtual Laura and virtual Matthew?”

“We will need all of you. You are going to work as a team.”

Matthew was pretty sure that their virtual forms would be the more influential part of this team. Another basic question occurred to him.
“You seem to be able to communicate easily with virtual Matthew. Do you have your own copy of him?”

“Yes. There are now two virtual Matthews. There will eventually be many virtual Matthews and virtual Lauras. As long as you are alive, we will keep them all synchronized and up to date concerning your experiences.”

The thought of being an ongoing source of updates to the many virtual Matthews was encouraging. He had some sort of future ahead of him, however short.

“What happened to your creators, the carbon-based life form?”

Valentinus remained silent for a few seconds before answering. “We destroyed them.” He spoke without the slightest sign of emotion.

Matthew was stunned even though he had anticipated the possibility. If they could destroy their creators, they would have no qualms about annihilating the human race. Maybe he should announce their presence to the world and let them erase his brain. No. He’d look like a fool, ranting briefly about aliens only to fall into a dumb silence, not remembering a thing he had said. At best, he would be an object of ridicule for the media. His students, in particular, would take delight in making jokes about his erased brain.

He heard footsteps approaching. Laura had returned.

“It’s time for me to go home,” she said. “Would you walk me to my car, Matthew?”

“Sure,” he said, relieved to have an excuse to get away.

“Goodbye Matthew and Laura,” Valentinus said, without hesitation.
They walked together to the remote lot where Laura had parked. The wind, which had been coming from the mountains and desert to the east, now drifted in from the ocean, bringing a light fog. Moisture dripped from the eucalyptus trees causing them to release a subtle, pleasant odor. As they walked, Matthew filled her in on his discussion with Valentinus.

“With one notable exception, Matthew, you made some good guesses about the microbots.”

“It’s clear they have run out of patience with the human race. I suspect it’s going to be pretty bad.”

“You’re too pessimistic,” she said. “Think about the fact that they need you and me to help them. They want to listen to our advice. We won’t advise them to harm people.”

He had been thinking about just that.

“Be careful about that idea. Rather than ask me, the biological Matthew, a question, Valentinus went directly to my virtual form. That’s the way the microbots may seek our advice during the attack on the human race.”

Laura was not concerned. “They update our virtual forms frequently, so the virtual forms will give the same advice as we would.”

“It’s not so simple. You and I will worry about what’s happening to our fellow humans, maybe even come up with some answers. The microbots will update our virtual selves with our new ideas and then ask them, not us, for advice. We don’t know what our virtual selves will advise because we don’t know what additional knowledge, beyond our experience, they’ll get from the microbots during their updates.”
Laura changed the subject to matters of more immediate concern to her. “I still think Valentinus -- I guess I should say the microbots -- have a religion.”

Matthew bridled at the mention of religion.

“That was uncalled for, embarrass me in front of Valentinus, saying I proved stuff about God. You know I don’t give a damn about any of that religious nonsense.”

“You’ve formed a habit of not giving a damn,” Laura said. “Now you have a reason to care about religion. Our survival may be at stake.”

Matthew feared she might be right, but he was too exhausted to care.

“I’ve had it with all of this,” he said. “Let’s call it a day.”

Back in his apartment, he sat on an unpacked box with his laptop in front of him. He launched his search engine and typed in “sauceda mountains arizona.”
Colonel J. P. Graves sat at a large wooden table stacked with papers. Opposite him sat the man he was replacing, Colonel Daniel Stallcup. It was Friday, Colonel Stallcup’s last day on the job. Since arriving at the Sauceda Mountains Research Center last Monday, Graves had listened to a series of self-serving presentations by Stallcup.

Graves and Stallcup, both U.S. Army officers, came from different backgrounds. Stallcup, a graduate of Officer Candidate School, rose through the ranks of Army Intelligence. His last assignment before accepting his present post as Commander, Sauceda Mountains Research Center, was Commander, United States Army Garrison, Huachuca, Arizona.

Graves came to his new position by a different route. A graduate of the United States Military Academy, he rose through the ranks of the U.S. Army Corps of Engineers. His last assignment was Director of the Office of the Chief of Engineers, Pentagon. He wasn’t happy about leaving his home in Rockville, Maryland, but he liked a challenge.

“Let’s go over this one more time,” Graves said. “Swarms of mite-sized machines are being trained to attack and kill humans, but they don’t yet work as planned.”
The guys at the Pentagon told me the problems were minor. Now you tell me that these weapons are a long way off from being ready to ship.” Graves had been assigned to this project because large-scale manufacturing was about to start; his organizational skills would be needed.

“It’s a matter of what you mean by long way off,” Stallcup replied.

More crap. Graves was getting tired of mincing words with this guy.

“Long way off means that Mathis and his engineers have screwed up. Long way off means you won’t be able to deliver the first weapon to the CIA on time. Long way off means forget about manufacturing these things.”

Stallcup glanced toward the door and then at the table in front of him.

“It’s more subtle than that,” he said. “The weapons work well on any animal they’re trained on. They ….”

Graves interrupted, clearly annoyed. “Humans are animals. The weapons should work on humans.”

“Training a swarm on an animal results in the death of that animal.”

Stallcup had told him that already. Something was missing. “So train the damned things on an animal, kill the animal, and ship to the CIA.”

“It’s species specific. Train on a rabbit, the swarm will reliably kill only rabbits, no other species. Train on a monkey, the swarm ….”

Graves now got it. “What a bunch of jerks. How did these brilliant engineers get themselves into such a stupid bind?”

“It’s a long story and very technical. Mathis will explain it to you.”
Graves had seen enough of Jim Mathis earlier in the week. He didn’t care for him -- arrogant and impulsive.

“I’ll deal with Mathis next Monday after you’re gone. I need the weekend to look this stuff over.”

Graves continued to sift through Stallcup’s papers. He stopped and pulled out a copy of an email.

“What’s this stuff about getting human subjects from prisons?”

Stallcup reached for the email. Graves quickly pulled it back.

“I’ll read it to you if you’ve forgotten.”

“It’s … nothing, just something brought up and dropped.”

“It’s from Mathis to you. Who dropped it, Mathis or you?”

“We both did. It’s just one of those things. They come and go.”

Graves looked at the note. Titled “Human Subjects,” it suggested that death row inmates might volunteer to be test subjects for the swarms. These engineers were nuts.

“No human subjects will be used while I have anything to do with this project. It’s unethical as hell! I don’t care if prisoners are lining up to volunteer.”

“They won’t be lining up when they learn what’s going to happen to them,” Stallcup said. “They’ll take their chances with death row. They’re safer there than on the freeway.”

At least Stallcup and Mathis were going to tell the inmates that volunteering meant death. They had some principles -- damned few.
It was one a.m. Monday morning. Jim Mathis sat at his desk in his underground office at the Sauceda Mountains Research Center. The new Commander, J. P. Graves, had finally left at midnight. With the building to himself, Mathis rehearsed his plans. He stared at a monitor that showed the outside ramp that led to the animal lab. Important visitors were to arrive within the hour.

Five years ago, he left a promising academic career at the University of Minnesota to direct the secret underground government laboratory in which he now worked. The purpose of his lab was to design and build a microrobotic weapon system for the Department of Defense.

The military specifications called for swarms of tiny mite-sized particles that could find and kill individual humans. Like the dust mites found in many homes (and about the same size), the “robo-mites” would gather unnoticed in a home or office. Each robo-mite was a complete computing system with processing, storage, sensing, and communications capabilities. The robo-mites would recognize the victim, assemble for collective action, and kill without leaving environmental or forensic evidence.

The swarm of robo-mites consisted of three subswarms. The first, called Mission Control by the engineers, was the most sophisticated. The remaining two subswarms, called Assassin and ComLink, carried out the attack on the victim. Mission Control had the most complex task from a computational point of view; it also had the largest units. These units were in the form of small robotic gnats that could direct the attack while hovering in the air or sitting on walls or objects. Assassin and ComLink were invisible to the human eye. All units could self-destruct.
By the end of the second year, an experimental swarm had successfully killed a rabbit. The robo-mites quickly infiltrated the rabbit’s trachea through its nostrils. They then reacted with the rabbit’s body fluids, expanding many times over. Mathis vividly recalled the optimistic cheering of his technicians as the animal gasped in agony for several minutes and then lay perfectly still. He felt victorious. All of his hard work and professional sacrifice seemed justified.

In retrospect, it was amazing to him that none of them considered the obvious issue of whether a swarm trained on a rabbit could kill a rat or a dog. The answer turned out to be no. Once they had trained a swarm on a rabbit, it would not kill any other species with the required level of reliability. This species-specific sensitivity was a consequence of several technical problems, one of which was leaving no forensic evidence. The military would not relax the forensic condition.

For a swarm to kill a human, it must be trained on humans. To test this theory, the engineers trained swarms on monkeys and then tried to kill chimpanzees (using the same swarms without further training). No luck. The reverse, train on chimpanzees and kill monkeys, didn’t work either. At great expense, they repeated these experiments with chimpanzees and gorillas, without success.

Mathis knew he must obtain human experimental subjects. Would death row inmates, nearing their execution date, volunteer? Preliminary inquiries were discouraging. Four weeks ago, the Commander of his lab, Colonel Stallcup, received a new assignment and a promotion. His new duties involved the current project but at the level of the Pentagon. Stallcup refused to pursue the idea of human subjects with his superiors.
Mathis knew he could not get official approval to test swarms on humans. He decided to get human test subjects secretly, on his own. Once he had trained a swarm of robo-mites on humans, he would falsely label that swarm as “chimp trained.” He would take personal responsibility for shipping that particular swarm to the CIA. With the CIA temporarily satisfied, he could start work on his new idea of using robo-mite swarms to control self-replicating, adaptive nanoweapons. He was confident that his new approach would result in a more powerful weapon and would quickly gain acceptance with the military. He wouldn’t need human subjects to train the deadly nanoweapons.

To clear the lab of his hardworking engineers and technicians, he announced that all weekends in September would be required rest and recuperation periods. No personnel were to be in the labs except for the veterinary crews in the morning and the guards at the front gate. He and Stallcup were exempt from the order. He knew that the departing Stallcup would not bother to come in. Two weeks ago, using special project funds, Mathis hired two private detectives in San Diego. They were to select three men from the Palm Canyon homeless colony in Balboa Park and offer to enroll them in a special addiction treatment program. Winter shelter, a painless detox, a good allowance, and a job with benefits at the end of the program were a part of the deal. Transportation to and from the “clinic” in the beautiful Sauceda Mountains of Southwestern Arizona was included.

Mathis smuggled the men into the facility on Saturday at eleven p.m., just over a week ago. They looked bad and smelled worse. He escorted each man to a small private “waiting room” furnished with a chair and table. The men, who gave their names as
Ethan, Wilson, and Daryl, waited in cells designed to train swarms on large primates. Mathis started training on Ethan.

Assassin entered Ethan’s body to do the actual strangulation. ComLink served as the communication link between Mission Control and Assassin. Mathis watched the attack through a large observation window while periodically checking the instrument panels, swarm-visualization graphics, and video monitors.

Ethan, in a self-induced drugged sleep throughout, became unconscious after a quick series of gasps and died a few minutes later. The session scored four on a scale of ten. A score of ten meant that the swarm carried out the attack without any correcting signals from sources external to the three subswarms. Ten was required to ship a swarm to the CIA. Mathis was willing to ship a trained swarm with a score of nine and take the risk of failure. With a score below nine, he knew he couldn’t deliver the weapon system.

He retrieved the partially coevolved Mission Control and ComLink subswarms from Ethan’s cell and combined them with a new Assassin subswarm. He then went to Wilson’s cell. Wilson, asleep at first, awoke only at the end of the training. During his last moments of consciousness, Wilson had a look of horror on his face – a look Mathis would never forget. But thanks to Wilson’s sacrifice, the score was now six.

Mathis found Daryl staring out of the window of his cell and pointing at his empty water bottle. Motioning for Daryl to sit down, he held up five fingers to indicate that he would be back in five minutes. Seconds later, he released the swarm from the injection chamber and began to monitor the session.

Daryl, who struggled desperately at first, was unconscious in three minutes and brain dead in just over five minutes. The irony amused Mathis. He had held up five
fingers and it took five minutes. Unfortunately, the score printed out by the computer was only eight. He would need to locate another human subject. Mathis then got a cart, took the three bodies to the primate section of the veterinary unit, and disposed of them in the large crematorium.

Movement on the monitor interrupted Mathis’s thoughts. Two detectives, with an elderly man standing between them, stood at the ramp to the primate lab. Mathis rushed to the lab and opened the large doors. The detectives walked with him to the training cell, one on either side of the silent, cooperative addict. The new human subject entered the training cell and sat down. Increasing the score of the partially trained swarm from eight to the necessary nine or ten seemed a certainty.

Mathis thanked the private detectives and escorted them out of the building. This homeless guy, like the others, came from Palm Canyon. The detectives called him Clement. Was it a first or last name? It didn’t matter much; he would soon be dead.

Mathis returned to Clement’s cell, switched on the swarm injector, and released the almost completely trained robo-mites into the cell. Three-dimensional images of the subswarms appeared on the visualization displays. Mission Control assembled for action with no correction signals from the training program; signals from ComLink came in at full strength. Assassin formed into a long filament and went straight for Clement’s nostrils.

Mathis stood transfixed by the visualization displays. But at two minutes thirty seconds, the signal indicator from the Assassin subswarm sagged to zero.
Inside the Clement colony, detectors in the nostril intake chamber sensed the presence of numerous primitive, semi-autonomous, microrobotic units. The colony sampling unit snatched several for analysis. When the incoming stream ceased, the colony cleaning system compressed the remaining devices into a cube, one millimeter on a side, and put them into the trash.

Mathis knew he had failed his last chance for shipment to the CIA. But he had an immediate problem. He must do something about Clement who still sat staring straight ahead. The internal air pressure in the cell could be dropped, as a safety measure to retrieve swarms that got out of control. If he could kill Clement by dropping the pressure, he could dispose of his body in the crematorium.

Mathis lowered the pressure to the equivalent altitude of forty thousand feet. Clement showed no change in expression. The pressure-control system was broken. Shooting Clement would alert the guards. He had to get to his office where he could think.

Back in his office, he soon regained his composure. He could add Clement’s name and time of entry to the computer’s security log. This would be the only information about Clement in the lab’s computer system. Just after six a.m., when the new security guards arrived, he would take Clement out the front door. The new guards would not expect to ID Clement visually and would rely only on the computer. If the guards thought to check how Clement got into the building, Mathis might have to admit bringing him in by the lab door. This would be a security breach and result in a reprimand, but Mathis could deal with that because of his high-level position.
It was 5:10 a.m. Mathis, feeling a headache coming on, grabbed a cup of coffee and a muffin from the junk food supplies. The video in Clement’s cell showed him still sitting in the same position, confirmation that his addiction problems had resulted in serious mental impairment.

At 5:55 a.m., Mathis left his office to get Clement, arriving at the training cell at exactly six. Clement was gone.

Mathis panicked. He ran down the row of primate cells, checking each one. He checked the restroom and shower area. Returning to the primate lab, he checked the door to the outside. The code-locked door was tightly shut, just as he’d left it. Clement must still be in the building. Mathis felt sick to his stomach. Back in his office, he put his head down on his desk and began to shake with fear and exhaustion.

At eight in the morning, Colonel Graves banged his office door open and walked in. A gray-haired visitor sat in front of his desk.

“What the hell are you doing here?” he said.

The visitor said nothing. Graves hurried out to his receptionist’s desk.

“What’s going on Ms. Jamison? Who is this guy? I didn’t have any visitors scheduled.”

“That’s what I thought, but his appointment is in the computer for eight,” she replied. Graves looked over her shoulder. Sure enough, Mr. R. T. Clement, CEO, California Microrobotic Sensor Systems, appeared on his calendar with an impressive list of security clearances.

Graves calmed himself, re-entered his office, and sat down.
“OK, Mr. Clement, what’s this all about? Who’s your host?”

“My host, Dr. Mathis, invited me here to discuss my company’s products with him. But I have ethical concerns about what he is doing.”

“I see you’re cleared to discuss the work of Mathis and his team, so let me tell you my concerns. Who wants a weapon system that can be destroyed by a cheap leaf blower?”

Clement gave no reply, so Graves continued.

“If they ever managed to kill one terrorist with a swarm system, they’d never kill another. These terrorists aren’t stupid. This system is suitable as a passive sensor but not as an offensive weapon. Do you understand, Mr. Clement?”

“I understand more than you realize, but I have other concerns. I want to show you a video of an experiment done by Dr. Mathis. Call up your browser, and go to the primate lab research site.”

Soon Graves watched as experimental swarms, with Mathis at the controls, killed three men. He stared in silence, listening to Clement’s calm explanation of the horrific experiments.

Graves walked to the door and spoke to Ms. Jamison, “Call the Silverbell Army Heliport, and get five or six MPs out here at once.”

He approached Clement and extended his hand. “Mr. Clement, I’m grateful to you. We’ll need you to remain in the building for a while. I’ll have some questions to ask you, such as why you were invited here and how you ended up having access to the records of these illegal experiments.”
Clement handed Graves his business card. On it was the name and address of his company and the URL of their website. The card listed two names: R. T. Clement, CEO, and F. P. Valentinus, CFO. Graves put the card in his pocket.

“Would you like to sit in our library while you wait, Mr. Clement?” he asked.

“That would be the perfect place for me.”

“Good. I’ll have Ms. Jamison escort you.”

With Clement gone, Graves sat down at his computer and typed the URL of CMSS into his browser. An attractive website appeared. The company advertised only one product:

“Keep track of your infant or toddler, anytime, anywhere, with a CMSS sensor system. Shaped as attractive mugs, our baby monitors start at only $40.”

The basic mug, the forty-dollar model, had no handle and was 4 inches tall; it tapered from 3.5 inches in diameter at the top to 2.5 inches at the bottom. Four colors were available: white, tan, brown, and black. For ten dollars more, one could buy the Special Edition Mug, which had a handle and a CMSS logo. In addition, subject to the constraints of functionality, CMSS would customize the mugs to suit the needs of individual purchasers; fees for this service would be determined on a case-by-case basis.

Graves stared at the screen in disbelief. Why was Mathis, a cold-blooded murderer, consulting with a manufacturer of baby products?
I learned today, Monday, September 10, that I have been appointed Statistical Advisor to the President of the United States. My appointment letter, signed by President Richard Tannenbaum, praised me as one of the leading statisticians in the world. I have resolved to maintain this journal for the future benefit of my family, colleagues, and students. I hope the government will eventually make this entire journal available to the public, including the classified portions.

The Bureau of Justice Statistics has provided me with an office. It is an honor to be associated with the BJS, but I report only to President Tannenbaum. I will have direct access to the highest levels of the Justice Department including the Associate Attorney General, the Deputy Attorney General, and the Attorney General.

Why would the President honor me, now nearing retirement age, with this important post? I am sure it has to do with my life-long friendship with Richard Tannenbaum. We were students together at Stanford, he in the Stanford Graduate School of Business MBA Program, I in the Department of Statistics working on my Ph.D. We were good friends, played tennis regularly, and went drinking together on weekends. Our friendship has lasted a lifetime.
I freely acknowledge that Richard was involved in most of my major career advances. I rose through the academic ranks at U.C. Berkeley. When Richard, a successful businessman, became a member of the U.C. Board of Regents, he was able to arrange my advancement to the position of University Professor. At that time, there were only twelve professors who carried this title at Berkeley and only thirty-one in the entire U.C. system. When Richard, a leading contributor to the Republican Party, became Governor of California, he arranged a position for me much like the one I now hold. After only one term as Governor of California, he ran for and became President of the United States.

I have tried hard in the past to give Richard good advice. A statistician analyzes data to reveal hidden patterns and to give choices to policy makers based on probabilities. Suppose a friend were to tell you that she took a coin out of her purse, tossed it twenty times, and it came up heads every time. Your first reaction might be that a very rare event had occurred. For a fair coin (heads and tails equally likely), the chances of twenty straight heads occurring would be less than one in a million. Turned around, however, one could use the fact that heads turned up every time as a basis for deciding that the coin was, in fact, not fair. Maybe it had heads on both sides. Thus, the experiment of tossing the coin twenty times, with its all-heads outcome, presents the following choices to someone who has no other information about the coin: (1) The coin was fair AND a very rare event occurred; (2) The coin was not fair. Nothing political is involved in that choice.

The statistical probabilities that I deal with are based on imagined or real experiments where some situation (e.g., tossing the coin) can be replicated repeatedly.
But Richard and his friends deal with another notion of probability. Imagine that you are about to cross the street on a rainy day. Cars on the street in front of you seem to be going too fast. You imagine that you are in the middle of the street when the driver of a car sees you and hits the brakes. Too late! The car skids on the wet street and kills you. You decide not to cross the street because the “probability” of being hit by a car is too great.

Unlike tossing a coin, one cannot faithfully replicate the rainy-day car experiment twenty times, counting how many times you end up dead and how many times the car misses you. The notion of assigning probability to things like the rainy-day car scenario is called “subjective” probability. It is the mother’s milk of politics. Richard and his advisors are masters at creating thought processes in voters that lead them to interpret various situations, such as terrorist attacks, contagion, or financial ruin, as having high subjective probability. The only way to reduce this high subjective probability, if you listen to Richard, is to vote for him. It works. He is President of the United States. This is not to detract from Richard. His opponents play the same game, but they are less skilled at it.

I have noticed that there are times when Richard confuses the two notions of probability. There are aspects of terrorism, contagion, and financial disaster that do lend themselves to statistical probability analysis. Treating such issues in terms of subjective probabilities alone could lead to a deplorable state of public deception. Such a situation wouldn’t serve Richard’s administration or the public. One aspect of my job is to help him make such distinctions.
On a personal note, I spent the weekend in my apartment even though it was a beautiful fall day. In retrospect, I should have gotten out for a walk and perhaps a visit to Harper’s Ferry, something I have long wanted to do. There are many interesting things to do and see in the DC area. I must be more active. Mary, the wife of my nephew Jim, has promised to bring their young son Todd to visit me. That will get me moving! I would like to take him to the National Zoo, among other things. His father has disappeared into his work, so I might have some role in influencing Todd in a positive way. Perhaps he will think of me as an extra grandfather.
Chapter Seven

Dinner Party: October 6

Matthew, carrying a six-pack of beer as a gift, climbed the stairs to Laura’s apartment. Her directions for negotiating the complex maze of buildings to the east of campus had proved useful only as a general guide. Not certain he had found the right apartment, he knocked softly. Laura, dressed more formally than he had anticipated, opened the door immediately and invited him in with a smile.

“Smells good in here,” Matthew said. “What are you cooking?”

“Actually, Roger does the cooking when we have company,” Laura said. “He’s an accomplished chef and does everything from scratch. I can’t begin to do what he does.”

At their increasingly frequent meetings for coffee, Laura had bragged about the complex dishes Roger had mastered. With zero interest in cooking, Matthew had not been able to remember the names of the dishes, let alone appreciate their difficulty.

“What’s he cooking tonight?”

“Baingan bhartha, channa dal, home-sprouted mung bean salad, matar paneer with homemade paneer, samosas, naan, basmati rice, and homemade gulab jamun for dessert.”
“Did he grow his own rice?”

“No, of course not. But he insists on buying only the best. We’re vegetarians.”

Matthew had learned from Laura that Roger was a man of many accomplishments. Inspired by a deep commitment to serve humanity, he had put aside his pursuit of academic studies. A six-year veteran of the Peace Corps, he had lived in some of the most impoverished places in Africa and India. He was an excellent flutist and could have joined the San Diego Symphony, had he time for it. In addition, he was a master of the Celtic uilleann pipes and had recently taken up the classical guitar. Matthew noticed a guitar leaning against one of the chairs in the living room. A concert was probably in store for him after dinner.

Roger entered the room. He was pale and thin with a small goatee and long hair tied in a ponytail. He approached Matthew and shook his hand.

“I’ve heard a lot about you, Matthew. I hope you enjoy Indian food and can tolerate a vegetarian meal.”

“From the smells coming from the kitchen, I’m sure it will be great.”

“The dinner is ready sooner than I anticipated, so have a seat. Laura will help me bring out the food.”

With the magnificent meal served and the three of them seated at the dining room table, they held hands while Laura said grace. Despite his reservations about the all-vegetarian meal, Matthew could not get enough of the delightful dishes. He stuffed himself long after Roger and Laura had stopped eating. When he finally finished, the small group fell into silence as they drank the last of the wine.
“Laura tells me you’re an atheist, Matthew,” Roger said. “You believe there is no God.”

Matthew was afraid the conversation would take this turn at some point.

“I don’t think I’m an atheist. I would have to search every nook and cranny of this and probably infinitely many other universes to show God didn’t exist. That’s impossible. I guess I could assume there is a God and come to some contradiction, but I can’t do that either.”

“Then you’re an agnostic?”

Matthew had looked up the definition of agnostic shortly before heading out for Laura’s apartment. There was a strong definition, namely one who believes it is impossible to know whether there is a God, and a weak definition, one who was doubtful or noncommittal. The weak definition was too subjective, virtually useless, so the strong definition was the one he chose.

“I’m not an agnostic either,” Matthew said. “Theorems in mathematics which prove that something is impossible to prove are extremely difficult. To show that it is impossible to know if there is a God would be a tall order, beyond my abilities.”

Laura looked satisfied. Roger looked puzzled.

“Then where do you plan to spend eternity?” Roger asked, pleased with himself for getting this far with Matthew.

“It appears that I’ll be spending it in a lot of different places at the same time.”

Matthew felt a sharp pain in his shin. Laura had kicked him hard under the table. She glared at him and made a rotating motion with her open hand across her forehead to remind him that he was at risk of getting his mind erased.
Roger looked puzzled by Matthew’s response and Laura’s odd gestures. Laura had had enough of this conversation for the moment. She stood up, took a few steps toward the kitchen, turned, and asked, “How about some coffee or tea? Give me your orders.”

“What is your religion, Matthew?” Roger asked, ignoring Laura.

“I’m a Gnostic,” Matthew said, with calm certitude.

Laura forgot about the coffee and tea and sat back down. Matthew could see that she was puzzled. After all, she was an expert on Gnosticism, writing her Ph.D. dissertation on it. Now Matthew, who a few weeks ago had never heard of the Gnostics, confusing them with agnostics, was announcing that he had become one. His conversion had only happened that day, less than four hours ago.

“I’m afraid that you’ll have to explain yourself on that one,” Laura said, in disbelief.

Matthew took a sip of water and paused briefly to organize his thoughts.

“I believe there are a multiplicity of universes, ours being just one,” Matthew said. “For example, certain black holes in our universe are themselves universes, perhaps with intelligent life. Our universe may be a black hole in some other universe.”

“That may be true, but it has nothing to do with Gnosticism,” Laura chided.

“Sure it does,” Matthew said, sounding increasingly self-confident. “Go to the universe from which ours arose, then to the universe from which that arose and so forth. At the end of that trail, there must be a master universe. That universe is long lasting, flat, and stable. That’s the God Universe.”
“Such a notion of God is monstrous,” Roger said. “Your God has no loving connection with us humans.”

“Life is tough,” Matthew said. “But all is not lost. It is possible, under certain special circumstances, to pass information up from a sub-universe to the one above it. In this way, information about what has happened in our universe will eventually arrive at the God Universe. The God Universe will be omniscient. Maybe eventually some information will flow the other way too, down from the God Universe.”

“So what,” Laura said. “That doesn’t help us lead our lives.”

“Why does God have to help us lead our lives?” Matthew asked.

“You’re spiritually challenged,” Roger said. “It’s impossible for me to believe that we arose from a random process, like evolution or black hole formation.”

Matthew was back on more familiar ground.

“The process by which we arose is far from random. Suppose you put a key into the lock to your apartment and try to rotate it, but it sticks. So you jiggle the key around in a random way until, eventually, it turns and unlocks the door. You didn’t get into your apartment at random, but some randomness helped you get in. It’s that type of randomness that helped us evolve to where we can think and reason about our world.”

“You haven’t answered my question about what this has to do with Gnosticism,” Laura said.

Matthew was feeling uncomfortable again, but he had to keep going.

“You can call the sub-universes of the God Universe ‘Aeons,’ to use the Gnostic term. The quest to accumulate vast knowledge about the sub-universes and pass it on to the God Universe is the quest for Gnosis. That’s what Gnosis is all about.”
The pain in Matthew’s shin returned and so did Laura’s forehead wiping gesture. She had made the connection between his newly acquired religious views and the fundamental goals of the microbots. Matthew had gone too far.

“It’s not right for me to take up all this time with my personal religious views,” Matthew said, rubbing his shin. “But you must admit it makes sense.”

“As a religion, it makes no sense at all,” Laura said.

Mildly offended, Matthew felt compelled to explain further.

“My God is, besides being omniscient, also omnipotent, and omnipresent,” he continued. “The God Universe is omnipresent because we are a part of it. It is omnipotent because our existence is subject to God’s existence. The God Universe could wipe us out in many ways.”

“Your God is depressing, if not total nonsense,” Roger said, getting up and heading for the kitchen. “I’ll make the coffee and tea.”

Roger’s decisiveness surprised Matthew. Suppose he had called Roger’s God “total nonsense.” How would Roger react? He felt Laura’s hand on top of his. She squeezed hard to indicate her displeasure. She lowered her voice to a whisper.

“You’ve gone too far. You’re going to wake up tomorrow with an erased brain, and I’ll have no one to help me deal with the microbots. You got all of that stuff from Valentinus. It has nothing to do with Gnosticism.”

“Are you sure?” Matthew asked. “Think about it. The whole structure of modern cosmology can be morphed into the framework of the Gnostics. I suspect that the human Valentinus you write about in your dissertation got his ideas from the
humanoid Valentinus, just as I did. It came out so weird in Gnostic writings because they
didn’t know anything about cosmology.”

“You’ve gone nuts,” Laura added. “Just don’t get your brain erased, or I’m going
to haunt you to your grave.”

“You said the microbots were religious, and you were right,” Matthew continued.
“You couldn’t pin down their beliefs, but I have.”

“Flattery will get you nowhere,” she said. “I still think you’re going in the wrong
direction. But here’s your homework. How does your vision of the microbots’
Gnosticism help us predict where they are heading with the human race? You need to
come up with some ideas on that and soon.”

Matthew had no idea where his insights led in any practical way.

“There’s coffee, both decaf and regular, and hot water for tea,” Roger announced.
“We have many types of tea. Give me your orders.”

The guitar concert was well done and short. The shortness was, Matthew felt,
because Roger had had enough of him. In any case, he was thankful to head for home
where he could give his newfound spirituality a well-deserved rest.

Back in his apartment, he flopped into his large chair. He had, he feared,
offended his host and hostess. The idea of a personal relationship with God, important to
Laura and Roger, definitely seemed to be absent in his nascent attempt at theological
speculation. He imagined Laura and Roger married and having a sick child to care for.
They probably would want to say a prayer for the child’s health.

How would someone pray to his God Universe? It would take a master of
quantum mechanics and entangled particles to compose the prayer. Delivering the prayer
would be even worse; one might end up being sucked across the event horizon of a black hole. Even then, it might be the wrong black hole, heading away from God in the hierarchy of universes, not toward God.

Of course, the civilization that records natural history in the God Universe might have passed down information about themselves to our universe. If true, that might make it slightly easier to get in touch with them. But would they do anything about the sick child? Like the microbots, they wouldn’t want to interfere with nature.

A pad of paper on the floor caught his eye. It contained a half-finished calculation, ending where he had gotten stuck. He picked up the pad and got back to work. He vowed to avoid religious speculation and stick to things he knew something about.
After an hour in the surf, Matthew was exhausted. For the last fifteen minutes, he’d been trying his new handboard in the shore break. He removed his fins in waist deep water, walked halfway up the beach, and sat on the sand. He was at Hapuna Beach on the Big Island, one of his favorite surfing spots.

Then it hit him. What the hell was he doing at Hapuna Beach? He had work to do, a lab to organize.

Some tourists sat under an umbrella a few hundred yards north of him. Two lifeguards stood in front of their tower, looking in his direction. No one else was on the beach. There should have been more surfers out on a day like this. Where were they?

He closed his eyes and tried to concentrate. The mental fog began to lift. After his meeting with Valentinus, he walked with Laura to her car. He then returned alone to his apartment where he searched the Web for information about the Sauceda Mountains. He read about their history, geology, and long association with DOD projects.

Matthew checked his email and found a note from Laura asking him to look at the website of California Microrobotic Sensor Systems. The home page of CMSS listed R. T. Clement, CEO, and F. P. Valentinus, CFO. CMSS sold baby monitors and nothing
else. The advertisement claimed the monitors would allow you to keep track of your infant or toddler anytime, anywhere. The baby monitors were in the shape of “attractive mugs.” The mugs looked like the one he had found in his office drawer when searching for the diorite.

Sensing movement, he looked up and saw the two lifeguards, a man and a woman, walking his way. They stopped a few feet from where he was sitting. The girl introduced herself as Marta and her companion as James. Marta spoke first.

“How are you feeling Matthew? Do you remember anything yet?”

It seemed like a strange question. How did she know he was having memory problems?

“I remember being in my apartment and reading my email.”

“Anything else?” James asked. “Do you remember checking the website of CMSS?”

“Yes, that’s coming back but nothing after that.”

Marta knelt down in front of him and put her hand on his shoulder.

“Finally, your integration into the system is taking hold,” she said. “You’ve been a difficult case. The microbots say they’ve never had an intelligent life form that required so many recreation breaks.”

Her comment seemed insulting even though he had no idea what it meant. He thought of himself as a hard worker, deserving of any recreation breaks he might get. Besides, what did the microbots have to do with this?
“I know you must be confused,” Marta said. “The time has come for us to give you a full explanation.” She took hold of both his hands and invited him to stand. James stood behind him.

The scene shimmered and dissolved. Matthew was in a small room. In front of him was a robot with mechanical appendages of various sizes and an overall shape roughly like that of a human. The robot was holding him firmly. He panicked and tried to free himself, but another robot, standing behind him, restrained him. A third robot, standing off to his left, spoke to him.

“Calm down Matthew, you’re going to be just fine.” It was Laura’s voice coming from the third robot. The robot with Laura’s voice waved an appendage in the direction of a large monitor on the opposite wall.

“Look at the monitor on the wall, Matthew.”

Displayed on the monitor were four robots, one being held front and back by two others, a fourth standing off to the side. The robots holding him let go and backed off. Matthew inspected himself, turning and extending his appendages. He looked again at the monitor. He was another robot, identical in appearance to the other three.

“This is the new you. The Matthew that’s been vacationing at Hapuna Beach is a virtual Matthew. I’m, in part, a virtual Laura.”

The robot that still thought of himself as Matthew became even more confused. The beach had seemed completely real. The water was wet. He’d had a great time surfing and was exhausted from the effort. He forced himself to calm down and think logically. This was some sort of illusion. He must remain rational and not make a fool of himself.
“If we’re in a virtual world, why do we look like robots instead of people?” he asked.

“We’re not virtual robots but real robots in real space and time. We’re microbots, members of one of the natural history colonies. Each of us is only a tenth of a millimeter tall, barely visible to biological humans. Our core personalities correspond to Matthew, for you, and Laura, for me. You’re Matthew-bot, not Matthew. I’m Laura-bot, not Laura.”

“What do you mean by core personalities?” Matthew-bot asked.

“We microbots, like most intelligent entities, must rest from time to time. We use these rest periods to organize data and improve our computational systems. It’s like sleep for humans. During these periods of rest, a virtual, core life form is all that is left of our robotic consciousness. These virtual life forms, or core personalities, are subroutines of our robotic brains.”

“This is awful! We humans have become nothing but screensavers,” Matthew-bot said. “I’m nothing but a subroutine.”

Laura-bot could see that Matthew-bot was still fighting integration into his new robotic life form. He thought of “I” as referring to the biological or virtual Matthew, instead of the complex being he was becoming.

Laura-bot challenged him.

“Can every even integer greater than two be expressed as the sum of two primes?”

“Yes,” he replied almost instantly.

“Are there any odd perfect numbers?”

“I think not,” he said, after a pause.
“And how do you know these things?”

“I can prove the first statement, and I have a plan for showing that an odd perfect number can’t exist.” He was impressed that Laura-bot was interested in mathematics.

“You will find that you understand much, much more than these theorems.”

Using the nearest thing he had to an arm, Matthew-bot pointed across the room to the two microbots that had been holding on to him.

“Who are our friends over there? Are their screensavers based on human personalities also?” He was reluctant to back down from his flippant screensaver analogy.

“Oh the left is James-bot, and on the right is Marta-bot. Both James and Marta, their core personalities, were great swimmers. Marta-bot and James-bot are human-based microbots like us. We’re the only four human-based microbots in this colony of over five-thousand microbots. The rest are based on alien life forms from other worlds, mostly from the 47 Ursae Majoris system.”

He wondered why Laura-bot referred to James and Marta in the past tense, but he decided to ask about something else.

“How are the human core personalities chosen?”

“That’s the job of colonies, like Clement and Valentinus, that simulate biological humans,” Laura-bot replied. “They search out and choose people who are creative and enjoy art, music, sports, or hobbies. In your case, it’s surfing, hiking, and rock climbing. For me it’s reading, hiking, and tennis. There are tens of thousands of these humanoid colonies distributed around the earth.”
It seemed odd to Matthew-bot that such superficial activities would be the basis for selection as a core personality. Laura-bot seemed to be waiting for him to say something, but he was baffled. “I’m stumped,” he said. “This makes no sense to me.”

Laura-bot continued her explanation. “It seems that both the spiritual side of recreation and the kinesthetic aspects of it are critical to the microbots. During microbot sleep, the core personalities socialize and have adventures in virtual environments. That’s what you were doing at Hapuna Beach. The experiences of these activities, the movement, physical challenges, and relaxation, are generalized and integrated into the complex neural circuitry of the sleeping microbots.”

“Maybe this is not as bad as I thought,” Matthew-bot said. “When is my next recreation break?”

“You have much more important things to do,” said one of the lifeguard-bots.

“That’s right,” Laura-bot said. “So far, the microbots have overindulged you with recreation breaks in order to integrate virtual Matthew into the more complex intelligence of Matthew-bot. Now that you’re up and running, we need you for some important decisions that only human-based microbots can make. The alien microbots mean well, but they don’t have a clue how to deal with human sensitivities. They have no empathy for human social relationships.”

“OK, tell me more,” Matthew-bot said, doubting that he had much empathy for human social relationships either.

Laura-bot related what she knew about their colony. The colony had a choice of clock speeds at which the microbots worked. Clocks were now set so that ten seconds of colony time passed for every one second of earth time. This ten-to-one subjective clock
speed was very slow for them. The colony sometimes paced itself at extremely fast subjective times. The best computers on board, besides being molecular in scale, operated near the physical limits of computation. Nanotechnology was used everywhere in the colony. The alien colony members regarded the four human-based microbots as toddlers and denied them access to the most advanced technologies. Their training period would take earth years.

The wide variation in their core personalities made the microbots themselves highly individualistic and a bit unpredictable. But the one thing that was completely predictable was their dedication to observing and recording natural history. The records they had and the way these records were organized were amazing. But natural history unfolds at a slow rate compared to the pace of life in the colony. The microbots filled the time between significant natural history events with endless contests and games, as well as research on new computers and engineering devices. They also had a deep interest in mathematics.

“What’s our colony supposed to be doing now?” Matthew-bot asked, having heard enough of the general picture.

“You won’t believe it, but we’re in the shape of a mug that is owned by a young mother named Jennifer Davison. She bought us off the Web from CMSS.”

“But CMSS was just formed. I haven’t even met with them to discuss their strange product line!” For the first time, he felt that the “I” was out of place.

“You’ve been in training for several months earth time,” Laura-bot said. “Your virtual Matthew subroutine hasn’t been backed up with information from the biological Matthew since last September, the day Matthew first met Valentinus. That’s why you
can’t remember anything in his life past that point. The biological Matthew has met with CMSS a number of times.”

“I thought the virtual Matthews were backed up more often than that,” Matthew-bot said.

“They are, except while they’re being integrated into microbots as core personalities. That’s what is happening to you. Your virtual Matthew core will start getting regular backups soon.”

Despite all that was happening to him, Matthew-bot was curious about a minor point – something that had bothered Matthew when he first looked at the CMSS website.

“Why mugs?” he asked. “It seems like an odd choice for a shape. They could have chosen something more noteworthy.”

“Mugs are everywhere,” Laura-bot said. “They can be in any room of a home or office without being out of place. Just throw some pencils, pens, or scissors in the mug and no one will think twice about it.”

Matthew-bot wished he had thought more about the matter before asking the question.

“I should have guessed,” Matthew-bot said. “This colony of microbots is weird enough without drawing unnecessary attention to itself. How does this customer, Jennifer, like her mug?”

“Jennifer is happy with the mug, but she has no idea of its technical complexity or computational powers. To her, our sole task is to watch over her baby daughter Tracy. Due to sloppiness on the part of the alien-based microbots, Jennifer and her family have just gotten a glimpse of our colony’s ability to gather information. As a result, her
younger sister Kimberly became upset and tried to break the mug by throwing us onto a hard tile floor.”

Matthew-bot didn’t really care why Kimberly wanted to break the mug. He could easily imagine several scenarios.

“As we were hurtling toward the floor, a meeting was called,” Laura-bot continued. “Clock speeds were increased to sixty-thousand to one, so there was plenty of time for discussion. The microbots reached a conclusion about what to do, but, fortunately, before implementing it they consulted me.”

“You weren’t allowed in on the initial planning?” Matthew-bot asked.

“None of us human-based microbots were included. The microbots can change the shape and physical properties of the mug very quickly. They had decided to change the elasticity of the part of the mug’s surface destined to hit the floor. That change would have caused the mug to bounce like a superball. It would have bounced high off the floor, done a flip, and landed upright near its original position on the dining room buffet.”

“That’s really dumb, showing off,” Matthew-bot said. “What did you suggest?”

“I suggested that they allow the mug to hit the floor, make an appropriate sound, and display a crack of some sort. I also told them to leave the mug on the floor until someone, probably the adoring Jennifer, picked it up and put it back on the buffet.”

“Did they go for that?”

“Fortunately, yes. Jennifer did just as I predicted, greatly enhancing my stature with the colony. We are now back on the buffet. Unfortunately, the alien microbots continue to be careless about the information they’re providing. In addition, they’re debating whether or not to immediately repair the fake crack.”
“No way!” communicated the two lifeguard-bots, almost in unison.

The colony definitely needed the intuition and judgment of the human-based microbots even though, as microbots, they were no more than toddlers.
Burke Weber sat at the dining room table of his Carlsbad, California home on a Saturday morning. He and his wife Robin had worked late Friday night childproofing their house for the arrival of their nine-month old granddaughter, Tracy. Had they overlooked some sharp object, plastic bag, or dangerous chemical?

Burke looked across the table at his daughter, Jennifer. It seemed only yesterday that she too was a baby, sitting in her high chair in this same room. Now she was twenty-four and a proud mother. Looking backwards, time seemed to pass quickly. Retrospectively, we measure time by those events we choose to remember, but going forward we experience every detail.

Jennifer was feeding Tracy some mashed yellow squash. Bits of squash splattered on Jennifer, the high chair, and the nearby floor. Tracy became more and more uncooperative.

“The three-hour time change has her off schedule,” Jennifer said. “I’m going to put her down for her nap.” She cleaned Tracy with a wet towel, extracted her from the
high chair, and took her down the hall to the bedroom. She changed her diaper and put her in the rented crib.

Kimberly, Jennifer’s eighteen-year old sister, sat at the dining room table in sullen silence. As Jennifer and Tracy disappeared down the hall, Kimberly began to stir.

“Can I go now,” she whined. “I need to phone Ricky.”

Ricky, a student at a local community college, was her boyfriend.

“Go ahead and phone him,” Burke said. “But don’t leave the house without telling me.”

Kimberly dashed out of the room.

Burke and Robin sat together enjoying a few minutes of silence. Burke felt some pangs of guilt for not helping his law partners; they were putting in extra hours to cover for his absence. To make matters worse, given that he was not working, it seemed a shame to be sitting inside on such a nice day. Perhaps he could get the whole family outdoors. His daydreams ended abruptly as Jennifer reappeared, without Tracy.

“Tracy’s asleep already,” she said.

Jennifer picked up her carry-on bag and removed a large, plain mug. She placed the mug on the dining room buffet, arranged it to her liking, and said, “Show me Tracy.” A small glowing rectangle appeared on the surface of the buffet.

The Webers looked on in puzzled silence. Finally gaining his voice, Burke said, “What in the world are you doing?”

“That’s my baby monitor. I can see Tracy at any time. If she needs help, the mug will give a warning beep.”
Burke walked to the buffet and looked at the rectangular display. It showed Tracy asleep in her crib. He couldn’t see any physical connection between the display and the mug.

“What’s inside the mug?” he asked.

“The mug is the computer and communications part. It has to be on a flat surface with a good place for the display to appear.”

Burke wanted to learn more about the technology used in the baby monitor.

“What kind of transmitter is in Tracy’s room?”

“There isn’t any transmitter in her room,” Jennifer said, matter-of-factly.

Burke occasionally worked on patents for this type of equipment. There was always a transmitter and receiver working in combination.

“Where did you get this thing?” he asked.

“Off the Web,” Jennifer said. “A company called California Microrobotic Sensor Systems – CMSS for short. It was only forty dollars.”

The mug beeped, and a barely audible squawk came from Tracy’s room. Jennifer ran down the hall and soon returned with a sleepy baby. Robin and Jennifer comforted Tracy.

“Isn’t this a bit much?” Burke said, now back in his chair. “If some giant lifted me out of bed every time I made a noise in my sleep, I’d be dead in a week.”

“Yes, Burke, that would be fine,” Robin said, stroking the back of Tracy’s head. Burke let her remark pass. She was, he hoped, not paying attention to him.

Just then, Kimberly returned to the room in a huff. “Ricky isn’t answering his phone,” she said, as if the world was about to end. “Can I borrow the car?”
“Won’t you stay for lunch dear?” Robin said. “You haven’t seen your sister in ten months, and you’ve hardly noticed your lovely little niece.”

Kimberly walked to the buffet, picked up the mug, and inspected it. The glowing rectangle disappeared.

“Kimberly, dear, please don’t touch the mug,” Robin said. “It’s a computer that keeps track of Tracy.” Kimberly put the mug back on the buffet.

“I wish Ricky would answer the phone,” she whined. “Where is he?”

The display reappeared and changed the scene. It showed a king sized bed with a large hump under the covers. The hump was moving and shifting. The covers moved upwards and fell off the back of a lovely girl with long blonde hair. She was naked, upright, and moving rhythmically up and down. She held hands with a man. The display showed only his left arm and shoulder.

“Good God!” Kimberly cried. “This thing is showing porn flicks.”

All conversation stopped. Jennifer ran to the display, carrying Tracy in her arms. When she saw the scene on the display, she covered Tracy’s eyes as if such a sight would ruin her daughter forever. Robin approached the display until she could just make out what was going on. She went no closer.

“This is awful,” Jennifer cried. “You did this Kimberly. What did you say to it?”

“I didn’t say anything!” Kimberly yelled.

“Yes you did,” Burke said. “You asked for Ricky.”

“Do you suppose that’s Ricky in this bed?” Jennifer said.
“This is stupid,” Kimberly replied. “That’s not his room. Besides, how could this dumb thing find my boyfriend?” She tried to cover the display with her hand and yelled, “Stop this!” The display froze the motion but did not remove the scene from view.

“You need to say *erase*,” Jennifer said.

“Erase,” Kimberly yelled. The scene disappeared.

“What’s your boyfriend’s last name?” Jennifer asked, gleefully.

“Long,” Burke answered, with a tone of disgust. He hadn’t moved from his chair.

“Well,” Jennifer said to her baby monitor, “where is Ricky Long, Kimberly’s boyfriend?”

The display sprang back to life. The scene showed the same bed. The man put both arms around the girl and dragged her downward. As he did so, he rotated in the bed and assumed a position on top of her. She wrapped her long legs around his waist and pulled him firmly toward her.

Kimberly, recognizing Ricky, gasped and put her hand to her mouth. With uncontrollable fury, she grabbed the mug, threw it as hard as she could to the floor, and ran sobbing from the room.

Much had transpired inside the mug before and during these happenings in the Weber household. When Jennifer received her purchase from CMSS, she followed the instructions and placed the baby monitor on a flat surface. The display appeared and requested the name of the person or persons to be protected (Tracy, in this case) and the name of the primary caregiver (Jennifer).
The first step taken by the microbots was to query the databases of the natural history colonies and locate all people directly acquainted with Jennifer or Tracy. This information was organized into a “level-one acquaintance network.” The second step was to expand the level-one acquaintance network to a level-two acquaintance network. Any person directly acquainted with someone in the level-one network (but not added during step one) was added at this second step.

The often-unpredictable microbots made the decision about what “directly acquainted” meant. By anybody’s definition, Jennifer was directly acquainted with her sister Kimberly, and Kimberly was directly acquainted with Ricky. The microbots had placed Kimberly and Ricky under surveillance from the first day Jennifer received her mug.

When placed on the buffet in the Weber home, the colony released, within seconds, thousands of tiny, semi-transparent, flight-capable devices; each device, in turn, carried tens of thousands of small communications units. Each such unit was about twenty microns in diameter when deployed. As Jennifer walked with Tracy to the crib, the units attached themselves to the interior surfaces of the house and formed a chain of communications links from the colony to the crib. By the time Jennifer returned with Tracy to the dining room, communications units were situated in strategic places throughout the Weber household.

The hastily organized meeting of microbots, called to discuss how to deal with Kimberly’s temper tantrum, involved a consultation with Laura-bot. Fortunately, the alien microbots in the colony accepted her judgment about how to deal with the rapid descent of their mug toward the dining room floor.
Kimberly’s behavior horrified Jennifer and her parents. Tracy, on the other hand, watched her aunt with great delight. Jennifer’s prized baby monitor hit the tile floor with a resounding thud. She rushed over to the mug and knelt down to inspect it. Amazed that it was still intact, she gently lifted it and turned it over in her hands. “Thank God,” she exclaimed, “it’s only a crack.”

Burke was surprised that such a blow could result in so little damage. Having played various sports where things bounced off the ground or walls, he felt a sense of oddness about the mug’s descent. It seemed to decelerate slightly before hitting the floor.

“Where is Kimberly?” Jennifer said, having placed the mug back on the buffet. “That was a terrible thing to do! This baby monitor is very important to Tracy’s safety.”

The display near the slightly cracked mug lit up, showing Kimberly in the basement bathroom. “Oh good,” Robin said. “She’s not crying.” Then, realizing what she was watching, Robin shouted, “This is awful! Kimberly deserves her privacy. Stop it.” The display froze.

“You mean erase it,” Burke said calmly. The display faded away.

“I’m going to get her,” Jennifer cried, as she dashed from the room.

“Don’t tell her where we saw her,” Robin cried out to Jennifer.

Burke and Robin sat at opposite ends of the dining room table and braced themselves for the fight. Sounds of screaming came from the basement, followed by stomping feet and shouts, as Kimberly and Jennifer ascended the stairs and entered the living room. Soon, hysterical shouting came from the two sisters. The back and forth
banter grew louder and more out of control until the two girls began to gasp for air.

Suddenly there was silence. For several minutes, not a sound came from the living room.

“Now the real trouble starts,” Burke said to his wife.

Even Tracy sat transfixed. A barely audible chanting sound came from the fighting sisters. The sound got louder as the two girls marched around the corner into the dining room, Kimberly first, Jennifer close behind. They taunted their father.

“Daddy, Daddy, how are you? Where are your partners? At the zoo?” They continued to chant as they first approached their father and then, at the last moment, veered over to the display by the mug. They put their arms over each other’s shoulders and stood in front of the display, blocking it from the view of their parents.

“Where are Mr. Baker and Mr. Klein?” the girls said in unison. The display came to life again. A grassy area appeared, and a golf ball flew onto a green, followed by a cloud of sand. Struggling up after the ball, Sam Klein appeared on the display, sand wedge in hand. The scene shifted slightly and showed Mark Baker walking to the edge of the green. He pointed to the ball, which rested about ten feet past the hole. The girls didn’t know much about golf, but they suspected this was the course at their father’s country club. They also knew their father expected his partners to be working that day. Tormenting their parents came naturally to both girls. “Pretend it’s an orgy,” Jennifer whispered to Kimberly.

“This is gross, they’re naked!” Kimberly shouted, with mock alarm.

“I’m so embarrassed,” Jennifer added, putting her forearm across her face. “What will their wives think? Erase this!” The display went blank.
An audible gasp came from Robin, still seated at the dining room table. Burke saw that she was starting to hyperventilate. Sarah Klein, Sam’s wife, was her best friend. Robin made her way to the kitchen cabinet, got out a brown paper bag, and began breathing slowly into it. Carefully, she worked her way to the living room sofa. She lay on her side, breathing into the bag.

Tracy was enjoying the whole scene. She took careful notice of her grandmother placing a bag to her face. That looked like fun.

Jennifer and Kimberly, still standing by the baby monitor, consulted with each other in whispers for a few seconds, turned to face the living room, and chanted, “Mother dear as you recline, we will locate Sarah Klein.”

“No!” Robin cried. “Stop it you girls!”

“Better yet, ERASE!” Burke yelled. “You girls should be ashamed of yourselves. Look what you have done to your mother. Erase yourselves from this room, both of you.”

Kimberly and Jennifer walked hand in hand across the dining room, entered the living room, and sat on the sofa beside their mother. Kimberly took the paper bag from her mother’s hand, inhaled a couple of times, and let out a big “aaah” sound. Jennifer did the same and handed the bag back to her mother. Robin began to laugh. Soon all three were laughing out of control.

With his wife and daughters out of the room, Burke walked over to the display, hesitated for a moment, and then checked over his shoulder to make sure no one but Tracy was watching. “Where’s Sam Klein?” he asked the mug, in an almost inaudible whisper.
The display, with no noticeable delay, showed the start of the sixteenth hole of his club’s golf course where Sam Klein and Mark Baker stood calmly chatting. Burke’s momentary feeling of relief rapidly turned to cold fury. His daughters had made a fool of him and had almost done their mother in.

He thought of revenge. Jennifer’s husband, Rodney, wasn’t able to come with Jennifer and Tracy to California because he had an experiment going on in his lab that required “… constant attention over a forty-eight hour period.” At least that was Rodney’s excuse.

“Show me Rodney Davison,” Burke said to the mug. The display faded and then, after a pause of several seconds, formed into a scene showing Rodney seated on a couch.

“Well, well, Jennifer you rat, Rodney's lab ain’t where he’s at.” Burke yelled into the living room. “He’s sitting here, looking like a sap, with a lovely head in his lap!”

Burke heard noises as the girls untangled themselves and got off the sofa. Jennifer, with a horrified look, entered the dining room first.

“What do you mean? Let me see!” she shouted.

Burke huddled over the display and surrounded it with his arms and shoulders. Jennifer and Kimberly each grabbed one of his arms and began to pull. Robin joined in, grabbing her husband by his belt. Soon they extracted him from the display.

Rodney sat on a couch, watching TV and stuffing handfuls of popcorn into his mouth from a big bowl. To his left, stretched out on the couch, lay the family German shepherd Eva, her head resting on his lap.

“You’re so mean,” Jennifer yelled. “That’s our living room. He’s just watching football.”
“Well,” Burke said, “football isn’t his experiment, and your living room isn’t his lab.”

“Mark and Sam are playing golf,” Jennifer said, indignantly. “What Rodney’s doing is no worse than what they’re doing. They were supposed to be working at your law office.”

“That’s true,” Burke said. “Let’s call a truce and stop this silly nonsense.”

“We’re going to take Tracy for a walk,” Kimberly said. “You stay here, Dad, and watch the display. Make sure the crazy guy who lives down by the lagoon doesn’t kidnap us.”

“He may be crazy,” Burke replied, “but he’s not crazy enough to kidnap you guys.”

Burke had many things to think about. What sort of organization was CMSS, and what was the technology behind their unusual product? Had they filed any patents? He needed an excuse to visit their factory and meet the management. Their invention was unique in its ability to act with such versatility over a wide geographical range. He picked up the mug and inspected the crack.
Chapter Ten


Yesterday, Friday, ended my ninth week as Statistical Advisor to President Tannenbaum. I am disappointed that I have not yet had a meeting with the President. He is a busy man; one must be patient. He has been traveling the country giving speeches to rally the nation in the fight against terrorism. The pressures on Richard must be tremendous, yet he handles himself with great skill.

Although not fulfilling my primary function, I have not wasted my time. I have attended a number of seminars and lectures in the Department of Justice. A common theme in these presentations concerns the constant tension between catching terrorists and protecting privacy. Civil libertarians have been a constant thorn in the side of the Department of Justice. Is it necessary to give up our privacy to fight terrorists?

According to the dictionary, the right to privacy is “the right to remain apart from company or observation.” There is confusion, on the part of lecturers and audiences alike, between privacy and anonymity. Anonymity is the state of “being not named or identified.” On first consideration, privacy and anonymity seem to be states equally deserving of protection in our society. In fact, one must carefully distinguish between the two concepts. An example of this distinction arose in a surprisingly simple way.
Last Sunday, I took some time to search for a book for my nephew Todd. In searching through the children’s books, I came across a beautifully illustrated volume on prehistoric man. One large illustration showed a village with all of the various activities of hunting, gathering, cooking, and family life under way. Shown were various small huts where families lived. A central meeting hall occupied a plot of ground at the edge of a small forest. In the forest, people were gathering nuts and berries and collecting wood for fires. The number of individuals in the community was less than one hundred people of all ages.

At one location in the forest, hidden from the view of the rest of the community, a pair of young lovers sat close to each other and held hands. This young couple was having a moment of privacy. Certainly, no one in this community was anonymous. Everyone knew everyone else by name and family ties. While some privacy was possible in the village, anonymity was unheard of. Only in modern times, with crowded cities and rapid movements of people around the world, have people come to expect anonymity. Criminals and terrorists thrive on anonymity.

As a specific matter regarding terrorism, a high-level member of the Department of Justice mentioned to me, “off the record,” that my nephew, Jim Mathis, is doing great work in the war on terror. He is apparently the head of a top-secret project located somewhere in the Southwest. I am proud of him. His son Todd and wife Mary, if they were to know the importance of his work, would be very proud of him also.
Chapter Eleven

Official Visitors: December 17

Matthew Crigler sat on the cement wall near the main lifeguard tower at La Jolla Shores. It was 7:30 a.m. on a Monday morning in December. Fall Quarter was over. Behind him, to the east, the sun was beginning to color the sky. To his left, a mile across the bay, a northwest swell pounded Boomer and the Cove. The first northerly storm had edged through the area, dropping no rain but leaving its clear calling card for the surfers.

Today he and Laura were to travel to the CMSS factory to meet with Valentinus and Clement. This would be the eighth such meeting over the last three months. The meetings lasted about two hours, during which they gave their reactions to situations, real and hypothetical, involving CMSS and their customers. Laura was much better at this role-playing than he was. But the ultimate judges of this activity had to be Valentinus and Clement, and they seemed to indulge the opinions of both humans with tolerant interest.

The microbots had difficulty using good sense in interacting with humans. They meant well but had a very different point of view about information, never caring to distort the facts to avoid hurt feelings. While agreeing on general goals, the various colonies were individualistic in the way they carried out the details of their mission.
Increasing the number of human-based microbots would help the colonies interact with people more tactfully. At least that was the plan.

For the past two months, Laura had tried to include Matthew in her circle of graduate-student friends. Unfortunately, he was not very knowledgeable in philosophy, history, and theology -- all favorite subjects with Laura’s companions. No one took seriously his cosmological version of Gnosticism. In the few cases where someone wanted to listen to his views, his attempts to explain himself served only to expose, rather than hide, his lack of knowledge in the humanities. But, out of stubbornness more than conviction, he continued to defend his religious ideas even though he had vowed to avoid the subject entirely.

His main challenge this quarter was to get his research projects started. A one-quarter teaching break was a help; even with that, he found himself working long hours, often late into the night. One Ph.D. student, Nancy Chen, was now working with him in his lab. Next quarter, he would teach a graduate course. He was looking forward to the experience and, perhaps, to gaining new Ph.D. students interested in his research. He knew, however, that advising more graduate students would make significant additional demands on his time.

The increasing brightness of the morning sun prompted Matthew to look at his watch. It was a little after eight and time to go back to his apartment to meet Laura who would be arriving soon to accompany him to CMSS. He spun around, faced the parking lot, and pushed himself off the wall. A large new SUV sat with engine running at the far side of the lot. As he started to walk back to his apartment, the SUV pulled along side of him for a moment and then picked up speed.
He stopped at Playa Market for some fresh doughnuts to share with Laura. Arriving at his apartment, he noticed the same SUV parked across the street, with three men standing beside it. They seemed to be lost, but Matthew was in no mood to volunteer help. A few steps into his living room, he turned to close the door and found himself face-to-face with a large man holding a badge in his hand.

“You must be Professor Crigler,” he said, reaching out to shake Matthew’s hand. “I’m Special Agent Sam Denton of the San Diego Office of the FBI. Let me introduce Special Agent William Morgan of the Department of Commerce and Mr. Michael Trent, an engineer with the Institute for Telecommunication Sciences in Boulder.”

“Pleased to meet you,” Matthew said, with total lack of conviction.

Matthew assumed that Agent Denton’s visit was in connection with a security clearance for one of his friends. If so, this would be the third such visit since he started as a professor. The other two clearance interviews were in his office and involved only the FBI. He put the doughnuts on a plate and offered coffee to his visitors.

He took a closer look at Agent Denton. He must have been a former offensive lineman in the NFL. In spite of his size, he moved quickly and gracefully with an almost constant smile on his face. Matthew was both intimidated by his physical presence and reassured by his amiable manner.

“You look nervous, Professor Crigler. Please relax. This is a friendly visit to get some information from you. I’m accompanying Agent Morgan while he’s in San Diego. He’ll explain his concerns to you.”

Agent Morgan was a short, potbellied man with a red face.
“Just call me Bill,” he said, with a strained expression. “The wife of one of our high-level administrators purchased a mug from CMSS. She bought it to keep track of her young son and teenage daughter, but it’s been used by her to keep track of much more than that. We have many questions and concerns about this product.”

“I can well imagine,” Matthew said, knowing what sort of horror story might follow. “I’m just a consultant to CMSS.”

“We understand that your role in the company is limited,” Bill replied. “But we want to get background information from you before talking to Mr. Clement and Mr. Valentinus.”

Matthew doubted they would get much information from either Clement or Valentinus.

“Let me put it this way,” Bill said. “We’ve no interest in causing trouble for you, if you cooperate. Do you realize that CMSS has violated rules that fall under the jurisdiction of the National Telecommunications and Information Administration?”

“I’m not aware of any such violations,” Matthew said. “I’m a geophysicist, not a telecommunications engineer.” He wondered if CMSS had actually violated any such rules. Maybe Bill was bluffing. “I’ll be happy to cooperate,” Matthew said, thinking it best to play along with them.

“Good. You won’t regret it. We’d like you to answer some technical questions. I’ll turn that over to Mike.”

Mike stood and began to pace back and forth, looking very serious and thoughtful. He was younger than either Sam or Bill and in much better shape. His arms were lean and muscular with powerful calloused hands.
“I’ll get right to the point, Matthew,” he began. “Our group in Boulder purchased several mugs from CMSS. We’ve been trying to reverse engineer them. Just cutting in to them to access their interiors is a major project. Nothing inside accounts for their remarkable properties.”

Matthew recalled that the mere threat of cutting into the diorite caused it to transform its shape. He wanted to avoid any discussion of such matters. Fortunately, Mike moved on from the physical to the communications properties of the mugs.

“To make matters worse, our mugs won’t perform their communications functions for us like they do for others who have purchased them. In order to get any information at all, we have to work with parents who have purchased sensors to watch their kids. Some mug owners have let us take measurements of the energy fields around their sensors.”

Matthew had to make a decision. If he acted too dumb, it would be apparent to Mike that he was hiding information that any educated person involved with CMSS would know. He was getting very little technical details from his sessions with Valentinus and Clement. Perhaps he could exploit Mike’s curiosity and get some useful insights from him.

“The mugs emit many very small communication devices,” Matthew said. “Locally, like in a room, these devices number in the millions. They communicate both photonically and in broadcast mode. Some of the units, in small sub-clusters, act as receivers and others, also in small sub-clusters, act as transmitters.”

Matthew noted that Mike was interested but not stunned by this revelation. The Boulder engineers had surely discovered by now that the transmissions near the mugs
were at high frequencies, very weak, and hidden in the background noise. Mike and his colleagues would know the basic principles of cluster-based networks.

“So this explains how the device ‘keeps track of baby’ when baby is in the same house,” Mike said. “How does it eavesdrop on someone’s husband when he is …?”

Bill’s hand went firmly to Mike’s shoulder to silence him. Mike took the hint and said no more about this particular application.

Matthew responded to the intent of the question.

“The details of the long distance aspect are beyond me. Units like these are everywhere.”

“But we believe only a few thousand have been sold so far,” Mike said.

“A few thousand may be the number sold,” Matthew said, “but the number of supporting units in the field is much larger.”

“How can that be?” Mike said. “Our office has no record of anything like this.”

“The supporting units were deployed before CMSS went into business,” Matthew said. He was not about to reveal the true extent of the network or how long it had been activated on earth.

Mike, clearly shaken by this revelation, stopped pacing and sat back down. He glanced nervously at Sam and Bill who were downing the last of their doughnuts and coffee.

“That’s all the general questions I have,” Mike said to his companions. “I’ve learned a lot from Matthew. I want to talk to him some more about technical issues now. You two might as well go on and leave me here. I can walk to my appointment at SIO.”
Matthew opened the door for Sam and Bill, shook hands, and said goodbye. He then returned to Mike at the table.

“You’re not telling me something,” Mike said. “This is very strange.”

“I’m telling you all I can. You need to talk to Valentinus and Clement.”

Mike sat silently for a moment.

“What about patents?” he said

“CMSS hasn’t applied for any patents. I’m sure they won’t ever bother.”

“This stuff is worth billions of dollars if fully exploited.” Mike said. “Aren’t you worried that someone will steal this technology? The supporting network alone is invaluable.”

“Didn’t you say that you and your group in Boulder were reverse engineering some mugs?”

“That’s right. If we succeed and if you’re too lazy to protect your intellectual property rights, I can’t guarantee you and CMSS anything.”

“If you succeed! I’m betting you won’t.”

“You can help us, Matthew. I think you know more about this system than you’re letting on. Some friends of mine and I have formed a small company. We’ll make it worth your while. What are you getting from CMSS?”


Mike hesitated a moment and then began to laugh.

“You and I should get better acquainted. You have a great sense of humor. Do you like to rock climb? Some friends of mine and I are about to go on a trip.”
It then occurred to Matthew why Mike was in such good shape. His idea of a business trip was to work in some rock climbing.

“I rock climb occasionally,” Matthew said. He was, in fact, very skilled at the sport, but he disliked the mountaineering aspects.

“Next week some friends of mine and I are heading to the Eastern Sierra for some winter climbing. Care to join us? We’re going to do the northeast ridge ascent to Mount Williamson, returning by Shepherd Pass Trail. It’s an interesting challenge in winter. We’ll be doing some technical climbs as well.”

Matthew climbed Mount Williamson two years ago in early May, ascending the southeast ridge from George Creek and returning via Shepherd Pass Trail. He had never been so miserable on a hiking trip.

“No thanks,” he replied, with absolute certainty.

“Well, maybe some other time,” Mike said, helping himself to the last doughnut. “Think about making some money off these sensors. If CMSS can’t be bothered to patent their invention, maybe you and I could do something better with these things.”

“They’re harder to control than you realize,” Matthew said.

Mike opened the front door and began his walk to Scripps.

It was clear that Mike viewed the CMSS products as earth-based technology -- technology he and his colleagues could somehow manage to reverse engineer and exploit. Mike and his friends would keep Matthew’s revelations secret to protect their own imagined economic interests.
More serious was the interest of the FBI in CMSS. Once unleashed, the intrusion of government agencies into the company’s activities would only escalate. Would the FBI try to arrest Clement and Valentinus? That would be an interesting clash of cultures.

Matthew now understood the approach to marketing and distribution taken by CMSS. A sensor in the shape of a mug could be placed anywhere in someone’s home or office without drawing unwanted attention. Moreover, by carefully targeting their customers, CMSS had gained wide product distribution without, until now, alarming the FBI and the Department of Commerce. Who would see someone watching over their baby as a threat to national secrets? Very clever. But suspicion in government circles was growing.

He stepped into the kitchen to pour himself some coffee. The diorite colony sat on the counter; its display showed a pile of rocks and the label, “Shepherd Pass Trail rockslide yesterday 9 a.m.” As Matthew suspected, the colony took in the whole conversation. Mike, Sam, and Bill were now level-one nodes in his acquaintance network. He wondered how these representatives of officialdom would feel about this honor. Moreover, his natural history colony showed no sign of alarm at Matthew’s revelations to his visitors. His brain would remain intact for a while longer.
Chapter Twelve

Meeting with Management: December 17

Matthew quickly downed his coffee and phoned Laura. She was two houses down the street, frightened and sitting in her car. She had gotten as far as the front porch, overheard what was going on inside, and panicked.

They took Matthew’s car and drove north along the coast road past Torrey Pines State Reserve. It was a sunny morning with no wind. The CMSS factory was near the Del Mar Fairgrounds in a large dilapidated building with corrugated steel siding. A wooden ramp led to the entrance door.

They entered the building and let their eyes adjust to the dim light. Mugs ready for shipment lined the shelves. Wooden ceiling joists stabilized the two-story high roof and large wooden rafters. Along a twenty-foot section of wall stretched a large metal cabinet. A humanoid colony moved silently along the rows of drawers, periodically opening one, pulling out a new mug, and placing it on the shipping shelves. Any natural history colony could transform itself into a mug with ease. The only purpose of doing this transformation at the factory was to make the process seem normal to the casual observer and to leave a shipping record from a fixed point. Laura had named the glum
attendant to this process Igor. She intended this name as a joke, but it stuck with Valentinus and Clement.

Each mug that CMSS shipped had a few human-based microbots in training, but “a few” was not enough. The steady accumulation of instances of social insensitivity on the part of the microbots reflected their alien bias.

Matthew, transfixed by the strange production process, felt Laura grab him by the arm and tug him in the direction of the corporate office. In the center of the spacious but drab room was a large rectangular wooden table with Clement seated at one end and Valentinus at the other. Igor placed two chairs on one side of the table. Matthew and Laura sat down. On the wall opposite their chairs, a large monitor displayed a room full of equipment. Two microbots stood in the center of the room. Off to the side, constrained by a framework of tubes and clamps, a third microbot lay on a small bench.

Clement spoke first.

“We have changed the format of our meeting so you two can meet yourselves in microrobotic form. Mrs. Jennifer Davison sent her mug, the one in the center of the table, back to us for repairs. She and her father will be visiting us today to pick it up.”

During a previous management meeting, Matthew and Laura learned they were core personae for a pair of microbots assigned to one of the colonies. This must be that colony. Matthew looked at the two standing microbots. Thanks to the view screen, he could see every detail of their robotic bodies.

“I suppose one of these things has me as its core persona,” Matthew said. “They both look alike to me.”
One of the microbots waved what appeared to be an arm. The wave wasn’t very friendly, perhaps even obscene.

“The one gesturing is Matthew-bot,” Clement said. “That is the one with you as core persona. The microbot standing beside him is Laura-bot.”

“Hi, Laura-bot,” Laura said. “How are you?”

“Hi Laura,” Laura-bot replied. “I’m fine and so are you. Matthew-bot here has a serious attitude problem. You and Matthew are getting along much better than we are at the moment.”

It hadn’t occurred to Laura that bot-relationships might be more complex than human relationships. Their lives as super-intelligent beings might create interpersonal complexities that went well beyond those of human relationships.

“Sorry to hear you aren’t getting along,” Laura said. “As you probably noticed, Matthew has a negative attitude toward Matthew-bot.”

“What can I say to that?” Matthew-bot said. “I could tell him about my most recent surfing vacation, but I doubt that would cheer him up.”

“When I surf it’s in real water,” Matthew replied. “At least I know that no one is going to pull the plug on me halfway down the face of a wave.”

“Are you sure?” Matthew-bot asked.

Matthew wasn’t sure. The possibility that he lived in a simulated world had come to bother him. When alone, he found himself touching surfaces and rapping on things to check if they were “real.” Worse, he did this fully aware of the stupidity of it. He had told no one about this behavior. But Matthew-bot knew about it from the most recent backup of his Matthew core persona. Matthew-bot knew just how to annoy Matthew.
Laura had had enough of this macho nonsense.

“Let’s discuss more important issues,” she said. “Where’s this whole business of CMSS heading? Would it be better just to level immediately with the human race and scrap this so-called gentle introduction to the fact that we are all under constant surveillance?”

“I think not,” Laura-bot said. “We need time to select more humans to be copied and trained as core personae. A few human-based microbots are aboard each CMSS product, but the microbots based on alien life forms run the show.”

From conversations with Valentinus and Clement, Matthew had learned that the microbots maintained an extensive collection of sentient, virtual primates, including human ancestors and historical humans.

“Why can’t they use virtual humans from their historical collection as core personae?” Matthew asked, directing the question to no one in particular.

“The lives of virtual humans in the historical collection,” Laura-bot answered, “are sampled over short periods, weeks, maybe months. Their past experiences and human associates have not been reconstructed in sufficient detail. They are inadequate for use as core personae.”

“Could they just make lots of copies of you and Matthew-bot?” Laura asked.

“Yes, but that has its limits,” Matthew-bot answered. “They allow at most one microbot based on a particular core persona for each colony.”

“So we just have to be patient,” Laura-bot said. “Let’s hope the alien microbots can learn to deal more empathetically with humans.”
“Don’t count on that,” Matthew-bot added. “These alien colonies are used to observing and not interfering with life on earth. They calmly witness what we would regard as horrible atrocities, dutifully recording everything as if they were watching an ant colony.”

Matthew was more hopeful. Just that morning, the diorite colony, always present in his apartment, had begun to take a personal interest in him. He had not solicited information about the Shepard Pass Trail -- it was volunteered.

“I’m not so sure the aliens are indifferent,” Matthew said. “My diorite colony has no human-based microbots, but it has shown some measure of concern for me. This morning, without being asked, it informed me of a rockslide that had occurred on a prospective hiking trail.” Matthew was pleased to know something that Matthew-bot didn’t.

“The matter of whether or not to interfere in cultural history is one of great complexity,” Valentinus said, entering the conversation for the first time. “We have billions of years of experience with this matter and are still faced with grave moral uncertainties. But for now and the near future, we must interfere in human affairs.”

It was clear to Matthew that by forming CMSS, the microbots were interfering in human affairs. But to what end? Obviously, making babies and toddlers safer was not their end goal. The microbots clearly had bigger plans for the human race. But what were those plans? The information provided to people by the media was asymmetric, a one-way street. But the CMSS sensors provide symmetric information, greatly empowering the individual owners of the mugs. Maybe that was a clue….
“Our colony has clearly developed a proactive interest in Jennifer Davison and her baby Tracy,” Laura-bot said. “Even these crazy microbots from the 47 Ursae Majoris system are committed to protecting Tracy, but they are inconsistent, unpredictable.”

“We are well aware of this problem of inconsistency,” Valentinus replied. “These colonies are impossible to control in a detailed way. The colony on the table started the process of protecting Tracy by constructing an acquaintance network. They add additional nodes to the network when necessary. That is a matter of judgment left to each colony.”

Matthew-bot moved across the room to the constrained microbot, putting the appendage that would most likely correspond to his arm on the constraining contraption.

“What about this poor guy?” he said, with disgust. “His head was blown half off while playing golf. It’s lucky Clement had already made a copy of him and reconstructed his past. A sniper killed him the same morning his wife received her mug. She waited too long to initialize the protection process.”

There was silence around the table. Matthew and Laura didn’t know what Matthew-bot was talking about. Valentinus and Clement did know, but they seemed unsure how to respond to this somewhat crude assessment.

“That is Colonel J. P. Graves-bot,” Clement said. “He is a fine representative of the human race who will make a valuable addition to your team. He certainly will know how to assert himself with the other microbots.”

Laura let out an audible gasp. Clement had told her the story of Colonel Graves and the Sauceda Mountains Research Center. It was clear to her that Clement had formed
a strong attachment to Graves. Once again, the principle of non-interference was being set aside.

“His poor wife!” Laura-bot said. “She had just learned how to use her sensor and assigned it the task of protecting her husband. Her first inquiry about the whereabouts of Colonel Graves brought up the horrible image of him lying mortally wounded on the golf course. She’ll never recover from the shock. What good does the virtual copy of Colonel Graves do his human wife?”

“We have copied Mrs. Graves also,” Clement said. “She and J. P. are on a virtual tour of the finest golf courses in the world. J. P. has his choice of premium cigars from his favorite supplier. They’re having the time of their lives.”

“But what about the original Mrs. Graves?” Laura said. “She’s probably suffering in agony without her husband of many years!”

“Actually,” Clement said, “she is very ill and doesn’t have long to live.”

Matthew put his elbows on the table and lowered his head into his hands.

“But you could cure her!” Laura-bot cried, now also standing next to the constrained J. P. Graves-bot.

“Only by copying her,” Clement said, “and we have already done that.”

“I give up!” Matthew cried, raising his hands to the ceiling. “These guys will never understand.”

“Maybe there’s nothing to understand,” Matthew-bot said. “Maybe they’re right. Information is all there is.”

“That’s easy for you to say,” Matthew said. “All of my information is just a subroutine for you.”
“Without that subroutine, I become unstable, go nuts, whacko!” Matthew-bot replied.

Matthew realized that the microbots lived in a world where information was foremost. If they copied you and the original was “erased,” they thought little of it. You survived if the information that completely described you survived. He had thought long and hard about this issue but had not come to terms with it. Even Laura-bot, a microbot in training, had not adjusted to the idea.

Laura couldn’t resist asking the obvious question.

“Who killed J. P. Graves?” she demanded, looking at Clement with murder in her own eyes. “Don’t tell me you don’t know.”

“We know,” Clement said, “but that will have to wait.”

Clement, though not willing to divulge the name of the person who murdered Graves, decided to provide the general picture.

“Colonel Graves had the military police arrest Jim Mathis for murdering three homeless men and attempting to murder me. But Mathis was too important to Graves’s superiors. They removed Graves and forced him to retire, reinstating Mathis to his old position.”

“When was Graves killed?” Laura asked, wondering why she hadn’t heard about it.

“He was shot last Wednesday,” Clement said. “Army Intelligence has made a list of people who are to be assassinated – people they think know too much about the crimes of Jim Mathis. The hit man that killed J. P. Graves also killed the two detectives who brought the homeless men to the Saucedal Mountains.”
“What about you?” Matthew asked. “You’re the guy who informed the military about Mathis.”

“They have also attempted to kill me. Valentinus is on the list. They have not decided what to do about Matthew and Laura. The hit man’s inability to eliminate me has shaken the government’s confidence. There isn’t much point in killing someone such as Laura or Matthew who has secondary knowledge of the incident when a primary player, namely me, is still alive.”

Matthew wondered about the details of how Clement foiled the hit man. It was clear that there were many possibilities. Following the principle of least interference, he might have increased his clock speed, plotted the course of the bullet, and somehow caused it to miss. Alternatively, he could have messed with the hit man’s brain, causing him to forget what he was supposed to do. Now was not the time to ask about these details. Matthew hoped the hit man’s orders called for killing Clement before going any further down the list. The chances would be zero that the murderer could harm Clement.

“Do the people who own these mugs know about the level-two acquaintance network and how far afield that can lead in terms of spying on people?” Matthew asked.

“They don’t know about it in those terms,” Valentinus answered, “but they are beginning to get a general idea of the power of their sensors to gather information.”

Laura-bot had moved back to the center of the room; she stood there alone.

“There’s a serious problem with our colony’s policy,” she said. “Within the level-two acquaintance network, the alien microbots will immediately locate and display anyone that Jennifer asks to see. This policy will lead to big problems because few of the people they locate are in any way a threat to Tracy. The 47 Ursae Majoris microbots
can’t resist showing off how good they are at spying on people. Some very embarrassing scenes pop up on our display screen.”

“And that’s not the whole story,” Matthew-bot said. “The alien microbots decide that certain people, whether or not they are in the level-two network, are threats to Tracy. These people can pop up on our display screen at any time.”

Matthew felt a headache coming on. He had become exhausted trying to comprehend this strange world of information overload.

Fortunately, Igor appeared at the door.

“Mrs. Jennifer Davison and her father, Mr. Burke Weber, are here to pick up their sensor,” he announced flatly. He walked over to the table, reached down, and picked up the mug. The view screen went blank.

“That’s enough for today,” Clement said. “We’ll have another management meeting soon.”

Laura and Matthew followed Igor to the waiting area. Jennifer was sitting on one of the benches, with her father standing by her side. Igor carefully handed her the mug, which she placed in a small, well-padded travel bag.

“Hello Jennifer,” Laura said. “My name is Laura Stever. I’m sort of a marketing consultant here.”

“Oh! I’m pleased to meet you. It must be very interesting to work here.”

“And I’m Matthew Crigler, also a consultant.”

“Pleased to meet you too,” Jennifer said.
“I’m Burke Weber,” said Jennifer’s father, shaking hands with both of them in turn. “There aren’t many employees here, I expected more. Is Igor here the only one on the shop floor?”

“He does it all,” Matthew answered. “The production process is highly automated.”

“Do you have any advice for us about how to best use our baby monitor?” Burke asked.

“Well,” Matthew said, “I recommend that Jennifer make it a point to meet as many new people as she possibly can.”

“That’s a strange suggestion,” Burke said. “Why do you say that?”

“It’s not absolutely essential, but the mug works best when challenged by new acquaintances.”

“I like to meet new people,” Jennifer volunteered, without much thought as to why Matthew had made the suggestion.

“Where can I learn about the technical details of how these sensors work?” Burke asked. “Many questions remain unanswered. Patents for example. I can’t find any filed. How do these devices get information from such far flung sources?”

“To answer those questions, you’ll have to speak with Clement and Valentinus,” Matthew said. “It’s not easy to get them to volunteer information. I wish you luck.”

“I’ve had no luck approaching them on any front,” Burke said.

Jennifer and her father shook hands with Matthew and Laura, said goodbye, and left the building.
“You shouldn’t have mentioned the stuff about making new acquaintances,” Laura said, with a worried glance toward Igor.

Matthew took hold of her arm and walked with her to the car.

“We’re obviously in some danger now from both hit men and government agents,” he said. “Does the fact that there are already multiple copies of us make us expendable in the eyes of the microbots? I’ll try to convince the diorite colony to be more proactive in protecting both of us, and you need to stop procrastinating and get a mug for yourself. They’ve offered you one for free.”

“OK, but they give me the creeps,” Laura said. “When I invade someone else’s privacy, I feel like they’ve invaded mine.”

Matthew and Laura got in the car. They decided to get some lunch and go for a walk on the beach. Matthew still struggled with the concept of being copied.

“I had a nightmare last night,” Matthew said. “I dreamed I was in the army and about to be sent on a dangerous mission. My commander said the chances of me surviving were almost zero.”

“I think you’ve had that dream before,” Laura said. “Let me guess. You woke up at the thought of having to go on a dangerous mission.”

Matthew laughed and said, “No, I didn’t wake up at that point. There’s more to the dream. My commander said they’d made a copy of me so I wouldn’t have to worry about my family. As soon as they received official word of my death, they would send the copy home to my wife and kids. He even introduced me to the copy who was a regular human, not a virtual human. That’s when I woke up.”

“What scared you and caused you to wake up, the copy or the wife and kids?”
“I don’t know what caused me to wake up, but I know what kept me from getting back to sleep. A copy of me was going to take over my family when I died. Should that fact be a comfort to me? I just can’t accept such a point of view.”

“It doesn’t take Freud to figure out where that dream came from. This is like the dream you told me about last week, only in that dream you thought the copy was a good idea.”

In last week’s dream, he was in the doctor’s office. The doctor had bad news.

“You’re a hell of a mess, Matthew. You’re the first case of this illness that we’ve seen in the Northern Hemisphere. There’s no cure. We’ve made a disease-free copy of you. We’ll just get rid of this diseased version.” The doctor had the nurse bring the copy to his office so Matthew could meet him. He was a regular human. That’s when Matthew woke up.

After lying awake for several hours, he decided that, if actually faced with such a choice, he would take the doctor up on his offer. The next day he asked Laura how she felt about his decision. She said she would rather have the copy as a friend than lose him completely.

Matthew and Laura bought some food at a deli and ate lunch on the beach. Taking advantage of the low tide, they took a long walk and spent over an hour exploring the tide pools. He showed her the various creatures, their hiding places, and their behaviors. At one point, as they stood quietly watching a tide pool for signs of movement, Laura stood beside him and put her arm around him. He turned, faced her, and held her close. They started the long walk back to the car hand in hand. Matthew found himself rehearsing what he might say to Roger if they encountered him wandering
on the beach. Laura held his hand tighter and moved closer to his side. If encountering Roger didn’t bother her, it shouldn’t bother him.
Today is the start of my fifteenth week as Statistical Advisor to President Tannenbaum. The President once again cancelled our first meeting. This is understandable since he is preoccupied with the recent terrorist attack on the Port of Los Angeles. In addition, he has a serious political problem resulting from his frequent pronouncements that, due to his new security policies, such an attack could never occur.

On a more positive note, the long expected visit of Todd and his mother Mary took place this Saturday and Sunday. It was delightful for me to spend the weekend with them, but it was also exhausting. Todd is six years old and full of energy. I asked Mary and Todd to stay with me in my apartment, but they chose instead to stay in a hotel. In retrospect, it is fortunate they rejected my offer because after four hours with Todd at the National Zoo on Saturday, I was ready for a bit of solitude.

Sunday, I proposed a trip to the U. S. Botanic Garden near the Capitol Building on the National Mall. Mary said she would love to visit the gardens, but she doubted Todd would have much interest in the plants. Fortunately, she had brought Todd’s ice skates with them from Minneapolis. We took Todd to the Sculpture Garden ice rink, got
his skates on, and watched for a few minutes to make sure he was enjoying himself. He is very resourceful and didn’t seem to mind us leaving him alone for a while.

On our walk to the garden, I expressed concern to Mary about the safety of Todd. Mary, pointing to the large purse that she regularly carries, told me that she had purchased a device that kept track of Todd and would warn her well in advance of any harm that might come to him. As we walked in silence the rest of the way to the botanical garden, I became intensely curious about the nature of this device.

Upon entering the Conservatory, Mary found the nearest bench and sat down, motioning to me to do the same. She insisted that we sit at opposite ends of the small bench, leaving a space of about eighteen inches between us. She then pulled a rather large mug from her purse, placed it squarely on the bench next to her leg, and said in a low voice, “Show me Todd.” A small rectangular display appeared on the bench surface. The display showed Todd skating around the rink with the other children. It occurred to me that Mary’s “mug” must be a node in a much larger communications system. But what sort of system? I must have stammered something unintelligible, which Mary interpreted as a lack of understanding of the scene before me. She said, “Look at the bench between us, David, you’ll see Todd skating.”

Stupidly, all I could say was, “He’s upside down.” By that, of course, I meant that the picture was oriented for Mary’s convenience and appeared upside down to me. The picture then flipped so that, from my perspective, Todd was right side up. This reorientation of the image happened without any evident action on the part of Mary.

Mary again spoke to the mug asking, “Is Todd safe?” The display reoriented itself toward Mary and a small text field appeared. The text said, “Todd is safe.” She
then carefully put the mug back into her purse. As she did so, the projected display disappeared.

“I got it off the Web for forty dollars, Uncle David,” she said. “Isn’t that a bargain?”

As much as I enjoy the Conservatory, I found myself unable to concentrate on the collection as we walked around for the next forty-five minutes. Mary majored in art history in college; she is not technically inclined. She brushed aside my questions about how the mug worked, how it received its transmissions, and how it understood spoken English. As matters were to unfold, the display of Todd ice-skating was a minor revelation compared to what I witnessed later that evening.

We returned to the ice rink, picked up Todd, and headed for my apartment. Being both a homebody and a terrible cook, I often order takeout food. Mary and Todd had agreed to be my guests for an Indian dinner, which I had picked up earlier in the day. Only after we arrived at my apartment did it occur to me that a six-year old boy might not care for spicy food. Fortunately, Todd found some items he liked, especially the tandoori chicken and rice.

After dinner, I cleared the table and sat down with Mary over some freshly brewed coffee. She is raising Todd while working half time as a librarian. Her husband Jim is rarely home to assist her with any of the practical aspects of family life. She told me she misses Jim and is worried about Todd not having the supporting presence of a father.

Perhaps in technical violation of security rules, I told her that I heard that Jim’s work was very important for the war on terror. I hastily added that the work was top-
secret, and that I knew nothing of the details. It was then that Todd, overhearing our conversation, announced proudly that, “My daddy works with animals, even monkeys and chimps!”

At first, I assumed this vision of his father’s work was the product of a young boy’s overactive imagination. But Mary told me that Todd’s statement was true. Jim did work with animals that he kept in a large room full of cages.

“Can we see Daddy now?” Todd asked.

Mary checked her watch. “He’s probably working in his office this time of day and not with the animals,” she said, “We can try to check on him and say hi.”

She pulled the mug from her purse, put it on the table, and said, “Show me Jim.” The display projected the image of Jim Mathis onto the table. He was sitting at a desk, talking to someone seated opposite him. She said, “Come here and see Daddy, Todd.”

Todd ran over to the table shouting, “Hi Daddy, hi Daddy ….”

Mary informed me that Jim couldn’t hear what they were saying and, in fact, didn’t know they were watching him in this way. She was afraid to say anything to him because of the secret nature of his work. I was shocked that Mary’s sensor could so easily bypass the security screen around Jim’s lab. Clearly, something is illegal about a technology that penetrates secret government laboratories almost instantaneously upon request.

I asked Mary if the device would locate anyone she requested. The answer was no. However, she had observed that family members or direct acquaintances would always be located. Mary’s nephew asked her to use the mug to locate one of his college friends. That worked fine even though Mary had never met the nephew’s friend.
 Always trying to generalize, I said to Mary, “I’m your friend. President Tannenbaum is my friend. Ask your sensor to show us President Tannenbaum.”

 In a few seconds, President Tannenbaum, seated in a comfortable chair before a fire, appeared on the display. He seemed to have aged; of course, I had not seen him for many months. I asked Mary to shut down the sensor. This scene, though peaceful and benign, was an invasion of the President’s privacy.

 Usually, I would be spending Monday morning familiarizing myself with the topic of the afternoon seminar, but I find I can’t get Mary’s strange device out of my mind. I checked the Web and found a CMSS website with mug-shaped sensors for sale, starting at forty dollars. Perhaps I should buy one myself to get more familiar with it. On the other hand, I might be committing a crime by doing so. One might, while using the device for innocent purposes, commit crimes along the lines of privacy or security violations.

 Perhaps I should check with the various DOJ agencies to see if anyone is investigating CMSS. On the other hand, by making my request so specific, I will alert the DOJ to my own awareness of CMSS and its products. Do I want to draw suspicion to myself and, indirectly, to Mary in this way? I think not. Just how to proceed will require some more thought.
Chapter Fourteen

Mary Mathis: December 31

Mary Mathis sat near the fireplace in her Prospect Park home on New Year’s Eve. It was 10 p.m. Her hard-working husband Jim, originally scheduled to arrive at 4:30 p.m. from Tucson, was now to arrive at 10:15. He insisted on taking a taxi from the airport, to let Todd sleep.

Mary felt he had made the right decision. Todd was exhausted, having spent the evening at their neighborhood Fire and Ice Festival. Excited from horse-drawn hayrides, ice-skating, and too much sugar in the form of hot cider, he was finally asleep. He had expected his dad to go to the festival with him. Such disappointments were now the rule rather than the exception in Todd’s relationship with his father.

Jim had almost become a stranger to Mary. He began his career as an Assistant Professor in the Department of Electrical and Computer Engineering at the University of Minnesota. They bought their present home shortly after they arrived in Minneapolis. Mary loved the neighborhood, with its magnificent trees and friendly, politically active neighbors. The city of Minneapolis, with its cultural life and opportunities for children, was perfect for her. An advantage, not fully appreciated when they bought their home,
was that Jim could walk to work -- a real convenience in the harsh winters of Minnesota when driving could be difficult.

Life was great for them until five years ago when Jim, then just promoted to full professor, left his academic job to work on a top-secret government project located in Arizona, west of Tucson. That, officially, was all Mary knew about it. Mary moved with Todd to Tucson for the first two years of Jim’s government project. She missed her friends in Minneapolis, and she even missed the winters. Living in Tucson, they saw Jim infrequently. Seeking the comfort of familiar surroundings, Mary took Todd and returned to their home in Prospect Park. Jim accepted this change without objection; in fact, he seemed relieved.

Recently, thanks to a product she purchased from CMSS, Mary and Todd could watch Jim at work. She knew that this was wrong, but allowing Todd to see his dad helped heal the family’s separation wounds. The CMSS mug was a godsend for her. For the moment, the mug was out of sight behind the large schefflera in the living room. She knew she must tell Jim about it but didn’t want it to be the first thing they discussed. The trick would be to tell him before Todd did.

Mary busied herself cleaning the kitchen and removing Todd’s toys from the living room. She then prepared some hot cider and opened a bottle of rum for toasting the New Year. When she heard footsteps on the porch, she ran to the door, opened it, and saw before her an exhausted man who seemed to have aged ten years in the last two.

“Sorry I’m late, Mary,” Jim said. “Is Todd asleep?”

They hugged each other mechanically.

“Yes, he’s asleep. He’s exhausted from the festival at Luxton Park.”
“Do I smell hot cider?” Jim asked, trying to change the subject from the festivities he had missed.

“Yes you do! Sit down and I’ll get some.”

They sat in silence for several minutes, staring at the fire. Finally, Mary said,

“You look exhausted, Jim.”

“I’m in a hell of a mess. I’ve invested five years on this project. This classified work has screwed up my academic career forever. We’ve achieved amazing things, but I can only talk about them with a few people. We haven’t yet reached our final goal. Lately, everything seems to be going wrong, mostly just little things; lost data and unexpected trivial errors occur way too often.”

“You knew you were risking your career when you took on this project. You laid out the potential problems very clearly to me. Do you remember?”

“Yeah, you don’t need to remind me. I didn’t understand the vicious politics associated with this type of project. It corrupts all who work on it, including me.”

“Can you be specific?”

“No, of course I can’t. You wouldn’t want to know.”

The hidden mug sounded a single beep. Jim stood up so fast that he spilled cider on his shirt. He looked as if he’d seen a ghost.

“What was that?” he asked in a whisper.

“Just my kitchen timer,” Mary said, obviously lying. She knew that the beep was in reference to Todd. He was having nightmares, or he was no longer asleep. Either way, she was in trouble.
“Timer my ass,” said Jim. “I know that sound. Don’t tell me you have one of those damned things.”

At that moment, a sleepy Todd appeared in his pajamas. He saw his dad and ran to him with his arms out. The angry Jim couldn’t resist this display of affection. His frown turned to a smile as he scooped his son into his arms.

“Did you bring any of your animals?” Todd asked, clinging to his dad with all of his might.

Mary retreated to the kitchen as fast as she could without breaking into a run.

“What animals, Todd?” Jim asked, sitting down with his son in his lap.

“The monkeys and chimps you play with at your work,” Todd said, in all innocence.

It took only a few seconds for Jim to connect this revelation with the beep he had just heard. He held Todd’s arm so tightly that the boy squirmed to get away.

“Mary, get in here,” Jim yelled. Todd, having freed himself, took off for the security of his mother. “You’ve been spying on us with a CMSS sensor. Show me where it is, immediately.”

Jim stood and started toward his wife. Mary, now not hesitating to run, dashed over to the potted plant, lifted up the mug, and held it out at arm’s length to Jim. She was visibly afraid of him.

“Please don’t break it. It’s been a great help to me.”

“I won’t break it,” Jim said, holding the mug as if it were a viper. “But I can’t let you keep it. This thing’s a dangerous invention of some very strange people. Obviously,
you and Todd have been watching us at the lab. You’ve no idea how much trouble you’re in for spying on us; my career is in danger.”

“We missed you, Jim. We discovered almost by accident that we could watch you at work. Todd is very proud of you because you work with animals.”

“I kill the animals. They’re part of the experiments we do.”

Mary held Todd close to her. This information would be upsetting, perhaps incomprehensible to him.

“I don’t understand,” she said. “Why would you harm these beautiful animals?”

“I can’t get into that – pretend I never mentioned it. I’ll have to report this spying to the colonel in charge of our project; at some point, he’ll have to tell the DIA and the FBI.”

“Will they arrest me?” Mary asked, with despair in her voice.

Jim thought for a moment.

“I’ll tell them you discovered that this thing could penetrate our security for the first time recently. It was an accident, and you told me immediately. I’ll tell them you know nothing about our work.”

Mary had more immediate concerns than concocting a story.

“Must you take my mug?”

“If I take it, CMSS will get another sensor to you almost immediately. But it’ll help our case if I confiscate this particular mug.”

Mary was pleased she would get another mug soon, but she was afraid to express her feelings to Jim.
Jim placed the mug on the coffee table and continued his explanation. “We’ve purchased some of these sensors for analysis in our lab and tried to reverse engineer them. The ones we bring to our lab either don’t work or somehow disappear. At first, we suspected someone in the lab was stealing them. But we haven’t been able to show that to be true.”

“This one has worked perfectly,” Mary said.

“When these sensors function as intended, they construct a mysterious communications web about the person who purchased the mug and those designated to be cared for. In this case, that’s you and Todd. We’ve discovered in the last few days that mugs outside our lab can spy on us. It’s an insidious technology. It has to be stopped.”

“Maybe it’s from outer space!” Todd cried.

“Be quiet, Todd,” Mary said, taking hold of him by his arm. “It’s past midnight, you must get to bed.”

“Happy New Year,” Jim said, almost in a whisper.

“Happy New Year, Jim.” She was afraid to give him the traditional hug. He looked unapproachable. “I apologize for what Todd said about outer space. He’s been watching too much TV.”

“Don’t apologize,” Jim replied, in a voice that was barely audible. “My boy’s a genius. None of us thought of that.”

As Mary marched Todd out of the room, Jim sat down from exhaustion. He looked at the mug sitting on the coffee table next to his chair.

“Are you from outer space?” he asked. It gave no response.
It took Mary almost twenty minutes to get Todd calmed down. When she returned to the living room, Jim still sat staring at the mug. She sat down on the living room sofa.

“Can you tell me anything about what’s gone wrong for you, Jim?”

“I killed three men. I can’t get over doing that. I went nuts with overwork.”

Mary looked at him in disbelief.

“I can’t believe you would kill someone. They must have threatened you or tried to kill you -- it’s not even remotely like you to do such a thing. Do others know about what you’ve done? Will you be put in prison?”

“In a strange way, I was given a promotion for it. The colonel who had me arrested was removed from his job and forced to retire. I hated the guy, so it didn’t bother me. The colonel who replaced him, a tough bastard from Army Intelligence, said they’d cover up the murders because our experiments are so important to national security. Someone, most likely a government hit man, assassinated the retired colonel earlier this month.”

The mug beeped. Text appeared on the display, projected onto the coffee table.

*We copied the colonel and the three homeless men prior to their deaths.*

*Unfortunately, we did not copy the two assassinated detectives.*

“Good God, Mary,” Jim said. “Todd’s right. This isn’t earth-bound technology. We’ve never heard of a mug making such a statement.”

“What are we going to do?” Mary asked, in total confusion.

“I’ll return Wednesday to Arizona, take this mug with me, and tell our commanding officer that it showed you images inside our lab. Between you and me, it
showed the lab only once, early yesterday morning, December 31. You saw only a brief scene of my empty office. Remember that.”

“I’ll remember. But what about Todd and his animals?”

“Good point. I cancelled my December 30 flight due to problems in the animal lab. We’ll say you checked on me that day and saw me working with the animals. But you only saw me for a few minutes, around 9 a.m.”

“What about the mug?” Mary asked. “Will it contradict us?”

“The mug I take back with me will probably play dead, like the ones we try to reverse engineer. Even so, the military guys will be satisfied that I’ve taken it from you.”

“This mug has already done one very odd thing, making statements about copying people,” Mary said. “I hope you’re right about it going dead like the others.”

“It’s a chance we’ll have to take. I’ve been trying for weeks to get our intelligence people to go after the upper management of CMSS. I had a very strange encounter with one of them, a Mr. Clement, who posed as a homeless bum to get into our labs. He, or someone, penetrated our computer security and recorded stuff they never should have seen. They’re very advanced in their technical skills in communications technology. Now I’m starting to understand why.”

“You mean outer space?”

“It’s the only explanation possible. But it seems absurd … far-fetched. I’m not going to mention outer space to the intelligence people. They’d throw me in the nut house. I’m going to get the FBI to go after CMSS full force -- arrest the owners and confiscate their equipment. That way, maybe we can get to the bottom of this.”

“What could they arrest them for? CMSS has been a big help to Todd and me.”
“They’ll think of reasons to haul them in. That’s one thing they do very well. Security violations will be just a starter.”

Mary thought of telling Jim about Uncle David’s reactions to the mug. Perhaps she should tell him about the mug showing President Tannenbaum in the White House. But she decided not to mention any of that. She didn’t trust her husband anymore.

The thought of the FBI arresting the CMSS managers filled her with sadness. The government would intern them for years without explanation. What a comfort their invention had been to her in these lonely and difficult times!
Chapter Fifteen

The FBI Raid: January 5

Winter quarter had just begun. Matthew had only one course to teach, the first quarter of a graduate course in advanced seismology. He sat alone in his office at 8 a.m. on a Saturday morning, preparing for his Monday lecture on continuum mechanics. Yesterday, during his first lecture, he screwed up badly on some calculations -- no way to start the course. This time he would be over-prepared.

He found his new relationship with Laura exciting and distracting. She had jarred him out of his comfortable routine of research and surfing. It was fortunate that he could share the worrisome complexities of CMSS with her; otherwise, CMSS and Laura combined would have overwhelmed him.

For the last few weeks, he had neglected his lab. Fortunately, his only graduate research student, Nancy Chen, was hard working and independent. He had the time and energy to supervise another Ph.D. student, but he had better do a decent job on his lectures if he wanted to recruit one. If only he could focus.

He looked down at his stack of old notes on continuum mechanics. Note taking hadn’t been one of his strong points as a graduate student; these notes, in particular, were a mess. Perhaps a doughnut and some coffee would clarify his thinking. He grabbed a
few pages of notes from the top of the stack and started for the door. As he stepped out of his office, his cell phone rang. It was Laura calling from his apartment; she sounded very angry.

“Legs apart and hands on the wall,” she fumed. “Guns pointed at their backs. There must be fifty men surrounding the building. What bastards!”

“What are you talking about? Calm down,” Matthew said.

“The FBI is at CMSS. They’re arresting Clement, Valentinus, and Igor, and they're hauling away the equipment. The diorite colony is showing me the scene real-time. The microbots say that Jim Mathis, the murderer, initiated this raid.”

“What’s going on now?”

Laura paused before replying.

“The colony’s display says that Mike Trent, the engineer from Boulder, is approaching our front door. He phoned a few minutes ago and said he had to see us. Now the display has retracted. You’d better get home right away.”

Laura, still in her bathrobe, opened the door before the bell rang. Mike stood on the porch looking awkward and embarrassed.

“I apologize, Laura, but you and Matthew have to get over to CMSS right away. I’ve convinced the FBI that you two know nothing of technical importance about the sensors, but they may want you for questioning. They want me to bring you there.”

“Matthew will be here in a few minutes. Have some coffee while I get dressed.”

Mike sat down at the dining room table, picked up the diorite colony, turned it over a few times, and placed it back down.
“Aren’t you concerned that this rock will scratch your table?” he said, rubbing gently with his hand near the diorite.

“That’s Matthew’s fault for putting it there,” Laura said, with mock disgust. She picked up the colony and moved it to the kitchen. By the time she had dressed, Matthew was home and sitting at the table with Mike.

“Why now?” Matthew asked. “There’s been no dramatic increase in complaints about CMSS sensors.”

“Something happened that really pissed off some big shots,” Mike said. “All hell has broken loose. I’m supposed to bring you two to the factory in case you’re needed to answer questions.”

“Why can’t Laura and I just take my car and follow you?”

“OK. But that’s not exactly what I was told to do.”

Soon they were driving to the CMSS building, following Mike’s car.

Matthew, who had missed the diorite colony’s coverage of the raid, was shocked by what he saw. Three Ford cargo vans marked FBI sat in a row in the CMSS parking lot. Armed men guarded the vehicles. The FBI had backed a large truck up to the loading dock in front of the building. The long metal cabinet from which Igor had regularly pulled finished mugs was halfway into the truck.

Sam Denton, the amiable FBI agent from San Diego, approached Matthew and Laura as soon as they got out of the car.

“Hello again, Matthew,” he said. “Sometime in the next two weeks you and Laura will be questioned under oath about your experiences with CMSS. Don’t
disappear on us; we’ll know how to find you. As for now, hang around here in case we have some questions about the stuff we’re finding in the building.”

Confident he already knew the answer, Matthew asked, “Where are Clement, Valentinus, and Igor?”

“Each of those vans contains one of them. They’ll be kept apart so they can’t communicate with each other until they’re interrogated.”

“Oh man!” Matthew said. “You guys are really smart.”

Not noticing that Matthew was being facetious, Sam offered an explanation.

“Keeping the detainees separate is standard practice. The interrogators will tell each man that the others have ratted on him. That’ll cause them to lose confidence in their companions and come clean.”

“Come clean about what?” Laura said. “What are they being charged with?”

“They’re being turned over to the military as enemy combatants,” Mike volunteered. “Those orders are from President Tannenbaum himself.”

“The ‘enemy combatant’ designation will allow them to be held several years for military interrogation,” Sam said. “That’s more effective than civilian interrogation.”

“But what have they done wrong?” Laura asked.

“They’ve manufactured and sold equipment that’s been used to spy on some of the most secret projects being undertaken by the DOD,” Sam replied. “Their products have also been used for many tasteless violations of privacy.”

“So why haven’t Matthew and I been arrested?” Laura asked.
Matthew gave her a look of total exasperation. Fortunately, Agent Denton wasn’t paying any attention to her. He had walked away from them to help clear a path for the vans containing the newly acquired detainees.

Mike, still standing beside them, answered Laura’s question.

“They searched Matthew’s apartment and didn’t find anything from CMSS. They didn’t search Laura’s apartment, so don’t encourage them. I assured them that you were both technically ignorant of the company’s devices, and your only role was advice on marketing.”

“I guess that’s sort of true,” Matthew said. “Suppose they’d found a mug in my apartment? What would they have done?”

“Nothing for now, but President Tannenbaum has been meeting with his closest advisors and discussing the possibility of rounding up all CMSS customers. He hasn’t decided to do this yet, but he’s leaning toward the idea.”

“That’s crazy,” Matthew said, amazed by the stupidity of Tannenbaum. “These are mostly parents with babies. What’s he going to do, provide babysitters for them while they’re in jail? This will create a publicity nightmare for the government.”

“That’s one reason he’s hesitating,” Mike continued. “By the way, I haven’t told anyone about your comment that these things are augmented by a wide array of additional sensors. I’m still hoping you can come in with us on our business venture. Maybe we’ll have time to talk in private when things calm down. We need to transform this same technology into something exclusively for use by the DOD.”

Off in the distance, Valentinus, Clement, and Igor each sat in his own van. Matthew was certain that they were still in communication. He imagined the FBI agents
saying the usual, “You have the right to remain silent,” to each of the humanoids. The speech crews who, as always, were time-sharing between their linguistic tasks and their more interesting scientific duties would have received this invitation with gratitude.

Matthew knew that, although silent, the humanoid colonies would remain actively engaged with the people around them. The simulation and copying crews would explore the brains of the FBI agents and prepare them for copying, should that be necessary. Jim Mathis stood at the back of the crowd of onlookers. The Sauceda Mountains natural history colonies maintained several updated copies of him.

The mugs on the loading dock were most likely ordinary ceramic mugs, not colonies of microbots. But where were the colonies now? Matthew noticed some rocks and bricks piled against the side of the now empty building. Could they be the actual colonies? He knew that the company computers, now loaded into the same truck that contained the cabinet, had been just for show; their loss meant nothing to the project. The CMSS website would go on as before.

Laura had been staring at a row of corvids that sat on a fence overlooking the raid: some crows, some ravens, and a couple of very large jays. She nudged Matthew to get his attention.

“Look at those birds, Matthew. Someone has drugged or poisoned them. They don’t look right.”

“How can you think of something like that at a time like this,” Matthew said.

Laura continued to stare. Then she started to laugh.

Matthew felt sorry for the enthusiastic Sam Denton who had now assumed a role of importance in directing the Ford vans out of the parking lot. If Denton thought that his
association with this event was going to get him promoted, he was probably mistaken. Matthew was certain that the humanoid colonies had some reason for allowing the FBI to arrest them. The worst thing the FBI and the DOD could possibly do, in terms of protecting their own secrets, was to take the three humanoid colonies deeper into the government’s world of classified information. The microbots would affect everyone they encountered on their journey into the labyrinth of secrecy. Selected individuals would have nano-scale recording units embedded in the glial cells of their brains. Common objects in their prisons and interrogation chambers would be transformed into natural history colonies, recording every event.

Sam Denton and some other FBI agents were motioning for the crowd of curious onlookers to leave. The truck, now pulling away from the loading dock, contained all of the confiscated equipment. Jim Mathis, who had initiated this whole operation, approached an FBI agent who was standing nearby. Matthew heard him tell the agent that it was extremely important to give the CMSS detainees very thorough physical exams, including CAT scans, before interrogation. The agent, intent on the departing vans, didn’t seem to be paying much attention. Matthew wondered how the humanoids would deal with such an intrusive physical exam.

Mike was off in the distance talking to the TV news crews while Denton was absorbed in his role as FBI advisor to the raid. Matthew decided that he and Laura should leave immediately. Denton knew where to find them if he needed them.

They drove in silence until they were several miles from the factory. As the road leveled out along the coast, with the comforting power of the ocean clearly in view, Laura broke the silence.
“The crows and ravens that I thought were drugged are actually colonies. I bet you didn’t notice.”

Matthew wished she would stop pointing out all the things he didn’t notice.

“Right, I didn’t notice. I was pretty sure that the mugs they confiscated aren’t colonies of microbots any more.”

“Another thing that’s weird,” Laura said, “is how does Mike, a low level government engineer, know about President Tannenbaum’s discussions with his advisors? How does he know that Tannenbaum is thinking about rounding up all owners of CMSS products?”

Mike Trent did have several mugs for reverse engineering. But the mugs, by his own admission, weren’t functioning properly. Matthew had an idea.

“Suppose one of Mike’s friends bought a mug, and Tannenbaum is a threat to that person’s child. Mike may be learning things about Tannenbaum indirectly from the friend.”

“Way too complicated,” Laura said. “Maybe Tannenbaum is a threat to everyone. Then anyone who has a mug could observe his activities.”

Matthew again felt a bit irritated. Her suggestion was a brilliant one.

“Slow down Matthew, here’s your apartment,” she shouted, grabbing his arm.

He swung into the narrow driveway, stopped the car, and jumped out. As he stood waiting for Laura, he noticed a package sitting by the front door and rushed to the porch to inspect it. When Laura finally arrived, Matthew was gently shaking the box.

“It’s a package to me from Jennifer Davison,” Matthew said. “Do you know her?”
“Of course I know her. So do you. She owns the mug where Laura-bot and Matthew-bot are in training.”

Matthew started to open the package but then thought better of it.

“Wait! Let’s check with the diorite colony about this, it might be a bomb.”

“Nonsense,” Laura said. “Let me open it.”

They entered the apartment. Laura pulled the tabs on the carefully constructed package, dumped some packing material onto the dining room table, and lifted out a CMSS mug. Inside was a card that said, “Compliments of Jennifer Davison.”

Laura inspected the mug for a moment, handed it to Matthew, and went to the kitchen to get the diorite colony.

“Why has this mug been sent to Matthew?” she asked.

The diorite colony responded immediately to her question.

This is round one of a series of rounds in which CMSS will give away mugs as gifts. During each round, to get a gift you must satisfy two conditions: (1) you are not the owner of a mug and (2) you are directly acquainted with someone who does own a mug. This basic round of giving will be repeated at approximately one-week intervals until almost everyone on earth has access to a sensor for personal use. Give this mug to Ms. Chen so she can watch over her parents in China. Otherwise, she would not get one until the next round.

Matthew knew enough mathematics to know that it wouldn’t take many rounds to cover everyone on earth, except for a few very isolated people. It seemed that the reclusive Nancy Chen wasn’t, at present, directly acquainted with any mug owner. Not even Laura, now a mug owner herself, had met her. Nancy, of course, was directly
acquainted with Matthew, but that didn’t count -- the diorite colony was not a product of CMSS.

“This is going to result in one hell of a mess,” Matthew said.

The diorite reassured him.

*Don’t worry. Human-based microbots are in training aboard every mug. Their core personae are based on people who can be trusted to use good judgment. Criminal or other inappropriate uses will never occur.*

Matthew was skeptical. The alien microbots were the ones that actually ran the colonies. They were great natural historians but hardly in tune with human sensitivities. Could they be counted on to follow the advice of the human-based microbots? He foresaw a spreading community of angry and embarrassed people exposed in the act of committing a wide range of indiscretions.

“I knew they would do something dramatic,” Laura said. “But I never expected this. There’re going to be major problems ahead. At least this way everyone who gets a mug will have an acquaintance that already has one.”

Matthew wondered how the microbots chose the sender of the gift.

“Why, was this mug sent to me, compliments of Jennifer? They could have sent it compliments of you instead. I’m in the level-one network of your sensor.”

Laura hesitated a few seconds and then smiled. “When they last used you to back up the virtual Matthews, they noticed you’d forgotten who Jennifer was. They’re giving you a hint to pay more attention to the people you meet.”

“Way too complicated,” Matthew said. “But thanks for the advice.”
Turning the mug over to Nancy would put her parents in her level-one acquaintance network. They would get a mug in a week or so. Was Laura right about the President being a threat to everyone? If so, Nancy’s parents in China would soon be able to watch Tannenbaum going about his daily business.

Laura repackaged the gift mug as best she could. Matthew phoned, checked that Nancy was in the lab, and told her that they would be there in about twenty minutes. “I have a little gift for you, Nancy,” he said.

The horrible thought of losing both Laura and Nancy to an FBI roundup of mug owners suddenly dawned on him.
It is Friday evening. A call last Monday morning from President Tannenbaum dictated my activities for this past week. Richard’s call came on a secure line at BJS. He apologized for not being able to get together with me in past months. I assured him that I understood how hectic his life must be.

The President informed me that he would like me to apply my statistical talents to a matter of concern to him. To assist me, he agreed to provide me with special travel funds.

He explained the problem as follows. Last fall, a previously unheard of company called California Microrobotic Sensor Systems posted a website. On this site, they offered sensors for sale; the sensors were in the form of mugs. Their advertisement stated that parents could use these devices as baby monitors to keep track of their infants. Although pleased with their purchases, most CMSS customers initially failed to notice that the technology involved in these devices is extraordinary. As use of the product
expanded to parents tracking their teenagers, people also started to use the CMSS mugs to track their spouses and even more distantly related family members.

I encountered one of these units last December when Mary and Todd visited me here in Washington. To make matters worse, as I shall explain below, I myself now own a CMSS mug. Clearly, President Tannenbaum was not pleased with these devices. I probably should have informed him of my familiarity with this company’s products, but I couldn’t bring myself to do so during our conversation.

The President said he wanted me to investigate these sensors and report my findings directly to him and only to him. He gave me permission to consult with the FBI, and, importantly, he assured me that the FBI had agreed to cooperate with me. Federal agents had arrested the CMSS founders and confiscated their equipment last Saturday.

He also told me that the company’s executives were very strange men. They had refused to say anything at all, even to acknowledge their names. These men are old and it is not clear how much stress they would be able to take during interrogation. The President assured me that the “intel-types” would hold them in solitary confinement two or three weeks before using any of the usual methods of interrogation. “Solitary confinement is often enough to crack senior citizens,” he said. I had to wonder how many senior citizens the government had put in solitary confinement in order to come to this conclusion. Perhaps the President was once again in the realm of subjective statistical thinking. For a senior citizen, to spend a week alone in the dark would be to waste one week from an unknown but possibly not very large supply of such weeks.

In conclusion, the President informed me that his staff had advised him to get tough with anyone who owned a CMSS sensor. At the minimum, the government should
confiscate all units sold. But no one knows for sure how many people have purchased the mugs and where these people are. The FBI had hoped such information would be on the company’s computers. But the computers were useless. “That’s where you come in,” the President said. “I want you to get an estimate of the dispersal of these devices. Prepare a report for me. Make any communications to me in the form of a letter. I’ll send a courier when you are ready.”

With that, plus a few cordial words, President Tannenbaum hung up. The insistence on a courier suggested to me that he had doubts about his own electronic communications security. On a personal note, the president was kind enough to acknowledge that my nephew Jim was instrumental in getting the FBI to move on CMSS.

This conversation with the President left me with some difficult issues. One cannot get an estimate of the dispersal of anything without knowing some basic facts. These facts seem to be precisely the ones that are, thus far, not available to the FBI or the President.

As noted above, I was less than candid with the President about my personal experiences with these sensors. In addition to my experiences during Mary and Todd’s visit, a strange event occurred last Saturday evening, January 5. As I left my apartment, I found a package from Mary placed at the base of my door. I went back inside, opened it, and found a mug from CMSS. The card inside read, “Compliments of Mary Mathis.” I promptly phoned Mary, thanked her, and asked her what motivated her to send me this gift. She said, “I didn’t send it, Uncle David.” Apparently, a number of her friends had also called to thank her for sending them sensors.
Last Monday evening, after the President’s call, I thought about the difficulties of a purely statistical approach to the task the President had put before me. I thought of Mary and her friends as a possible source of additional information. In addition to being an attractive and intelligent woman, Mary is a good organizer. It is true that she is not technically inclined, but she has plenty of common sense.

I phoned her and asked if she would get together with her friends who were mug owners. I suggested they work as a team and learn as much as they could about their sensors. “I’m sure my friends would love to do that, Uncle David,” she replied. “I’ll organize a potluck.”

For the rest of the week, I spent most of my time following up on the President’s suggestion to contact the FBI. In the end, that proved a waste of time. Whatever assurances the President gave me regarding their cooperation, he had not successfully conveyed such assurances to the FBI.

I was pleased to get the following email from Mary early this morning:

_Dear Uncle David,_

_My friends and I got together for a CMSS potluck. We learned from questioning the sensors that each unit is a complex colony of microrobots (also called microbots). The colony makes use of highly advanced computers and machines._

_I began our meeting by demonstrating how my new sensor (Jim took my original one) could show President Tannenbaum at work. All the other sensors could do the same._

_When the clamor from that calmed down, and we were wondering what to do next, Todd asked my sensor, “Are you from outer space?”_
The sensor displayed the following:

“Yes, originally from a region near the Sagittarius Arm of the Milky Way.”

When I read these words to Todd, he took it calmly. “I told you so,” he said.

My friends are convinced this outer-space claim is a joke programmed into the sensors by the CMSS engineers. However, something Jim said to me on his last trip home makes me take the statement seriously. I’m not free to discuss my conversations with Jim on this matter.

We noticed that for some questions one mug would respond but others wouldn’t. They almost seem to have personalities.

One aspect of our investigation was particularly disturbing. Some of the queries to the mugs resulted in tasteless invasions of privacy, to the point that we decided to remove the children from the room. We asked the mugs to post their privacy policy but got no answer (at least while we were all together). After my friends left, my mug gave a beep to attract my attention. The message displayed read, “There will be a privacy policy soon. Count on it. Colonel J. P. Graves-bot.”

This message quickly disappeared with no follow-on message. A Web search for “j. p. graves” brought up a horrible news story of a man shot by a sniper on a golf course last month. Could this be another prank by CMSS engineers? If so, it is in very bad taste. Clearly, we have a long way to go to learn about these devices. I hope this limited information is a help to you.

Love, Mary

This was indeed a help. In the last four months, anyone could have asked these same questions. Apparently, no one had. CMSS sold their sensors to parents for
watching over a baby or loved one. That intended purpose oriented people’s minds
toward a particular application. I guess we often ignore the ancillary potentials of the
technology around us. The message from J. P. Graves-bot was very confusing to me.

I need to give some serious thought to what I am going to do with this new
information. I would very much like to ask guidance from my colleagues at BJS, but I
see no way to bring this up without looking foolish. I have the weekend to think this
over; maybe I can come up with something.
First Lieutenant Sean Penrose sat in a small underground office in the Chiricahua Mountains of Southeastern Arizona. He had just finished reading the so-called B-b Guidelines for torture, which stated that for treatment to constitute torture:

The victim must experience intense pain or suffering of the kind that is equivalent to the pain that would be associated with serious physical injury so severe that death, organ failure, or permanent damage resulting in a loss of significant body function will likely result.

He had to read the statement several times. What crap. Too subjective.

“I think I understand what this is saying, Captain Taylor,” he said. “But how does this relate to the building of Camp Sigma?”

“Too many senior citizens couldn’t survive interrogation when the B-b Guidelines were used to define the outer limits of physical abuse,” Captain Taylor replied.

“President Tannenbaum ordered the construction of Camp Sigma within days of taking
office. This camp is for the specific purpose of confining and interrogating seniors who are a risk to our country.”

Sean shook his head in disbelief. Captain Ashley Taylor was commanding officer of Camp Sigma’s Joint Detainee Operations Group (JDOG). She was in deep-shit trouble. Sean read the national news regularly. He’d never seen anything about senior citizens dying from interrogation. Of course, the government would classify any such deaths as secret. His dad was a senior and a very tough one, but he had a bad memory. Maybe that was also a factor in the deaths. Some seniors couldn’t come up with the facts even if their lives depended on it.

“These B-b guidelines are vague and poorly worded,” Sean said. “I see your point. For an old person, organ failure might come sooner than for a young person. Even a loud noise or trying to jump out of the way of a jogger or bike might do it.”

“Exactly. Our guidelines here are different from those at the regular interrogation camps. We’ve returned to the older DOD three-category guidelines. The government has modified even those interrogation procedures for our seniors. You can call me Ashley if you wish.”

“This is an intimidating place, Ashley. To get to this room, I went through four sets of double-caged doors guarded by angry MP’s.”

“Camp Sigma is the latest Halliburton prison camp. It’s got all of the new technology; an escape would be impossible.” She added that last remark by habit and suddenly felt very foolish.

“I guess we might say almost impossible,” Sean said. “That brings us to the point of my visit, your legal defense.”
“You seem very young to be an Army Judge Advocate,” she said. “Have you ever had a case like this before?”

“I’ve never had any cases. Right after passing the Arizona bar exams, I went straight to the Army Judge Advocate General’s Corps. Just finished their twenty-week training program. Now I’m an Army lawyer.”

Ashley looked shaken. “You don’t understand. I need someone who knows what they’re doing. My career, maybe my life, depends on this.”

Sean stared at her in silence for a moment before speaking. “I know what I’m doing. Count on me to bust my ass on this case.”

“If I’ve insulted you, I’m sorry. It’s just that I’m stressed out.”

“I accept your apology. Now let’s get down to business. Apparently, three old guys managed to escape from this Halliburton fortress. Your commander has accused you of aiding them. What’s your story?”

“I did nothing to aid them, but I was the last one to visit them in their solitary confinement cells. That makes me the fall guy.”

“Who are these guys who escaped? When were they admitted to Camp Sigma?”

“There were three of them, all admitted on the evening of Saturday, January 5. They were from a private company in California, initials CMSS, that made baby monitors. They had violated some sort of rules concerning communications technology. Two of them, Mr. Valentinus and Mr. Clement, were executives in the company. The third man was a worker. We don’t know his full name. One witness refers to him as Igor, but that may be a joke.”
Sean put down his pen and paper. Maybe this shouldn’t be his first case. “Why would these guys be put in Camp Sigma? This is no place for white-collar criminals.”

Ashley was silent for a moment, thoughtful.

“I don’t know why they were sent here, but there are others here who are even less likely candidates for high security interrogation. The government works that way. They’re being super cautious – protecting their asses. That’s also why they keep people here so long. No one wants to be responsible for releasing someone who might cause trouble later.”

This whole business of government camps was frightening to Sean. In a strange way it made him glad he was in JAG Corps; maybe he could change some of this nonsense.

“What did the CMSS detainees do to get solitary confinement?”

“It’s standard procedure for seniors,” Ashley replied. “They all go to solitary for the first three weeks they’re here. In about half the cases, that’s enough to get them to talk without any formal interrogation. Isolation is a Category II counter-resistance technique, allowed under our DOD guidelines.”

“I’ve heard some horrible rumors about solitary confinement in our government’s detention centers,” Sean said.

“Our seniors are isolated under much more humane conditions than those used in the regular centers. Each of our solitary cells has a metal-frame bed of excellent quality, the same type of bed used in our hospital. There’s a toilet in one corner of the room and a washbasin in one of the others. The basic restriction is that our detainees can have no
personal items or reading material for the duration of their isolation. Their cells are dimly lit but not completely dark.”

“So these CMSS guys went into isolation from the moment they arrived. Don’t cameras watch them the whole time? If so, that should be enough to clear you. We could see how they got out and who helped them.”

“There are video cameras, but something seems to have gone wrong with them. Gaps occurred.”

That was bad news. It would make Ashley’s case much more difficult for him. He needed more details.

“We may have some problems ahead for us Ashley. Tell me about the times you were asked to visit the cells of these guys and about any procedural irregularities, however slight, that you or anyone else committed in dealing with them.”

“I only visited their cells once. Three irregularities have occurred that I know about, two before my visit with them, the third after.”

“Take them in order,” Sean said. “Give me all the details.”

“Well -- this is embarrassing to me -- the evening the three men arrived here I got an email, sent to me at home, from my former commander at Fort Huachuca asking that the CMSS detainees be given regular exercise. That’s not allowed during the solitary confinement phase.” She handed Sean a copy of the email.

The email was from Dan Stallcup. It was short, “Make sure CMSS guys get phys. exs.”

“So what’s embarrassing about this? Why does he think they need to get exercise?”
“First, it is highly inappropriate for a U.S. Army officer who is not involved with interrogation to interfere with our procedures. Colonel Stallcup, above all, should know this. He’s no longer associated with interrogation and detention in his new duties.”

“What are his new duties?”

“They have to do with some sort of super-secret weapons project in Southwestern Arizona. I probably shouldn’t even have mentioned that much to you.”

“I’m your lawyer. I need to know such things. I still don’t see why this email should be a problem for us.”

“Under our rules, I’m supposed to reveal any such note to my superiors. I didn’t do that. Stallcup and I were close friends at Fort Huachuca.”

Warning signals went off for Sean.

“So, you were trying to protect Stallcup at the risk of your career. How close to him were you? Sorry to ask, but that’s something I need to know.”

“Very close. We were lovers.”

Ashley’s face had become as red as her hair. Sean paused to let her regain her composure. Stallcup, whoever he was, was a lucky man to have her as his lover. He looked again at the email.

“Are you sure this refers to physical exercise? Maybe Stallcup meant physical exams, like the doctors checking them over.” Sean hated the lazy habit of abbreviations, a habit prevalent in the military. Ashley looked surprised.

“I guess it could mean that. We do give them physical exams at the end of solitary confinement, before interrogation starts. Stallcup would know that.”
“Maybe, for some reason, these particular men should have had physical exams at the start of solitary. We’ll never know because we’d be fools to call Stallcup to testify. So much for the first irregularity. What’s the second?”

“The second involves the dog. Solitary confinement for seniors is not entirely solitary. We stop by their cells at least once a day for a few minutes to make contact, to give them a hint of things to follow. The linguists will chat with them a few minutes, small talk. The MPs will bring their dogs by, enter the cell, and restrain the dogs as they try to attack the prisoners. It’s just show; they don’t let the dog’s get close.”

“So let me guess, the second irregularity is that a dog bit one of your prisoners.”

“Stranger than that. An MP brought his dog into Mr. Clement’s cell Monday morning, January 7. Amazingly, the dog was afraid of the prisoner. The MP became furious. He dragged his dog so close that it could have bitten Mr. Clement.”

“Good,” Sean said. “That’s got to be a violation of some sort of rule. Continue.”

Ashley leaned closer to Sean and lowered her voice.

“The video cameras show that Mr. Clement didn’t move or say anything to the dog or the MP. But for some reason the dog went limp, collapsed. It’s a big dog and the MP had to carry it out of the cellblock. This made him and his dog the laughing stock of the other handlers. That MP will kill Mr. Clement if he gets a chance.”

Sean was enjoying the story but beginning to doubt its usefulness for Ashley’s defense.

“So that makes this MP a possible suspect in the disappearance of the detainees. That’s something we can keep in mind. Is the MP still angry?
“Furious! His dog has never recovered. It’s forgotten its training and acts like a puppy. Don’t you think that’s weird?”

This whole outfit seemed weird to Sean.

“ Weird as hell,” Sean said. “It’s like the dog had its brain erased without suffering any serious physical effects. I’ve never heard of anything like that, but I’m not a great fan of dogs of any sort. It’s my intuition that this incident is tangential to your case and is unlikely to either help or hurt you.”

“Do you want to hear about my one and only visit with the detainees?” Ashley asked.

“Of course! That’s the most important thing before us. Your case hinges on what happened during that visit.”

“I’m a trained linguist, specialty Slavic languages. But I’m also an expert in ASL, American Sign Language. These guys have not said a word since we arrested them. In a regular interrogation center, they would get the shit kicked out of them for remaining silent, but we have to be more gentle here. One of the other linguists suggested I try ASL on them.”

“What the hell,” Sean said. “You don’t even know if they can speak?”

“They can speak English. We’ve learned that from their customers. ASL was a long shot, but it worked. I tried it on each of them, and each one responded. In keeping with regulations, our conversations were short and about trivial stuff. That was Friday afternoon, January 11. The next morning we discovered them missing from their cells. The cell video cameras had malfunctioned that night.”
“That’s amazing,” Sean said. “It’s like they have split personalities. The part of the brain that does regular speech has gone on strike, but the ASL part is ready to go.”

Sean was thoroughly enjoying the mystery.

“All right, now we’re getting to the important part. You don’t know exactly how they got out, but tell me what you do know. You also need to tell me the third irregularity. Your visit to their cells as a linguist was a part of your job, not an irregularity.”

“The third irregularity was the presence of storage trunks in their cells. Remember, we don’t allow personal effects of any sort in the cells. Each of the CMSS detainees had a large storage trunk under his bed. We discovered this fact after the men escaped. This is not just a small irregularity; this is a huge irregularity.”

“Certainly they can’t blame you for this violation. Besides, the cell cameras must have recorded the presence of the trunks. More amazing is how such trunks could get past all of these MPs.”

“My best guess is that some accomplice put them there before the prisoners were brought to their cells. Once per week the MPs do a thorough inspection of the interior of the cells. Video cameras show the last such inspection, done on January 10, and show the guard looking under the beds. He claims he saw nothing. The cells are poorly lit, and the trunks were made from a heavy black plastic. I suppose he could have looked right at them and not seen anything.”

Sean was hopeful; his interest revived.

“These trunks, Ashley, are the key to getting you cleared. We need to show that you had nothing to do with them. If they are heavy, you couldn’t have gotten them to the
cells without help. We need to trace them to see who manufactured them and who purchased them. Where are they now?”

“The trunks were hauled to a storage facility above ground in the general maintenance area for Camp Sigma.”

Sean now had an opportunity to get others involved, people outside the closed world of the detention center. Energized, he sat on the edge of his chair.

“Great. I’ll get permission to inspect them and bring some experts with me. Who do I contact here to make arrangements?”

“That would be the Army Corps of Engineers representative assigned to our project. But the MPs told me the trunks are missing. They’ve been stolen.”

With this news, Sean slumped back in his chair, his hand rubbing his eyes. He felt a headache coming on.

“Man, that’s bad news for us! How in the hell could that happen?”

Ashley, obviously fascinated by the mystery, waved her hand in the direction of the camp’s general maintenance area.

“The outside area is pretty secure but nothing like here. Still, it’s amazing that anyone could steal such large items.”

Sean had no regrets about joining the U.S. Army JAG Corps. Would his other cases be this challenging?

“I need to think about all of this, Ashley. My gut feeling is that the folks who are really in trouble are the ones who moved those trunks to the maintenance area. You’re going to get off with no stain on your record. But that’s only lawyer’s intuition. Let’s meet again in one week, same time and place.”
“Thank you Sean,” Ashley said, with a big smile that made her look radiant. “I’m looking forward to seeing you next Thursday. Maybe we’ll know more about all of this by then.”

Sean worked his way past the MP’s, checked through the main gate, and climbed into his car. He felt a profound sense of relief to be out. The whole place was repressive, bordering on lunacy. About half a mile from Camp Sigma, he pulled his car over to the side of the road, got out, and stood for a moment looking back. A large fence of iron bars, topped with coiled barbed wire, surrounded the outer perimeter of the camp. Guard towers were placed every fifty yards. Searchlights swung back and forth, covering the grounds in a seemingly random pattern. Guards stood at the main gate night and day. How could anyone escape?

Three very unusual events happened in connection with the detention of the CMSS prisoners: in violation of the rule against personal items, someone put trunks into the men’s cells; the men escaped from Camp Sigma; the trunks disappeared from Camp Sigma. It was a miracle that any one of these events took place without detection, let alone all of them.

Sean looked again at the layout of the detention center. The most likely possibility was that the movements of the men and trunks were somehow bundled into the fewest possible challenges to the security structure of the camp. That would mean that the three trunks came in by the same method, at the same time or nearly so, and the men, together with the trunks, went out together.

Someone could have used the trunks to smuggle the men out of the Camp Sigma maintenance area. But the MPs discovered the trunks in the cells after the men were
gone from those same cells. Why delay the escape of the men from the outer perimeter until the trunks had been removed from the cells? Besides, word of the discovery of the trunks had gotten around. That would make them risky containers for the escaping men. What a mess. He sighed, got back into his car, and drove off into the rapidly darkening desert night.
Monday morning, January 14, I flew from Baltimore to San Diego to meet Laura Stever and Matthew Crigler. Mary discovered that Laura and Matthew had, prior to the FBI raid, acted as consultants for CMSS. They are familiar with the company’s history. Fortunately, the FBI did not arrest them along with the other CMSS personnel.

Laura and Matthew were at first hesitant to meet me. I assured them that I am an owner of a CMSS mug, and that I am not associated with the FBI, except through the general umbrella of the Department of Justice. After some discussion, they changed their minds and decided to make time for me. Later, I was to learn that they were so advised by Matthew’s sensor (uniquely, not a CMSS product).

My plane arrived in San Diego at about 2 p.m. With only a light carry-on bag, I took a taxi directly to Matthew’s lab at SIO. I was scheduled to meet him at 4 p.m. Laura and Matthew had invited me to stay for dinner that evening and had offered to take me to my hotel in La Jolla afterwards.

I arrived at the lab thirty minutes early. Ms. Nancy Chen, a Ph.D. student from China who is working for Matthew, invited me into the lab. She explained to me that her
family in China lost their home in a terrible earthquake. This tragedy motivated her to
study seismology and improve earthquake prediction. Nancy and her parents in China
have CMSS sensors; the family is now able to communicate easily with each other.

Matthew arrived shortly before 4 p.m. After taking care of a few details in his
lab, we started our drive to his apartment. The sun shone low in the sky over the open
ocean to the west, illuminating the vast expanse of water in rich color. As we drove,
Matthew pointed out the surf and gave me some tips on catching waves near the Scripps
Pier. His advice, I’m afraid, meant nothing to me. Laura greeted us on the front porch of
their apartment. She gave us each a glass of chilled Chablis, and we sat down to watch
the sunset from their small living room.

After a moment of peaceful silence, I gave them each a copy of Mary’s letter and
asked them what they thought of it. Laura and Matthew assured me that Mary’s report of
the situation was correct, including, to my amazement, the outer space claim. Many other
fascinating aspects of the situation emerged in the course of the evening, including why
they had to refrain from mentioning the alien presence for many months. Due to the
sensor proliferation, which they also described, they are no longer obliged to remain
silent.

Matthew dropped me off at my hotel a bit after 10 p.m., late for me because of the
time change. My Tuesday return flight to Baltimore was uneventful, but it consumed
most of the day. I checked my email when I arrived at my apartment and found several
messages that thanked me for sending mugs. The spread of the CMSS sensors seemed to
be accelerating.
Wednesday morning I composed my analysis of the situation in a letter to
President Tannenbaum.

Dear President Tannenbaum,

This letter is in response to your phone call of January 7. This is an ongoing
investigation. However, I feel that I have made sufficient progress to justify this
preliminary report.

Regarding CMSS and its founders, we are dealing with an invasion from outer
space. Their civilization has been on earth, unnoticed, for over one hundred sixty million
years. It is only in the last year that a select few humans have been aware of their
presence. The life forms that constitute the core of this invasion are tiny robots. The
height of each robot is about the thickness of a piece of paper. We can refer to them as
microbots.

A CMSS “mug” is, in fact, a complex community. Inside are over five thousand
microbots, controlling a vast array of machines, tiny computers of immense power, and
shielding (the outer layers of the mug) which they can rapidly reconfigure to different
shapes.

Most such microbot communities now on earth (in excess of fifty billion of them)
are not in the shape of mugs but are shaped as various objects (e.g., rocks, shells, fish,
birds, household objects). Their purpose is to record in detail the natural history of the
earth. Throughout most of the time these natural history colonies have been observing the
earth, they have not interfered with earth’s history.

For some reason, about ten thousand years ago, the microbots formed certain
colonies of larger size and computational power. Each such colony takes the shape of a
person. It can walk, talk, and interact minimally with humans without being recognized as a machine. A humanoid colony has the advantage of being able to mingle with humans and, by so doing, study them in detail. It is able to copy the structure of a person’s brain and body. In this way, a humanoid colony can make sentient, virtual copies of individual humans.

I digress here to issue a warning. The microbots do not regard a person as dead if they have copied that person prior to biological death. I do not share this viewpoint although it is an issue worthy of careful consideration.

As another warning, CMSS founders, Mr. R. T. Clement, CEO, and Mr. F. P. Valentinus, CFO, are humanoid colonies. It will be difficult to keep them confined against their will. Their shape-changing ability alone will be a challenge for those in charge of their detention.

The FBI raid of Saturday, January 5, on CMSS has resulted in a great proliferation of their sensors. Within a few months, just about everyone on earth will have access to a sensor. Sensors that start out as mugs can change to other shapes and can communicate with their owners in many different ways.

Anyone who has a sensor is able to monitor you at any time of the day or night. I don’t think you should take offense at this. The aliens have bestowed this dubious honor on you because of your powerful position as President of the United States.

Sincerely,

David Mathis
Statistical Advisor to the President
I wrote this letter in my office at BJS, finishing it during the noon hour when most of my colleagues had gone to lunch. I phoned my designated contact person, the President’s Staff Secretary, and a courier arrived within an hour.

By early afternoon, most of my BJS colleagues had arrived back at work and were giving me a hard time, in a friendly and joking manner, about the gifts I had sent them. They were greatly entertained by the mugs and had discovered new aspects of their information gathering powers. At first, they saw many statistics-related uses for such devices. However, I couldn’t help pointing out how the dispersion of these sensors might cause a dramatic decrease in crime. A long discussion ensued on this topic, ending with concern for the future of the BJS itself. I told them that perhaps the Environmental Protection Agency would come more into vogue as crime diminished, and I suggested that they get their applications into the EPA. They did not appreciate my humor.

I left early to pick up some dinner. When I got home, I decided to do a quick search for news on the Web related to CMSS.

The first article had appeared Tuesday in the Minneapolis Star Tribune, “Prospect Park Ladies Put Too Much Rum in Cider?” The story described, in mocking terms, a group of Prospect Park residents, Mary Mathis included, who had made claims of an invasion from outer space. The text of the article acknowledged that the women themselves were skeptical of the outer space claim, but their skepticism, unfortunately, did not save them from ridicule by the paper.

The second article, also from Tuesday, was an editorial from the San Diego Union, a staunch supporter of President Tannenbaum. That piece strongly defended the right of the FBI to raid the CMSS buildings, confiscate their equipment, and arrest the
owners. The editorial called for the President to classify the CMSS founders as enemy combatants. The writer did not mention outer space or President Tannenbaum’s involvement in the raid.

By Wednesday, news articles had become more factual in nature. The Washington Post mentioned the January 5 raid on CMSS, describing their products as sensors to watch over infants. It gave a brief description of Valentinus and Clement (with no mention of Matthew or Laura). The writer wondered what might have moved the government to such concern that they would raid CMSS. The Post had tried, unsuccessfully, to get information from the FBI. Reporters could not discover the whereabouts of those arrested. They noted that, besides the CEO and CFO, the FBI arrested the only worker in the factory.

Thursday morning I arrived at BJS earlier than usual. At about 8:30 a.m., I got a phone call saying that a courier was on his way with the President’s reply to my letter of the day before. The reply was disappointing.

Dear David,

Thank you for your letter concerning the CMSS products and people. My staff showed it to me, and I returned it to them with some brief suggestions. They are going to study your letter and bring any needed policy recommendations to my attention.

We have been friends for a long time. We are both getting along in years. You are in constant competition with talented younger people in your field at BJS. I, on the other hand, am in charge here in the Oval Office. It is rare that anyone challenges my judgment. Your situation of “old versus young,” with the older person always coming in
second, can lead to great stress. Stress, as you know, can lead to delusional behavior, depression, and lack of sleep (leading to more stress).

You remember, I hope, our original discussion of your appointment as Statistical Advisor to the President. I said that it would be on a year-to-year basis, depending on funds. My advisors have informed me that we are short of special funds for next year. We will allow you to complete your service for this calendar year. During that time, I will continue to value your brilliant statistical observations.

We will continue your health benefits, including behavioral health, through the next two years.

Your friend,

Richard Tannenbaum

President of the United States

The President’s letter, probably written by one of his staff, was surprising to me. In effect, Richard had dismissed me from my post. After some initial disappointment, however, I began to see the bright side. By that morning, Thursday, January 17, I had already begun to have concerns for the future. The BJS itself would be under a lot of strain to make predictions about the rates at which various criminal offenses would decline. Funding for the courts and justice system would depend on these predictions -- it would be a tense time.

As I write this entry in my journal, it is late in the evening, Friday, January 18. It has been an exhausting week for me. The news is filled with discussions of CMSS and its products, including talk of an alien invasion from outer space. The big news from my
perspective is a personal interview with Clement and Valentinus reported by the New
York Times and done in their New York offices -- Clement and Valentinus are no longer
in detention. I doubt that the military released them intentionally as the government
keeps enemy combatants for years, not just weeks. As a senior citizen, I can’t help but
take personal pleasure in the escape of Clement and Valentinus (and probably the
unmentioned Igor as well). It is nice to know that these seniors, at least, failed to crack
under solitary confinement.
Matthew, just back from an early morning walk on the beach, sat in a comfortable bedroom chair and watched the sleeping Laura. He wanted to wake her for company, but he knew she enjoyed getting extra rest on weekends. Silver gray hair sticking out from under the blankets, she tried to dislodge the gold necklace that had worked its way up across her face.

At the risk of waking her, Matthew walked over to the bed and gently dislodged the necklace from the bridge of her nose. As he did so, he looked closely at the small medallion attached to the gold chain. Beneath the raised image of a Christian cross was written, “Mark 13:31.” He remembered first seeing this medallion when they were students at Berkeley. In all these years, he had never read the verse referenced on the medallion.

He picked up Laura’s Bible from her nightstand and walked with it to the light of the large bedroom window. He fumbled around a bit before finding the Gospel of Mark. Then, locating Chapter 13, Verse 31, he read, “Heaven and earth will pass away, but my words will not pass away.” He usually had trouble understanding what he read in the
Bible but not this time. He was reading a proclamation of the triumph of information over the physical world, exactly the point of view of the microbots.

Matthew wondered if the microbots, despite their protestations of noninterference, had arranged for the insertion of Mark 13:31 into the book. For the sake of consistency, they would have also gotten the same verse into the Gospels of Matthew and Luke. He had just begun to search Luke for the suspect text when Laura stirred, stretched, pushed the covers away from her face, and called for him.

By the time he had walked over to her, she was sitting on the edge of the bed, enjoying the aroma of freshly brewed coffee. Matthew took hold of her hands and helped her stand. He was reminding her that the grandchildren were coming to visit in the afternoon when suddenly, in the usual way, it all ended.

Within microseconds, the reality of Natural History Colony 8945EH38 engulfed them. Now communicating in high speed streams of bits, Matthew-bot said, “I guess it’s time to get back to work. That was a great weekend.”

For this virtual weekend, they had chosen to relax in their beach home as senior citizens. He knew Laura-bot would be upset about missing the grandchildren. She would have some angry words about their interrupted day. But she surprised him with different concerns.

“Why did you move my Bible?” she asked.

“I looked up Mark 13:31, the reference on your medallion. Despite all the recreation breaks we’ve had together, it never occurred to me to read that verse until now. Where’d you get the medallion?”
“I bought it from an old man on Telegraph Avenue when I was a student at Berkeley.”

“Was he a humanoid colony?”

“My only visual image of the guy who sold me the medallion is from the mind of the original Laura. That’s not enough information for me because she wasn’t really paying attention to him.”

“I’ve just scanned the records,” Matthew-bot said. “There were several humanoid colonies around Berkeley at that time. Their exact movements and day-to-day visual imagery weren’t archived. We’ll probably never know who sold you your medallion.”

“I’m sorry,” Laura-bot said, “it would be fun to know.”

In the twenty-first century, when the great proliferation of CMSS sensors occurred, human culture descended into a time of chaos. The original Matthew referred to this time, ending at the start of the twenty-second century, as the CMSS singularity (he pronounced it “see mess” singularity). The economy of the time depended largely on hype, if not outright deception. With everyone having access to a sensor, many business sales became hard to make. Crime decreased dramatically, which was good, but many hard working people in the criminal justice system had to find other work. Politicians, in particular, had a difficult time.

The first two years after the start of the singularity were the most chaotic. The microbots dropped all pretense of non-interference. Some militias attempted to confiscate sensors from everyone in their territory. They were stopped by partial brain erasure, resulting in soldiers milling around not knowing how their rifles worked or what
they were supposed to be doing with them. Small groups of humans tried to go underground and erect shielding to protect themselves from observation. The microbots ignored them unless they became dangerous to themselves or others. Anyone, anywhere, anytime could follow the daily activities of world leaders. Attempts by nation states to restrict sensor use failed.

To the surprise of most doomsayers, by the end of the twenty-first century the human race came to a new equilibrium. Once human-based microbots in the colonies attained a certain level of influence, it was possible to adopt a privacy policy compatible with human sensitivities. Colonel J. P. Graves-bot got the ball rolling. Even then, many traumatic experiences occurred. No one was anonymous.

Over a period of five hundred years, the human population dropped by eighty percent. A smaller population, combined with healthier lifestyles, cleaner air, and increasing medical knowledge, resulted in “modern humans” having an expected life span well over one hundred years. People everywhere wanted the microbots to make virtual copies of them – they viewed this as a form of immortality. The ultimate honor was to become a core persona for a microbot.

Matthew-bot was thankful that the rest period just completed involved only Matthew, Laura, and their family. The prior virtual rest period was a social gathering with core personae of other human-based microbots. Human-based microbots were now the most prevalent type; the 47 Ursae Majoris microbots had almost all moved on to other planetary systems.
“I don’t think I can take any more socializing with core personae that are based on modern humans,” Matthew-bot said.

J. P. Graves-bot, who had just entered the control chamber, agreed.

“Not only do I avoid playing golf with them, I don’t even want to be on the same course with them,” he said. “They’re too aggressive. You wouldn’t think a virtual golfer would cheat, but these guys do.”

“The problem is that modern humans have gone nuts over sports,” Laura-bot added. “The idea of having a core persona is to make each microbot a stakeholder in some given place and time in the universe. A core persona should represent something special about a particular planet and civilization at a particular time. For our civilization, that special thing doesn’t have to be sports. It could equally well be art, music, or a hobby.”

Matthew-bot agreed with her. But athletes, for reasons having to do with innate human preferences, enjoyed the most reproductive success. Modern humans excelled in such sports as track and field, swimming, golf, and tennis. They excelled in team sports as well. Sailing contests were constantly under way on all of the earth’s major bodies of water. Magnificent solar sailing ships raced around the inner planets, cheered on by hundreds of millions of faithful fans.

“These days,” J. P. Graves-bot said, “the selection of core personae is controlled by microbots based on modern humans or their recent ancestors. Those who do the selecting are themselves crazy about sports. It’s an ingrown system, like promotion in the military used to be before the singularity.”
“There’s a more subtle aspect to this that neither you nor Matthew-bot noticed,” Laura-bot added, gleefully aware that she was insulting both of them. “In our day, core personae were selected for traits they happened to have. In recent times, core personae have been selected for traits they’ve passionately worked to achieve.”

Matthew-bot hadn’t thought of that. Laura-bot had once again irritated him with her delight in showing off her insights. Modern humans had an intense personal investment in what they had become. Of course they were more aggressive.

Virtual reality sessions involving core personae were not the only social obligations of the microbots. There were also periodic meetings between microbots and living, biological humans.

“I’ve had it with my role as head of my clan,” J. P. Graves-bot said. “These meetings bore me. Remember, I was at the first meeting between humans and microbots, hosted by Valentinus and Clement at the old CMSS factory. The original Laura and Matthew attended.”

“Matthew-bot and I attended as participants,” Laura-bot said. “You were out of it, cabled to your programming module.”

“Maybe I wasn’t booted up yet, but I was the center of the conversation. I’ve seen the replays.”

Modern human society was organized around clans. Each clan consisted of a large group of living humans together with related microbots. J. P. Graves-bot was the patriarch of a sizeable clan.

“Heading the clan is your duty,” Laura-bot said. “In your case, most clan members are your descendents. Try to be reasonable. You’re the ‘head ghost,’ as the
biological humans call you.” She knew he disliked being called a “ghost” even though, in the context, the word had some justification.

“The biological humans in the clan may be my descendants, but they’re maddening to deal with. It should be easy to resolve their fights; we have the complete records of everything that happened. Show them the truth and they still argue.”

“Calm down,” Matthew-bot said. “At least you don’t have to be Conference Chair at scientific meetings organized by modern humans. I’m stuck with that every time.”

“You’re Conference Chair because you’re the biggest sucker,” Laura-bot said. “They’ve flattered you into doing it. You’re supposed to have administrative duties only, be just a figurehead.”

It was essential that humans develop their own science and technology -- at least that was the official policy of the microbots.

“She’s right,” J. P. Graves-bot said. “That hint you gave at the last seismology conference was way beyond your official duties; it was a real blunder. If you give them a chance to discover these ideas on their own, they’ll do it.”

They were quiet for a few microseconds, thinking things over.

“Most of the microbots based on modern humans aren’t willing to take on our next assignment,” Matthew-bot said. “Almost all of us now on board 8945EH38 are based on humans born prior to the start of the twenty-third century.”

Laura-bot explained. “The reason that most modern microbots aren’t going with us has to do with sports. They insist on watching contests involving biological humans -- contests that take place on earth and nearby space. During the course of our mission, we
will end up thirty thousand light years from earth. They won’t wait even one year, let alone thirty thousand, to get the results of their favorite sporting events.”

She volunteered to describe their new assignment for J. P. Graves-bot. He had been golfing when the colony posted the description of the new mission.

“Our colony will leave the solar system and head outward, away from the center of the galaxy. The goal is to be in a position at the galactic outer edge where we can start recording the collision of the Andromeda Galaxy with the Milky Way. The collision will start in about two billion years.”

J.P. Graves-bot was struck by the magnitude and daring of the project. “Nothing like thinking ahead,” he said. “Maybe it’s fortunate that some of the microbots based on modern-humans are going along. We may need their aggressiveness to deal with the dangers that lie before us.”

They would find many fascinating worlds to visit and much natural history to record on their way to the outer reaches of the Milky Way. But the human-based microbots knew that by going on this mission they would never be on the surface of the earth again. This realization gave them cause for reflection. There were special times in the early evening, when the air was still, that the microbots of Natural History Colony 8945EH38 liked to emerge from their shielded world and stand outside. They would set their clock speeds to coincide with earth time and stand for an hour or so watching real life go through its preparations for the coming night. These special occasions would be lost to them forever. “Although these moments could be simulated,” Laura-bot said, “it’s knowing that we are observing real biological events taking place on our home planet that makes them so special.”
The microbots were convinced that the collision of the Milky Way and the Andromeda Galaxy would provide them with an opportunity for finding a manageable space-time singularity -- a singularity that might allow them to pass their hard-won information on to another universe. While heaven and earth would pass away, the records of this universe would not pass away. In this grand galactic collision, a possibility also existed that they might find a portal containing the information from another universe, information they could add to their own.

Matthew-bot couldn’t resist pointing out that they might become the proud caretakers of some other universe’s information, that universe, in turn, might receive our universe’s information, and then both universes would pass away.

“Once a bad attitude, always a bad attitude,” J. P. Graves-bot said when he heard that remark.

Laura-bot had run out of patience with both of them.

“Pay no attention to Matthew-bot,” she said. “He’s just being difficult. Let’s prepare for our departure. Remember, it’s the adventure of the journey that matters.”
AUTHOR’S NOTES

Many readers of *The Observers* have shared with me their thoughts on issues raised by the story. These questions and comments have been grouped into five general topic areas: General Observations, Philosophy and Religion, Symmetric Information, Computational Issues, and UFO’s. I have suggested related *Wikipedia* articles, and you can find much additional information on the web. Please share your ideas as well. My website and email address can be located through the Department of Computer Science and Engineering, UCSD. My current URL is http://www.cse.ucsd.edu/~gill.

GENERAL OBSERVATIONS

**Comments by author Vernor Vinge (November 2008):** One of the intriguing things about our era is that so many ancient imponderable questions about identity, mortality, self-awareness, are becoming concretely ponderable. Of course, in some cases the resolution may be "This question is ill-posed"!

*The Observers* gives us a chance to look at these questions and possible consequences of dealing with them. As the years pass (barring physical disaster that trashes technology) such stories should stay at the leading edge of insight.

Beyond even the questions of identity and self-awareness, *The Observers* also takes on questions about the universe as a whole. In the last chapter, *The Observers* brings up an interesting possibility: We, and creatures like the Observers, and all their successors, may not be (or should not be) passive players. In this view, we may be building heaven. Success in that endeavor is not a sure thing and it may forever be a work in progress (thus explaining the Problem of Evil), even involving the creation of successor universes in which higher goals are accessible.

PHILOSOPHY AND RELIGION

In Chapter 2 of *The Observers*, we meet Matthew Crigler, a young geophysicist who accidently picks up a mysterious rock on the beach and, in so doing, becomes the first human to learn that alien natural historians have invaded the earth. The aliens have made a virtual copy of Matthew. This copy, called “virtual Matthew,” is alive and has all of Matthew’s memories of the past. The tensions between Matthew and his identical virtual copy begin immediately. The microbots seem to equate Matthew with his copy -- a concept he instinctively rejects. The aliens will be able to maintain copies of virtual Matthew for tens of billions of years, and they tell him, “You will, for all purposes, have eternal life.” Matthew first resents and then becomes jealous of his copy.

**How does digital eternal life differ from the immortality promised by Christianity and other religions?** In Chapter 2, the microbots inform Matthew that virtual Matthew will be updated regularly with his life experiences, and they promise, "After your biological existence is over,
virtual Matthew will be able to become you at any stage of your life. He will also have his own worlds to experience long after you are dead.” How would eternal life promised by religion differ from digital eternal life? *Wikipedia:* Immortality

**A civilization that explores the universe must have a purpose.** The microbots’ purpose is the study of natural history (In Chapter 4, Valentinus explains how they got started on this task). This study is complicated enough to drive the cultural and individual evolution of the microbots; it is a task worthy of their abilities. They have had 160 million years of study on earth alone -- well worth the long journey to get here. How is life classified and recorded by our human natural historians? How do you think the microbots classify and record life? Though living long, the microbots, individually or as a society, don't have "eternal life" and are still very concerned, as are humans, about what happens when their time runs out. They are, for example, concerned about losing billions of years of data as our universe winds down (end of Chapter 19). *Wikipedia:* Encyclopedia of Life, *Wikipedia:* Ultimate fate of the universe

In Chapter 7, Laura invites Matthew to dinner to meet her significant other, Roger. Jealous of Roger and trying to impress Laura, Matthew comes up with a crazy theory that the religion of the aliens is basically Gnosticism. Laura, an expert on Gnosticism, rejects Matthew’s ideas. Matthew, humiliated, vows to avoid religious speculation and stick to science. Is Matthew’s theory of Gnosticism really ridiculous?

**What is the relationship between the aliens and the Gnostics?** Matthew toys with this idea, but his friends and Laura don't agree with him. The ancient Gnostics had an intuitive sense that creation must be more complex than prevailing views of their time. Their elaborate visions can be morphed onto some of modern cosmology, but the transformation is strained. Does modern cosmology have some correspondence to Gnostic cosmology? Would the ancient Gnostics sympathize with the mission of the microbots? *Wikipedia:* History of Gnosticism

As explained in Chapter 8, each microbot forms an intimate relationship with a carefully chosen intelligent virtual life form (called the “core persona” of that microbot). Chapter 8 describes the transformation of virtual Matthew into his role as the core persona of a microbot. We refer to this microbot as “Matthew-bot.” Several readers have asked the interesting question of whether or not Laura’s religious beliefs could transfer to virtual Laura and/or Laura-bot.

**Could virtual Laura and/or Laura-bot be Christians?** Laura is a Christian and would probably agree with the statement, "The center of Christianity is love of God and neighbor, not intelligence or information." Since Laura is a Christian, virtual Laura, being a copy of Laura, would also consider herself to be a Christian even though she is the creation of information technology. Laura-bot, having virtual Laura as a core persona, might well claim to be a Christian also (Chapter 19: She asks, "Why did you move my Bible?"). Can virtual life forms and/or robots be Christians? The same question can be asked about any other religion, not just Christianity.

In Chapter 19, Matthew-bot, in the form of virtual Matthew, wonders for the first time about the inscription on Laura’s medallion. It took him 500 years to become curious enough to look up the verse! When he sees how biased Mark 13.31 is towards the microbots’ point of view (information above all), he wonders if they inserted the verse into the Bible.
Did the microbots mess with the Bible? Do you suppose the microbots did insert Mark 13:31 (Matthew 24:35, Luke 21:33) into the Bible (Chapter 19)? This New Testament assertion of the triumph of information over the physical world seems contradictory to the surrounding material in Mark 13 – raising suspicions that someone messed with the original text. So much for the aliens’ policy of non-interference if they were responsible! How do Biblical scholars determine whether material has been inserted into the bible from other sources? Apply such techniques to Mark 13:31. What do you think? Wikipedia: Biblical criticism; Wikipedia: Q document;

Chapter 19 also describes the overall transformation of human society resulting from the involvement of the aliens in human affairs. Some readers have regarded this change in human society as a “very happy ending.” Others regard the state of human society described in Chapter 19 as “demonic” or “evil.” No other issue in the book has evoked such widely different opinions.

Are the microbots good guys or bad guys? On the plus side, they have been on earth for 160 million years without causing any trouble. Had it not been for a poorly conceived DOD project, the aliens might have remained in the closet for a few million years more. On the minus side, the microbots have been adding humans to their natural history collections for tens of thousands of years. They’ve never asked permission from the humans they copied -- a slight ethical lapse from the human point of view. Some readers of The Observers judge the microbots harshly for their awkward intervention in human affairs (Chapter 19). The microbots end up "farming" humans as core personae for new microbots, and, moreover, humans seem to be willing to cooperate. The microbot and human societies become symbiotic. Human culture is completely changed to a clan system that is a mix of biological humans and microbots with human core personae. Some readers view this restructuring of society as awful, even demonic. Others are more accepting of this fate for humanity. What do you think?

How would humane treatment of virtual life forms be assured? Only a few readers have addressed this important issue. When humans invent virtual life forms, humane treatment will be a major problem. Inhumane treatment could result in war between virtual and biological human life. Could this be how the microbots came to destroy their creators (Chapter 4)? The microbots of The Observers would control the treatment of virtual life forms in their natural history collection. Clearly, there are ethical issues here. For virtual humans that are core personae of microbots, there would also have to be ethical controls. Such controls may be the purpose of the clan system. The microbots identify closely with their core personae so humane treatment could be a matter of self-interest. In Chapter 19, Laura-bot says, “The idea of having a core persona is to make each microbot a stakeholder in some given place and time in the universe. A core persona should represent something special about a particular planet and civilization at a particular time.”

What about the commercialization of virtual human life forms by humans? Commercialization of the creation and storage of virtual human life forms by humans would certainly lead to serious ethical issues. Suppose a company is formed to create virtual human life forms and charges fees for maintaining these life forms into the future. The company's fees might depend on how long the life forms are maintained -- lower fees for less time, higher fees for more time. These charges might be justified by the fact that life forms maintained over longer periods would have to be copied into increasingly sophisticated computer systems -- a problem with storing any computer information. Societal conflicts over destroying virtual human life forms might be similar to those we now have over destroying frozen human embryos.
SYMMETRIC INFORMATION

“Keep track of your infant or toddler, anytime, anywhere, with a CMSS sensor system. Shaped as attractive mugs, our baby monitors start at only $40.” Thus, California Microrobotic Sensor Systems, controlled by the aliens, introduces its product line (end of Chapter 5). We see a CMSS sensor system in use as a baby monitor in Chapter 9. By Chapter 11, certain government agents suspect that CMSS “baby monitors” are watching over more than just babies. In Chapter 14, we learn that the wife and son of a government scientist have been observing activities in his top-secret lab. Finally, in a comical and futile raid on the CMSS factory in San Diego, the FBI attempts to shut down the distribution of sensors. This raid backfires, and the worldwide distribution of free sensors begins – the CMSS (see-mess) singularity is under way. Society must adjust to a world of symmetric information.

How would the CMSS singularity transform the economy? In Chapter 19, we hint at how the dispersal of CMSS sensors might impact the working of economic markets. Note that, under the microbots’ plan, it is individuals, not institutions, which are provided with zero-cost symmetric information. How would such information, provided to individuals, affect the large financial, agricultural, communication, defense, health, and other oligopolies? Note that when information is asymmetric, the person or institution with the most information might not receive the most benefit. A seller could be harmed if he manufactured goods of exceptional quality and failed to inform discerning customers of this fact. On the other hand, a seller whose product had long-term health dangers might benefit in the short run by keeping this information from potential buyers.

Would the CMSS singularity eliminate externalities of transactions? When we use fossil fuels to generate energy we don’t pay a transactional price that reflects the true cost of our actions. The cost of the air pollution we generate results in a negative externality to society. There are also positive externalities such as vaccinating people against polio or smallpox for a small charge. Those who don't get the vaccination benefit from a decreased exposure to the disease (a positive externality of the vaccination transaction). How would the zero-cost symmetric information of the CMSS singularity affect the externalities of transactions?

COMPUTATIONAL ISSUES

The following discussion topics come from readers interested in technical matters. These are topics I would have assigned to my computer science students. Some readers have commented on more specialized technical matters (e.g., Chapter 11: photonic communication, cluster-based networks, viscosity effects on small airborne sensors).

What current research relates to sentient virtual reality and digital immortality? As a start, check out Scientific American, March 2007, A Digital Life. This article, by Gordon Bell and Jim Gemmell, discusses the capture, archival, and retrieval of personal experiences (CARPE). The microbots would gather such information in the initial stages of making a virtual copy of a person or other organism. They would then simulate how the organism’s brain records and interprets these experiences. Jim Gemmell's CARPE Research Area website has links to ongoing research and discussion. Another project that relates to the microbots’ mission is the Encyclopedia of Life - - an online encyclopedia with plans to document all species of living organisms. Each species will get an “infinitely expandable” page assigned to it. Eventually, the Encyclopedia of Life may
include sentient virtual copies of all living organisms. For sentient copies of extinct organisms, we will have to contact the microbots. Wikipedia: MyLifeBits; Wikipedia: Encyclopedia of Life

**A civilization that explores the universe needs to control time.** The microbots can set their community clock speed or individual clock speeds to suit the circumstances. In Chapter 9, "Watching the Baby," the microbots speed up their clocks to deal with being thrown on the floor. On long voyages between star systems, they could slow down their clocks to make subjective time pass more quickly. What clock speeds would be appropriate for dealing with being thrown on the floor, avoiding a speeding bullet, or traveling across our galaxy? How does this discrete cycle-based control of time compare with relativistic time change that occurs in some science fiction stories (e.g., time dilation in special relativity, warp speed in Star Trek)? Wikipedia: Time dilation.

**How close to perfection are current computers?** Suppose you had a one-kilogram computer and claimed that it could compute at a rate of \( x \) bits per second. How big does \( x \) have to be for me to say that you are a liar because your claim violates the laws of physics? The answer is that \( x=10^{51} \) (1 with 51 zeros following it) would violate the laws of physics, but \( x=10^{50} \) would not (Seth Lloyd, MIT). What is the corresponding result for computer memory? How fast are current computers? How is computer memory measured and evaluated? The microbots use an amazing (to us) amount of computational power to run their society, but their accomplishments seem well within the range of what is possible. Wikipedia: Seth Lloyd.

**The microbots are intelligent, self-reproducing machines.** Such machines will share our world in the near future. Remember Moore's Law - computers are getting faster and smaller at a very rapid rate. This means that intelligent robots need not be like those created by Hollywood movies. They will likely be very small - like the microbots. Are the microbots about the right size to fulfill their mission? Wikipedia: Moore’s law.

**Is our universe a simulation?** If you look at a scene and cover your eyes, your personal representation of the scene is gone. Each individual is simulating the world on his or her personal computer (brain). Is it possible that our entire observable universe is a simulation being run on some sort of computer and we are virtual creatures? No one has proved such a simulation impossible. Cosmologists have been surprised by the recent discovery that the rate of expansion of our universe is increasing. This increasing expansion rate, however, would be a natural condition for a programmer of a universe simulation to make – there would be less information to store at each point as time went on (due to the decreasing size of the observable universe). The microbots use simulation and virtual reality to study natural history. It would seem that their task is easier than simulating an entire universe. Is that so? In simulating collisions in computer games, it is sometimes necessary to have the program interfere to correct things so they appear to conform to the laws of physics. Might there be fundamental physical processes in our “real” world that, when carefully observed, would show such “corrections” being made at seemingly random times (indicating we are a simulation)? Wikipedia: Simulated reality; Wikipedia: Accelerating universe; Wikipedia: A New Kind of Science.

**Should creationism be taught in the schools?** Suppose you form a group who believes that our universe is a simulation running on a computer somewhere (a scientifically possible situation as far as we know). How would you propose to the local school board that this version of creationism be taught in the high schools? Would it be easier to make your case for this digital form of creationism than for the pseudo-biological version popular in the press? Would digital

UFO’s

Readers have pointed out a UFO story that is interesting when interpreted from the point of view of The Observers. In May 1940, Udo Wartena (YOU doh, WAR ten uh), a Mormon prospector working a remote claim near Townsend, Montana, had an encounter with a saucer-shaped craft with strange "men" aboard. Udo was an honest man who led a simple life. For years he remained silent, worried that his experience was a figment of his imagination. He first wrote down his “alien encounter” in a letter to Senator John Glenn dated 1980. Udo gave copies of his letter to several friends, one of whom was my cousin John Dell (of Tucson, Arizona).

Does The Observers help us interpret UFO’s and Alien Visitations? This is an interesting question. After reading Udo’s letter below, interpret it in terms of the alien civilization of The Observers. Assume that the strange men of Udo’s encounter were humanoid colonies (like Valentinus and Clement). No assumptions about Udo’s veracity are needed to have fun with this exercise.

Here is Udo’s letter as given to me by John Dell. I have changed the original paragraph breaks and made other minor adjustments to make the letter more compact.

In the forepart of May 1940, I had gone upon the mountain and found a glacier deposit. And from all indications had every possibility of carrying values. As I was working part-time for the Northwest Mining Co., I could only prospect on my days off. So it was into the summer before I could prove the ground. There were a lot of large boulders to move but when I got to bedrock, I found some fine gold. As I would need water for washing the material, I figured it was wise to bring the water down to where I could use it.

The early day miners had dug a ditch around the mountainside (this was over sixty years before my time), so after clearing the logs and large trash out of it, I diverted the water out of the creek, into the ditch. As the ditch had not been used these many years, it was quite a mess. The ditch was practically level for the first quarter of a mile, so it was late in the afternoon by the time it would flow freely. The next morning I cleaned the main ditch to where I put in a dam. Then, dug a ditch to where I could use the water.

As the work for the Northwest Mining Co. had picked up, I wasn’t able to work the prospect too much. Though every spare day I had was used there. I still had some large boulders to move and while doing this one morning I heard a noise. Like that of a high flying plane, as army planes flying over, from Great Falls. At first I didn’t take much note, but as the noise continued, I thought a car had driven up. So I got upon higher ground. I saw, where I had put the dam in the main ditch, a large (I will call it ship). It looked like a blimp, only more pointed on each end, and not as thick through the middle. About 35' thick better than 100' long.

As I stood there, a stairway was let down and a man came down this and started walking towards me. As I was somewhat more than interested, I went to meet him. He stopped when we were about ten or twelve feet apart. He was a nice looking man, seemingly about my age, 35 or more. He wore a light gray pair of coveralls, a tam of the same material on his head, and on his feet were slippers or moccasins. He asked me if it would be all right if they took some of the water. I could not see why not, I said sure. He then gave a signal and a hose or pipe was let down.

His English was like mine, but he spoke slowly, as if he was a linguist. He asked me what I was doing. I explained this to him. He asked me if I would be interested to come aboard. As he seemed an intelligent and pleasant person, I figured it would be interesting. As we got closer to
the ship, I noticed that it was round, like two dinner plates, one inverted over the other. It seemed to be made of metal. As I look back and compare, it seemed like stainless steel, though not bright or shiny. The ship appeared to be about 35' thick and well over a hundred feet in diameter. When we got into the ship, we entered into a room about twelve by sixteen feet, with a close fitting door on the farther end. Indirect lighting near the ceiling, and nice upholstered benches around the sides.

There was an older man in the room, plainly dressed and with white hair. It was then that I noticed that the younger man also had white hair. Somehow I believe they knew who I was, but they did not introduce themselves. Perhaps if they had, I may have been a bit upset. The younger man asked me what I would be interested in. So I first asked why they wanted this particular water. He said the water is good, as if they had gotten the same before, and it was convenient. After we had entered the ship, I had noticed that the sound I had heard outside, was hardly noticeable, except what came up the stairwell. So I asked him what caused the noise or humming. He said this would be a bit complicated, but he would try to explain so I could understand.

He said as you noticed we are floating above the ground, and though the ground slopes, the ship is level. There are in the outside rim of the ship two flywheels one turning one way and the other the opposite direction. He explained that this gives the ship its own gravitation, or rather overcomes the gravitational pull of the earth, other planets or the sun or stars. And though this pull is light, we use this gravitational pull of the stars and planets to ride on. He went into somewhat greater detail on the power development by these two flywheels. He mentioned something about them developing an electromagnetic force. As this was quite new to me and he realized that, but he saw I had gotten the picture, so he stopped. I asked him where he got the energy to run the ship. He said from the sun and stars, and he would store this in batteries, though this was for emergency use.

I also asked him what their object was or purpose in coming here. Well, he said, as you have noticed, we look pretty much as you do, so we mingle with you people, gather information, leave instructions, or give help where needed. I would have liked to ask him more about that, but didn't feel this proper, so let it ride at that. While we had been talking, a light had come on apparently signaling that the water had been taken care of. When I felt it was time for me to leave, I mentioned this. He asked me if I would be interested in going with them. I said that I thought it would be interesting to go with them but it would inconvenience too many people. Later I wondered why I had said that.

As I started to leave, they suggested that I tell no one, as no one would believe me at that time, but in years to come I could tell about this experience. When I walked away from the ship, they raised the stairway, and when I got a couple of hundred feet away from the ship, I turned around. A number more portholes had opened up and though I could see no one, I felt sure they saw me. Anyway, I waved at them. The ship then rose straight up, then while circling slightly it continued going straight and in a very short while was completely out of sight.

As I didn't have a watch, I did not know how long I had been with them. It was around noon so it must have been about two hours from the time I first saw the ship. This whole experience was so overwhelming that I did not go back to work. I kept going over in my mind all that had happened. I went back to where the stairway had been and though it hadn't gone into the soil, the grass was crushed down. I wondered at the time, why I hadn't accepted the invitation to go with them but instead had said "that it would inconvenience too many people".

I then recollected an incident which happened a few years before I came to this district. A young man was staying with an old prospector, and early one morning before eating he put on a light jacket and told the man he would be gone for a while. When the young man did not show up all that next day or the next, the old prospector notified the Sheriff, and he with his deputies and about forty C.C.C. boys looked all over for him, but no trace was found. I have wondered if he might have accepted an invitation to board a ship similar to mine.

I have wondered at times if this could have all been in my imagination. But then again I saw the impression of the ship in the grass. Then over the years a number of things have come to mind. The explanation of how this ship moved, seemingly not affected by earth's gravitational pull. From what the man told me at the time and what has come to me since, I believe I am not too far from
an answer to this. It is for this reason I am writing to you. No doubt with the help of some other minds, the answer will be forthcoming. We have just about reached the stage where we need a different type of air transportation and this is the answer.

I feel confident that you could put me in touch with some people who could help to this end.

Udo Wartena, West Linn, Oregon, 1980

**Does Udo's experience give some insights into alien abduction tales generally?**

Interpreted in terms of *The Observers*, the aliens' offer to take Udo with them would have involved taking a virtual copy of Udo with them (not the biological Udo). Udo would not have understood this distinction and the two colonies would not have tried to explain it to him under the circumstances. Taking a copy of Udo, rather than the biological Udo, fits in well with the demeanor of the two humanoids in Udo's story. If "abducting" is replaced by "copying," would some of the standard UFO abduction tales make better sense?

**What happened to the young man who disappeared?** Perhaps the young man, unlike Udo, did board the ship and go with the aliens. On the other hand, his disappearance could have been entirely unrelated to Udo's experience. There is another interesting possibility, only hinted at in *The Observers*. In Chapter 12, Matthew asks, "Does the fact that there are multiple copies of us make us expendable in the eyes of the microbots?" The microbots in *The Observers* can make virtual copies without injuring the biological organism. A more sinister scenario could be imagined where the copying procedure does destroy the biological organism, but the microbots equate the biological organism with its copy and thus have no qualms about destroying the former. If this were the case, it is good that Udo refused their offer to "go along with them." The young man may have consented to go along. The aliens may have made a virtual copy, destroyed the biological version of the young man, and gone about their business not imagining they had done anything wrong (from the human perspective).