

Presence of Mind

by Edward M. Lerner

When new capabilities create new dangers, there are two ways to respond....

Chapter 1

Thwock.

The bright red ball rebounded with a most satisfying sound, although the racquet continued on its arc without any apparent impact. Doug Carey hurriedly wiped sweat from his forehead with the back of his racquetless left arm, carefully keeping his begoggled eyes on the ball. Precisely as he'd intended, the ball passed through a translucent green rectangle suspended in the vertical plane that bisected the court. The ball instantly doubled its speed.

Across the court, his opponent grunted as he lunged. Jim Schulz caught the ball on the tip of his racquet and expertly flipped the orb back through the green region. The ball redoubled its speed. Doug swore as he dived in vain after the ball. It swept past him, obliquely grazed the floor, and careened first from the rear wall and then from a side wall. The ball winked out of existence as it fell once again, untouched by Doug's racquet, to the floor. "Good one," he panted.

Jim waved his racquet in desultory acknowledgment, his T-shirt sodden with sweat. "Pull," he called out, and a new red ball materialized from the ether. Jim smacked the ball to the court's mid-plane, just missing the drifting triple-speed purple zone. The unaccelerated serve was a cream puff; Doug ruthlessly slammed it through purple on his return. A red blur shot past Jim to a brown "dead zone" on the rear wall, from which the suddenly inert ball dropped like a brick. This ball, too, disappeared.

"Roll 'em." Yet another red ball appeared, again in midair, this time at Doug's invocation. He twisted the racquet as he stroked the ball, imparting a wicked spin. The serve curved its way across the court, rebounding oddly from the floor and side wall.

Not oddly enough. Jim pivoted gracefully, tracking the ball around the rear corner. He stepped behind the ball as it sailed off the back wall, from which position he casually backhanded it. The ball soared lazily to midcourt, aimed squarely at a drop-dead zone scant inches from the floor.

Doug dashed to center court, ignoring an alert tone as he crossed the warning line on the floor. He desperately swung his racquet into the slight clearance between the vertical brown region and the floor. He misjudged slightly: the body of the racquet swept effortlessly through the court's vertical bisection plane, but the handle struck with a thud. A loud blat of disapproval drowned out his sharp intake of breath, but not the jolt of pain that shot up his arm. All but the offending handle vanished as he dropped the racquet. "Damn, that smarts!"

"You OK?"

Doug grimaced in response, rubbing his left hand against his right forearm just below the elbow. He pressed a thumb into a seeming birthmark on the forearm, and was rewarded with a subcutaneous click. "I think we're done for today. Don't watch if you're feeling squeamish." The words, forced between clamped teeth, indicated his distress. He grasped firmly with his left hand, and twisted. The right forearm popped off, to be placed gently onto the court floor. Doug massaged the shocked area vigorously. "To coin a phrase, ouch."

Jim walked to center court, beads of sweat running down his face and glistening in his lop-sided mustache. He sported possibly the last long sideburns within western civilization. "Anything I can do?"

"Uh-uh." The answer was distracted.

His friend pointed at the numerals glowing on the ceiling. "Twelve to ten, pretty close. Let's pick up there next time. I'll call you tonight. Abracadabra." The last phrase was directed at the court, not Doug. Jim disappeared as thoroughly as had the out-of-play balls earlier, but with the added touch of a puff of white smoke.

"Abracadabra," Doug agreed. Jim's half of the room promptly vanished, revealing at what had been center court the wall that had so rudely interrupted the game. He studied the quarter-inch-deep gouge in the plasterboard that indicated by how much his depth perception had failed him. Virtual racquetball with

real divots: Maintenance would just love that.

Sighing, he reached for the Velcro buckle of his game goggles-and missed. Look, Ma, no hand. He was more successful with his left arm. The colored regions floating about the room, the glowing scoreboard, the lines on the floor-all of the ephemera-disappeared. Stark white walls now surrounded him, interrupted only by glass-covered, inset mini-cam ports and the thin outline of a tightly fitting door.

Doug laid down his computer-controlled goggles carefully, although its LCD eyepieces and stereo speakers weren't all that fragile, then wrestled himself back into the prosthetic forearm. Hopefully, the impact of racquet on wall hadn't injured the limb. He'd find out soon enough.

Doug glanced at his wristwatch, and it was as late as he'd feared. The more conventional part of work called.

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Doug strode from the virtual-reality lab to his office, whose laser-carved wooden nameplate announced him to be Manager, Neural Interfaces Department. He paused beside his secretary's desk to check out his tie. He'd have been amazed if it hadn't needed straightening. No surprises today.

The reflection in the sidelight to his office door revealed someone tall and well built, if not as thin as he'd like. Still, 185 pounds at six-foot two was respectable. Thick and unruly hair, all black but for a hint of gray at the temples, remained damp from his post-game shower. His most prominent feature was a nose too large for his taste. Aquiline, Doug reminded himself, aquiline. Like an eagle. The hint of a mischievous smile flashed and was gone. What eagle had a bump like this on its beak? His hood ornament had come courtesy of a long-ago pick-up football game gone a little too enthusiastic. He tugged the knot into something more closely resembling its intended configuration, then entered his office.

A visitor stood waiting inside his office, scanning titles on his bookshelf. She turned to face him. It was Cheryl Stern's first job interview at BioSciCorp, and Doug found himself taken aback. Cascades of wavy brown hair framed a face graced by wide-set hazel eyes, an upturned nose, and a sensual mouth. Her brief smile seemed forced and out of practice. She was slender and, he guesstimated, about five-foot four. All in all, very attractive. He was instantly shamed by a memory of Holly.

Doug hastened to offer her a guest chair, shut the door, then hid behind his desk. Her application sat in a manila folder in front of him. He got his mind back on the interview and the resume. The resume, he reminded himself severely, that had earned her the invitation to this meeting.

"Thanks for coming in, Cheryl. I hope you didn't have any trouble finding us."

"Your secretary's directions were great. I gather she gets to give them out a lot."

The implied question was: how many people am I competing against? He also couldn't help noticing that she sat perched just a little too far forward in her seat. He tried for a friendly grin. "There's no opening per se. I'm sure you know how few people there are in the neural-interfacing field. When a resume as good as yours crosses my desk, I make a point of talking to its owner. If you're as talented as this suggests, I'll make a spot."

She relaxed a bit at his answer, but said nothing.

"Let's start with one of those open-ended questions interviewees hate-I try to get those out of the way before taking candidates to lunch. That way, you'll actually get to eat. Why don't you tell me a little about yourself?"

It was quickly clear that she wasn't going to volunteer anything not already on her resume. "Excuse me, please, Cheryl. What I'd like to hear is more along the lines of what you're looking for in a job. For instance, why did you contact BioSciCorp?"

It took a few tries, but he eventually got her to open up. "...And neural interfacing fascinates me. Still, when I consider the potential of linking the human brain directly with a computer, my imagination can't quite handle it. Sure, I know all of the standard predictions: speed-of-thought control of complex machinery, immediate access to entire libraries, mind-to-mind communications between people using the computer as an intermediary. What I don't believe is that any of us truly understands what these capabilities would really mean. If we pull it off, neural interfacing could have as big an impact on civilization as the industrial revolution."

"I agree, it'll be astonishing. However, that's not exactly what we're working on here."

“Close, though.”

“One step along the way,” he conceded. “Mind if I do a quick overview of what we're up to here in my little corner of BioSciCorp?”

“I'd like that.”

“OK, then. Basically, we're trying to walk before we run. The human brain is the most complex piece of neural engineering that we know, right?” She nodded to fill in his pause. “The truth is, we-humans-don't begin to understand how the brain works. We're not even close to cracking the code. That's why BSC is trying to connect a computer to a much simpler structure of nerve cells.”

“Say you do connect a lower life-form to a computer. How would you know if any communication was taking place?”

“Who said anything about lower life-forms?” He took a moment's malicious satisfaction from her puzzled look, then relented-sort of. He raised his right arm, thinking hard about his hand. The microprocessor-controlled prosthetic hand slowly rotated a full 360°, its wrist seam unseen behind a shirt cuff. In the suddenly silent room, Doug heard the whirrr of the motor by a freak of sound conduction through his own body.

“You've connected to the nervous system.” Her eyes were wide with wonder. “That's astonishing.” Then the other aspect of Doug's revelation struck home, and she cringed. “Oh, I'm sorry. I just get so wrapped up in technology. I don't mean to make light of your, uh...”

“No need to feel uncomfortable, Cheryl.” He lifted a wry eyebrow. “In the land of the prosthesis manufacturer, the one-armed man is king.”

She had to laugh—a trait he couldn't help but find endearing in a prospective employee. “Um, but seriously, how did you do that?”

“My stomach alarm went off ten minutes ago. What say BSC springs for lunch, and we pick up afterward?” “That's a deal.”

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After lunch and a promising continuation of Cheryl's interview, Doug did some management by walking around.

There'd been a virus attack while he'd been eating. They'd been semi-lucky. On the one hand, the invader was not benign. On the other hand (an expression from which Doug could not break himself), the program was clumsy and well understood. Well understood, that was, at the Inter-Agency Computer Network Security Forum, the federal crisis-management organization that strove valiantly, if with mixed success, “to stem the rising tide of computer break-ins.” The Web announcement of the forum's formation had brought unbidden to Doug's mind the image of King Canute drowning in a sea of hostile data. A far-from-bitsy bit sea.

The virus was brand-new that day, and hence unknown by and invisible to the company's Internet firewall, but the forum's web site already listed eighteen attacks. Behind a cute pop-up window (Dyslexics of the World Untie) hid a cruel, if apt, intent: randomly scrambling the memory of the invaded computers computers. It had to be a new infestation: their backup files were all uninfected.

In short, they'd had a close call. He wondered if they'd be as lucky the next time.

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Cheryl's stomach rumbled with apprehension as she approached the BSC lobby. So long as it only rumbles, she thought. Spending my first day on the job in the Women's Room is no way to make a good first impression.

She didn't exactly understand the source of her misgivings. Both interviews had gone well, and Doug had extended the job offer quite quickly. She certainly seemed to hit it off with her new boss. Maybe that was the problem—she didn't want to hit it off too well. She knew the effect that her looks had on men, and-on the job—it annoyed the hell out of her. Off the job, she never found the time for it to matter.

After replaying the interviews in her mind, she decided that neither Doug nor his all-male staff had seriously questioned her. They'd concentrated instead on selling BioSciCorp. Why were they so eager to hire her? Not that she didn't need the job...

When she asked him about it, instead of answering, Doug took a fat folder from a stack on his desk.

He flipped rapidly through it, extracting several thick papers and plopping them with authority onto the blotter. The pages were dog-eared from use and heavily heavily annotated with scribbles in the margins and highlighting marker.

Cheryl realized that he wasn't going to say anything. She picked a familiar paper, copied from the Proceedings in Neural Computing, from the stack; she had written it. She scanned all of the photocopies, and found that she'd authored or coauthored every one. Her new boss, it seemed, had pored over every one of her contributions to the journals of technical societies. The articles' well-worn condition made clear an interest in her work long predating her recent job inquiry. So much for a favorable first-day impression. "You're right, of course. These say everything you could ever need to know about my capabilities. I apologize for being so touchy."

Doug studied her frankly, with a twinkle in his eye. "I can say with absolute conviction that I admire you solely for your mind."

She couldn't help noticing that some unliberated recess of her mind took umbrage at his jest.

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Like noontime on most weekdays, the condominium was largely empty. The first moans that drifted through the stairwells and down the hallways therefore therefore went unremarked. The moaning grew gradually louder, more insistent, and began making its presence known throughout the building. A mother blushed for her totally oblivious three-year-old, and turned up her TV. The passing mail carrier smiled at the same imagined lust. Len Robertson, a meteorologist for the National Weather Service who was working the second shift that week, pulled his absent wife's pillow over his head in the vain hope of falling back asleep.

The moans grew louder, and somehow unhappy. There was a hint of wildness, and then of pain, under the inarticulate whimpering. The embarrassed mother swept up her son and carried him, screaming in protest, on a suddenly urgent errand. Robertson threw off his blanket in disgust and donned his robe. He met the equally puzzled postal worker in the second-floor hall.

The meteorologist was about to suggest calling the police when the ambiguous moaning turned into an anguished scream. His mind flashed to a headline case of years past: the cannibal killer in Milwaukee who had tortured and murdered several people in his apartment. There might be no time to wait for the police. Robertson hurried back to his apartment for the handgun in his nightstand drawer. "Call 911," he shouted, not waiting to see whether the letter carrier obeyed.

"No, no, NOOOO!!" Screaming filled the empty hall. But on what floor? He burst through a fire door into the stairwell, where noise reverberated confusingly. Were the screams coming from upstairs? Heart pounding, Robertson tried to distinguish new shouts from the echoes. "Go away! Go away! GET OUT!" As he crept warily into the third-floor hallway, the words dissolved into inarticulate shrieking. The bellowing was coming from 322-Mr. Cherner's unit. Where were the police?

The meteorologist didn't stop to think about what he was doing. Robertson charged into the flimsy door with his left shoulder. The wood gave way with a splintery, crunching sound. He pointed the gun in a subconscious imitation of a TV detective's two-handed grip. "Stop!"

But the shrieking didn't stop. Robertson watched in horror as Cherner, all alone, forced yet another inhuman scream from his throat. Bloody channels of flesh were torn from his face. Cherner's eyes, round and impossibly wide, seemed to focus on nothing. "It's OK," Robertson forced himself to say. "It's OK now. You're safe." The swiftly approaching sirens should have offered the meteorologist some encouragement that he was right.

But the drops of gore falling silently to the rug from Cherner's own blood-soaked hands denied even that modest hope.

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Work expands to fill all available horizontal surfaces. Then again, maybe it was just Cheryl. Papers covered her new desk, table, and much of the floor: electronic, mechanical, and electro-mechanical diagrams of the prosthetic arm; program listings for its embedded microprocessors; higher-level design descriptions; programming reference manuals. An open medical book on the human nervous system balanced precariously on the rim of her waste basket.

The mess obscured, along with most flat surfaces, the considerable progress that Cheryl had made. In her first week here, she felt she'd mastered the basic principles of the arm. Doug and company had managed a truly elegant bit of engineering. Still, momentarily stymied, she refreshed herself on its basics.

An array of ultraminiature sensors in the socket end of the prosthesis intercepted incoming impulses from the truncated efferent nerve branches in the stump. An electronics module then ferreted out of the sea of information the individual impulses directed to specific—and former—arm, hand, and finger muscles. Next, the electronics dynamically translated these “muscle” commands into a computer program that controlled the overall motion of the motorized prosthesis. Finally, mechanical linkages converted the rotation of the various computer-controlled electric motors into bending motion in the metal joints. In short: nerve impulses in; prosthesis motions out.

But brain-directed motion was only half the wonder of the device. Another swarm of sensors, scattered throughout the prosthesis, detected pressure, temperature, and relative position of simulated skin and bones. The resulting data flooded into a second electronics module, which converted the torrent into concise, useful information. Electronic transducers then modulated, amplified, and narrowcast this status information into the stump. The projected electrical fields impinged on afferent nerves, tricking the truncated branches into “thinking” that they were once again whole and connected to biologic tissues. The central nervous system of spine and brain had no way of knowing that the incoming sensations were artificially stimulated. Environmental data in; nervous impulses out.

Together, the two parts of the system provided brain-directed control of the arm, with near-instantaneous feedback. Cheryl marveled that so much technology fit somehow into an apparatus that so closely resembled a human forearm. How long, she wondered, will it be before I fully understand this?

“I asked if you could use a hand.”

Cheryl looked up from her paper-strewn desk, unaware of the furrow of concentration creasing her forehead. Doug stood in her doorway, an expectant look on his face. She'd apparently missed his original question, but couldn't help noticing the phrasing. It was her job, in every possible sense of the expression, to give him a hand. She pondered momentarily if his irony was intentional.

“One hand won't make much of a difference. Perhaps a forklift.” It was evidently an acceptable response. He had a nice laugh, she thought.

“I know the look of someone left wallowing too long in the documentation. Maybe I could come in and ... no, that won't work. Maybe you could step down to my office and we could discuss the project.” “Sounds good.”

The walk down the hall gave her time to formulate a question. “Look, I understand the arm in general. It's the details that are holding me up.” She took his grunt as encouragement to proceed. “The big question in my mind is: how ever did you develop the software for the device? It must be amazingly complex.”

They reached Doug's office and he gestured her inside. They took opposite sides of the conference table. “I imagine it is pretty hairy, but I'm not sure. It'll be your job to figure that out.”

She could only stare at him in disbelief.

Doug's PC was behind him, its screen filled with tiny text. As Cheryl watched, the display blanked and the screen saver kicked in. Large words appeared and floated about randomly: Eschew obfuscation. Later that day she looked up both words. The phrase meant: don't be obscure. Right.

An explanation popped into her head as suddenly as the screen-saver message. In hindsight the answer was obvious. “The prosthesis isn't programmed. It's trained.”

“Uh-huh.” Without warning, he lobbed the staple remover with which he'd been fidgeting. “Heads up.” She extended her right arm to nab it. “OK, toss it back.” There was a tremor in his arm before the artificial hand settled into position for the catch. He resumed his fidgeting. “Notice the difference?”

Ah, the Socratic method. Cheryl had had college professors who'd favored the technique—leading the student to truth through questions. She hated it. She'd never wondered why the Athenians had made Socrates take poison.

What had she just seen? “The wavering in your arm. It was a midcourse correction, wasn't it? The

arm must remember which commands worked right the first time and which require corrective impulses. The more motions it saves and categorizes, the better it gets at directing arm motion.”

A nasty thought crossed her mind. “There are lots of possible motions for most purposes. When you threw that staple remover, I could've leaned towards or away from it to make my reach more convenient. I might have caught it at the top of its arc, or near the floor, or anywhere in between. If I weren't basically lazy, I might have jumped from my chair and leaned over the table to catch it. Heck, how many slightly different but completely acceptable ways are there to position and move your fingers for the final grab?”

“Go on.”

He was enjoying this, she could tell. Maybe his mischievous grin was infectious, or maybe it was only his enthusiasm, but she found herself enjoying the battle of wits. She'd figure it all out. “You disassembled a bit. You didn't train it, not directly. It trains itself. The arm saves every nerve impulse-every command-that you send it, the instantaneous position of every joint, every motion that it makes. If a motion is smooth, if it's not immediately followed by a mid-course correction, the attempted solution is good. If there is a midcourse correction, the attempted solution is bad. In an inefficient but persistent way, the arm consistently fine-tunes its own programming.

“OK, I'm supposed to deduce how the software was developed. That must mean that the arm can dump its accumulated file of attempted motions to a PC. You want me to review the arm's ‘lessons learned’ and synthesize an equivalent, but more efficient, set of rules.” A double thumbs-up indicated that she'd gotten it right. Since Doug was now flipping a pencil end over end between the fingers of his right hand, that second thumb was quite an accomplishment. “Now I know why you fidget with everything on your desk all of the time. You're always in training.”

The tip broke off his pencil as she spoke. The mischievous grin grew broader. “Nope. I'm a multidimensional type of guy. Fidgeting is its own reward.”

* * *

“Liz.” There was no answer, so Betty Neville tapped on the closed door. Nothing. She rapped louder, until the ill-fitting door rattled in its frame. Her boss was alone, but a call had transferred back to Betty's desk after five rings. “Liz?” Nothing.

Betty took the transferred call off of hold. “I'm sorry, sir. Dr. Friedman seems to have stepped out. May I take a message?” She scribbled down the man's name and number. It figured-this was the call Liz had been waiting for all morning. “Yes, I'll be sure she gets this.”

Liz must have stepped out while her back was turned. Maybe she'd been on the phone herself or had her head stuck in the supplies cabinet at the time. Must be only for a moment, or Liz would've said something, or caught her eye at least. Odd that Liz had left the door closed. Well, Betty thought, she might as well put the message slip onto Liz's desk and grab whatever lurked in the out basket. Liz's head lay in the out basket, amid a pool of drool, eyes wide with astonishment staring sightlessly into unknown distances. Liz's body slumped awkwardly half on, half off the desk. As Betty watched, rooted to the spot, gravity prevailed. Liz slid from the desktop to the floor, head, limbs, and torso each striking the planked floor with a hollow thud. The falling figure had the lifelessness of a rag doll. The lifelessness...

Betty found her voice again. She was still screaming when the people from the office across the hall arrived.

* * *

Brown and white shards flew everywhere as the pressure of the butter knife exceeded the strength of the breadstick. “That,” Doug explained for Cheryl's benefit, “was for practice. I eat cholesterol for science.”

The Neural Interfaces Department had, as usual, gathered for lunch in the BSC dining room. Someone down the table-from where she sat, Cheryl couldn't tell who-described this tradition as “better living through chemistry.” She didn't find the food that bad, but then again, she hadn't been eating it for long.

Dick Conrad, a programmer with an Einsteinian shock of hair, brushed crumbs from his otherwise empty bread plate. “So, anyone have plans for the weekend?” The chorus of answers included mostly yard work, deferred shopping, and possible theater trips. Cheryl's own plans consisted primarily of

laundry; she didn't bother to contribute.

Doug grabbed another breadstick. "I generally get that question from people waiting for someone to ask them their plans. Dick, what are you doing this weekend?"

"I expect to spend it here. New M-and-M game."

Cheryl groaned mentally. Rather than candy, they were-again-talking Magic and Mayhem. Strange quests in imaginary castles and labyrinths, fighting equally nonexistent wizards and monsters for their treasures. As far as she could tell, all of these games were alike. And pointless.

The revolution in VR technology had given arcades a new burst of popularity. The VR goggles and instrumented gloves-not to mention the super-fast computers needed to control them, to paint the goggles' screens with synthesized worlds, and to update those images to correspond to every movement of the adventurer's head and hand-were quite expensive. The cost, at least, limited the amount of time that teens could spend at the games. Adults were another story, especially adults at companies like BioSciCorp that owned VR equipment for more serious purposes. The difference between a man and a boy is the price of his toys.

The men rattled on for what seemed like forever about M-and-M. Cheryl was relieved when someone finally noticed that time was passing, and that they needed to get upstairs and back to work.

Relieved, that was, until she discovered that during lunch a new virus had invaded BSC's network and wiped out-minimally-her morning's work.

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For at least the fourth time that evening, the words on the screen seemed to blur. That meant it was time to get up and walk around again. Doug pushed himself away from the desk, hoping that there would still be something to graze on in the vending machines.

It was closing in on 10 P.M., and the end was not yet in sight. The end of the work day, that was. The due date for their NSF grant-renewal papers approached with perilous speed. He ignored the thought that NSF meant "non-sufficient funds." The National Science Foundation had so far coughed up the money for half of the development of the experimental prosthesis, and Doug very much wanted to keep it coming. BioSciCorp faced enough of a financial stretch going it alone once the technology was sufficiently proven for commercialization.

A Coke and some chocolate perked him up. He made the rounds of the offices to see how things went with his fellow stuckees. At his third stop, he found Cheryl staring fixedly into her PC screen, surrounded, as always, by dead trees. She was doing her damndest, he knew, to synthesize a set of generalized arm-motion rules for the grant progress report. "Can you use some help, or is it beyond that?"

She stood up and stretched, graceful as a cat and a testimonial to aerobics. "That felt good. Sure, if you can spare a few minutes."

"Shoot."

Cheryl gestured at her PC. "I'm drowning in data. Do you have any idea how many arm motions you make in a day? And they're like snowflakes: no two are exactly alike. Beside, the longer you use the prosthesis, the more data it stores and the bigger its lessons-learned file grows. There's gotta be a way to see the bigger picture."

Doug perched gingerly on the single exposed corner of the cluttered desk. "Have you synchronized data from the arm with the physical-training videos?"

"I tried." She plopped back into her chair to keyboard something. A window opened up on the display, in which a tiny, sweaty, begoggled Doug dashed randomly about an empty white room waving a short rod. The counter in a corner of the window, its rightmost digits changing with blurring speed, observed the passage of time down to the millisecond. "It doesn't help. No offense, but you look like a marionette on drugs."

"An unstrung marionette, at that," he agreed. "This is how you've been looking at the videos?" He took her silence as assent. "Try this." He bent over, trying with limited success to ignore their proximity. A few keystrokes changed the screen image dramatically. The visualized room doubled in size and developed various colored markings, the wand in mini-Doug's hand blossomed into a proper racquet,

and a similarly equipped opponent materialized. Thuds and thwocks of the bouncing red ball and grunts from the hard-working players burst forth from the PC speaker.

Cheryl's jaw dropped as she watched the players bat pseudoballs about the VR racquetball court. Her shocked expression quickly turned into one of annoyance. "Having a little fun with the new girl? Someone might have told me what was going on in these so-called exercise videos."

He straightened up hurriedly. Bent over her as he'd been, unavoidably smelling her hair, all he needed was the suggestion about having fun with the new girl. It didn't matter that that wasn't how she'd meant her words. "The old hands find it easier to analyze the motions with the graphics filtered out. We slipped up in not showing you the VR view. Sorry." "You slipped up in not mentioning it was VR!" Her jaw jutted out belligerently.

Hell, what did they talk about at lunch most days, if not VR? This was nuts. Of course, while Cheryl ate with the group, she didn't join in much. She stayed at a distance, as if any friendliness on her part would be misinterpreted. He'd asked his secretary about Cheryl; Teri made the same reading. What other important information had Cheryl's standoffishness caused her to miss?

He made a quick decision. "We need a mental break. Let's go play racquetball."

"We've got too much work to do. I do, anyway."

"This is work. You need to understand the exercise videos."

She stood up and glared at him. "I do understand them. Now. I would've days ago, if you'd shared your little secret."

Everyone was cranky from overwork, he told himself, including him. That he took a tantrum more personally from Cheryl meant that maybe she was right-maybe he didn't relate to her as simply "one of the guys." Damn it. He didn't know which of them he was mentally cursing. Maybe both. "Ever done virtual racquetball? Any VR sport?"

"No." The tone revealed a disdain for VR of which he'd previously only gotten glimpses. "I'll stick with the real world."

"Not if you want to make any headway reverse engineering what the arm has taught itself."

The implied critique of her professionalism evidently stung, but she was too angry to back down. She gestured at her slacks and sweater. "These are hardly racquetball clothes, and I don't have a racquet." The answer conceded his point without any move towards cooperation.

Doug got off the corner of her desk. "You do aerobics after work. Whatever you wear at your health club is fine. Meet me by the VR labs in ten minutes. I'll change and bring spare gear." Hoping to reduce the tensions, he added, "Ask the game program to put my face on the pseudoball. Rumor has it that that's very therapeutic."

He took the brief up-twitch of her lips for success. "Great. See you in ten."

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Why, with so much work to be done, was she playing playing? Cheryl stood, ill at ease, the VR rod awkward in her hand. Through borrowed VR goggles she saw only the webless wand, herself in leotard and sneakers, and an all-white room. She'd told herself while getting changed to keep an open mind. It was a thought, she felt, her boss would describe as free advice and worth every penny.

"Answer if you can't hear this." Doug's words were loud and clear in her goggles' tiny earphones.

"Whatever." She assumed, correctly, that the room had hidden microphones.

"Open sesame," she heard, and Doug appeared on the other side of the suddenly enlarged chamber. His cut-offs were frayed; his well-worn T-shirt declared, "I'm virtually certain that I'm real or really certain that I'm virtual. Or vice versa." Her senses rejected what her mind told her: that he stood in another room down and across the hall. She assumed that the video cameras in this room captured her with equal verisimilitude. She suddenly felt self-conscious in her leotard.

"You say it, too."

"Do I have to?" Cheryl sounded petulant even to herself. Damn it. She'd cooled down enough to know she had fences to mend. "OK, then. Open sesame." The room sprouted virtual lines on its floor and varicolored zones on its walls and mythical midcourt center plane. The rod in her hand became the handle for what looked like a conventional racquet. She knew, however, that she held an expensive piece

of electronics. The rod captured every nuance of her grip and its own exact position and attitude in the room. The handle reported continuously, by IR beams, to sensors in the walls. In other games, this same instrumented rod could become a golf club or a baseball bat or a wizard's staff.

He taught her, with a mixture of quips and examples, how VR racquetball was played. An unseen computer responded to voice cues (that every serious gamer personalized) for such functions as serving the ball and changing handicap levels. ("What handicap? I don't need any damned charity," she'd protested-until he'd slammed a ball past her via a pro-level, triple-speed purple zone. She might as well have swung at a meteor. "Well, if you insist.") Multiple video cameras and a lot of computing power triangulated their exact position at any point in time.

She was most surprised by the revealed mysteries of her VR goggles. A low-power IR source shone continuously continuously into each eye; the reflections of these invisible beams off her retinas helped reveal precisely where in the virtual scene she was looking at each instant. ("Helps? What else does our friend the computer need to know?" He'd gently pointed out that the position and orientation of her head in the room were also helpful. IR transmitters in her goggles reported that, too.) The VR gear was surprisingly sophisticated. Maybe her opinion of VR games was a bit knee-jerk.

"All right," said Doug. "Enough stalling. Let's volley for first serve." To the unseen computer, he added, "Roll 'em."

From that moment on, she was too busy enjoying the activity to spare any thought to assessing its merits.

* * *

"CLASS OF '05 RULES."

"Shit!" snarled Dick Conrad. Similar sentiments rang up and down the hall, some punctuated by the frustrated pounding of fist on desk. The invader slithered impudently around his PC screen, devouring, with Pac-man-like determination, Dick's section of the NSF grant-renewal report.

Dick removed horn-rimmed glasses to massage the bridge of his nose. He had a bitch of a headache, knowing all too well the implication of those many nearly concurrent shouts. Those complaints meant a coordinated, time-delayed viral attack throughout BioSciCorp. It meant that every computer at BSC, and the backup file copies going back for who knew how long, were likewise infected. To have a prayer of meeting the deadline on the grant renewal, they'd have to get new computers and recover from printed drafts scattered around the office. The engineer couldn't face thinking about all the changes he'd made since he'd last printed out a draft.

He knew how important this grant was to Doug. He couldn't imagine how Doug would take this incident.

In thus discounting his imagination, Dick was absolutely correct.

* * *

"Beep."

Intent on predicting the path of the pseudoracquetball, Doug found the electronic tone disorienting. Balls in midair make no sounds. It took a moment to recognize that the sound had not come from within the game, from the earpieces in his goggles. Once he'd decided that the sound had originated from his wrist, its meaning became obvious: his watch had chimed the hour. He kept the watch running five minutes fast, a bit of subterfuge which usually got him to meetings on time. That made it about five minutes before eleven.

The ball changed course with a healthy thwock, sign of a solid hit with a firm grip on the racquet. The novice level at which Cheryl was playing meant that his returns moved at a quarter of the speed to which he was accustomed. The slow-motion return gave him plenty of time to analyze his stroke. Perfect. The prosthesis had done precisely what he'd intended. Remember that, right arm of mine.

The thought of the phrase triggered a neural response mastered through lengthy sessions of biofeedback. His brain initiated a nerve impulse, an electrochemical chain reaction that traveled from brain to spinal chord to nerve branch. Sensors in the prosthesis, in due course, picked up the signal. Circuitry in the arm then recognized the unusual character of the pulse pattern. Instead of commanding a muscle to move, this signal told the prosthesis to write a "well-done" notation into its embedded memory.

Arm motions that he identified in this manner were automatically retained whenever he interfaced the arm to a lab computer for data extraction. Still, it was almost eleven, and there was work left to do that he'd meant to finish before going home tonight. "Much as I'm enjoying this, I gotta get ba--"

Unexpected pain jolted his arm. He stared in horror at the hand that suddenly clenched his racquet handle with agonizing intensity. For a bewildering instant, the prosthesis signaled conflicting sensations of boiling heat and numbing cold, of feather-light tickling and vise-like pressure.

After an endless moment, the arm lost all feeling.

* * *

It didn't help, Cheryl decided, that Doug kept referring to the incident as "a disarming experience." The words were typical: a play on words and a deprecating reference to his disability. The bitter tone—that was another matter.

"I'm sorry, Doug."

He looked up from the inert prosthesis lying on his desk. "Unless you set loose the virus, quit saying that."

She was about to explain that it was understanding, not an apology, she was offering when the tension in his voice registered. Sympathy was the last thing he wanted. This project, his whole professional life, were struggles to beat the odds. A struggle that some juvenile juvenile asshole seemed to have, if only temporarily, derailed. Sympathy would only make things worse.

"All right, I'm not sorry. I'm pissed."

"You're not that, either. I currently hold the exclusive, worldwide franchise. It didn't come cheap."

Maybe so, but some emotion was wringing her gut. She felt awful, and knew Doug felt worse. What could she do to help?

"Thanks again for the job," she blurted.

The subject change made him blink. "You earned it. Don't make a big deal of it."

She wasn't sure if this was a way to get his mind off his own problems, or only something that she'd needed to get off her chest. Either way, she plowed ahead. "I gather you haven't been on the job market recently?"

He finally looked her in the eye. The triumph of curiosity over depression? "Things are bad?"

"Only in our niche." It was her turn to sound bitter. "Only in neural interfacing."

Doug seemed to first notice the disembodied limb on his blotter. He opened a desk drawer and tucked away the inoperative prosthesis. "I have seen more resumes than usual," he conceded. "Look, I knew the research program at your old place shut down. I knew that when I interviewed you. Feinman was the heart of the program, and he had a stroke. It's a real shame, but it happens."

How about a frozen expression of horror so awful the mortician can't do anything about it? Ben Feinman had had a closed-casket memorial, but Cheryl knew. She was good friends with Fran Feinman, and Fran had had to tell someone. Does that happen, too, Doug? But all that she could bring herself to say was, "And Yamaguchi?"

"She wrapped her car around a lamppost. My friends at NeuralCorp say she'd been preoccupied with something. Believe me—car wrecks happen." He glanced self-consciously at his stump. "Shit happens."

It was the first time he'd ever alluded in her presence to the loss of his arm. She wanted to respond to his statement. She wanted, suddenly, to know him. To know Doug the person, not the wisecracking boss. After years of keeping her distance from men at the office, she wasn't sure how. And as she hesitated—

"I can't face cleaning up this mess tonight." She followed his glance to a clock; it was past midnight. "Correction—this morning. I'm going home to catch some Zs." Unhappy with an opportunity lost, too confused by her stymied impulse to think to ask if he could still drive himself home, she followed him to the all but empty parking lot.

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Theodore Roosevelt Island, a wooded oasis on the Potomac River, can be accessed only by footbridge from an isolated parking lot on the Virginia shore. The island is much favored by local

elementary schools as a picnic stop on the way to or from field trips into the District of Columbia. Today, three busloads of the little monsters had gobbled their sack lunches and were now running amok under the resigned eyes of teachers and parent helpers.

Jim Schulz ruefully shook his mustachioed head. Why had he allowed himself to be talked into coming here on a weekday? He'd lived in Northern Virginia quite long enough to know better. His supposed companion on this outing, Doug Carey, stood nearby, absorbed with his new camcorder. Occasionally, the ground apes quieted enough for Jim to hear the motorized hum of the camera panning or zooming. Jim's attempts at conversations were impatiently shushed.

Jim's mind wandered until an approaching petite figure caught his attention. The woman was casually dressed in peg-legged jeans with artfully torn knees, a tan sweater with pushed-up sleeves, and scuffed sneakers. Her light brown hair was done up in a French braid from which a few endearing strands had escaped. Nice. He had no idea what he'd done to attract her-but he wasn't about to question his good fortune.

"Beware the cyclops."

"Cyclops" must mean the lens of the camcorder. Dammit, she knew Doug.

Doug caught the Odyssey reference, too, although he continued shooting whatever vignette had caught his eye. "Who goes there?"

"No man."

"That's for certain," Jim had to interject. He gave her an exaggerated once-over that made her blush.

"Don't harass the staff, please." Doug finished whatever he'd been shooting, then lowered to his side the hand holding the video camera. Robohand. "Hi, Cheryl."

"Hi, boss. I assume your parting directive doesn't apply in neutral territory."

Doug nodded. To Jim, he explained, "After we finished the proposal from hell, I told everyone I didn't want to see them for a week. This one," he tipped his head towards Cheryl, "really worked her tail off."

Jim stepped to the side to gaze pointedly at her nicely rounded rear. "It looks fine to me."

"Quit that."

"Thanks, Doug, but I can fend for myself." She turned to Jim. "I know you from somewhere, you wannabe dirty old man. I recognize those sideburns. Oh, yeah," she brightened, "you're in Doug's training videos. Why haven't I seen you at the office?"

"Jim? Work at BSC? He can't tell a computer from a kumquat. He plays from a VR arcade near his house in Alexandria. The Internet handles VR racquetball as well across town as between adjacent rooms."

That incredulity was a bit much, Jim thought. He wasn't that computer illiterate. Many years ago, he'd even taken a beginning programming class, coursework the University of Wisconsin had obligingly accepted as a foreign language. As far as he was concerned, computer languages were as foreign as they came. What else could you say about a language in which $I=I+1$ was meaningful?

In any case, Jim knew the difference: kumquats had seeds. He also knew how to get even. It'd be hitting below the belt, but he was piqued enough not to mind. "So, you two kids going together?" Doug was predictably aghast. Before his friend found his tongue, Jim added, "No, of course not. What was I thinking, expecting St. Douglas to date, and someone from the office yet? He might disqualify himself from that seat he's been coveting on the Supreme Court."

The crack earned him an angry glare. It didn't require telepathy to know what was crossing Doug's mind: dark thoughts about Holly. Lost Holly. When would his friend truly accept that that stage of his life was over?

"I don't see people from work." Stereo answers came from Doug and Cheryl.

We'll see about that, Doug. Nothing like pondering the loss of something to make you want it. Jim beamed at Cheryl. "An excellent policy, my dear, excellent. Did Doug ever mention that I can't tell a computer from a pistachio? Or was that an artichoke heart? Whatever. I have trouble with all this technical stuff. Some growing thing." He looped an arm through hers. "Allow me to introduce myself."

After an afternoon of window shopping, Doug, Jim, and Cheryl wandered into a touristy area of Old Town Alexandria. Doug's stomach rumbled, and he checked his watch for confirmation. "I could sure use some dinner."

They were in front of a posh Italian restaurant. All three were in jeans; Doug wore a T-shirt and Jim a faded army surplus camouflage jacket. Cheryl stole a quick look at the menu in the front window, then gestured vaguely at her own casual clothes. "As if we're dressed for this place."

The men exchanged an amused look. "Follow me," Jim said, "I'm a friend of the owner." They went around the corner to a side entrance. The chef's effusive greetings made clear to Cheryl that Jim was the owner. The restaurateur pointed to a genuine butcher-block table in a corner of the bustling kitchen. Disappearing into the kitchen-side door to his office, where he kept a spare suit, Jim called, "Have a seat, folks. Gotta schmooze with the paying clientele, but I'll be back."

Jim was lying, but it was for a good cause.

* * *

Doug and Cheryl sat in silence—all the more awkward for following Jim's ceaseless ebullience. "Quite an interesting guy," she finally offered.

He raised an eyebrow at the closed office door. "Rebel without a clue? Yeah, he is interesting, and it's reassuring that someone's working to keep us out of Vietnam." They jerked back as their legs accidentally touched beneath the tiny table.

By tacit agreement, Jim was a safe subject. "Where's he from?" asked Cheryl.

"Milwaukee. His dad works at a brewery Jim will only identify as producing 'the beer that made Milwaukee malodorous.'" As Doug spoke, a waiter spread a damask tablecloth over the butcher block. Three place settings and a wax-covered Chianti bottle with candle followed. When just Doug and Jim ate here, as they often did, Jim threw dish towels over the wood—and they weren't always clean towels. Certainly they never had a candle. And now Jim had conveniently disappeared. Damn that man—first flirting with Cheryl, then playing matchmaker. How transparent can you get?

They fell silent again. Somewhere behind them, a knife chopped manically on a cutting board. A voluble chef's assistant made a point by clanging the counter with his ladle. Cutlery and plates clattered in and out of the oversized dishwasher.

Perhaps the clinking and clanging was too suggestive, or perhaps the flickering candle flame was. Maybe it was the so long foregone company of an attractive woman. Maybe he'd only been out in the sun too long today without a hat.

Whatever the cause, Doug found his mind slipping into a familiar memory. Light was flickering there, too, but its source was a short-circuited turn signal that refused to respond to its control. The darkness there crowded in on him.

Flickering, flickering...

* * *

The rental car was mangled, its bent frame keeping the doors from opening. Judging from the razor-sharp fragments covering occupants and vehicle interior alike, its windshield had been replaced with cheap, nonautomotive glass. At least Doug didn't think the stuff mandated by law could shatter like this. Whatever mishap had necessitated replacing the windshield must have also deployed the airbags; they had not been replaced.

After pressing his belt into service as an impromptu tourniquet, the two of them tried not to look at, or think about, Doug's mangled right arm. The injury—like the meandering bastard, presumably blind drunk, who'd veered from his lane and driven them off the deserted road—was too much to handle just yet. Once the tourniquet stopped his bleeding, they tried to crawl out the now-glassless front window. The effort gained them only assorted new cuts and abrasions.

"Holly?"

"Hm?" she finally answered. Her attention seemed focused on the tree that grew from the center of the engine compartment.

"We'll be OK. Honest."

She had hair and eyes as dark as the night. Eyes that most evenings he could get lost in. By the green

flickering of the turn signal that would not end, her skin looked unhealthy. "I know." Tension in her voice belied the words.

"I love you."

She took forever to answer. "I love you, too."

"See if I ever do Florida again." He'd followed the spring-break tradition twice before: neverending parties down the coast. In his junior year he'd met Holly and, to his amazement, the mob scene at Lauderdale hadn't appealed to her. He'd begged her all winter to come with him, and finally worn her down. Now this.

"Uh-huh." He worried about her being so quiet, but she seemed OK. No visible wounds, anyway. Maybe, he decided, she was going into shock. He huddled against her as best he could to share his warmth. Trapped behind the steering wheel, his right forearm shredded, he couldn't even comfort her by squeezing her hand.

In other circumstances he might have remembered to loosen the tourniquet occasionally. Might. It was impossible to think about himself, though, as Holly slowly withdrew into herself. She fell silent. As Doug kept a helpless vigil, her face grew ever paler.

She died of internal bleeding as the first hint of dawn appeared in the eastern sky.

His last coherent thought, losing consciousness himself as help finally arrived, was one of biting irony. As the highway patrolmen urged him to hold on, they spoke urgently of freeing him from the wreckage by applying the Jaws of Life.

* * *

"Doug? Are you OK?"

He returned to his surroundings with a start. It took him a moment to recognize his companion. "Um, yeah. Yes, sure, I'm fine."

Cheryl laid a hand over his. It felt fire-hot. "All of a sudden, you were gone. What were you thinking about?"

He couldn't tell her, he just couldn't. His mind hunted desperately for another topic. One other subject was on his mind; it, too, was bad-but not as awful as Holly's death. "Cherner," he mumbled. "Cherner and Friedman."

"Bob Cherner? Head man at Neurotronics?"

"Do you know him?"

"Only by reputation. He's supposed to be good." She looked at him strangely. "What about him?" Following his gaze to their overlapped hands, she pulled hers back hastily.

"He's been institutionalized." His skin remained warm from her touch. "Remember the night of the Class of '05 virus attack? After my arm seized up?" Cheryl nodded. "You were upset at the coincidence of Feinman and Yamaguchi dying so close together. Well, there may be more going on. Once our grant-renewal application was out the door, I went through three weeks of old email. My messages to Cherner were all returned as nondeliverable."

"That's odd."

They were too intent on their conversation to notice their host approach with a tray of antipasti.

"That's what I thought, so I called him in Philadelphia. A very rattled secretary said he was out sick. She wouldn't say anything else."

"What did you do?"

"I went online and found another Neurotronics employee to call. I claimed to be an old friend of Bob's, which was only a slight exaggeration, and said I'd heard he was out sick. Could she help me find him? She hemmed and hawed a bit, but I finally pried the name of a hospital out of her."

"Before, you called it an institution."

He couldn't suppress a shiver. "The engineer at Neurotronics called it a hospital. I called, and the hospital would only say a Robert Cherner was registered. They wouldn't tell me anything about his condition, or let me talk to him. That was odd enough to make me look them up. Cherner's in a mental hospital."

"You mentioned someone Friedman?"

“Liz Friedman, over at NeuralSoft. Stroke. I'll spare you the details, but she died in her office one day last month.” He sipped at his ice water. “I don't like it.”

A voice sounded behind him. “Liz probably wasn't too wild about the idea, either.” Doug whirled. Jim Schulz stood there, holding a tray. “How long have you been hovering?”

Jim set down three plates, handed the tray to a passing busboy, then dropped into the remaining chair. “Long enough.”

Doug tried to work up some indignation. “Jeez, I know this is your place, but you have no right to eavesdrop. It's probably nothing, anyway.”

The restaurateur looked sadly at Cheryl. “He's already told you I'm suspicious, right? A bit antiestablishment? Given you the ‘keep us out of Vietnam’ line?” Jim didn't wait for an answer. “I heard about four mysterious deaths or illnesses, all to key people in your field. Correct?” When no one contradicted him, he prodded his still angry friend on the arm. “Doug, all I know about neural interfacing is that it's a brand-new area. There aren't many people in the field yet. Right?”

“Right,” Doug begrudged.

“How many?”

“About thirty full-timers. Maybe a hundred total.”

“And you don't find four such incidents suspicious?”

The coworkers exchanged helpless glances, as if afraid to answer.

“You're lucky I'm here.” Jim stabbed an olive with his fork. “Allow me an analogy. A hundred of you neuro-weenies makes it perfect.

“What would you say if, over a few weeks, three senators died and a fourth showed up in a booby hatch?”

When put like that, it seemed foolhardy not to see a pattern. A very dark pattern. Doug's blood ran cold as a thought worthy of Jim's paranoia crossed his mind.

Cheryl had the same realization. “Doug? What if someone is targeting neural interface researchers? Wouldn't we be high on the list?”

Wordlessly, he reached out for her hand.

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The woman nervously twisted a lock of her straight black hair, but showed no other signs of her recent widowhood. Perhaps worrying what impression might be given to her visitors by her casual garb and sunlit living room, Fran Feinman tipped her head towards the chaos-filled family room. “It's hard to retain a funereal air around that. I thank God for the twins every day.”

“I'm glad the boys are OK,” said Cheryl. The words sounded dumb to her, but she never knew what to say on a condolence call. She was less sure of herself when her visit had an ulterior motive. “I meant what I said at the memorial service about taking Josh and Scott for a weekend. Whenever you'd like.”

“Thanks, but none of us are ready for separation yet.”

The room fell silent, except for overflow from the children's play. Doug found his tongue first. “Mrs. Feinman, I appreciate your seeing us.”

“Fran, please. Any friend of Cheryl's is always welcome.”

He forced out the words. “I don't know how to approach this tangentially. Please understand that I don't ask this question lightly. Was anything-unusual-about your husband's death?”

The women exchanged a look; Cheryl broke eye contact first. “I had to tell him, Fran. I had to tell him what little I knew.” After that extraordinary dinner at Jim Schulz's place, that was exactly true.

Mrs. Feinman shifted in her chair. The motion was slight, but it was an obvious turning away from Cheryl. “All right, Doug, the look on his face, that was unusual. Oh, it was far worse than that. It was horrible. Ben died with an expression of absolute terror.”

Doug squirmed in his own chair, but he had to continue. He and Cheryl could be next. “Fran, have you any idea what could have frightened him?”

The widow twisted a handkerchief so fiercely that several stitches of embroidery gave way with audible pops. “Ben? My Ben wasn't afraid of anything. He had all of the fear burnt out of him in the Gulf War.”

Cheryl gently laid a hand on her friend's arm. "Then what, Fran? Why that look on him? It must've been bad-I don't believe you scare easily either."

Mrs. Feinman just shook her head.

Doug began to pace. "You're sure Ben was alone when he had the stroke?" "The kids and I were at a Saturday matinee, some harmless cartoon." Memory of the twins' delight made her smile briefly. "Ben was alone in the den when we left. He said he'd brought home too much work to join us. I closed the den door on my way out. He was dead in his chair when we returned.

"Because of the look, the police examined the house. My fingerprints were the top set on the inside and outside knobs of the den door." She hugged and rocked herself as she sat. The twins' play sounded especially noisy in the suddenly silent room.

"Did you notice anything unusual about Ben before this? That day? That week?" No thought underlay Cheryl's questions, but there had to be some meaning to this strange death.

"He'd had a physical maybe a month earlier. He was in fine health, the doctor said, perfect health. Ben was full of energy, full of life."

Nothing. Doug racked his brains. "Is the den like it was?"

"Yes." Fran's eyes brimmed with tears. "I haven't been able to face it yet."

When Doug and Cheryl examined Ben Feinman's home office, the tidy room seemed somehow to mock them. The neatly arranged desktop told them nothing; neither did the neural-interface helmet that had apparently dropped to the floor when Ben had slumped in his chair. Doug traced his finger over a doodle on the desk blotter—a meaningless bunch of deeply inscribed intersecting ovals, all nearly obliterated by a dark scribble—then wordlessly led the way from the den.

* * *

Inch-tall green words floated on an otherwise darkened screen: "A man's reach should exceed his grasp, else what's a backscratcher for?"

"Must we have that?" Cheryl asked Doug. They were cloistered in his office, regrouping from yesterday's unenlightening visit with Fran Feinman.

"What?"

"That screen saver. Can't it show something a little less distracting?" She had unadulterated black in mind.

"I share the wisdom of the ages. You'd pay good money to read that from a fortune cookie."

"That's not where I generally go for wisdom."

Doug shrugged in resignation, swiveled toward his desk, and reset his screen saver to a boring clock display. After a moment's thought, he suppressed its synthesized ticking sound. "Better?" To her nod he added, "Thought it would be. Time heals all wounds."

"Not Ben's."

Doug sobered up instantly. Death was a real downer, a lesson he'd learned the hard way once before. "Sorry. You've got to understand this is my way of dealing with stress." That, and sitting in the dark, brooding. He'd tried not to do that at work, though—and anyway, the office drapes admitted too much light. "I made a call last night. The doctor handling Cherner's case will see us. We've got an appointment in Philly after work."

She stood and looked out the window. The clusters of people on the plaza, chatting and smoking and sipping coffee, seemed foreign to her.

Cheryl wondered when she'd return to their world. Or if.

* * *

Doug had made the appointment at Shady Acres Sanitarium, but it took Cheryl's charm to get them past the doctor overseeing the case to visit with Bob Cherner. They weren't all that sure now that it had been such a good idea.

At first, the sanitarium belied Doug's preconceptions. The grounds were immaculately groomed and, true to the name, dappled by the shade of old oak trees. The front lobby was light and airy. Sunlight streamed through windows into a marbled foyer. Cheery paintings decorated the walls and extended up the curved staircase.

Cherner's room was a different story. The only furniture was a small bed bolted to the floor, devoid of head- or footboard. Its single window was small, high, and barred. The door had no inside knob. And, oh yes, the walls and door were padded.

"Doug?" began Cheryl. The tremor in her voice suggested the same misgivings that he felt. "Does he even see us?"

He forced himself to study the man they were visiting. Doug knew Bob professionally, had sat on a few experts' panels with him at symposia. The Cherner he remembered was alert, witty, with humor dancing in his eyes. The man seated on the bed stared dully into a corner, indifferent to their presence. No trace of personality showed in his eyes. Swatches of bandages covered the ruin they'd been told he'd made of his face.

Nor had Doug ever known Bob Cherner to wear a straitjacket.

"No," he answered softly, "I don't think he does." He stepped close to his ill colleague. "Bob? It's Doug Carey. We need to talk." A flicker of eye motion showed that Doug had been heard. Had he been understood? He had no way of telling. "Bob, what happened to you?"

Cheryl broke the uncomfortable silence. "It's no use. You heard what they did to him."

Repeated electroshock. But what choice had there been when Bob struggled insanely whenever he came out of sedation? Even in the straitjacket, they'd been told, it was feared he would injure himself by fighting with such frenzy against his restraints.

Now Cherner was silent, passive, inert.

Doug tried again. "It must be awful. Terrible. But you're not alone. We know something is happening to neural-interface researchers. Several have died. You must help us stop it from continuing." He didn't know why he chose the impersonal pronoun.

Nothing.

Cheryl sighed, then came over to join Doug. She looked past the bandages, and deeply into Cherner's eyes. They were blank, lifeless: twin black holes of the soul.

Fighting tears of helplessness, Cheryl backed away. Would Doug wind up like that? Would she? The notion was far scarier than death. "I have to go. I have to."

"In a moment." Doug took out a pen and pocket calendar. A thought had come to him, probably stupid, but it was the only idea he had. He drew on an inside cover, then held the simple sketch for Cherner to see.

For a moment, the only reaction was a bulging of the patient's blank eyes. Then he took in a deep breath, and began a scream of such primal terror that Doug almost dropped the pad. Muscles bulged within the confining straitjacket; fabric strained. Spittle flew from his lips.

The raver lunged from the bed, head lowered like a battering ram. Only the near paralysis of Cherner's legs from hours sitting motionless saved Doug; a leg buckled, and Cherner collapsed, screaming, to the carpeted floor. His eyes, so recently vacant, were now filled with murderous rage. He struggled desperately to regain his feet.

The door crashed open, and white-coated men brushed Doug roughly aside. It took three people to subdue the man thrashing on the floor. "What did you do?" demanded an orderly, jabbing an air-spray hypo against Cherner's neck. Cherner arched his back at the sting of the injection, then fell still.

Doug looked helplessly at the drawing he'd made: a copy of the overlapping ovals from Ben Feinman's desk blotter. They must lie at the root of the problem. They obviously meant something.

But what?

* * *

Sheila suspected something was wrong. For starters, she didn't remember her own last name, although the name on her driver's license felt right when she'd read it. She assumed that the license in the purse underneath her desk was hers since it bore her likeness. She'd needed the mirror in a compact to reach that conclusion.

People chattered in the hall outside her-office? None of the noises seemed familiar. Then again, its voice was distracting, dominating. How could she recognize other sounds when it spoke so loudly?

What could be wrong? Sheila thought she might ask one of those noisy people, but wasn't sure

exactly what to ask. She opened her mouth to test a question; only an inarticulate gurgling emerged. Did she used to speak? She couldn't remember. She strode from the building, waving in vague response to the calls of her coworkers. There were things to be done, important things.

It insisted.

* * *

Sweat rolled down Doug's back as he shoved the lawnmower about the small yard. This section was the hardest; with its ten-degree grade, it alone justified a self-propelled model.

Alas, it would be years, if ever, before he used a self-propelled mower-or any powered mower. Motor vibrations drove his prosthesis nuts, unless he turned down the sensitivity to approximately the Captain Hook setting, with which he had so little control that he'd probably lose his other hand. A truncated rose bush showed the folly of a prior experiment performed with a borrowed gas mower.

Three more strips and he'd take a trip into the house for a cool drink. Despite his grumbling, the mindlessness of the job at hand appealed to him. Rote tasks liberated his imagination, freed his mind for whatever problems were at hand. It worked better than parking himself in an easy chair and ordering himself to think. He reached the uphill end of a row and began a turn. Pivoting the mower, his gaze swept across the Perlman's cedar deck, on which Cindy Perlman, a pale grub of flesh bulging out of halter top and short shorts, lay draped across the chaise lounge. He continued the turn, carefully avoiding eye contact. She was a friend and good neighbor, but seeing her up close in that outfit could strike him blind.

Doug continued his ruminations. He and Cheryl had been thrown for a loop by the incident at the sanitarium. What was it about that sketch? Now Cheryl could dress. Not that he could imagine her going to pot like Cindy Perlman, but if Cheryl did ever gain an excess ounce, she would surely wear something appropriate.

It'd been unseasonably cool yesterday, and Cheryl had worn a bulky sweater with that knee-length skirt and black heels. All very proper, of course, but something about the fuzziness of the sweater was so, so ... cuddly. The other day she'd worn slacks and a plain white blouse to work. Then there were the jeans she'd worn on Roosevelt Island. Now, that emerald blouse she wore with the beige linen suit. What was that slick material? Silk maybe, or satin, but he wasn't quite...

He jerked to a halt in midrow. What are you thinking thinking? he asked himself, although the answer was obvious. Doug couldn't visualize his own wardrobe to that level of detail. So rote tasks freed his mind for the problems at hand? Liberated his mind? Hah!

Maybe he'd break for that cold drink now. In a bit, it seemed, he'd need a very cold shower. She works for you, you Australopithecine jerk.

His subconscious hunted for a safer topic. In a way, Bob Cherner qualified. What did Cherner and Ben Feinman have in common? His pocket calendar sat beside the phone, as it did every weekend. He opened it to the sketch that had made Cherner go postal, the drawing copied from Ben Feinman's blotter. He found scrap paper and a pencil, and began doodling. Oval followed oval; loop succeeded loop. The shapes overlapped at a common center, radiating from that spot.

Something tickled the back of his mind as he drank. A critical thought had just skittered across his subconscious as he sat and stupidly stared. What?

His hand stuck briefly as he lifted the soda from the table. He glanced at his prosthesis and discovered that he'd unthinkingly crushed the can, sloshing Coke all over the place in the process. The artificial limb didn't have any moisture sensors. What was that errant thought? Ben's drawing had been half obliterated by scribbling. Obliterated? Would striking out the sketch have placated Bob Cherner? It wasn't an experiment Doug was eager to perform, even if he were allowed back.

He waggled the dented can; it wasn't quite empty, so he took another sip. The scribbles-what might they have covered? They might have covered anything, dolt. Whatever was under the scribbles was covered. That was the point. Focus.

Point. Focus. Hmm. Doug did a mental rewind. Spot. His subconscious was trying to tell him something. He wiped the soda from the scrap of paper on which he'd been jotting. At the center of the drawing, in the part of the figure that Ben had most heavily obliterated, Doug made a single, central dot. A spot.

Point, spot, focus: they were all good words, useful words. Still, although they'd helped him find his way, he didn't think they were the key word. They weren't the word that had flitted across his mind.

That word was radiating.

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"Whadayya call a bunch of Apple computers at the University of Hawaii?" asked the disembodied voice.

Cheryl groaned. She'd barely stepped out of the shower when the lobby annunciator warbled. The steamy mirror confirmed her worst fears: her robe was old and ratty, and the towel/turban around her sopping-wet hair was little better. In the kitchen, hopefully, battle continued with the dreaded math book. When Cheryl had peeked in before her shower, the book had been winning.

"Come on up, Doug. Apartment 411." Who else would announce himself that way? She buzzed open the lobby security door. Moments later, someone rapped on her front door. She checked the peephole: her boss. Letting him in, she warned, "One word and you're dead meat." He was dressed for, and smelled fresh from, yard work. She figured that at present she smelled better but looked worse.

"Does a particular word put me at risk, or any word at all?"

"Next time, call ahead, dammit."

He tried to look abashed. It came out as boyish charm, but that was close enough to mollify her. While she pondered this reaction, a trickle of water down her neck reminded her of her condition. "Can whatever brings you wait a few minutes? I'd like to dry my hair."

"Sure."

"Honey?" She raised her voice. "Come out here, please?" Boyish charm turned briefly to apprehension, then faded into feigned indifference. Aha. Doug was interested in her love life. Cheryl never dated anyone from the office, let alone the boss-why did his reaction please her? She wasn't accustomed to indecisiveness, and her confusion angered her. She turned that indignation outward: what business did he have appearing here unannounced and on a weekend? He'd never been here, for chrissake. She presumed he'd found her address on the Net.

Carla stepped from the kitchen. She was nine years old and tall for her age, with her father's red hair and blue eyes, and her mother's delicate features. "What is it, Aunt Cheryl?"

"Hon, this is Mr. Carey, my boss. Doug, this is Carla. I wanted you to both know the other was here while I get myself together."

The hair dryer drowned out everything for a while: thick hair dries slowly. She worried about Carla the whole time. How was Doug around children? Part of her wondered how Doug felt about children. What was her problem?

When she turned off the dryer, there were giggles from the kitchen. Her immediate reaction was: Let the kid do her homework. A happier thought displaced the first. When had Carla last sounded so silly?

Cheryl loved her niece, but Carla was a daunting responsibility. It turned out that a little girl could shed a lot of tears in six months. Then again, losing your parents to a junkie gunman at the neighborhood 7-Eleven justified an ocean of tears. Cheryl's own eyes misted. God, but she missed her sister.

"Aren't you glad you did your math?" Giggle, giggle. "And why's that?" Giggle. "Because life is a word problem," man and child recited together. Chortle, chortle.

Thanks, Doug.

Cheryl got dressed and joined them in the kitchen. "Fine," she said. "I can't take the suspense. What do you call a bunch of Apple computers at the University of Hawaii?"

"MacademiaNet," he deadpanned.

She curled her lip at the awfulness of the pun-until she noticed Carla's priceless confusion. The corners corners of Cheryl's lips quirked upward. She laughed, and Carla-without a clue why-laughed with her. Thank you, Doug.

Whatever brought Doug here, he'd done good.

* * *

After kidding around for a bit, Cheryl sent her niece to her room to finish the homework. She busied herself putting on a pot of coffee, saying nothing. This wasn't a social occasion, and it was past time for

Doug to explain himself-even if he did have a way with Carla. She kept her back to him so he couldn't see her smiling at the memory.

With a sigh (what was on his mind, she wondered), Doug began. "Nice kid."

"Uh-huh." The coffee started, she straightened odds and ends on the counter.

Sighing again, he restarted. "I know what the ovals are. What set off Cher-ner."

"What!?"

He dug out his pocket calendar and opened it to the overlapped ovals. "Mean anything to you?"

"Nothing. Doug, we've been through this. You said you knew." She ignored the bouncing-on-the-bed noises from the other room. He unclipped a pen and placed a single dot in the center of the ovals. "Now?"

Of course. "It's an atom." She felt her eyes go round. "But why did Ben obliterate it? Why did it affect Cherner like that? What do atoms have to do with neural-interface research, anyway?"

"I get at most one insight a day, and that's on good days." He looked at her wistfully. "I'd sorta hoped that you'd know."

* * *

Sheila brushed past shoppers browsing at the electronics store, ignoring their complaints. She rummaged through parts bins and crowded shelves, confused by how the aisles were organized, but unable to ask questions.

With a grunt, she dumped everything at the checkout station: switches, cables, batteries, radio-controlled toys, aluminum utility boxes, relays. She dug a wad of bills, straight from the ATM, from a pocket.

She must have made the teenaged cashier nervous-he ran the merchandise past the bar-code scanners as fast as humanly possible. He looked unhappily at a prompt on his terminal. "I need your name and address, ma'am." She stared at him, helpless, before finally shaking her head. No.

"It's company policy. Don't worry, ma'am, we don't give out the information."

She gaped at him, her upper lip quivering.

He tried once more. "It's so we can mail stuff. You know, like flyers for sales."

With a roar of inarticulate fury, she flung money onto the counter. He hadn't yet bagged her purchases, so-still shrieking-she swept them from the counter into a shopping bag already loaded with an assortment of household chemicals. Without waiting for change, or looking back, she stomped off.

Directions for assembling bombs from such materials were available all over the Internet.

* * *

Doug browsed Cheryl's living-room bookshelves as she readied the kid for bed. They told him only what he already knew: she was a bright woman.

The bedtime story finally ended. There were squeals as his hostess tucked in Carla. "G'night, kiddo."

"Mr. Carey is funny. Can he come back?"

The whispered answer was unintelligible, but embarrassment was writ large over Cheryl's face when she returned. "More coffee?"

"No, I'll be running along." He'd had more on his mind than atoms when he'd come over. Doug resolved to act now, even if her niece had spoken before he did. "But ... could I interest you in racquetball tomorrow?"

Cheryl rolled her eyes. "You overheard the little imp's suggestion."

"Carla's question. Not your answer. What do you say?"

"Not what did you say. Doug Carey, you have a touch of class."

"So about tomorrow?"

"I'll have to see if a neighbor can watch her, but yes. I'd like that. I'll call you."

He was halfway home before it occurred to him to wonder whether Cheryl thought tomorrow was two friends getting together or a date.

* * *

Doug sat bolt upright in bed, a matter of enormous magnitude having finally penetrated his awareness. First, he'd been too busy being disgusted with himself for lusting after Cheryl. After that, he'd obsessed

on the new-found meaning of the sketch. And then, maybe, he'd asked out Cheryl.

For all of his obvious attraction to Cheryl, Doug had not thought guiltily about Holly even once today.

He wasn't sure if he felt guilty about not feeling guilty.

* * *

Doug hunched over, waiting for the pseudoball. His first surprise came when Cheryl won the pregame volley for serve. Another surprise followed on its heels.

"Let 'er rip."

She'd not only been practicing, she'd personalized her game prompts. The serve flashed through a green region and doubled its speed. He pivoted to his left to return it with a backhanded stroke. Passing center court, the ball kissed purple and went hypersonic.

With a grin she slammed the red missile right back at him. He got the racquet up to his face just barely in time to protect himself. Idiot, the ball's not physical. It can't hurt you. The badly timed ricochet from his racquet was a pathetic lob she smashed back at him through purple again. He didn't even try to touch the resulting blur.

"Now why did you call out a novice's handicap for me?" He saluted with his racquet. "I'm suitably chastised. Who've you been playing with?"

"Never mind. Just keep your wits about you." She served under cover of her answer. As the pseudoball zipped through a brown drop-dead zone, she called, "Reset handicap to level three."

Doug dived for the plummeting orb, reaching it just in time to give it a flip. With anyone else, the maneuver would have been suicidal, but it sailed over Cheryl's, petite Cheryl's, lovely head. "Hah."

His game came back into balance as he claimed the serve. Two points later, he was over the shock of her unexpected skill at the game. "Wow, I thought someone had sent in a ringer." Squinting at her in shorts and tee-shirt, he added, "Although I can't imagine where she'd hide." She repaid the crack with a floor-skimming return that cost him a volley and the serve.

Somewhere around a score of eight-six, he achieved that rare state of automatic play that made the game so rewarding. Step, step, stroke. Ball shooting like lightning across the court, then as quickly coming back. Step, step, stroke, and back it goes again. Stroke, stroke, stroke. He wasn't really there, nor was she. Some part of his mind knew where the ball was, and the walls, and the drifting color zones that changed the motion of the ball.

While reflexes maintained volley after long volley, his thoughts entered a free-floating state not unlike a good lawn mowing. Racquetball with Cheryl-it was a simple thing, really. He couldn't remember when he'd last had such a good time. Stroke, step, step, step, stroke. Amazing how her game had improved since the one time they'd played. His arm was cooperating too. Step, backhand slam. Nothing like having your arm go haywire to impress a woman.

He stumbled as the memory struck home. That damned Class of '05 virus had done a number on his arm all right-luckily he'd only had to go back a week for an uninfected backup. His next stroke came an instant too late, with a weak grip, and Cheryl clobbered the ball.

As she caught her breath before serving, Doug tried to push everything out of his mind. Something was teasing his memory, something that he sensed was vital: a mood like just before he recognized the cartoon atom. He forced in and out a few deep breaths of his own. He lost the next volley, but regained the trance state. Step, step, stroke. Dash to the rear court for her return. Step, step, smash. Shuffle forward. Balance on the balls of the feet. Step, turn, backhand. He continued on autopilot as images crowded his mind. The Pac-man-like Class of '05 virus. Neural-interface circuits. Atoms, spinning atoms, galaxies of atoms. Nerve impulses, in his brain, traveling across his spinal chord and down his arm. Pac-man chomping up screenfuls of information, computerfuls of data. Stop signs and traffic lights.

Step, step, stroke. Sensors in his arm transforming electrochemical impulses into electrical signals the prosthesis could manipulate. Pac-man racing down his arm. Step, pivot, stroke. Neural nets in the prosthesis learning to recognize, in hours of biofeedback sessions, which transformed nerve impulses meant bend my wrist and open my hand and wiggle my fingers. Pac-man reversing: racing up his arm, up his spinal chord-

With a holler, Doug tossed his racket into the air. The ball shot past him as the racquet turned end over end. He caught the handle, as it fell back to earth, with what he felt to be great panache.

“Why did you do that? It was the best volley we've had all day!” “Sorry,” he shrugged. “But if you can spare a few minutes from the game, I think I know what's been happening to everyone.”

* * *

Doug and Cheryl had been playing racquetball at BSC where the VR court time was free. Now they retreated to his office. Behind the closed door, the smell of sweaty clothes and sweating bodies should have been overpowering. They didn't notice.

“Are we at risk?” She lowered herself gingerly onto a chair. Without a hot shower, her muscles were already seizing up.

“You, no. Me, possibly-but I doubt it.”

“What's happening?”

“It's a virus.”

She leaned forward, glowering. “Ben Feinman was a friend, a good friend. I find that in very poor taste.”

“No, a computer virus.” He retrieved a schematic drawing from his desk. “My arm. Remember how our Class of '05 friends made my arm lock up?” At her nod, he continued. “Think about a virus attacking through a neural-interface helmet.”

“Oh ... my ... God.” She shuddered. “Can that happen?” “When the Class of '05 virus hit, I got some weird sensations through the prosthesis before it froze. I was so mad, and it was such a crunch finishing the proposal on time, that I put it out of my mind.”

He unrolled the schematic. “You know there's a neural network between the main microprocessor and the nerve sensors. Why? Because the routine metabolizing in every cell in my body constantly generates electrochemical noise. The neural net is always learning how better to dredge useful signals out of that din. OK?”

She nodded.

“I tend not to think of it this way, but what trains the arm also works on other neural nets.” He tapped his upper arm, his neck, and, most emphatically, his forehead. “Biological neural nets. Neuron nets. My nervous system. Even as I learn to operate the arm, it learns how best to signal skin pressures and joint positions back to me. What I so casually call ‘training the arm’ is nothing so simple. The arm and I are symbiotic. Every time I think I've achieved better performance, what's really happened is that each side of the partnership has learned to better communicate with the other.”

Cheryl rested her chin on her hand in thought. She knew, even better than he, how a state-of-the-art neural-interface helmet was built. She had codeveloped the helmet that might have killed Ben Feinman. Now she wrestled with Doug's theory, leveraging her knowledge of the helmet. She looked for a flaw and found none.

“I'm not using the arm or a helmet, so I'm safe. You're using only the prosthesis, and the nerve branch up your arm seems far too narrow a comms channel to pass a threat. But a helmet wearer...”

Ben, like Doug, had started out with biofeedback training. How many times had she seen him with electrodes taped to his head, wires snaking to an oscilloscope. Day after day of learning to concentrate his thoughts until he could steer the glowing phosphorescent dot wherever he chose on the screen. Hell, everyone at the office had tried it. A chill ran down her spine as she realized what might have happened had not Ben been the quicker study.

In her too vivid imagination, her old boss, her friend, sat, his eyes closed, wearing his helmet. Signals from the computer passed through a neural net to Ben; his thoughts, his reactions, returned through the neural net to complete the experiment. If nothing came across-as had, at first, so often been the case-Ben would groan or mutter or curse, then open his eyes to see on-screen what he should have received. Then he'd keyboard what small impression, if any, he'd gotten through the helmet.

Other times it would be Ben's job to send. That, too, hadn't worked at first. Again Ben would chastise the machine, then type directly what he'd attempted to mentally transmit via the interface helmet.

How many sessions had she monitored? How many experimental runs had it taken before Ben and

the supervisory program in the lab's big server had really communicated? Months, she knew. She wasn't sure exactly how many, because Ben had gotten secretive towards the end. Moody. Something had been on his mind. Christ, in his mind.

“Are you OK?”

She waved him to silence. Training-first Ben and then Doug had talked about training. That wasn't right, not really. Neural nets weren't smart, couldn't think, couldn't be taught. It was whimsical to talk about them learning. No, a neural net was only electronic circuits modeled after bunches of neurons, just another way to process inputs into outputs. What a neural net did do was adapt. Optimize. Mindlessly it moved away from any output state that feedback rated as bad for its current inputs. Mindlessly it adjusted towards a state that feedback rated as better. Being electronic, a neural net adapted fast.

Ben's corrections via the keyboard: that was feedback to drive the optimization. Later, the neural net in the helmet had adapted directly to the perceived success or failure of a signal to pass through it, in either direction. Doug's arm was like that, she remembered-it distinguished smooth from jerky motions and it automatically reinforced whatever worked.

By the time of his death, Ben had stopped using a keyboard. His helmet, like Doug's arm, had achieved self-adaptation.

Her mind's eye panned back to encompass first two spectral computers, then three, then many. Lightning bolts connected the machines, stylized communications links. One of the computers, she saw, harbored a nasty, slithering object-the visualization of a virus. The creature crawled through the network of her imagination. It was mindless and fast. She wanted to cry out as it moved ever closer, but she couldn't. Finally, the virus was here, and it butted up against the neural interface itself.

When Doug called to her, she didn't hear him. She was lost in a nightmare of her own making. As if it had found another comm line to transit, another computer to infect, the virus kept butting against the neural interface. Unlike any other barrier it had ever encountered, however, this barrier adapted. This barrier trained. This barrier learned with lightning speed how best to modify itself so that signals on one side would pass with absolute fidelity to the computer on the other side. This barrier helped.

When, in her mind's eye, the virus slithered across the oh-so-cooperative barrier into one more computer and began its attack, she screamed.

For the latest computer to be invaded by the virus was Ben Feinman's brain.

* * *

The small office became confining, claustrophobic. Doug and Cheryl separated briefly to shower, then went out for a walk. The sky had clouded up while they'd been inside; they had the bike paths under the trees mostly to themselves. Good-this conversation was not something they wanted overheard. Seeing her shiver, he put an arm around her shoulder. She tensed briefly, then relaxed. He didn't know whether she'd reacted to his gesture, the feel of synthetic skin, or the memories his prosthesis must now awaken. He didn't think he wanted to know. Her arm trembled beneath his hand. He knew that she'd helped develop Ben's helmet. Did she blame herself? He knew that he would.

“Doug?”

“Hmm?”

“Why the atom? What does that mean?”

Some bicyclists spun around a blind curve, sending them scurrying aside, giving him a moment to pick his words. “Ben scribbled over his drawing, wiped part of it out.”

“No atom, then. I still don't get it.”

Doug thought about poor Fran Feinman, about what they could tell her. He thought about the final torrent of confusion that must have run in insane fury through Ben Feinman's brain as the invader did its work. Its damage. Its killing.

“We saw an atom, we just didn't recognize it as one. What Ben obliterated was the nucleus.”

Cheryl shuddered. She saw it too, now. She knew well which virus had been the most resistant to eradication, most ruthlessly destructive, had time and again reduced their computers to ravaged repositories of a single phrase repeated over and over. The same phrase that, she realized, must echo endlessly in what little mind remained to Bob Cherner. In tones of weary wonder, she recited it.

“Stop nuclear now.”

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The doors of the Inter-Agency Computer Network Security Forum were locked; an armed guard answered Doug's knock. The engineer took the implied seriousness as a promising sign. Vague hints about insight into a major virus outbreak got Doug and Cheryl into the office of a forum official named Glenn Adams.

Adams was in his early fifties, with pale blue eyes, a broad forehead, and brush-cut gray hair. Half of the people they had passed in the hall on the way to his office were in jeans and tee-shirts: programmers. Adams, in a business suit and tie, was representative of the other half. From Adams' stiff posture as he sat, Doug guessed ex-military. A photo on the office wall showed the guess was correct.

There was no good way to begin. “I've got a strange tale to tell. I hope you'll hear me out before passing judgment. Keep in mind that between us, Cheryl and I have four computer-science degrees and twenty-plus years in the industry. We've both published extensively in our field, which is neural interfacing.”

Adams accepted the list of publications Doug offered. “OK.” “You're familiar with the ‘no-nukes’ virus?”

Adams rubbed his nose thoughtfully. “An outbreak a couple of months ago. Wiped out hard drives with an antinuclear power slogan.”

Cheryl nodded. “That's the one.”

“Law enforcement aside, it's already off our scopes. The antivirus product companies got the template for ‘no-nukes’ into their definition files right away, though it's hard to get rid of once your network is infected. Pretty typical bug, really.”

Here goes, thought Doug. “What we've learned about no-nukes is far from typical.” He spoke for ten minutes to the ever more skeptical-looking official.

When Doug stopped, Adams asked, “Is this right? You claim the ‘no-nukes’ virus attacks people through neural-interface helmets, that it scrambles not only computers but also brains.” He got a nod. “The attack mode, overwriting memory, can leave human victims dead or insane. Brains aren't wired exactly alike, because of genetics and differences in what and how people learn. That makes what gets overwritten the luck of the draw. It sounds like the helmet design and the learning previously done by its neural network can also influence the nature of the attack.” Cheryl leaned forward. “These aren't claims; we're telling you what's happening. The forum must issue an advisory to warn people. We've got to stop this line of research, at least until we can totally eradicate the virus.”

“It's a little soon to tell anyone anything.”

“Look, dammit, it's happening.” Doug grimaced. “As we speak. People are dying, and worse. Did you hear what I said about Bob Cherner? Far from too soon, it's already too late for him.”

“This is so speculative. Can you explain how this could possibly work?”

Doug stood and stared. “Look, Feinman's and Cherner's attackers were obviously ‘no nukes.’ I admit: I don't know exactly how the attack gets through the helmet-I came here thinking the forum would want to try figuring it out. Perhaps you forum sloths could get off your spreading obscurocratic asses and look into it?”

“Sit down and calm down,” said Adams. Cheryl, he noted, shot her companion a scathing look that meant the same thing.

Doug ignored them both. “What will it take to convince you?” “You say Cherner and Feinman were attacked at home. And what about, um...” Adams checked his notes, “Yamaguchi? She had a car accident. Surely you don't claim that she was wearing a neural-interface helmet while she drove. Of all of your cases, only Friedman fell ill in her office.”

“Was killed,” Doug corrected. “Home or office doesn't matter. The victim networks into a bigger computer than the one at her desk. What does the virus care about wire length?” He felt a blood vessel pulsing in his neck. “Ben Feinman told his wife he'd brought work home. Perfectly normal to access the office computers from home. Or...” a light bulb of enlightenment went off over his head, “he could've been computer gaming. That'd explain why no one from his office ever asked Fran for whatever he'd

been doing. He was playing hooky from a Saturday matinee with the kids.”

“You don't know that Cherner had a helmet at his apartment. And you haven't explained Yamaguchi in her car.”

“Think, man. If the onslaught doesn't kill them outright, these people have voices inside their heads. Voices that don't stop, don't sleep, don't go away. Their brains are fried. As the virus keeps attacking, keeps writing, it only gets worse.

“Maybe the victims can't speak anymore. The helmet's whole purpose is to interface the cerebrum, the seat of consciousness and rational thought, to the computer. The cerebrum is probably the first thing attacked.

“I imagine that they can't think straight, can't reason, can't call for help, can't form a plan beyond make it stop. So-if a victim isn't killed outright-he takes off his helmet, or knocks it off, or stumbles and it falls off. He flees like a wounded animal, seeking refuge that doesn't exist, because the enemy is within.

“I imagine Cherner and Yamaguchi both made a dash for the psychological security of home. Yamaguchi didn't make it; when the pain got too much, or too little of her brain was left, she ended it in the only way left: at a lamppost. Cherner was tougher. He made it home, but that changed nothing. The invader was still there, its voice getting louder and louder. By then, he couldn't think straight enough to end it all, so he tried to rip the thing out. Through his own face, he tried to rip it out.”

Doug scowled at Adams. “Instances of that virus are still out there. The bastard who wrote that virus is still out there. And the world is full of sick copycats who adopt and evolve successful viruses.

“What are you going to do about it?”

“Well, I have your statement. If you leave your business cards, I'll know how to get back in touch.”

“That's it?” Doug's soft words carried venom. “You're sentencing people to pure hell. A statement from me to the Washington Post and a posting of my findings to the Net won't have the credibility of a pronouncement from the forum, but maybe they'll save someone. We'll goddamn well see.” He stood. “Come on, Cheryl. I imagine Glenn has coffee to drink and forms to file in triplicate.”

The bureaucrat winced. Before he could get out a retort, Cheryl jumped in. “Sit, Doug. This is no time for macho nonsense.” She took two pieces of paper from her purse and handed one to each man. “This is a SIGNIT mailing list: Special Interest Group in Neural Interfacing Technology. Not many names, and I've marked the people we think were affected.”

Adams scanned his sheet. “Is this enough data to be statistically significant?”

Did the casualties have to reach statistical significance? Remembering Cheryl's admonition, Doug willed himself to be calm. “You're obviously ex-military. Have any contacts in a three-letter agency?”

To most of the country, that question might have suggested the Environmental Protection Agency. Inside the Washington Beltway, it meant intelligence agencies, the CIA and its ilk. “Sure.”

“Ask about black work done by Sheila Brunner and Tom Zimmerman.” Black work was highly classified, to the point that its existence was generally denied.

“Agency folk aren't famed for their senses of humor. You sure you want this?” Doug and Cheryl both nodded.

“Wait here.” Adams stood. “I'll go make some calls.”

* * *

Doug turned to Cheryl. “Is it me, or is our host stalling?” Adams had just been paged from the lobby.

“What do you expect? That was quite a dare you made. And who are Sheila Brunner and Tom Zimmerman, anyway? What do you know about them?”

“I'd like to hear that too, Mr. Carey. Behind closed doors would be prudent.”

Adams had reappeared; with him were two serious-looking men. One was short and barrel-chested, with Mediterranean coloring. The other was taller, wiry, and fair. Both men's suit coats bulged under their left arms. The taller one seemed to be waiting for an answer.

Doug directed his response to Adams. “Your friends have names, Glenn?”

“Ted Benson, and this is Alexandros Kessarlis.” Badges flashed. “FBI.”

Adams' office didn't accommodate five very well, either spacewise or for air conditioning, but Doug didn't care. The agents' swift appearance suggested that his wager had paid off. "Did Glenn mention anything beside the names I dropped?" Kessarar shrugged; Benson did nothing.

"Good. I'll tell you about Brunner and Zimmerman, something I should have no way of knowing. Then, maybe, the government will do something."

Benson gestured for him to continue.

"I don't know Brunner or Zimmerman personally. I've seen their names repeatedly on conference attendance summaries. They're on the newest SIGNIT membership roll. Neither ever presents a paper or participates in an expert's panel. In five years, neither has submitted a paper to any neural-interfaces journal. "The NIT community is too small to hover on the edges, never contributing, without being noticed. I bet that means they're working on something black." He caught Benson's eye. "How'm I doing?" The agent looked back dispassionately.

"Have it your way. Your rapid response to Glenn's call tells me one thing. Something unpleasant and unexpected happened to one or both of them. Glenn may not like it, but I've got an explanation for disasters befalling people in this field."

Benson shrugged. "Hand-waving. Doom and gloom. Do you write for a checkout-counter news rag?"

"You want specifics?" Doug was maddened by their stonewalling. "Fine. An unexpected stroke, perhaps, or a heart attack." He looked for a reaction. No? "How about sudden mental illness? Strange behavior, probably nonverbal."

Watchful eyes narrowed, concession enough. "OK, that's it: sudden mental illness. Look, you must've checked clearances on us after Glenn's call. We've both done intel work; we've both held tickets." In the intelligence community, tickets denoted access to top-secret, compartmentalized material. You didn't get a ticket without an exhaustive, fifteen-year background check and a polygraph interview. "It's been a while since we've used 'em, but peace did break out all over. How about you cough up a little information?"

The agents considered. "They were working on neural interfaces for possible mind-controlled weapon systems," Benson finally offered. "Separate projects, both starting to show real progress. Very hush-hush.

"A few weeks ago, Zimmerman tried torching a nuclear power station. We don't know why. The plant survived, but Zimmerman went up like a roman candle. It took some arm-twisting, but we got the story reported as an escaped mental patient."

Doug remembered the news coverage. Someone on a publicity tour of the nuke plant had stuffed his pockets with sealed, gasoline-filled plastic bags. And he had a butane lighter. Doug's stomach lurched; he changed the subject. "And Brunner?"

Benson looked grim. "Brunner walked out of her office, ignoring all questions. People said she looked strange. Distracted.

"She never returned, and we can't find her."

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"So that's it?" asked Jim. He was changing into customer-schmoozing garb as he spoke. "We're from the government; we're here to help. That's it?"

Doug fidgeted with a pencil from Jim's desk. "Maybe. Mostly. Some positive steps." The forum had the connections to do things Doug couldn't pull off on his own. The first was an immediate cessation of helmet use. Most neural-interface research was federally bankrolled, like Doug's own NSF grants. Government sponsors had speedily endorsed the forum's recommendation that experimentation halt. Companies got the message that any continuation with private resources would doom any future funding or contracts. The projects on indefinite hold included Doug's own prosthetics effort; he'd had to scurry to reassign all of his staff to other parts of BSC.

Doug's and Cheryl's own queries of SIGNIT members had encountered mostly disingenuousness and dissembling-NIT research could lead to a paradigm shift in computing and many billions in profits. FBI agents got answers where Doug and Cheryl encountered evasion. The toll was even higher than the

engineers had feared: fourteen dead, eight driven incommunicative incommunicative and insane-and one, Sheila Brunner, still unaccounted for.

Jim tucked in his dress shirt. "And if she decides to go after a nuclear plant?"

"There are no guarantees, but the FBI thinks that's covered. Her picture has been sent to every power plant and nuclear-defense facility in the country. If she tries a Zimmerman, she'll be recognized. Best guess is she's dead or amnesiac or otherwise incapacitated.

The restaurateur took a tie from the rack behind the door. "I don't like it." My friend, you are way too trusting. "This woman did intel stuff?"

"Highly classified stuff, yes."

Jim frowned at the knot he'd left in the tie: lopsided. "Aren't you fingerprinted in the clearance process? If she were dead or incapacitated, wouldn't she have been identified by her prints?" The engineer stiffened in his chair. Hadn't thought of that, had you? "It seems to me Sheila is still functional enough to be hiding.

"Now what do you suppose she has planned?"

* * *

Doug sat in his house, pensive after lunch at Jim's. Perhaps his old friend had a point: a paranoid could have enemies. Too bad he couldn't be diverted by the newfound novelty of Cheryl's pleasant company. She planned to work all weekend, getting up to speed on the non-NIT project to which she'd been lent: "I can't be slacking off if I'm going to date a big-boss type."

What if Sheila Brunner was hiding? That would be scary, FBI assurances notwithstanding. Despite no-nukes brain damage, Zimmerman had functioned well enough to come up with an attack plan. He'd acted normal enough for admittance to the public tour of a nuclear plant. Mental hijacking did not preclude another assault from being as-or more-ingenious.

And were the FBI alerts distributed widely enough? He recalled Bob Cher-ner's hysteria at the sketch of an atom: would any reference to the word nuclear set Sheila off? Say, a hospital with a nuclear medicine department? A class on nuclear physics?

Whatever she was going to do ... why hadn't she done it already? The other unfortunates had all died or been stricken weeks ago.

He stiffened. Damn, but assumptions are dangerous things.

The FBI guys had given Doug their cell-phone numbers. "Ted, when did our missing friend go missing?"

"Eight days ago. Why?" "Probably nothing. Let me think something through, and I'll get back to you."

Did it mean anything? Many people were careless about computer hygiene. It would be simple to believe that Sheila Brunner was the victim of sloppiness in updating antivirus definitions as much as of no-nukes. Too bad Cheryl wasn't here to talk this through with.

Eight days ago. He walked over to his home PC. What viruses were most prevalent eight days ago? Lots of web sites published such data, including the forum's.

His memory was correct: the biggest was Frankenfools, a rant against biotech-and a simple hack of no-nukes.

With a shiver of premonition, he did a "people search" on Sheila Brunner. She lived about ten miles away. No longer, of course-the FBI would surely have her place under surveillance-but if she lived nearby, she presumably worked nearby, and she had disappeared from her office. Chances are she was still somewhere in this area.

The largest biotech company in this county was BioSciCorp.

* * * "Beep beep beep."

Doug cursed at the fast-busy tone he was hearing. He'd known BSC's phone system was getting an upgrade this weekend, but not how long that would take. He tried Cheryl's cell phone but only got her voicemail. The cell phone was probably in her purse in her office, while she was off in a lab. He shot a message to her office email address, not that he could count on her to read it.

From his car, Doug called back Ted Benson, and got voicemail this time. He took the option to be

rung through to a Bureau operator. "Track him down!" Doug demanded. He left his cell phone number as, horn blaring, he ran a red light.

He careened into the BSC parking lot. The high-speed impact with a speed bump jarred his arms. A microprocessor misunderstood the twitch; his prosthesis decided on its own to jerk the steering wheel violently to the right. As the car spun, tires squealing, he saw first scattered lights on in the office building and second, a trenchcoated woman getting out of a sport utility vehicle. His car skidded sideways into a parked minivan. His last thought as he blacked out was that one of the lit offices was Cheryl's.

* * *

Sheila turned in confusion at the unexpected noises. She didn't hear well these days. Had she ever? There was a car in the lot she didn't remember, crumpled against a van. That explained the noises.

"Do not alter the human genome," thundered the voice in her head. "Death to Frankenfools." It was hard to think with that constant shouting. Did the newly arrived car matter? "Death to Frankenfools."

She lost interest in the smashed car, the bidding of her voice ever insistent. A bulky object in her coat pocket banged against her side. The parking lot was almost empty; her sport ute was parked close to the Frankenfool building. Soon, she thought at her voice. It continued its oration, unimpressed.

Sirens sounded in the distance. Were they approaching? Feet pounded in the lot, weekend guards running to inspect the accident. "The human form is not to be tampered with. This folly must stop." She could recite the litany verbatim, if only to her mind's ear. The sirens were getting closer. She hastened to the far end of the parking lot, reaching for the box in her pocket as she walked.

* * *

Doug woke into a familiar nightmare, although the side-impact airbag had taken the worst of the crash. His car door would not open. A turn signal was ticking.

"Sir, are you all right?" It was a building guard. "Don't move. I've called an ambulance."

He shrugged off his seat belt and slid to the passenger side. The driver's door was crunched shut against the minivan. "Move aside!"

The trenchcoated woman was lurching away. Her coat was filthy, her hair matted. A homeless person, fleeing attention? Or a brilliant scientist driven insane by voices inside her head? The sport ute argued for the latter. As he stumbled after her, she emitted an inarticulate cry, wrestling with something tangled in her pocket.

A guard recognized him. "Mr. Carey, sir. You shouldn't move."

"Sheila!" he called, ignoring the advise. "Shei ... la!"

The woman turned, wild-eyed. She tugged frantically at something in her pocket. Fabric tore; a metallic box came loose. A whiplike appendage of the box snagged in the pocket lining; she ripped the-antenna?-free and it twanged straight. The box had a large button in its center. Twitching, muttering, she aimed it at the row of parked vehicles nearest the BSC building.

A radio remote control?

"Bomb!" he called over his shoulder. He was so close. The sirens were almost here. "Sheila, wait! This isn't your plan; it's a computer virus." She paused in confusion, gurgling something interrogatory but unintelligible. "Remember your research." He leapt mid-sentence-not at her, but at the end of the aerial. His prosthesis closed around the tip of the antenna. Stay closed, he ordered the artificial limb. His grip was solid; a hard tug pulled the box from her hands as he belly-flopped into the asphalt.

County police cruisers and an ambulance fishtailed into the lot. Each of the BSC guards held Sheila Brunner, barely, by an arm. A paramedic helped Doug to his feet; a county cop gingerly took the remote control from him. Doug's head was ringing.

In his peripheral vision, someone rushed from the BSC lobby. He turned: it was Cheryl. Investigating the sirens, perhaps. Her eyes were wide, taking in his battered appearance. She slipped an arm around his waist, supporting him as he slumped against her. "We need to get you to the hospital."

A cop in his cruiser called for a bomb unit. More sirens were converging. Sheila Brunner sagged as a paramedic administered a sedative.

Cheryl was safe. Sheila just possibly had been given a second chance. He looked at his wrecked car and smiled in satisfaction.

* * *

The Sun was not shining. Birds weren't chirping. Only the painkillers kept Doug from aching head to toe.

Life was good.

He sipped from a mug of soup. "This hits the spot."

"I'm glad." Cheryl sat to his left, holding his good hand. "I am so glad." She wasn't talking about his opinion of her soup.

"What did you tell Carla about this? I don't want her to worry about me."

"Just the car accident part, and that you'll be OK." Silence stretched awkwardly as he finished the soup and set down the mug. "Doug?"

"What, dear?" Two simple words, but they felt great. "You can do something else. I can do something else. I just hate that the field will go under-it had such potential. We'll never be rid of all viruses. Why would anyone risk using a neural interface ever again?"

He bent his right elbow, raising the prosthesis. The wrist swiveled and flexed; the fingers curled one at a time into a fist and then individually back open again. "Because, with suitable precautions, it's the right thing to do. We don't let viruses, and the fools that write them, prevent us from using computers. We won't let them keep us from other progress. You wondered what our department's next project would be, since prosthetics are on hold ... I think we've found it: defenses we can trust."

He smiled at Cheryl and gave her hand a squeeze. "Some things you just work at until you get them right."

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