TelePresence

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Catherine Harriman was doing her homework when she died.

Her physics teacher had assigned the class an exploration of Newton's three laws of motion, and so right after dinner, she rushed back to the family's virtual reality room to jack into telepresence. She settled her body into the simulator, pulled on the datagloves, and fitted the spex over her eyes, expecting to find herself back in the classroom.

Instead, the instant she entered VR, a blinding light hit her, accompanied by a loud explosion.

Catherine put her arm up to cover her eyes. *What the hell's going on?*

Then she heard friendly laughter.

"Who is that?" she said aloud.

"It's me," came a familiar voice. "How do you like my new instant greeting?"

Catherine dropped her arm. Rosa Guiterro stood in front of her, dressed in a silvery jumpsuit that flowed like water.

"Rosa! Have you been waiting for me?"

"Sí. I wanted to surprise you with my new greeting."

"Well, you certainly did. But please don't do it again."

"Aw, come on, Cath, it was all just for fun. I wanted to try out my new hello on a friend before surprising one of the boys."

The two girls giggled. "You mean before surprising Jason, don't you?" Catherine asked.

Rosa winked. "Hey, forget the greeting. What do you think of this?" She floated up a meter and twirled around. Her outfit shimmered and glimmered, and Catherine could clearly make out "enhancements" underneath the avatar's virtual clothing.

"You're wearing pads," she said.

"Only in VR," Rosa replied. "I wish they'd let us wear these things in school."

"You know the rules."

"Yeah." They both did. After hours, students could portray themselves any way they wanted within a certain set of guidelines. But during the school day, they had no choice. Whatever appearance you had in real life that morning was what got scanned into the system. Without that dress code, Catherine imagined, almost all the girls would give themselves a little extra padding. The boys would probably show off fake muscles as well.

Rosa floated back down to the floor. "Listen, Caitlin and Naomi are supposed to be meeting me at the VR Mall in a few minutes. Want to join us? We're planning to set up a floating chat space so everyone can see us."

"Later, chica. I got to get to work on physics."

Rosa stuck her tongue out at Catherine and disappeared. Catherine smiled, shook her head, and got to work.

Mr. Lynch's assignment had been to start in a standard environment, in which the three laws of motion (and, come to think of it, all the other laws of physics programmed into the network) mimicked the real world exactly. Then you had to suspend each law individually, and come up with a demonstration that clearly showed how motion was affected.

Catherine always enjoyed these types of homework assignments, no matter how hard she found them. But she always liked to begin from scratch. So she waved her right hand from one side to the other, and the classroom around her changed to a large, empty room with white walls. Waving her hand wasn't necessary, of course, but she enjoyed the feeling of casting a magic spell.

Let's see, she thought. *The first law states that an object in uniform motion stays in its motion unless acted upon by an outside force. So what if objects just randomly speed up and slow down for no reason? That sounds like fun.*

She waved her hand again, and a collection of eight perfectly round spheres in all sorts of bright colors appeared floating at eye level in a circle.

She manipulated the spheres, first increasing their size to that of bowling balls, and then decreasing them to the size of baseballs. Next she changed their colors so they spun around in the order of the spectrum: red, orange, yellow, green, blue, indigo, and violet. She made the last one transparent.

I bet Mr. Lynch will give me points for that. He's such a dweeb.

Finally, she was ready to try her experiment. She released the hold of both virtual gravity and Newton's first law on the spheres, and with a wave of her hand, set them all in motion.

The spheres started moving as if they had minds of their own. Catherine watched as one sphere kept speeding up and slowing down in a straight line towards the other side of the room. Another sphere moved in a widening spiral, almost crashing into a sphere that zigged and zagged all over the place. Catherine smiled at her handiwork. She raised a hand to record her simulation—

—and a sphere smacked her in the back of the head, almost knocking her over.

"Ouch!" she shouted. She rubbed the sore spot and turned to look behind her, where she found the blue sphere sitting on the white floor.

What the hell? That wasn't supposed to happen. Virtual environments were programmed to be safe by the telepresence school authorities. Even if a ball had hit her during gym, she wouldn't have felt any pain.

She stopped rubbing her head because her hand began to feel wet. She looked at it and gasped.

Red blood covered her hand all the way down to her wrist, as if a glove had been painted on her.

She began to hyperventilate, and she took a few deep breaths to calm herself. The other spheres kept whizzing around the white room, leaving multicolored trails in their wake.

This is nuts. Even if my head was bleeding, my hand wouldn't look like this. I'd better turn everything off and report this to the school.

She waved her hand to banish the spheres, but they remained in the room, flying around in all directions.

Catherine felt her heart beating harder against her chest. She had created the spheres; she should be able to destroy them. Perhaps she should do this one step at a time.

"Stop," she said aloud.

The spheres kept moving, and the blue one suddenly lifted off the floor and flew right at her face.

She ducked just in time. As the sphere sped by, she could hear a drop in its tone, and she felt her hair pulled along with the wind.

"This is nuts," she said aloud.

"Welcome to my virtual world," an electronic voice said.

Catherine whirled around. "Who said that?"

"I did," replied the voice. "You're in my world now. I can do anything I want."

The spheres froze in their tracks. Then they floated slowly towards Catherine until once again they surrounded her in a circle, revolving around her at eye level.

Catherine felt herself sweating under the datagloves. She watched the spheres carefully, readying herself to duck. "Rosa, is that you?"

Electronic, buzzing laughter emanated from the walls. "I'm the Destroyer. I'm here to kill you, Catherine Harriman."

The spheres suddenly stopped revolving around her. Instead, each sphere rotated around its own axis. Catherine watched as each sphere began to display a monstrous visage, which turned to face her. It was as if someone had painted the same picture on each sphere — a twisted face with huge eyes and a mouth full of jagged teeth.

The mouths began to move, and the voice echoed from each sphere. "Are you scared, Catherine? Are you frightened?"

For an answer, Catherine ducked below the circle of spheres and ran towards the closest wall. She waved her bloodied hand at its blank white surface, expecting a door to form so she could flee. But no door formed.

"Come on," she muttered. "I know how to do this."

She tried again, and still the wall remained blank. In desperation, Catherine ran at the wall, slamming into it with her right shoulder in the hope that maybe she had created an opening but couldn't see it.

The wall didn't budge. She felt her hair tingling with electricity, and slowly she turned around to look behind her.

Where eight grimacing faces had been, there were now more than she could count, forming a wall just a few meters away.

"You can't run, and you can't hide," said hundreds of overlapping voices from the spheres.

Catherine closed her eyes. "I've got to get out of here," she said aloud. The way to exit VR was standard:

turn off the VR feed, take the spex off your head, remove the datagloves from your hands, and step out of the simulator. Since she couldn't turn off the feed, she automatically went to step two, and took the spex off her head.

It was a fatal mistake. Not only was her mind still trapped in VR, but now she was blind as well. She could still hear the voices, echoing in the distance, becoming louder and louder. "Catherine, Catherine..."

"Who is that? Just tell me who you are! Help!"

"I'm coming to get you..."

Catherine tried to put the spex back on, but she fumbled with them, and they fell to the floor. Electricity coursed through her body. She felt a burning pain searing her from the inside out, as the electronic voices overwhelmed her ears with hysterical laughter.

That was the last thing she experienced before she blacked out.

#

"Mr. Louis? They're here."

Tony had been working in virtual reality when he heard the voice in his head; he pushed a button on the earpiece of his spex and watched the world turn dark. "Already? They're early."

"I know," came the voice of his assistant, Dawn Castner. Since Tony had turned off the spex, her voice now came over the intercom that sat on his desk.

Tony lifted the spex off his head and blinked a few times. He looked at the flatscreen on his desk that displayed an image of the outer office. Outside, his assistant sat at her desk while eight men and women in suits stood around. It bothered him to discover that all of the members of the commission were white. No one black like him; no one Hispanic despite the huge Hispanic population of the state.

"I guess we ought to begin," he said, glad as always that his voice could only be heard by Dawn over her earbud. He looked down at his blue jacket and maroon tie, just to make sure he still appeared presentable. "Send in the commission chair, please."

Tony watched on the screen as Dawn nodded and turned to one of the women in the group. She instructed the visitor to enter Tony's office, and asked the others to take seats and please wait, as Mr. Louis wanted to meet with the chairwoman first. Most of the commission members quickly sat down, but two of them lingered in front of Dawn's desk, challenging her right to keep them outside. The chairwoman spoke to them briefly, and then they settled down.

Tony changed the view on his flatscreen to a neutral brown and stood up just as the door opened. The view had not done justice to the chairwoman, a tall, striking woman whose solemn expression displayed a no-nonsense attitude. Tony walked around the desk to shake her hand.

"Suzanne Palmer, I presume," he said. "I'm Tony Louis."

She gave him a quick smile and then resumed her solemnity. "Indeed."

"It's a pleasure to meet you in RL at last. Please, have a seat."

As they sat on opposite sides of his desk, Tony watched Palmer take in all the old movie posters on the

walls. "Eclectic," she said. "I like it."

Tony shrugged, doing his best to appear both unconcerned and grateful for the compliment. "I barely notice them anymore. I do most of my work in VR."

She nodded. "Makes sense, I suppose. But what if the system goes down, or some other problem arises?"

"Then I guess I can't do my work for that day. But it's no different from what happens in any office these days when there's a blackout. Your office is probably just as dependent on electricity as mine is."

Palmer nodded again. "You don't have to get defensive, Mr. Louis."

Tony frowned. "Was I? I apologize if that's the case."

She waved it off. "Don't worry about it. I was trying to see how you'd defend your telepresence system from such criticism." She paused. "You know that I'm personally in favor of adopting telepresence for California."

"So you've said over the phone."

Palmer took a deep breath. "However, you should realize that some members of the commission are still reluctant to turn the public school system over to you."

Tony clasped his hands together and smiled. "That is why I arranged for this demonstration. I'm hoping it'll do more than preach to the converted. Is your commission ready?"

"Anytime."

Tony pushed the intercom button and asked Dawn to show the rest of the commission into his office. He shook hands with each one in turn and then said, "I'd like to thank all of you for coming all the way from Sacramento to Los Angeles."

One of the men said, "That's not exactly a hardship," prompting the rest to chuckle.

"True," Palmer said. "While here, we're planning to take advantage of it. I know of at least one holo studio I want to visit. We're also hoping for a tour of Grauman's Chinese Theatre."

Seeing an opportunity to promote VR, Tony said, "You know, Grauman's is one of many places that made itself available for virtual tours as well."

A tall bearded man named Steven Silver grunted. "It's not the same," he said, and one of the women, a petite lady named Crystal Bordewieck, frowned and nodded in agreement.

Well, Tony thought, *at least I now know who my main opposition is.*

"It might not be the same," Tony replied, "but that doesn't mean it's all for the worse. Especially when it comes to education."

Tony found himself going into lecture mode. He couldn't help it, but he tried to keep his tone light. "Telepresence is a form of communication technology, and education and communication technology have always gone hand in hand. The eighteenth century saw the start of our country's public education system. Most of our schools in the nineteenth century had little in the way of equipment: slate, chalk, a few books. By the 1870s, mass-produced paper allowed students to take their work home and share it with their parents, but not until the twentieth century did students abandon their inkwells for ballpoint

pens. Teachers went from blackboards to filmstrips to television sets and VCRs. As the old millennium ended and our century dawned, computers and the Internet changed the way we interact and do research."

"Mr. Louis?" Palmer said.

"Yes?"

She smiled. "Cut to the chase."

"Certainly. The upshot is that although VR technology has existed for many years, leading to the creation of the private telepresence school system, this technology has never been embraced by any public school system. It is my hope that with what you see today, you will make the decision that this system is right for California — and, perhaps, for the rest of the country as well."

He looked at the blank faces of the commissioners. "Are there any questions?"

The commissioners looked at each other, but no one raised a hand. Even Mr. Silver and Ms. Bordewieck remained silent.

"Then let's get started. Follow me, please."

Tony led them out of his office, and along with Dawn they walked over to the giant training room, with thirty full simulator units in five rows of six. He watched as the commissioners walked around the room studying the equipment.

"Is this a classroom?" one asked.

Tony shook his head. "All the classrooms exist in virtual reality. We use this room for training new teachers."

With the help of Dawn and a few other staff members, Tony showed the commissioners how to jack into their version of VR. He kept a careful eye on all of them as they put on their spex and datagloves and settled into the units. Two of the commissioners — not Mr. Silver and Ms. Bordewieck, unfortunately, as Tony would have expected — seemed to have looks of distaste on their faces as they had to deal with the equipment. Fortunately, the rest of them, including Ms. Palmer, seemed to accept the technology with equanimity.

When everyone was set, Tony pushed his master switch and suddenly the darkness disappeared, replaced by a well-lit classroom with desks, terminals, and a screenboard. Tony stood at the front of the room, while the eight commissioners sat at desks.

"Well, what do you think?" Tony asked.

One of the women shrugged. "It looks like a classroom. I honestly don't see what's so special about it."

Tony nodded. "We always use a classroom as a baseline to begin the school day. It's a useful simulated environment. Most students are used to it, and we find that it sets the tone properly. But there's so much more that we can do here than is possible in a conventional classroom. Allow me to show you."

Tony took a deep breath and mentally prepared himself for the next hour, during which he would demonstrate many of the standard techniques that had been developed for teaching in virtual reality. A lot of them, he noted with pride, were techniques that he himself had developed to take full advantage of VR. He had planned his presentation carefully, to start with the minor techniques so he could wow the

commissioners at the end.

"As I go through these demonstrations, I want you to watch for the three things where they help us the most: activities, self-direction, and focus. Those are the three categories we've kept in mind as we've developed ways of teaching in VR."

He started by calling up a variety of screenboards, one for each desk, to show how VR allowed a teacher to pitch material to each student at his or her own level. He showed how a teacher could meet each student's needs precisely, so a gifted student and a student having trouble could interact in the same classroom and be of benefit to each other.

"In a regular school, a hyperactive student who needs to wander around every so often can be distracting. In VR, you can minimize those distractions, because you can allow that student to wander around in their own part of virtual space until they're ready to rejoin the class. More often, though, you can find some other way to engage the student whose mind is wandering. No one is ever bored here."

After a few other general demonstrations, he delved into specific subjects. One subject that stood out was biology. Tony demonstrated a frog dissection lesson, performed on virtual frogs so that the students could avoid harming real animals.

"Recent polls show that a majority of our state's residents are opposed to animal experimentation," he reminded them. "We can dissect anything we want without killing, and the students can't cut themselves with the scalpels."

The commissioners seemed impressed with the detail in the frogs; a few of them even "ooh"ed and "aah"ed as they made incisions and removed the internal organs. Tony smiled as two of the commissioners compared the frogs' livers and realized that individual differences had been programmed in.

After a few more subject-specific demos, Tony turned back to the general. "Some of you are probably wondering how our teachers collect homework assignments," he said. "It's quite simple. All homework is done in virtual reality as well."

"All of it?" Ms. Bordewieck asked. "What if students need to visit a local library to do research?"

"They can and do, of course, but we also keep an electronic library in our system, and we're up to date on almost every major publication. Even if a student does research outside of telepresence, they write their papers inside."

"What if they don't know how to type?" Palmer asked.

Tony smiled and snapped his fingers. A screen appeared floating next to him. "Watch," he said. He began to recite the alphabet, and as he did, the letters appeared on the screen.

"Our students can also handwrite their assignments," he said, as his words continued to appear on the screen. "If you look in the desk, you'll find virtual paper and pens. The system can tell them exactly how legible their writing is, so they can work towards better penmanship."

Tony snapped his fingers again, and the screen disappeared. "No more 'dog ate my homework' excuses," he said.

"How about 'The computer ate my homework'?" Mr. Silver asked.

"The computer is our system. If there was a glitch and the homework got deleted, we'd have a record of

it and know that the excuse was legitimate." He paused. "Ladies and gentlemen, it's now time to show you the full value of a telepresence education: the ability to create simulated environments. Let me see..."

He hesitated for a moment over the earthquake simulation, then decided to go ahead with it.

"Ladies and gentlemen, for the next demonstration I must ask you to remain calm. I'm about to shake things up a bit, and I want to assure you that it's taking place only here in VR, and not in RL."

The group nodded, and Tony pushed a button on the desk. Suddenly the classroom began to shake, accompanied by a deep rumble emanating from everywhere. The commissioners jumped up in alarm.

Palmer darted to the front of the room and grabbed Tony's shoulder. "Mr. Louis! Please."

Tony pushed the button again, and the shaking and rumbling abruptly ended. A few of the people in the room sighed with relief, and Mr. Silver glared at Tony.

"What's the point of this?" he asked. "To frighten us?"

Tony shook his head. "Absolutely not. I apologize if you were frightened; most students find it fun."

"Fun?" Ms. Bordewieck asked. "You have got to be kidding."

"No, I'm not," he replied. "A lot of students liken the experience to an amusement park ride. They know that they're really safe. For those who have never been in an earthquake before, it's exciting."

"Surely that isn't the point," Palmer said.

"No, of course not. The earthquake simulation has two objectives. The first time I went through it, I lived in New York City, which, until recently, never experienced earthquakes. It gave me the chance to feel what someone living in California might experience. Made it easier for me to understand the news, and what led to the destruction of the original Golden Gate.

"As for the other reason...we've successfully used the simulation to teach older kids proper evacuation techniques. The original impetus for telepresence school was to develop the safest possible learning environment. Not only are students safe in their own homes, but they can learn how to stay safe in the real world."

"Of course," Mr. Silver said, "I imagine that during a real earthquake, a student might find himself trapped in your system, unable to flee."

"No. In the event of a natural disaster, or any other threat to life, the user is automatically disconnected from the system. There are safety features of that sort built throughout, and I'd be glad to provide you with as many specifics as you need."

Tony changed his tactics. "Ms. Palmer. Friends. I truly did not mean to scare you but to enlighten you. The biggest strength of telepresence as an educational tool is our ability to simulate almost anything."

As he talked, the scene around them changed.

"I want you to imagine teaching astronomy on the surface of the moon," he said, and they found themselves on a lunar landscape, with a first-quarter Earth hanging in the sky. "Or teaching Shakespeare's plays in the Globe Theatre of his day," he said, and the desolate lunar surface melted into the pit of the famous theatre, with a troupe of actors in costume on the stage. "Or teaching French via real-time communication with native speakers," he said, and they were back in the classroom, but now there

floated twenty screens on the front wall, each showing a different smiling face with a geographical location listed underneath. "Finally, we all know how art and music are always the first subjects cut when there's a budget crisis. What if you could teach art and music in a fully equipped studio, without ever needing to scrounge for supplies?" The classroom disappeared and was replaced by a divided room. On one side sat canvases, paint brushes, and easels; on the other sat a variety of musical instruments, including violins, cellos, saxophones, trumpets, recorders, drums, and one grand piano.

Tony waved his arm around. "That is the beauty of telepresence school. That is the promise of virtual reality," he said, and the room once more became a standard classroom.

"I hope you've found my demonstration helpful," Tony said. "If you have any questions—"

Suddenly Dawn's voice spoke in his ear; she sounded agitated. "Mr. Louis? May I interrupt?"

He nodded. Knowing that the other people in the classroom SE couldn't hear Dawn, he said aloud, "Folks, would you excuse me for a moment? My assistant needs my attention. Feel free to look around, do anything you wish. After all, another advantage of VR is that you can't break anything."

As the commissioners started walking around the virtual classroom, Tony walked over to a far corner. Subvocalizing, he said, "Dawn? What's going on?"

"We have a problem," she replied. "A big one."

<p style="text-align:center">#</p>

Tony had remembered many incidents of violence from his childhood. But his late mother had always done her best to protect him from the worst of it.

Nothing had prepared him for this.

Catherine Harriman's body lay slumped in her simulator. Her head hung to one side, with her tongue lolling out of her mouth. Her eyes were frozen open, glassily staring at nothing.

How horrible, he thought.

"Mr. Louis?"

Tony looked up. A man dressed in an impeccable blue suit walked across the yellow police holotape that the LAPD had set up as a barrier. As he crossed, the tape flickered a moment and then reestablished itself, with the letters "LAPD" continuing to scroll from one of the four emitter poles to the next.

"I'm Agent Cutter from the FBI. I've been sent from Washington to investigate this." He showed his badge to Tony, who peered at it, confused.

"You came all the way from Washington? For an accident?"

"If this is an accident, Mr. Louis, it's a dangerous one. I'm helping out the LAPD because of my expertise with odd cases."

Tony nodded. "There's no way that the telepresence system could do this," he said.

"Which is why I'm here. Mr. Louis, could someone have set up the system to do this deliberately?"

"Used our system to commit murder? Impossible."

"Are you sure?"

Tony decided to conceal his true level of expertise. "I'm not really an expert on the technology, Agent Cutter. I came from the educational side. I developed techniques for using the telepresence system to improve education and then implemented those techniques over our entire California network."

"Is that what you do now?"

"I wish. I'm now the Executive Director. I run the whole system. Makes it harder to play with the details."

Cutter nodded. "I understand. That's why I never took an SAC job."

"SAC?"

"Special Agent in Charge. I prefer to stay in the field."

Tony stared into the distance for a moment. "I understand. On the one hand, I can do a lot more good for a lot more people from my current position. But on the other hand..." He looked at Catherine Harriman's lifeless body and shuddered. "On the other hand, I'd never even heard of this girl until today. You lose something when you're not in the classroom."

"Mr. Louis, I'm going to need your help in conducting my investigation."

"I'd prefer to do my own investigation," Tony replied.

"I'm sure. But in the meantime, I'd like to ask you for access to all the students in Harriman's classes, as well as the teachers."

"Of course. I doubt you'll find out anything, though. I'll have my assistant prepare you a list." He paused. "Will you want access to our system too, for the interviews?"

"Will I need it?"

Tony nodded. "As far as the telepresence system is concerned, all of California is one big school. Harriman may have lived in LA, but she's probably got classmates and teachers all the way from Crescent City to San Diego."

Cutter nodded. "The ultimate in desegregation."

Tony winced, and Cutter immediately said, "I'm sorry, Mr. Louis. I didn't mean to —"

Tony waved it off. "It's okay. No offense taken."

"Thank you. I like everything I've heard about telepresence school. What I said was meant as a compliment." He sighed. "But it does make conducting an investigation a lot harder."

"Will you want access to the system today? We can probably set you up this afternoon."

The agent shook his head. "I think I'll start with personal interviews here in Los Angeles. Then I'll take you up on your offer. But I'll still need access to your system to get a feel for what goes on inside. Virtual reality has probably changed a lot from the last time I was in it."

#

Despite his own expertise with their VR system, Tony knew better than to try to investigate the technological aspects of the tragedy on his own. When he returned to his office that afternoon, he assigned his Chief Systems Operator, Franklin Yee, the task of figuring out what had happened to Catherine Harriman.

It didn't take long. The next morning, Tony found a message from Frank saying that he had solved part of the puzzle and requesting a ten o'clock meeting. Since Frank lived in Oakland, the two of them met in a large white VR conference room, with normal avatars representing them.

Even sitting at a table, Frank still filled the room with his presence. As he talked, his legs shook back and forth and he gesticulated with his arms. "Our system's been compromised, all right. Let me show you."

A three-dimensional grid of white lines appeared, hovering above Tony and Frank. As Frank pointed at the different pathways, the ones he mentioned lit up in an eerie blue.

"This schematic represents a recording of the real-time connections that took place yesterday afternoon. You see this pathway here, and that one? They show that someone hacked our system."

Tony looked up in surprise. "This was an inside job."

Frank smiled. "I'm glad to see you still remember how to read the grid."

"You're the only one who knows more than I do, Frank," Tony replied. "Just because I've been working behind a desk all these years doesn't mean I haven't kept up with the technology behind our system. Can we take a closer look?"

"Certainly." Frank stood up, and Tony followed suit. The grid grew larger and larger until Tony and Frank stood on one of the blue pathways, now frozen in time. Other blue pathways, each about the width of a sidewalk, led off in all three dimensions.

"Follow me," Frank said. He walked along the pathway, and Tony stayed a few paces behind. They turned onto a pathway that curved upward into a loop and began to climb. Even though he had done this before, Tony still felt amazed at the fluidity of VR. As they walked up the loop, the environment changed its orientation. By the time they got to the "top" of the loop, it had become the bottom, and the rest of the world appeared rotated one hundred and eighty degrees from what it had been before.

The world turned upside down, Tony thought.

"Well, here we are," Frank said, falling to his knees to study the pathway. "We're standing on a VR feedback loop. Whoever hacked our system began by taking control of VR exactly where we are."

Tony joined Frank in examining the ground. At first, it maintained the appearance of solid blue. After a moment, however, Tony saw a series of tightly coiled blue fibers that gave the pathway its solid structure.

"I feel like I'm looking deep into the system," Tony said. "Like in one of those old cyberpunk movies."

"You would know about that better than I would," Frank replied with a smile. "Do you know what this really is?"

Tony hesitated. "A control loop?"

Frank smiled. "Precisely. Induced by the hacker himself. He managed to convince the system that he deserved the same level of clearance as you or me, and got the system to grant him full root access."

They stood up. "Well," Tony said, "even if he hacked our system, that still shouldn't have given him the power to kill someone."

Frank scratched his right cheek and looked away. "Well..."

"What?"

Frank clenched his hands. "There *are* ways to kill someone in VR."

Tony felt stunned. "You're kidding. How?"

"Through fright mostly. Put someone on a virtual roller coaster, and their mind and body will react exactly as if they're on the real thing. It's autonomic."

"Automatic?"

Frank's hands cut through the air as he explained. "No, autonomic. The nervous system. If you frighten someone in VR, their breathing will become rapid and their heart will beat faster, until their autonomic system goes out of whack."

"But that shouldn't happen. The telepresence system's programmed with safeties." He paused. "Isn't it?"

"Well, yes," Frank admitted. "But those safeties depend upon constant monitoring of a person's vital signs. They're usually set at a reasonable threshold, such as a maximum heart rate of two hundred beats per minute for one of the students. Change that threshold and you can kill someone."

"I'm not sure I understand," Tony said, although a cold feeling in his heart told him otherwise.

"Suppose you reprogrammed the system to turn off only if someone's heartbeat reached *five* hundred beats per minute. Since that's not possible, the system would stay on until the person went into cardiac arrest."

"Is this really possible?"

"Well, you or I could program it, as could members of my team. But most people wouldn't be able to do it."

"So is that what killed Catherine Harriman?"

Frank's eyes darted back and forth, as he studied the grid. "Maybe. I have no idea if that's the exact method the killer used, although we do know that she died of cardiac arrest. It's just one of many possible ways to kill someone in VR."

Tony resisted the urge to grab Frank by the collar and ask him why he had never revealed this possibility before. Instead, he took a deep breath and said, "So how do we find this hacker before he tries something like this again?"

Frank shook his head. "I wish we could. But he covered his traces too well."

"Unacceptable. There must be something you can do."

"I'm sorry, Mr. Louis. Unless he tries this again, I can't trace him."

Tony crossed his arms. "Fine. We're done for now. Put a full report together within the hour so I can pass it along to the FBI and the police." He paused. "As much as I hate to say this, if they request it, I'm

authorizing you to give them full access to our system. Maybe they have ways to trace this hacker that we don't."

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Tony emerged from VR, and was surprised to discover that it was past noon. His stomach gurgled, and an empty feeling inside reminded him how long it had been since his breakfast of bran flakes in soy milk. He pinged his assistant, who was eating a salad at her desk.

"Dawn, could you get me something from the fridge?"

"Sure. I'll pop in one of the hydrowave lasagnas."

"Thank you."

Tony leaned back in his chair and stretched his arms. He felt the ache in his back muscles, and he reminded himself to get some exercise before the week was out.

"Mr. Louis?" came Dawn's voice over the intercom. "I haven't had a chance to get your lunch yet; you've got a phone call from Suzanne Palmer. Do you want me to tell her you're busy?"

"No, no, I'll take it now. Thanks." He pushed a button on his desk, and Palmer's image appeared on his screen. "Ms. Palmer. What can I do for you?"

"You can provide me with some information. I presume you've seen the news this morning?"

Tony shook his head. "I've been consulting with our Chief Systems Operator all morning. What was on the news?"

Palmer sighed. "The LA Times Holosite is reporting the death of one Catherine Harriman, a student in your system. They're saying that she died in her simulator, and that her death wasn't an accident. Do you know anything about this?"

Tony hesitated. "Nothing I'm at liberty to say."

"I see," she replied.

Neither of them spoke for a moment. Then Tony said, "I hope this isn't going to affect your commission's work too badly."

"Frankly, it is. Which is why I was hoping I could get some straight talk from you."

He sighed. "All I can say right now is that we're helping out the authorities and conducting our own investigation. We hope to have answers within the week."

"I'm afraid we need them sooner."

"I thought your commission wasn't making a final decision for a few months."

"We weren't, but the death of Catherine Harriman changes things. Four of the commission members want to end our study now and recommend against adopting the telepresence program."

Tony frowned. "Let me guess. Mr. Silver and Ms. Bordewieck are two of the four, right?"

"Oddly enough, no. I really shouldn't be telling you this, but your demonstration convinced them. However, the news about Catherine Harriman pushed four others in the opposite direction." She paused. "It was almost five."

"Who was the fifth?"

"Me."

"Oh," Tony said. "I see. I'm glad you're still giving us a chance."

She sighed. "For the moment, I'm willing to give you and the police time to find out what happened. It wasn't too hard to convince the rest of the commission to keep our study open; otherwise, we'd have no reason to continue enjoying Los Angeles at taxpayer expense." She gave Tony a quick smile, and he responded in kind. "But it's still a disturbing development, Mr. Louis, and I'd appreciate it if you could keep us informed of your progress as quickly as possible. Too long a delay, and I'll join the opposition."

#

Tony spent the rest of the day going over psychological profiles of the "students of concern" whose schooling had caused them to intersect with Catherine Harriman. There were a lot of them, which was not surprising, given the 150,000 students enrolled in telepresence school. To make things easier, he had decided to eliminate students outside of Catherine Harriman's immediate age range, so he only studied the files of students from grades ten to twelve.

The files made for fascinating reading as Tony explored the alphabet soup of students' issues: LD, ADD, ADHD, NDD, and RFD, just to name a few. All the acronyms that psychologists had come up with instead of simply saying that a student was a pain in the butt.

As soon as that thought came to Tony's mind, he rejected it. It was true that he sometimes took the cynical view; but more often than not, a diagnosis of a student's particular problem led to treatment. Some students who didn't respond to traditional schooling thrived in virtual reality. He had even used the argument in his report to the commission.

But sometimes, Tony would think back on the years he had been a teacher and the frustrations he dealt with every day when teaching certain students. As sad as it made him, he felt thankful that he no longer had to deal directly with their problems on a daily basis.

His reverie was interrupted by Dawn's voice broadcasting into his VR office. "Mr. Louis? Could you come out of VR, please?"

Tony pushed the earpiece button and removed the spex. A moment later, the door opened and Dawn walked in. "Mr. Louis. Are you okay?"

"Of course, Dawn. What's up?"

She frowned slightly. "It's past seven. Are you planning on going home?"

"Seven? Already?" He glanced at the far wall where he kept his clock in VR; then, remembering that he was in RL, he checked his wristwatch. "So it is. I guess I lost track of time." He looked up at Dawn, who was biting her lip. "Why are you still here? You could have left at five."

Dawn sat down. "I was worried about you. I called Ben and let him know I'd be working late, and I called Sheryl on your behalf."

Tony nodded. "Thanks, Dawn. Was Sheryl understanding?"

"She will be once she receives the bouquet of roses you're sending her."

The two of them looked directly into each other's eyes and cracked up. The laughter lasted for almost half a minute, then trickled away.

Tony looked down at his desk and wiped away the tears of frustration and laughter. "Thanks, Dawn. I needed that."

"I take it you're feeling a lot of pressure about Catherine Harriman."

Tony sighed and looked into the distance. "This wasn't supposed to happen. Ever."

"You can't blame yourself, Mr. Louis."

"I know, I know. But still." He leaned back in his chair and looked at Dawn again. "Do you know why Timothy Easton developed the telepresence school system in the first place? He had lost a good friend in a school shooting. The point of the system was to eliminate all possibility of violence in schools." He shook his head. "Now look at what's happened."

"One killing in a thirty-year-old system. I'd say those are pretty good statistics, especially compared to the RL ones."

"It still hurts. Telepresence school is supposed to be a safe haven; that's the point of it all. It's what I remember most about my own first day of telepresence school."

His assistant looked confused. "You went to telepresence school? I didn't think — I mean — well, sir, back when you were a kid, it must have been expensive."

"It was."

"But then — I don't understand."

"It's okay, Dawn." Tony smiled. "I grew up poor, but I managed to attend a telepresence school starting in sixth grade."

"How?"

"I snuck in."

Dawn looked even more confused. "Were you a juvie?"

"Me? No, although it was only by the grace of my mother that I kept out of trouble. I grew up in Harlem, New York City." He paused. "I'm curious. What does that mean to you?"

Dawn's gaze unfocused for a moment. "Not much."

"I'm not surprised. Harlem's always been an odd neighborhood. Its history is filled with upswings and downswings. It was my bad luck to grow up during one of its lowest downswings, just after the Manhattan Rezoning Project, when Queens, Brooklyn, and Staten Island became independent. The wealthier parts of the city cut off resources to the poorer parts." Unspoken but understood by both of them were the racial undertones to that piece of history.

Dawn nodded. "Resources including schools?"

"Exactly. Those of us who grew up in Harlem got the worst of the school system. I always liked learning, but the school I attended as a kid —" Tony shuddered. "It was a bad place."

"In what ways?"

Tony fell silent for a moment, trying to decide what he felt comfortable sharing. Then he said, "The usual ways. Bullying, killing, the occasional rape."

Dawn gasped. "Rape? In sixth grade?"

"Be grateful that comes as a surprise to you."

Dawn nodded. "I am."

"Thank God for my mother. She knew I needed schooling, and so she did her best to inculcate a love of learning in me."

"So did she sneak you into telepresence school?"

"No, I did that myself. Despite the zoning, my mother and I were allowed to go downtown, because she had a pass from her job. On weekends we used to run errands together. So one day, as we were walking through the streets of Manhattan, I saw a pair of spex sitting inside a car, right on the dashboard. I'm ashamed to say that I took them."

Dawn's jaw dropped. "I have a lot of difficulty visualizing you breaking into a car."

Tony smiled. "If you're having trouble visualizing it, perhaps a pair of spex would help."

They both laughed, then Tony continued. "Sometimes I still can't believe I did it. But I did, and for about a day I took on the role of a kid named Andrew who wasn't as enthusiastic a learner as I was. Made the teacher suspicious." He paused. "I still remember how shocked I was when I looked into a VR mirror and saw a white boy staring back at me."

"I can imagine."

"Anyway, I spent the day pretending to be Andrew, until I was found out." He smiled and shook his head. "I still can't believe it sometimes. But the teacher, Miss Ellis, got me my own equipment and snuck me into the school again, this time under the name Howard." He paused. "At least I got to be black. After all, there were other black kids in telepresence school too, even though I never got to know them. But oddly enough, I became friends with the kid whose spex I stole."

"Really? Did he ever find out?"

Tony took a deep breath. "Yeah, he did."

"How?"

"I told him."

"Oh."

"Andrew had wanted to get together in RL. He thought I lived in Forest Hills, a swanky neighborhood in Queens County. Since he lived on Long Island, closer to me in real life than any other student in the school save one, he suggested that we make the time to get together and hang out for a day at a nearby playground. So I told him the truth, hoping that our friendship would convince him to keep my secret."

He paused. "Two days later, I was called in to see Andrew's father. He was none too pleased with either me or Miss Ellis."

"What finally happened?"

"They threw me out, of course. Andrew's father was on the board of the school, and he was angry with Miss Ellis for sneaking me in. It cost a lot of money to run the system, and my presence meant that everyone else's bills would get higher.

"The teacher, though, Miss Ellis. She wouldn't give up on me. The following week she set up a home classroom in her brownstone for me. She spent the mornings teaching in telepresence, and the afternoons teaching me."

"Wow. She sounds like a saint."

Tony took a deep breath and nodded. "That's the most important lesson I learned from my experience, the commitment of teachers. It still amazes me how cheaply we regard education in the United States. Taxpayers don't see the benefits of public education. Too many of them think their money is being wasted." He paused. "Don't get me started on the wealthy, who send their kids to private schools. They're the worst."

Dawn looked flummoxed. "They're our clients."

Tony sighed. "I know, I know. But they were never the ones I cared about as much in the first place."

Dawn's shocked expression prompted Tony to backtrack. "I don't mean that I don't care about them, or their kids. I love the kids. But it always bothered me how private schools pay their staff less than public schools. Kind of made me wonder what that was all about."

"We pay less than public school," Dawn said softly.

"Yes, and I really wish we could pay more. Our teachers have been through much more extensive training. They deserve a lot more money. Maybe if we can convince the public schools to adopt telepresence, our teachers will finally get the money they deserve."

Tony rubbed his eyes, then continued. "Thank God most of them consider teaching a calling. Could you imagine what would happen if one day all the teachers in the United States decided that the low pay just wasn't worth it anymore?"

The question hung in the air. Finally, Dawn broke the silence. "So why did you come to California?"

He shrugged. "Most people go to New York to reinvent themselves. But if you're from New York, where do you go? There's only one other city that has that same reputation of being able to make an unknown into a star."

"Los Angeles," Dawn replied.

Tony nodded. "Exactly. So once I had finished my own education, I chose to move out here." He paused. "Let's not forget my love of old science fiction and fantasy films. It's a lot of fun living in the town that invented them."

Dawn smirked and shook her head. "I know you better than that, Mr. Louis. There's got to be another reason. A practical reason."

Tony smiled, pleased by Dawn's insight. "Well, yes, there is. California and Texas buy the most textbooks in the country. Like it or not, that affects what the publishers choose to publish. If you're going to make money in that field, you've got to be able to sell to California."

He paused. "Do you see where I'm going with this? As far as public education is concerned, where California leads the rest of the nation is sure to follow."

"So if California adopts telepresence..."

"It'll be the biggest step in pulling it off all over the United States." He yawned and rubbed his eyes. "Enough of this. Go home, Dawn. I will too. I think I need to get some sleep."

Dawn smiled. "That's a good idea. After all, it is a school night."

#

Conrad Haise was practicing on a VR basketball court when both the ball and the universe got away from him.

Like many other telepresence students, Conrad participated in intramural sports. Having finally reached eleventh grade, Conrad was now eligible for the top tier, provided he could beat out enough of the seniors. So although the season didn't start until the spring, he had made a commitment to practice three times a week until then.

His coach had given him special permission to run actual game programs, so instead of dribbling around the court and shooting baskets alone, Conrad was deep in the middle of a real game as a center, with nine virtual players programmed at realistic skill levels.

He hefted the ball, ready to shoot it into the basket, when suddenly all of the virtual players froze, as if the system had crashed.

The ball flew away from him. It bounced against the wall once, then hit the floor. Then it rolled back to Conrad, until finally it stopped right at his feet.

Conrad shrugged. He bent over to pick up the ball—

—and once again, it flew away from him.

Okay. Something is seriously weird here.

Conrad walked over to one of the players, frozen in the middle of a running step. He waved his hand in front of the player's face, and nothing happened.

The ball rolled slowly towards him, and came to a stop at his feet. Conrad examined it for a moment, then bent over to pick it up.

As soon as he touched it, the familiar reddish-orange rubber ball turned into a translucent solid sphere. Conrad brought it close to his face and looked through it, watching it shimmer.

It looks like water, he thought. *A solid sphere of water.*

He closed his eyes, and when he opened them again, the VR world looked the same. *This is too weird. I'd better end the session and report this.*

Conrad opened his mouth to speak a command, but before he could say a word, the ball of water thrust itself onto his head. Conrad began to choke.

Then, without any warning, the virtual players vanished and the court became a swimming pool. Conrad found himself covered in water, flailing his arms around, with his mouth and nose filled.

He struggled against the water, swimming to the surface, where he coughed and spit until he could breathe again.

"Help!" he screamed. He reached for the spex that he knew were sitting on his face in RL —

—and a burst of electricity illuminated the water. Conrad felt himself starting to burn, from the inside out, and he fell into unconsciousness.

#

"It's another victim," Agent Cutter told Tony. "This time in San Francisco. Kid was found slumped over in his simulator, just like the Harriman girl." Cutter sat in Tony's office, still looking immaculate in his blue suit despite having just come from the heat outside into the cool air conditioning. Tony, on the other hand, kept wiping sweat off his forehead with the green handkerchief that Sheryl had given him just for that purpose.

"What's the kid's name?"

"Conrad Haise."

Tony pointed towards his phone. "May I?"

Cutter nodded. "Would you mind putting it on speaker? The local cops have spoken to the family, but I haven't had a chance yet."

Tony considered the question for a moment. "I need to make a condolence call, Agent Cutter. I'll let you listen if you want, but I'd appreciate it if you'd stay quiet and make your own call later."

Tony found the Haise family's contact information and called them. An image of a boy with sandy blond hair appeared on Tony's flatscreen, along with the kid's name, age and grade: Paul Haise, 14, 8th grade.

"Hi, this is Tony Louis, the director of the telepresence school system. May I speak with your parents?"

Paul looked a little shocked. "Um. My Mom's busy at a neighbor's."

"What about your father?"

He shook his head. "Dad died a while ago."

"Oh," Tony said. "I'm sorry. I'm calling to express my condolences on the death of your brother."

"Uh-huh. I found him."

Cutter leaned forward. He stayed out of the visual pickup, but gestured with his hands at Tony to indicate that he wanted to hear more.

Tony nodded. "Um, Paul, I hope this isn't intrusive, but would you mind telling me what happened?"

The kid shrugged. "I walked into our VR room and found Conrad in his simulator."

Tony waited for the boy to say more. When he didn't, Tony simply replied, "Thank you," despite Cutter's signals that he wanted more information. "Again, let me say how sorry I am. Will you tell your mother that I called, and that she can call me back at this number?"

"Uh-huh. Listen, Mr. Louis, I want to see my friends, and the police took my simulator away along with Conrad's for evidence or something. Can you talk to them? Most of my friends live in SoCal, so I need to go back inside."

Of course the kid would need his friends, Tony thought. *He just lost his brother.*

"You'll be able to soon, I promise. But for now, we've got to let the police do their work."

Cutter looked at Tony and raised his eyebrows, but said nothing.

"Thank you, Mr. Louis."

"You're welcome, Paul. Goodbye."

Tony turned off the video linkup, and Cutter spoke. "That was irresponsible of you. You can't promise that kid that he can go back into telepresence."

"What are you talking about?"

"I'm talking about two murders, Mr. Louis. Unless you can tell me that your system is safe, I'm going to have to shut it down."

"You don't have the authority."

"Be reasonable. You know that even in a regular school when there's a tragedy, the school closes for a day or two."

"Or the school stays open and provides grief counseling. How would it look to the families if we closed down?"

"Are you sure it's the families you're concerned about? Or is it the commission?"

Tony glared at the agent. "I resent that."

Cutter shrugged. "Resent it all you like. But I know what's going on, sir. Remember that I come from Washington. I can smell politics a mile away."

"You misunderstand me. The safety of my students is paramount. What I resent is the implication that I would feel anything else."

The two of them sat in silence for a moment, and then Dawn's voice came over the intercom. "Mr. Louis? Sorry to interrupt, but Frank Yee is calling from Oakland. He says it's important."

"Put him on the phone."

Frank's image appeared on the flatscreen, and before he could say anything, Tony spoke. "Frank, this had better be really important. I've got the FBI in my office."

"Good, good," Frank said. "They'll want to hear this as well. Has there been another incident?"

Tony looked up in surprise. "Well, yes. How do you know that?"

"Because my tracer worked. We got him."

Cutter pushed his way into the visual pickup and looked at Frank. "Got who?" he asked.

"The hacker, of course. We know how to find him."

#

Despite Cutter's objections, Tony insisted that the two of them enter VR to talk directly with Frank. Since Tony's office only had a single pair of spex, they walked to the training room and entered telepresence via two simulators. Dawn came along to help Cutter into the system and at his insistence remained in the room, monitoring their conversation, in case they needed to be removed immediately.

As before, they sat in a large white VR conference room filled with a floating grid representing the pathways of the system. Cutter kept looking around slowly, as if he expected to be attacked at any moment.

"How did you find him?" Tony asked.

Frank pointed at a bunch of pathways in the grid. "Water."

"Water?"

He nodded. "The hacker programmed a basketball court to become filled with water, which is one of the most difficult things to program properly in VR. It takes thousands of petaflops to get it to follow proper physicality."

"What in the world is a petaflop?" Cutter asked.

"A thousand trillion floating point operations per second," Tony replied without thinking. "Ten to the fifteenth power."

Cutter looked at Tony in amazement. "I guess you know more about the details than you claimed," he said.

"Tony's only second to me," Frank said with a note of pride.

Tony glared at Frank, and Cutter said, "Well, well, well. Hiding something, Mr. Louis?"

"Nothing important. I had Frank turn over everything we found."

Cutter grunted. "I'll let it go for now. I'm still not sure what a petaflop is. Can I have an answer in English?"

Frank smiled. "It's a measure of computer speed. The VR processor has to run faster to simulate fluids than to simulate anything solid. Which means that if someone wants to control it directly, he has to stay in constant contact with it. He can't just program it and let it run on its own."

"So what you're saying is that he made himself easier to trace because he had to keep an open line?" Cutter asked.

"Yes," Frank said.

Cutter nodded. "That tells us something about his profile. The unsub didn't just want to kill Haise remotely. He wanted to participate directly in the murder."

"Unsub?" Tony asked.

"Unknown subject," Cutter replied. "You're not the only ones with your own jargon."

Frank pointed at the schematic. "The kid is something of a computer genius. You can see from these pathways that he did an excellent job of covering his tracks, by bouncing his presence all over the system. Frankly, I'd like to hire him to work on the network."

Cutter looked askance, and Tony glared at Frank again. "Let's see about justice first, Frank, before we start doling out mercy."

"Of course, of course," Frank said.

"Enough of this," Cutter said. "What's the unsub's name and address?"

"I don't know," Frank said.

Cutter raised an eyebrow. "You said you got him."

"I meant that I know how to find him in telepresence. But like I said, he's a genius. He knows we've found him in VR, and he's threatened to kill anyone who comes after him."

"That doesn't make sense," Tony said. "He can only do that in VR."

Frank rolled his eyes. "That's my point, Tony. No one knows where he is in RL. The only way to find his physical location will be to seek him out in VR. Once someone has found him in virtual space, I can run a Levinsonian trace to find his location in real space."

"So the only way to find him is to go after him on his own terms," Tony said.

"Or we could wait for him to strike again. I might be able to—"

"No," Tony interrupted. "We have to stop him now."

"That means someone's going to have go after him inside the system," Frank said. "Who's going to do that?"

"Me," Tony said.

For a moment no one said a word. Then suddenly the three of them were joined in VR by Dawn, who had a worried look on her face. "Mr. Louis, no. You should let the police handle it. They'll find him eventually."

"What are we to do in the meantime? Close down the school system?"

"Don't forget the commission," Dawn added.

"Honestly," Tony said, "they're the last thing on my mind. I'm worried about the students." He turned to the FBI agent. "Agent Cutter, here's my plan. Frank will keep a trace on me as I go into the system. Once I've found the kid, he can get an RL location for you. Then Frank pulls me out of the system, and you have the local cops pick the kid up wherever he is."

Cutter shook his head. "I don't like the idea of a civilian going after the killer."

"It's my system, Agent Cutter. I'm responsible, and as you've just learned, I know more about it than almost anyone else in the world." He paused. "To be blunt, you don't have the authority to stop me."

Cutter took a deep breath. "Fine. But I'll want to stay in the loop at all times." He looked at Frank. "Can you program this system to fight the kid, so he can't hurt your boss while he's inside?"

"That's certainly possible," Frank said. "Maybe I can reprogram the safeties, so they're harder for the kid to override."

"I was thinking of something else," Tony said. "Frank, earlier you said that the kid had achieved some sort of root level of access to the system. Do you remember when we programmed something even more powerful?"

Frank lifted his head back. "Yes. I remember."

"Do you still have the programs?"

"I...I think I can find them."

"Let me know once you do, and then I'll go after the kid."

"Tony..." Dawn put her hand over his. "Be careful."

Tony nodded, and smiled, trying to put on a brave face while inside he was scared to death. "I will."

#

A few hours later, Frank and Tony met back in the virtual conference room, where Frank gave Tony a virtual handheld device.

"Here," he said as he passed over the tiny box. "The Omni."

Tony chuckled. "That's right. That's what I insisted we call it." He turned the device around a few times in his hands; it was smaller than a pack of tissues and had only one button and a screen. "Does it still have everything we gave it?"

Frank scratched his left ear and nodded. "You push that button and it'll give you absolute power over the system. Anything you want to happen in VR will, if you just think of it."

"The power of a god..."

"The power of good programming," Frank replied.

A thought occurred to Tony. "There's no way the hacker could have gotten a hold of our programs, is there?"

Frank shook his head. "I kept them isolated from standard telepresence."

Tony nodded. "It's a shame, though. The Omni was the only way we were able to expand VR from sight, hearing, and touch to also include smell and taste."

"It was too dangerous," Frank said. "Remember the last time we used it?"

"It almost fried your brains."

Frank nodded. "The human mind was never meant to be so directly connected to the computer-generated world. Seriously, Tony, don't use the Omni unless you absolutely have to." He paused. "That's another reason to find this kid. If we could study his brain, we might be able to figure out a way to create five-sense VR safely."

Tony sighed. First Frank had suggested hiring the kid as a consultant; now he suggested putting the kid under a microscope. His mind certainly went in many directions. "Let me find the kid first, Frank."

Frank nodded again. "Sorry. Anyway, I've set things up for you so the first step to find the kid will be fairly easy. Just stay on the path I've traced for you outside the conference room."

Tony placed the Omni in a pocket of his jacket. "Thanks again, Frank."

"Good luck," he said, and he disappeared to monitor the system from outside.

Although Tony knew that he was being monitored by both Frank and Agent Cutter, he felt horribly alone. He deeply wished that Frank or Dawn could have stayed in communication with him while he found the kid, but Frank had advised against it, as that would make it easier for the kid to know they were trying to track him in the real world. Tony sighed and stepped through the door leading out of the conference room.

He expected to find himself in a hallway. Instead, he found himself in a dark void with glowing pinpoints of light scattered in the distance.

"My God," Tony said with a chuckle. "It's full of stars." He looked down at his feet to study the pathway that Frank had created for him. Just beyond the linoleum platform upon which he stood, a shimmering band of gold led off into the distance. Tony put his foot down on the band, and was relieved to discover that it felt solid.

Then he noticed that the path was divided into tiny bricks, and he smiled. Frank often teased him for his love of old fantastic films. It must have amused him to arrange for Tony to follow the yellow brick road. He wondered if Frank had any other surprises like that in store.

Well, as long as I don't run into the Martians or any former California governors, I should be okay.

Tony walked along the road for about twenty minutes, resisting the temptation to step off into the darkness. He wasn't sure if he would fall or fly, but he knew that in either case he would get no closer to the kid.

Finally, he saw a faint blue glow emanating from the end of the road, and he stepped up his pace. A minute later, he found himself standing in front of an elaborately carved wooden set of double doors that displayed a graceful tree pattern. Huge glowing blue letters formed an arch above it.

Tony looked at the letters, paused for a moment in disbelief, and laughed out loud. The message read: SPEAK, FRIEND, AND ENTER.

Tony's laughter died down as he suddenly realized that perhaps the old movie cues weren't Frank's doing. The kid might be into old movies; it was common for adolescents who couldn't deal with the real world to retreat into fantasy worlds of books, films, and games. If that was the case, Tony might have a lot of difficulty making a connection with the kid long enough for the trace to do its work.

Then again, he thought, *if the kid loves old movies as much as I do, maybe we'll have something to talk about.*

He approached the door. Recalling how the riddle was solved in *The Fellowship of the Ring*, he spoke aloud.

"Friend," he said.

Nothing happened.

Oh, right. In the movie, the word had to be spoken in Tolkein's Elvish. He strained to recall the Elvish word for friend spoken by the wizard Gandalf. Finally he remembered.

"*Mellon*," he said. But again nothing happened. Tony pondered the riddle again, and then took a stab at it using California's second official language.

"*Amigo*," he said in Spanish, and with a loud creak the doors swung slowly outward. A stairway led upwards into darkness. Tony walked through the doors and began to climb.

The stairway ended at another door, this one painted white and with a brass doorknob. Tony touched the doorknob, and when nothing happened, he turned it and opened the door with a click.

Without taking a step, Tony found himself inside a teenage boy's bedroom. Books, data disks, and game wafers covered an unmade bed. A pile of clothing sat in the corner, spilling out of a closet. At the desk, typing on a virtual terminal, sat a kid. He wore a shirt of thick red and blue horizontal stripes. The kid's avatar emitted a green aura that told Tony he had found the hacker.

Tony uttered the code word "Peaches" under his breath, and felt a tingle as the trace began its work. It completed its first step, as the kid's name floated briefly above the desk, lingering just long enough for Tony to read it.

"Alex Hanover?" he said aloud.

The kid stopped typing and swiveled around.

"Ah. I see you found the place." He gestured around the room. "I recreated my bedroom in VR. Like it, Mr. Louis? It's an accurate, real-time environment."

Tony felt surprise at hearing his name. "You know me?"

Alex nodded. "Of course I do. You're the school principal."

"Close enough," he replied. "Do you know why I'm here?"

"Because of Catherine and Conrad."

Tony nodded. "I'm also here to help you. But you're right to mention your classmates." He paused, and then spoke more softly. "You shouldn't have killed them."

Alex scrunched his face up. "You don't understand. They all made fun of me when we first met in sixth grade. They called me Alex Pushover and kept doing it. Catherine and Conrad were the ringleaders."

"Alex, that was five years ago."

"Yeah, Mr. Louis, but I've been stuck with them since then." He looked at Tony with the beginnings of

tears. "Do you know what they did last year? They earned my trust, told me that a girl I liked was just waiting for me to call her, and egged me on to confess my own feelings." He crossed his arms. "Well, I did, and it turned out to be a joke. I was the laughingstock of everyone."

"Why didn't you tell anyone?" Tony asked.

"I did. Three years ago. Instead of punishing them, you put me in different classes for a year. I lost out on the teachers I liked."

Tony sighed and tried to appear sympathetic. "I'm sorry, Alex, but I wasn't the one who did that to you. I hope you understand that." He reached out and put a hand on the kid's shoulder and felt gratified when Alex didn't pull away.

"Do you understand?" Alex asked.

Tony nodded. "I do. I know what it is to be marginalized. I grew up poor in Harlem."

"It's not the same," Alex replied. "If the world is so bad, then we should stay in VR all the time, where it's safe." A cold look appeared in his eyes. "That is, it will be, once I get rid of the bad people. The ones who make fun of us."

"We can't do that, Alex. Everybody is entitled to have access to VR."

Tony heard Dawn's voice in his ear. "We found him; he's in Palos Verdes. We just need another minute or two to locate the simulator."

A loud alarm buzzed, and Alex looked horrified.

"You set up a trace." His blue eyes turned a deep red. "I thought I could trust you."

"Alex, you can trust me." Tony placed his other hand on Alex's other shoulder and looked him directly in the eyes. "I'm here to help you."

Alex jerked himself away. "You're just like all the others," he said. "You make me think I can trust you, and then you betray me. You've ruined everything."

He pushed himself up from his chair, which rolled into the clothing pile. His hands twitched. "I'm going to get you before they can get me."

Tony heard Dawn's voice in his ear. "That's it. I'm pulling you out."

"No!" he shouted. "He might run! I just need a little more time."

"Sorry, Mr. Louis," Alex said. "Your time's up."

As Tony watched, the bedroom and everything in it, including Alex, grew larger, until Tony was the size of an ant. He looked around for a means of escape, and ran towards the pile of clothes, hoping to hide underneath it.

"I'm coming after you, Mr. Louis..." Alex's voice boomed in Tony's ears.

Just before Tony reached the pile of clothes, he felt a hand grab him and lift him up, until Tony found himself staring into Alex's enormous face.

"I could swallow you," Alex said. "You're a nothing, just like all the rest."

Tony reached into his pocket, grabbed for the Omni—

—and using two thick fingers, Alex plucked it out of his hands.

"What's this?" he asked.

"Nothing," Tony said.

Alex tossed Tony onto the pile of clothing. Tony watched in alarm as Alex pushed his finger on the Omni, to no effect. "My fingers are too big to push the button," Alex said.

Suddenly Tony heard a cacophony of voices intruding from the real world. "He's got the Omni!" "We have to pull Tony out!" "Give us a few more seconds!"

The room melted back to normal size from Tony's perspective, and he rolled off the pile of clothing and onto his feet. Alex now held the normal-size Omni in his hand, his finger poised over the button.

Tony raised his hand. "Alex, don't do that. You don't know what that device will do to you."

Alex glared at him. "What is it? Don't lie, or else..."

Tony felt the crackling of electricity in the air. "It's an interface device. You push that button, and it will connect you directly with the system."

Alex's face lit up. "Even more directly than I am now? Cool."

He pushed the button, and suddenly he was covered in glowing blue pulses, which shot across his avatar in all directions. Tony recognized the effect from when Frank had last used the Omni; it meant that Alex now had ultimate control over VR.

"My God," Alex said, as the pulses flew. "I thought I had taken control, but this... What power. What incredible power."

The world around them started to change rapidly, reminding Tony of a flickering light. The bedroom disappeared, becoming scenes from dozens of old films, one after the other: *The Time Machine, 2001, Star Wars, WarGames, The Last Starfighter, The Matrix, Ender's Game, Lunar Revolt, Dorato Positive, Halt Catch Fire, Cracker, The Weather Hack, Higher Law...*

"Wait a minute," Alex said, and the images froze. He gestured with his hands, and suddenly, the characters from different films started interacting with each other, in ways their creators had never intended. Neo from *The Matrix* sat at a computer from *WarGames*, connected to cyberspace via a primitive acoustic modem. Charlie from *Dorato Positive* injected a virus into Roh Kwontaek, the villain-turned-hero of *Cracker*. Android Delta C-7 of *Higher Law* plugged into Mycroft the AI computer from *Lunar Revolt*.

"Wow," Alex said. "I don't just control the world now. I control the people within it." He glared at Tony. "Including you."

Alex gestured again, and once again the world flickered through all sorts of environments. Tony was battered by changing pictures, warbling sounds, variations in temperature, bitter tastes, and even pungent odors. He tried to close his eyes and to cover his ears, but it didn't work. Alex was bypassing Tony's receptors, and using the ultimate power to mount an assault directly on Tony's mind.

Tony felt himself getting dizzy from all the direct sensory input. His heart started racing faster. His lungs

strained to gasp another breath. He collapsed to the floor, knowing that soon he would pass out and die—

When suddenly, Alex vanished, and Tony heard Dawn's voice echoing inside his head. "Tony, they got him. They've disconnected him from VR. Do you hear me? You're safe now."

Tony nodded; his senses felt drained. He felt his body pulled out of the simulator by gentle hands, and he saw the real world replace the virtual world just before he fell into unconsciousness.

#

The next day, Tony sat in his office with Ms. Palmer, filling her in on the details of Alex Hanover's case. When he finished, she asked, "So what happens now?"

"He's in an institution for observation."

"What about his parents?"

"Father's dead. Mother claims she had no idea." Tony paused. "She's a rich lawyer who hired nannies to watch over Alex, so she may be telling the truth."

Ironic, Tony thought. *Alex's second victim was also being raised by a single mother. They had more in common than either of them realized.*

Palmer's next words pulled Tony away from his thoughts. "I'm still concerned with the vulnerabilities of your system. As is the whole commission, now."

"Don't be. Frank Yee has gone through the system and fixed all the back doors that Alex used to give himself root access. No one will be able to do that again."

She shook her head. "It doesn't matter. Most of the members of the commission still think that a telepresence school system would be more dangerous than what we have now."

"I strongly disagree," Tony replied. "Think about Columbine and Beslan, just to name two examples. In one case, the violence came from within. In the other, it came from without. But in both cases, if the students had been spread throughout a telepresence network, the tragedies could have been averted."

"We don't know—"

He pressed on. "It's not the VR system that caused the deaths of Catherine Harriman and Conrad Haise. It's the same thing that always happens: cliques form, students bully other students, and kids become marginalized."

Palmer sighed. "My point exactly, Mr. Louis. Apparently bullying and marginalization still happen in your telepresence school."

"True," Tony admitted. "We've found that out now. But it happens much less often. Students are able to find many more people who share their interests, meaning that they're less likely to feel marginalized. They meet students from all walks of life, from all different backgrounds. Our school teaches something more important than simple reading, writing, and arithmetic. It teaches tolerance and understanding." He paused. "Diversity, Ms. Palmer. That's why the VR system is even more important than before."

Palmer remained silent, and Tony handed over a pair of spex. "Would you put these on, please? I'd like

to show you one final demonstration before you make your decision."

Palmer hesitated, then took the spex from Tony. He looked into her eyes and saw a trace of fear. "Please. Give me this last chance to convince you."

She looked back at him, nodded, and placed the spex over her eyes.

Tony pushed a button. "Ms. Palmer, I'd like to introduce some old friends of mine from telepresence school."

Four figures appeared: two white women, one Asian woman, and one white man. They greeted Tony, who nodded to each of them in turn.

"I've asked them to appear here today to give you some final testimony for your commission." He turned to the first friend, a woman in a white lab coat. "Janice?"

"My name is Janice Mann. I was born in San Francisco, but I spent most of my school years in Neptune Beach, Florida. During Hurricane Carol, my family lost everything. But I didn't lose my friends. I knew people from all over the country, and they were all hoping for things to work out. I think I would have despaired without that network." She paused. "I'm a physician today, specializing in disaster management."

"Thank you, Janice." Tony looked at the Asian woman; her avatar wore a flight suit.

"I'm Sandra Chang. I grew up outside Washington, DC. If it weren't for telepresence school, I wouldn't be where I am today. You see, my teacher encouraged my interest in space travel by letting me explore the planets of the solar system, on foot." She laughed. "I still remember how primitive some of the simulated environments looked. But the fact is that I wasn't a book person. My learning profile showed that I was more of a visual and experiential learner. Traditional learning can't hold a candle to telepresence school in that regard. So, thanks to VR, today I'm an astronaut with the NASA-ESA Mars Project."

"Thank you, Sandra." Tony looked at the last woman of the group, who was dressed in a blue blouse and skirt, along with a black beret that completely hid her hair. "Debby?"

"My name is Debby Sommer. I grew up Jewish in Monsey, New York. If you know anything of that town, you know that it's a heavily religious Jewish enclave, and I barely saw anyone outside of that world as I was growing up. Most girls in my community get a minimal secular education and then end up raising children and not having any sort of career. But my parents wanted me to know the world outside our own. So they enrolled me in telepresence school, and I got to see that there were many more options available to me. I still ended up as a wife and mother, and I'm still a part of my community, but I don't feel as isolated from the rest of the world as a lot of other people I know. I have a part-time job working in cultural outreach, which may go full-time once my children are older."

Palmer nodded absently, then turned to the last of Tony's friends, the white man. His avatar wore a sleek blue suit and a pair of wire-rimmed glasses. "Who are you?" she asked.

"My name is Andrew Drummond," he said.

"*You* I've heard of," Palmer replied with surprise. "The financier and philanthropist."

"I do a little of this, a little of that," he replied. "It's all because of Tony." He smiled at Tony, who smiled back.

"Explain," Palmer said.

Drummond nodded. "I was a snot-nosed kid. I grew up with wealth and privilege, and frankly, I couldn't see the point of school. My mother spoiled me rotten. My father almost gave up on me, but then they introduced the first private telepresence school, in the Eastern time zone, and he saw it as a way to get me interested in learning. He never did things halfway, though; he became a major donor to the school and joined the Board of Trustees, all in the hope that I would start taking my education seriously."

"Did it work?" Palmer asked.

Drummond smiled. "Not at first. It was more fun than the other schools I had gone to, I'll grant that much, but I still didn't care for learning. It wasn't until I met Howard here that I discovered that learning could be fun."

Palmer looked confused. "Howard?"

Drummond chuckled. "That's how I got to know Tony at first. As a boy named Howard." He turned to look at Tony. "She doesn't know?"

Tony shook his head. "Tell her."

Drummond explained how Tony had broken into telepresence school, and how he had gotten to know Tony as a friend for a few months before he eventually found out the truth.

"I knew that what Tony was doing was wrong, and I was still pissed at him for having stolen my spex. I wanted him to be punished, and so..." He paused for a moment and glanced at Tony. "So I told my father, and he kicked Tony out of the school."

Palmer turned to Tony. "Is this true?"

"Yes," Tony replied. "But there's more."

Drummond continued. "I only knew Tony for a few months, but after I had gotten my revenge, I realized that I missed him. So I talked with my dad, and with my teacher, and I managed to reconnect with Tony. He came over to visit me in Port Jefferson a few times. A few years later, we found the scholarship money to bring him back to telepresence school."

"So," Palmer said with a hint of sarcasm, "you would credit your interaction with this one person as the experience that changed your life."

Drummond chuckled. "Don't get me wrong. I'm not saying that I changed overnight. But Tony and I had become friends, and I really wanted to see him again. He was the only kid I knew who was willing to break through my obnoxious behavior and stay my friend. I think it was out of guilt for stealing my spex."

Tony shook his head. "It was your fault for bringing them into Manhattan with you, Andrew. That's what you got for using them to play games instead of just going to school."

They both chuckled, and then Drummond continued. "Games. Sometimes I still can't believe I wasted so much of my time on such trivial things." He shook his head. "In the end, Ms. Palmer, it took Tony here to show me what it was I was really missing. I'm not saying that I wouldn't have found a similar path without his help. But I'm pretty sure I would be a different person today if I hadn't become friends with him."

Palmer turned to look at Tony for a moment; Tony kept his gaze on Andrew.

"You see, my Mom — well, there's no good way to say this. She didn't like black people." He paused. "She might have passed that prejudice along to me, if not for Tony. Because it's one thing to learn about other people through books and videos. But it's another thing to interact with them directly." Drummond nodded at Tony, indicating that he had finished.

"Thank you, friends," Tony said to his four erstwhile classmates. He turned to Palmer. "I hope this final demonstration has made its point. But I have one more thing to say before you go back to the commission to make your decision.

"We live in a world where we pay lip service to equality in public education, but in reality, it's a joke. Some districts always have more money for resources, and some always get the short end of the stick. We both know how unjust that is. People can only truly be on the same playing field if they all have access to the same level of quality in their educational choices.

"Thurgood Marshall argued those same points in *Brown versus Board of Education* over a hundred years ago. Despite the Supreme Court ruling, the idea of equal access to education has always been something of a pipe dream. But with the telepresence system—" Tony paused. "Today we have the ability to make that dream a reality, for the public good. Don't let this one incident, as tragic as it was, destroy that dream."

Palmer pursed her lips for a moment, then nodded. "Mr. Louis, we will let you know."

#

Tony couldn't remember the last time he had visited the cemetery, here in the farthest reaches of Long Island. His memory told him that he had been here on a warm, sunny day in the middle of July, but which July? Not last year, not the year before...

The car came to a perfect stop in front of the gate, and Tony grunted as he pushed himself out of the back seat. The computer informed him that it would pull the car over to the nearby lot, and that when he was ready to be picked up he should just signal it. The door pulled itself shut and the car drove off.

It had been warm in the car; outside, the fall weather bit at his ears. An overcast sky lent a gloomy tone to the visit. Tony bundled himself more tightly into his coat, being careful not to hurt the flowers he held, as the cold wind brushed past him with a soft howl. His teeth began to chatter, and his feet crunched on the brittle leaves.

That's the one problem with spending so much time in VR, he thought. *You forget that you can't adjust the real world around you when it gets uncomfortable.*

The grave was situated a short distance from the entrance, and Tony headed straight toward it. But after a minute of walking, he stopped short. In his direct path, he noticed a group of new mourners attending a graveside funeral, and heard the words of the minister pass over the coffin. "Ashes to ashes...dust to dust..."

Tony gave them a wide berth, paying his respects to the family by walking as far around as he could.

Finally, he arrived at the grave that belonged to the most important woman in the world besides his mother: that of his former teacher, Miss Ellis, who rescued him from a world of violence and pulled him into a world of learning. He stopped walking at the edge of her grave and noted with slight sadness that her plot no longer lay in an uncrowded section of the cemetery. Somehow, he always felt that her death should have been the last one ever, and it always bothered him to see more headstones gathered around

hers.

Then again, she had always preferred a crowded neighborhood.

Tony read the words on the modest headstone to himself, words he had adapted from a famous Henry Brooks Adams quotation:

"A TEACHER WHO AFFECTED ETERNITY"

Miss Ellis had not had any family, and Tony had taken it upon himself to see that she received a proper funeral and burial. As he stood there, his mind drifted back to the bookends of his friendship with her.

He thought back to his first memory of the comforting Miss Ellis, the white teacher in telepresence who smiled at him instead of scowling. He remembered his shock the first time he met her in real life, and discovered that she was as black as he was, with a thick red scar seared across her right cheek.

He also remembered the shock of the day he came to her door, and she didn't answer. He tried his thumbprint and discovered that it still opened the door. An odd smell had overwhelmed him, and he had realized it was the smell of death. According to the coroner, her heart had simply given out while she lay sleeping a few days before Tony had come to visit. Once again, he wondered at a world in which a person could vanish and not be missed right away. He wiped away a bit of moisture that trickled down his cheek. He owed her so much, and there was no way he could ever pay her back completely.

But at least he could give her the news. He stared at the headstone and spoke softly.

"It's done, Miss Ellis. I took your dream, and I've made it a reality. Governor Gelb has signed the legislation. California's public school system will be completely moved to telepresence within the next five years. I imagine the rest of the country will follow suit within my lifetime." He paused. "I'm only sorry you aren't still around to see it."

He bent over the grave and lay the bouquet of flowers on the grass. Then, recalling a Jewish custom he had learned about from Debby Sommer, he found a small rock and placed it on the headstone, to indicate that he had visited. It would most likely last longer than the flowers anyway.

The breeze suddenly died down, and a shaft of sunlight broke through the clouds, illuminating the ground and warming Tony's face. Then, as quickly as it had appeared, it vanished, swallowed up in the grayness of the day.

Tony smiled at the headstone, then turned on his heel and walked away. *The future still awaits us*, he thought, *and there is still so much to do.*

<div align="center">END</div>

— *with thanks to Tom Easton*