Since his first pro sale to *Asimov's* in 2005, Ted Kosmatka has sold stories to *F&SF, Cemetery Dance, City Slab,* Ideomancer, and elsewhere. His tales have been translated into Hebrew and Russian, and have been reprinted in both Gardner Dozois's *Best SF of the Year* and Jonathan Strahan's *Best Science Fiction and Fantasy of the Year.* In his latest tale, Ted explores some of the possible ramifications of illuminating quantum mechanics with . . .

DIVINING LIGHT

Ted Kosmatka

It is impossible that God should ever deceive me, since in all fraud and deceit is to be found a certain imperfection.

—Descartes

I crouched in the rain with a gun.

A wave climbed the pebbly beach toward me, washing over my foot, filling my pants with grit and sand. Around me, the rocks loomed black and big as houses.

I shivered as I came back to myself and for the first time realized my suit jacket was missing. Also my left shoe, brown leather, size twelve. I looked for the shoe, scanning the rocky shoreline, but saw only stone and frothy, sliding water.

I took another swig from the bottle and tried to loosen my tie. Since I had a gun in one hand and a bottle in the other—and since I was unwilling to surrender either—loosening my tie was difficult. I used the gun hand, working the knot with a finger looped through the trigger guard, cold steel brushing my throat. I felt the muzzle under my chin—fingers numb and awkward, curling past the trigger.

It would be so easy.

I wondered if people have died this way—drunk, armed, loosening their ties. I imagined it was common among certain occupations.

Then the tie opened, and I hadn't shot myself. I took a swig from the bottle as reward.

I watched the waves rumble in. This place was nothing like the dunes of Indiana, where Lake Michigan makes love to the shoreline. Here in Gloucester, the water hates the land.

As a child, I'd come to this beach and wondered where all the boulders came from. Did the tides carry them in? Now I knew better. The boulders, of course, were here all along, buried in soft soils. They are left-behind things—they are what remains when the ocean subtracts everything else.

Behind me, near the road, there is a monument—a list of names. Fishermen. Gloucestermen. The ones who did not come back.

This is Gloucester, a place with a history of losing itself to the ocean.

I told myself I'd brought the gun for protection, but sitting here in the dark sand, I no longer believed it. I was beyond fooling myself. It was my father's gun, a .357. It had not been fired for sixteen years, seven months, four days. The math came quickly. Even drunk, the math came quickly.

My sister Mary had called it a good thing, this new place that was also an old place. *A new start*, she'd said. *You can do your work again. You can continue your research.*

Yeah, I'd said. A lie she believed.

You won't call me, will you?

Of course I'll call. A lie she didn't.

I turned my face away from the wind and took another burning swig. I drank until I couldn't remember which hand held the gun and which the bottle. I drank until they were the same.

During the second week, we unpacked the microscopes. Satish used a crowbar while I used a claw hammer. The crates were heavy, wooden, hermetically sealed—shipped in from some now-defunct research laboratory in Pennsylvania.

The sun beat down on the lab's loading dock, and it was nearly as hot today as it was cold the week before.

I swung my arm, and the claw hammer bit into the pale wood. I swung again. It was satisfying work. Satish saw me wipe the perspiration from my forehead, and he smiled, straight white teeth in a straight dark face.

"In India," he said. "This is sweater weather."

Satish slid the crowbar into the gash I made, and pressed. I'd known him for three days, and already I was his friend. Together we committed violence on the crates until they yielded.

The industry was consolidating, and the Pennsylvania lab had been the latest victim. Their equipment had come cheap. Here at Hansen, it was like Christmas for scientists. We opened our boxes. We ogled our new toys. We wondered, vaguely, how we had come to deserve this. For some, like Satish, the answer was complicated and rooted in achievement. Hansen was more than just another Massachusetts think tank, after all, and Satish had beaten out a dozen other scientists to work here. He'd given presentations and written up projects that important people liked. For me it was simpler.

For me this was a second chance given by a friend. A last chance.

August 2008

We cracked open the final wooden crate, and Satish peered inside. He peeled out layer after layer of foam packing material. It was a big crate, but inside we found only a small assortment of Nalgene volumetric flasks, maybe three pounds' weight. It was somebody's idea of a joke—somebody at the now-defunct lab making a statement of opinion about their now-defunct job.

"The frog is in the well," Satish said, one of his many opaque expressions.

"It certainly is," I said.

There were reasons for moving here. There were reasons not to. They were the same reasons. Both had everything, and nothing, to do with the gun.

The lab gates are the first thing a person sees when driving up on the property. From the gates, you can't see the building at all, which in the real-estate sector surrounding Boston speaks not just of money, but *money.* Everything out here is expensive, elbow room most of all.

The lab is tucked into a stony hillside about an hour upcoast of the city. It is a private, quiet place, shaded by trees. The building itself is beautiful—two stories of reflective glass spread over the approximate dimensions of a football field. What isn't glass is matte black steel. It looks like art. A small, brick-paved turnaround curves up to the main entrance, but the front parking lot there is merely a decorative ornament—a small asphalt pad for visitors and the uninitiated. The driveway continues around the building where the real parking, the parking for the researchers, is in the back.

That first morning, I parked in front and walked inside.

A pretty blonde receptionist smiled at me. "Take a seat."

Two minutes later, James rounded the corner and shook my hand. He walked me back to his office. And then came the offer, like this was just business—like we were just two men in suits. But I could see it in his eyes, that sad way he looked at me, my old friend.

He slid a folded sheet of paper across the desk at me. I unfolded it. Forced myself to make sense of the numbers.

"It's too generous," I said.

"We're getting you cheap at that price."

"No," I said. "You're not."

"Considering your patents and your past work—"

I cut him off. "I can't do that anymore."

He leveled his eyes at me. Two beats. "I'd heard that. I'd hoped it wasn't true."

"If you feel I came here under false pretenses—" I began climbing to my feet.

"No, no." He held his hand up to stop me. "The offer stands. We can carry you for four months." He leaned back in his leather chair. "Probationary project members get four months to produce. We pride ourselves on our independence; so you can choose whatever research you like, but after four months, it's not up to me anymore. I have bosses, too; so you have to have something to show for it. Something publishable, or on its way to it. Do you understand?"

I nodded.

"This can be a new start for you," he said, and I knew then that he'd already talked to Mary. "You did some great work at QSR. I followed your publications; hell, we all did. But considering the circumstances under which you left . . ."

I nodded again. The inevitable moment.

He was silent, looking at me. That was the closest he'd come to mentioning it. "I'm going out on a limb for you," he said. "But you've got to promise me."

I looked away. His office suited him, I decided. Not too large, but bright and comfortable. A Notre Dame engineering diploma graced one wall. Only his desk was pretentious—a huge black monstrosity that you could land aircraft on—but I knew it was inherited. His father's old desk. I'd seen it once when we were still in college a dozen years ago. A lifetime ago.

"Can you promise me?" he said.

I knew what he was talking about. I met his eyes. Silence. And he was quiet for a long time after that, looking at me, waiting for me to say something. Weighing our friendship against the odds this would come back to bite him.

"All right," he said finally. "You start tomorrow."

There are days I don't drink at all. Here is how those days start: I pull the gun from its holster and set it on the desk in my hotel room. The gun is heavy and black. It says *Ruger* along the side in small, raised letters. It tastes like pennies and ashes. I look into the mirror across from the bed and tell myself, *If you drink today, you're going to kill yourself*. I look into my own gray eyes and see that I mean it.

Those are the days I don't drink.

There is a rhythm to working in a research laboratory. Through the glass doors by 7:30, nodding to the other early arrivals, then sit in your office until 8:00, pondering this fundamental truth: even shit coffee—even mud-thick, brackish, walkin'-out-the-pot, shit coffee is still better than no coffee at all.

I like to be the one who makes the first pot in the morning. Swing open the cabinet doors in the coffee room, pop the tin cylinder and take a deep breath, letting the smell of the grounds fill my lungs. It is better than drinking the coffee, that smell.

There are days when I feel everything is an imposition—eating, speaking, walking out of the hotel room door in the morning. Everything is effort. Calling people back is more than I can bear. I exist mostly in my head. It comes and goes, this crushing depression, and I work hard not to let it show, because the truth is that it's not how you feel that matters. It's how you act. It's your behavior. As long as your intelligence is intact, you can make cognitive evaluations of what is appropriate. You can force the day to day. And I want to keep this job; so I do force it. I want to get along. I want to be productive again. I want to make Mary proud of me.

Working at a research lab isn't like a normal job. There are peculiar rhythms, strange hours—special allowances are made for the creatives.

Two Chinese guys are the ringleaders of lunchtime basketball. They

pulled me into a game my first week. “You look like you can play,” was what they said.

One is tall, one is short. The tall one was raised in Ohio and has no accent. He is called Point Machine. The short one has no real idea of the rules of basketball, and for this reason is the best defensive player. His fouls leave marks, and that becomes another game—a game within a game—to see how much abuse you can take without calling it. This is the real reason I play. I drive to the hoop and get hacked down. I drive again.

One player, a Norwegian named Umlauf, is 6'8". I marvel at the sheer size of him. He can’t run or jump or move at all, really, but his big body clogs up the lane, huge arms swatting down any jump shot made within reach of his personal zone of asphalt real estate. We play four-on-four, or five-on-five, depending on who is free for lunch. At thirty-one, I’m a few years younger than most of them, a few inches taller—except for Umlauf, who is a head taller than everyone. Trash is talked in an assortment of accents.

Some researchers go to restaurants on lunch hour. Others play computer games in their offices. Still others work through lunch—forget to eat for days. Satish is one of those. I play basketball because it feels like punishment.

The atmosphere in the lab is relaxed; you can take naps if you want. There is no outside pressure to work. It is a strictly Darwinian system—you compete for your right to be there. The only pressure is the pressure you put on yourself, because everyone knows that the evaluations come every four months, and you’ve got to have something to show. The turnover rate for probationary researchers hovers around 25 percent.

Satish works in circuits. He told me about it during my second week when I found him sitting at the SEM. “It is microscopic work,” he said.

A scanning electron microscope is a window. Put a sample in the chamber, pump to vacuum, and it’s like looking at another world. What had been flat, smooth sample surface now takes on another character, becomes topographically complex. Using the SEM is like looking at satellite photography—you’re up in space, looking down at this elaborate landscape, looking down at the Earth, and then you turn the little black dial and zoom toward the surface. Zooming in is like falling. Like you’ve been dropped from orbit, and the ground is rushing up to meet you, but you’re falling faster than you ever could in real life, faster than terminal velocity, falling impossibly fast, impossibly far, and the landscape keeps getting bigger, and you think you’re going to hit, but you never do, because everything keeps getting closer and sharper, and you never do hit the ground—like that old riddle where the frog jumps half the distance of a log, then half again, and again, and again, and never reaches the other side, not ever. That’s an electron microscope. Falling forever down into the picture. And you never do hit bottom.

I zoomed in to 14,000X once. Like God’s eyes focusing. Looking for that ultimate, indivisible truth. I learned this: there is no bottom to see.

Satish and I both had offices on the second floor.

Satish was short and thin. His skin was a deep, rich brown. He had an almost boyish face, but the first hints of gray salted his mustache. His features were balanced in such a way that he could have been the fit and healthy

son of any number of nations: Mexico, or Libya, or Greece, or Sicily—until he opened his mouth. When he opened his mouth and spoke, all those possible identities vanished, and he was suddenly Indian, solidly Indian, completely, like a magic trick; you could not imagine him being anything else.

The first time I met Satish, he clamped both hands over mine, shook, then clapped me on the shoulder and said, "How are you doing, my friend? Welcome to research." He smiled so wide it was impossible not to like him.

It was Satish who explained that you never wore gloves when working with liquid nitrogen. "Make a point of it," Satish said. "Because the gloves will get you burned."

I watched him work. He filled the SEM's reservoir—icy smoke spilling out over the lip, cascading down to the tile floor.

Liquid nitrogen doesn't have the same surface tension as water; spill a few drops across your hand and they'll tend to bounce off harmlessly and run down your skin without truly wetting you—like little balls of mercury. The drops will evaporate in moments, sizzling, steaming, then gone. But if you're wearing gloves when you fill the reservoir, the nitrogen could spill down inside and be trapped against your skin. "And if that happens," Satish said while he poured, "it will hurt you bad."

Satish was the first to ask me my area of research.

"I'm not sure," I told him.

"How can you not be sure?"

I shrugged. "I'm just not."

"You are here. It must be something."

"I'm still working on it."

He stared at me, taking this in, and I saw his eyes change—his understanding of me shifting, like the first time I heard him speak. And just like that, I'd become something different to him.

"Ah," he said. "I know who you are now. You are the one from Stanford."

"That was eight years ago."

"You wrote that famous paper on de-coherence. You are the one who had the breakdown."

Satish was blunt, apparently.

"I wouldn't call it a breakdown."

He nodded, perhaps accepting this; perhaps not. "So you still are working in quantum theory?"

"No, I stopped."

"Why stop?"

"Quantum mechanics starts to affect your worldview after a while."

"What do you mean?" he asked.

"The more research I did, the less I believed."

"In quantum mechanics?"

"No. In the world."

There are days when I don't drink at all. On those days, I pick up my father's .357 and look in the mirror. I convince myself what it will cost me, today, if I take the first sip. It will cost me what it cost him.

But there are also days I *do* drink. Those are the days I wake up sick. I walk into the bathroom and puke into the toilet, needing a drink so bad

my hands are shaking. I look in the bathroom mirror and splash water in my face. I say nothing to myself. There is nothing I would believe.

It is vodka in the morning. Vodka because vodka has no smell. A sip to calm the shakes. A sip to get me moving. If Satish knows, he says nothing.

Satish studied circuits. He bred them, in little ones and zeroes, in a Thompson's Field Programmable Gate Array. The array's internal logic could be changed, and he allowed selective pressure to dictate chip design. Genetic algorithms manipulated the best codes for the task. "Nothing is ideal," he said. "There's lots of modeling."

I didn't have the slightest idea how it all worked.

Satish was a genius who had been a farmer in India until he came to America at the age of twenty-eight. He earned an electrical engineering degree from MIT. After that, Harvard, and patents, and job offers. "I am just a simple farmer," he liked to say. "I like to challenge the dirt."

Satish had endless expressions. When relaxed, he let himself lapse into broken English. Sometimes, after spending the morning with him, I'd fall into the pattern of his speech, talking his broken English back at him, an efficient pidgin that I came to respect for its streamlined efficiency and ability to convey nuance.

"I went to dentist yesterday," Satish told me. "He says I have good teeth. I tell him 'Forty-two years old, and it is my first time at dentist.' And he could not believe."

"You've never been to the dentist?" I said.

"No, never. Until I am in twelfth grade in my village back home, I did not know there was special doctor for teeth. I never went because I had no need. The dentist says I have good teeth, no cavities, but I have stain on my back molars on the left side where I chew tobacco."

"I didn't know you chewed."

"I am ashamed. None of my brothers chew tobacco. Out of my family, I am the only one. I try to stop." Satish spread his hands in exasperation. "But I cannot. I told my wife I stopped two months ago, but I started again, and I have not told her." His eyes grew sad. "I am a bad person."

Satish stared at me. "You are laughing," he said. "Why are you laughing?"

Hansen was a gravity well in the tech industry—a constantly expanding force of nature, buying out other labs, buying equipment, absorbing the competition.

Hansen labs only hired the best, without regard to national origin. It was the kind of place where you'd walk into the coffee room and find a Nigerian speaking German to an Iranian. Speaking German because they both spoke it better than English, the other language they had in common. Most of the engineers were Asian, though. It wasn't because the best engineers were Asian—well, it wasn't *only* because the best engineers were Asian. There were also simply more of them. America graduated four thousand engineers in 2008. China graduated three hundred thousand. And Hansen Labs was always looking for talent.

The Boston lab was just one of Hansen's locations, but we had the largest storage facility, which meant that much of the surplus lab equip-

ment ended up shipped to us. We opened boxes. We sorted through supplies. If we needed anything for our research, we signed for it, and it was ours. It was the opposite of academia, where every piece of equipment had to be expensed and justified and begged for.

Most mornings I spent with Satish. I helped him with his gate arrays. He talked of his children while he worked. Lunch I spent on basketball. Sometimes after basketball, I'd drop by Point Machine's lab to see what he was up to. He worked with organics, searching for chemical alternatives that wouldn't cause birth defects in amphibians. He tested water samples for cadmium, mercury, arsenic. Point Machine was a kind of shaman. He studied the gene expression patterns of amphioxus; he read the future in deformities.

"Unless something is done," he said. "A generation from now, most amphibians will be extinct." He had aquariums filled with frogs—frogs with too many legs, with tails, with no arms. Monsters.

Next to his lab was the office of a woman named Joy. Sometimes Joy would hear us talking and stop by, hand sliding along the wall—tall, and beautiful, and blind. Did acoustical research of some kind. She had long hair and high cheekbones—eyes so clear, and blue, and perfect that I didn't realize at first.

"It's okay," she said. "I get that a lot." She never wore dark glasses, never used a white cane. "Detached retinas," she explained. "I was three."

In the afternoons, I tried to work.

Alone in my office, I stared at the marker board. The great white expanse of it. I picked up the marker, closed my eyes, wrote from memory.

When I looked at what I'd written, I threw the marker across the room.

James came by later that night. He stood in the doorway, cup of coffee in his hand. He saw the papers scattered across the floor. "It's good to see you working on something," he said.

"It's not work."

"It'll come," he said.

"No, I don't think it will."

"It just takes time."

"Time is what I'm wasting here. Your time. This lab's time." Honesty welled up from somewhere deep. "I shouldn't be here."

"It's fine, Eric," he said. "We have researchers on staff who don't have a third of your citings. You belong here."

"It's not like before. I'm not like before."

James looked at me. That sad look back again. His voice was soft when he spoke. "R&D is a tax write-off. At least finish out your contract. That gives you another two months. After that, we can write you up a letter of recommendation."

That night in my hotel room, I stared at the phone, sipped the vodka. I imagined calling Mary, dialing the number. My sister, so like me, yet not like me. I imagined her voice on the other end.

Hello? Hello?

This numbness inside of me, a strange heaviness of things I could have said, not to worry, things are fine; but instead I say nothing, letting the

phone slide away, and hours later find myself at the railing outside, coming off another blackout, soaked to the skin, watching the rain. Thunder advances from the east, from across the water, and I stand in the dark, waiting for life to be good again.

There is this: the feeling that my mind could not contain my perspective. I see myself outside myself, an angular shape cast in sodium lights—eyes gray like storm clouds, gray like gunmetal. Dreaming and waking are indistinguishable. The gravity of memory pulls me down, because once you've learned something, you can't unlearn it. Darwin once said that the serious study of math endows you with an extra sense, but what do you do when that sense contradicts your other senses?

My arm flexes and the vodka bottle flies end over end into the darkness—the glimmer of it, the shatter of it, glass and asphalt and shards of rain. There is nothing else until there is nothing else.

The lab.

Satish said, "Yesterday in my car I was talking to my daughter, five years old, and she says, 'Daddy, please don't talk.' I asked her why, and she said, 'Because I am praying. I need you to be quiet.' So I ask her what she is praying about, and she said, 'My friend borrowed my glitter ChapStick and I am praying she remembers to bring it back.'"

Satish was trying not to smile. We were in his office, eating lunch across his desk.

He continued. "I told her, well, maybe she is like me and she forgets. But my daughter says, 'No, it has been more than one week now.'"

This amused Satish greatly—the talk of ChapStick, and the prayers of children. We finished our lunches.

"You eat rice every day," I observed.

"I like rice," he said.

"But every day?"

"You insult me, my friend. I am a simple man trying to save for my daughter's college." Satish spread his hands in mock outrage. "Do you think I am born with golden spoon?"

In the fourth week, I told him I wasn't going to be hired after my probationary period.

"How do you know?"

"I just know."

His face grew serious. "You are certain?"

"Yeah."

"In that case, do not worry about it." He clapped me on the shoulder. "Sometimes the boat just gets sink, my friend."

I thought about this for a moment. "Did you just tell me that you win some and you lose some?"

Satish considered this. "Yes," he said. "That is correct, except I did not mention the win part."

During my fifth week at the lab, I found the box from Docent. It started as an email from Bob, the shipping guy, saying there were some crates I might be interested in. Crates labeled, "Physics," sitting in the loading dock.

I went down to receiving and looked at the boxes. Got out the crowbar and opened them.

Three of the boxes were of no interest to me; they held only weights, scales, and glassware. But the fourth box was different. I stared into the fourth box for a long time.

I closed the box again and hammered the lid down with the edge of the crowbar. I went to Bob's office and tracked down the shipping information. A company called Ingram had been bought by Docent a few years ago—and now Docent had been bought by Hansen. The box had been in storage the whole time.

I had the box taken to my office. Later that day, I signed for lab space, Room 271.

I was drawing on my marker board when Satish walked into my office.

"What is that?" he said, gesturing to what I'd written.

"It is my project."

"You have a project now?"

"Yes."

"That is good." He smiled and shook my hand. "Congratulations, my friend. How did this wonderful thing happen?"

"It's not going to change anything. Just busy work to give me something to do."

"What is it?"

"You ever hear of the Feynman double-slit?" I said.

"Physics? That is not my area, but I have heard of Young's double-slit."

"It's the same thing, almost; only instead of light, they used a stream of electrons." I patted the box on the table. "And a detector. The detector is key. The detector makes all the difference."

Satish looked at the box. "The detector is in there?"

"Yeah, I found it in a crate today, along with a thermionic gun."

"A gun?"

"A thermionic gun. An electron gun. Obviously part of a replication trial."

"You are going to use this gun?"

I nodded. "Feynman once said, 'Any other situation in quantum mechanics, it turns out, can be explained by saying, "You remember the case of the experiment with two holes? It's the same thing."' "

"Why are you going to do this project?"

"I want to see what Feynman saw."

Autumn comes quickly to the East Coast. It is a different animal out here, where the trees take on every color of the spectrum, and the wind has teeth. As a boy, before the moves and the special schools, I'd spent an autumn evening camped out in the woods behind my grandparents' house. Lying on my back, I'd stare up at the leaves as they drifted past my field of vision.

It was the smell that brought it back so strongly—the smell of fall, as I walked to the parking lot. Joy stood near the roadway, waiting for her cab.

The wind gusted, making the trees dance. She turned her collar against the wind, oblivious to the autumn beauty around her. For a moment, I felt pity for that. To live in New England and not see the leaves.

I climbed into my rental. I idled. No cab passed through the gates. No cab followed the winding drive. I was about to pull away, but at the last second spun the wheel and pulled up to the turnaround.

"Is there a problem with your ride?" I asked her.

"I'm not sure. I think there might be."

"Do you need a lift home?"

"I'll be okay." She paused. "You don't mind?"

"It's fine, seriously."

She climbed in and shut the door. "Thank you," she said. "It's a bit of a drive."

"I wasn't doing much anyway."

"Left at the gate," she said.

She guided me by stops. She didn't know the street names, but she counted the intersections, guiding me to the highway, blind leading the blind. The miles rolled by.

Boston. A city that hasn't forgotten itself. A city outside of time. Crumbling cobblestones and modern concrete. Road names that existed before the Redcoats invaded. It is easy to lose yourself, to imagine yourself lost, while winding through the hilly streets.

Outside the city proper, there is stone everywhere, and trees—soft pine and colorful deciduous. I saw a map in my head, Cape Cod jutting into the Atlantic. The cape is a curl of land positioned so perfectly to protect Boston that it seems a thing designed. If not by man, then by God. God wanted a city where Boston sits.

The houses, I know, are expensive beyond all reason. It is a place that defies farming. Scratch the earth, and a rock will leap out and hit you. People build stone walls around their properties so they'll have someplace to put the stones.

At her apartment, I pulled to a stop. Walked her to her door, like this was a date. Standing next to her, she was almost as tall as me—maybe 5'11", too thin, and we were at the door, her empty blue eyes focused on something far away until she looked at me, *looked*, and I could swear for a moment that she saw me.

Then her eyes glided on past my shoulder, focused on some dim horizon again.

"I'm renting now," she said. "Once my probationary period is over, I'll probably buy a condo closer to work."

"I didn't realize you were new to Hansen, too."

"I actually hired in the week after you. I'm hoping to stay on."

"Then I'm sure you will."

"Perhaps," she said. "At least my research is cheap. It is only me and my ears. Can I entice you in for coffee?"

"I should be going, but another time perhaps."

"I understand." She extended her hand. "Another time then. Thank you for the ride."

I turned to go, but her voice stopped me. "James said you were brilliant."

I turned. "He told you that?"

"Not me. I talk with his secretary, and James has spoken about you a lot, apparently—your days in college. But I have a question before you go. Something I was wondering."

"Okay."

She brought her hand up and touched my cheek. "Why are the brilliant ones always so screwed-up?"

I said nothing, looking hard into those eyes. The silence between us attenuated, became so thin it was see-through.

"You need to be careful," she said. "The alcohol. I can smell it on you some mornings. If I can smell it, so can others."

"I'll be fine."

"No. Somehow I don't think you will."

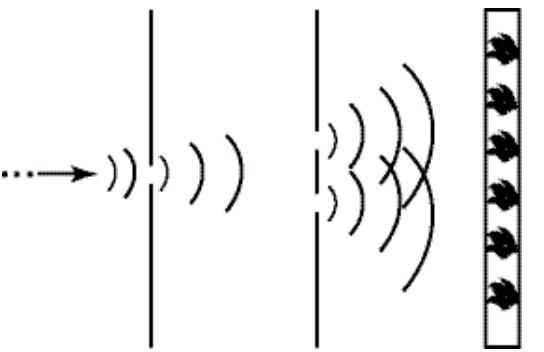
The lab.

Satish stood in front of the diagram I'd drawn on my whiteboard.

I watched him studying it. "What is this?" he asked.

"The wave-particle duality of light."

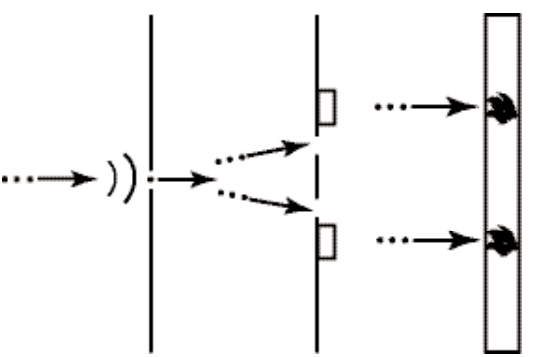
"And these lines?"



"This is the wave part," I said, pointing at the diagram. "Fire a photon stream through two slits, and the waves create a pattern on the phosphorescent screen behind the slits. The frequencies of the waves cancel each other out at certain intervals, creating an interference pattern. Do you see?"

"Yes, I think so."

"But if you put a detector at the two slits . . ." I began drawing another picture under the first. "Then it changes everything. When the detectors are in place, light stops behaving like a wave and starts acting like distinct particles, like a stream of little bullets.



I continued. "So instead of an interference pattern, you get two distinct clusters of phosphorescence where those tiny bullets hit the screen behind the slits."

"Yes, I remember now," Satish said. "This is very familiar. I believe there was a chapter on this in grad school."

"In grad school, I *taught* this. And I watched the students' faces. The ones who understood what it meant—who truly understood—always looked troubled by it. I could see it in their expressions, the pain of believing something which can't be true."

"This is a famous experiment. You are planning to replicate?"

"Yeah."

"Why? It has already been replicated many times; no journal will publish."

"I know. I've read scientific papers on the phenomenon; I've taken tests on it, and given tests on it; I understand it mathematically—hell, most of my earlier research is based on the assumptions that came out of this experiment. But I've never actually *seen* it with my eyes. That's why I want to do it. To finally see it."

"It is science." Satish shrugged. "You don't need to see it."

"I do," I said. "Need to. Just once."

The next few weeks passed in a blur. Satish helped me with my project, and I helped him with his. We worked mornings in his lab. Evenings we spent in Room 271, setting up. The phosphorescent plate was a problem—then the alignment of the thermionic gun. In a way, it felt like we were partners, almost, Satish and I. And it was a good feeling. After working so long by myself, it was good to be able to talk to someone.

We traded stories to pass the time. Satish talked of his problems. They were the problems good men sometimes have when they've lived good lives. He talked about helping his daughter with her homework, and worrying about paying for her college. He talked of his family *Backhome*—saying it fast that way, *Backhome*, so you heard the proper noun; and he talked of the fields, and the bugs, and the monsoon, and the ruined crops. "It is going to be a bad year for sugar cane," he told me, as if we were farmers instead of researchers. He talked about his mother's health and advancing years. He talked of his brothers, and his sisters, and his nieces and nephews; and I came to understand the weight of responsibility he felt.

Bending over the gate arrays, soldering tool in hand, he told me, "I talk too much, you must be sick of my voice."

"Not at all."

"You have been a big help me with my work. How can I ever repay you, my friend?"

"Money is fine," I told him. "I prefer large bills."

I wanted to tell him of my life. I wanted to tell him of my work at QSR, and that some things you learn, you wish you could unlearn. I wanted to tell him that memory has gravity, and madness a color; that all guns have names, and it is the same name. I wanted to tell him I understood about his tobacco; that I'd been married once, and it hadn't worked out; that I used to talk softly to my father's grave; that it was a long time since I'd really been okay.

Instead of telling him these things, I talked about the experiment. That I could do. Always could do.

"It started a half-century ago as a thought experiment," I told him. "To prove the incompleteness of quantum mechanics. Physicists felt quantum mechanics couldn't be the whole story, because the math takes too many liberties with reality. But there was still that troublesome contradiction left to be reconciled: the photoelectric effect required light to be a particle; Young's results showed it to be a wave. Only later, of course, when the technology finally caught up with the theory, it turned out the experimental results followed the math. The math says you can either know the position of an electron, or the momentum, but never both. The math, it turned out, wasn't metaphor at all. The math was dead serious. The math wasn't screwing around."

Satish nodded like he understood.

Later, working on his gate arrays, he traded his story for mine.

"There once was a guru who brought four princes into the forest," he told me. "They were hunting birds."

"Birds," I said.

"Yes, and up in the trees, they see one, a beautiful bird with bright feathers. The first prince said, 'I will shoot the bird,' and he pulled back on his arrow and shot into the trees. But the arrow missed. Then the second prince tried to shoot, and he, too, missed. Then the third prince. Finally the fourth prince shot high into the trees, and this time the arrow struck and the beautiful bird fell dead. The guru looked at the first three princes and said, 'Where were you aiming?'

"'At the bird.'

"'At the bird.'

"'At the bird.'

"The guru looked at the fourth prince, 'And you?'

"'At the bird's eye.'"

Once the equipment was set up, the alignment was the last hurdle to be cleared. The electron gun had to be aimed so the electron was just as likely to go through either slit. The equipment filled most of the room—an assortment of electronics and screens and wires.

In the mornings, in the hotel room, I talked to the mirror, made promises to gunmetal eyes. And by some miracle did not drink.

One day became two. Two became three. Three became five. Then I hadn't had a drink in a week.

At the lab, the work continued. When the last piece of equipment was positioned, I stood back and surveyed the whole setup, heart beating in my chest, standing at the edge of some great universal truth. I was about to be witness to something few people in the history of the world had ever seen.

When the first satellite was launched toward deep space in 1977, it carried a golden record of coded messages. The record held diagrams of chemical structures, and mathematical formulas. It carried the image of a fetus, the calibration of a circle, and a single page from Newton's *System of the World*. It carried the units of our mathematical system, because mathematics, we're told, is the universal language. I've always felt that

golden record should have carried a diagram of this experiment, the Feynman double-slit.

Because this experiment is more fundamental than math. It is what lives under the math. It tells of reality itself.

Richard Feynman said this about the slit experiment: "It has in it the heart of quantum mechanics. In truth, it contains only mystery."

Room 271 held two chairs, a marker board, a long lab bench, and several large tables. I'd hung dark canvas over the windows to block out the light. The setup sprawled across the length of the room.

Slits had been cut into sheets of steel that served to divide the areas of the setup. The phosphorescent screen was loaded into a small rectangular box behind the second set of slits.

James came by a little after 5:00, just before going home for the evening.

"They told me you signed up for lab space," he said.

"Yeah."

He stepped inside the room. "What is this?" he said, gesturing to the equipment.

"Just old equipment from Docent. No one was using it, so I thought I'd see if I could get it to work."

"What are you planning exactly?"

"Replicating results, nothing new. The Feynman double-slit."

He was quiet for a moment. "It's good to see you working on something, but isn't that a little dated?"

"Good science is never dated."

"But what are you expecting to prove?"

"Nothing," I said. "Nothing at all."

The day we ran the experiment, the weather was freezing. The wind gusted in from the ocean, and the East Coast huddled under a cold front. I got to work early and left a note on Satish's desk.

Meet me in my lab at 9:00.
—Eric

I did not explain it to Satish. I did not explain further.

Satish walked through the door of room 271 a little before 9:00, and I gestured toward the button. "Would you like to do the honors?"

We stood motionless in the near-darkness of the lab. Satish studied the apparatus spread out before him. "Never trust engineer who doesn't walk his own bridge."

I smiled. "Okay then." I hit the button. The machine hummed.

I let it run for a few minutes before walking over to check the screen. I opened the top and looked inside. And then I saw it, what I'd been hoping to see. The experiment had produced a distinctive banded pattern, an interference pattern on the screen. Just like Young, just like the Copenhagen interpretation said it would.

Satish looked over my shoulder. The machine continued to hum, deepening the pattern as we watched.

"Would you like to see a magic trick?" I asked.

He nodded solemnly.

"Light is a wave," I told him.

I reached for the detector and hit the "on" switch—and just like that, the interference pattern disappeared.

"Unless someone is watching."

The Copenhagen interpretation posits this: Observation is a requirement of reality. Nothing exists until it is observed. Until then there are only probability waves. Only possibility.

For purposes of the experiment, these waves describe the probability of a particle being found at any given location between the electron gun and the screen. Until the particle is detected by some consciousness at a specific point along the wave, it effectively takes every path through spacetime. Therefore, until a particle is observed passing through one slit, it could theoretically be passing through either—and thus will actually pass through both in the form of probability waves. These waves interfere with each other in a predictable way and thereby produce a visible interference pattern on the screen behind the slits. But if a particle is detected by an observer at either of the two slits, it can't then be passing through both; and if it can't pass through both, it can't produce an interference pattern.

This would seem self-contradictory, except for one thing. Except that the interference pattern disappears if someone is watching.

We ran the experiment again and again. Satish checked the detector results, carefully noting which slit the electrons passed through. With the detectors on, roughly half the electrons passed through each slit, and no interference pattern formed. We turned the detectors off again—and again, instantly, the interference pattern emerged on the screen.

"How does the system know?" Satish asked.

"How does it know what?"

"That the detectors are on. How does it know the electron's position has been recorded?"

"Ah, the big question."

"Are the detectors putting out some kind of electromagnetic interference?"

I shook my head. "You haven't seen the really weird stuff yet."

"What do you mean?"

"The electrons aren't really responding to the detectors at all. They're responding to the fact that you'll eventually read the detectors' results."

Satish looked at me, blank-faced.

"Turn the detectors back on," I said.

Satish hit the button. The detectors hummed softly. We let the experiment run.

"It is just like before," I told him. "The detectors are on, so the electrons should be acting as particles, not waves; and without waves, there's no interference pattern, right?"

Satish nodded.

"Okay, turn it off."

The machine cycled down to silence.

"And now the magic test," I said. "This is the one. This is the one I wanted to see."

I hit the "clear" button on the detector, erasing the results.

"The experiment was the same as before," I said. "The detectors were on both times. The only difference was that I erased the results without looking at them. Now check the screen."

Satish opened the box and pulled the screen out.

And then I saw it. On his face. The pain of believing something which can't be true.

"An interference pattern," he said. "How could that be?"

"It's called retrocausality. By erasing the results after the experiment was run, I caused the particle pattern to never have occurred in the first place."

Satish was silent for five full seconds. "Is such a thing possible?"

"Of course not, but there it is. Unless a conscious observer makes an observation of the detector results, the detector itself will remain part of the larger indeterminate system. The detectors don't cause wave function collapse; conscious observation does. Consciousness is like this giant spotlight collapsing reality wherever it shines—and what isn't observed remains probability. And it's not just photons or electrons. It is everything. All matter. It is a flaw in reality. A testable, repeatable, flaw in reality."

Satish said, "So this is what you wanted to see?"

"Yeah."

"Is it different for you now that you've actually seen it?"

I considered this for a moment, exploring my own mind. "Yes, it is different," I said. "It is much worse."

We ran the slit experiment again and again. The results never changed. They matched perfectly the results that Feynman had documented decades earlier. Over the next two days, Satish hooked the detectors up to a printer. We ran the tests, and I hit print. We listened as the printer buzzed and chirped, printing out the results.

Satish pored over the data sheets as if to make sense of them by sheer force of will. I stared over his shoulder, a voice in his ear. "It's like an unexplored law of nature," I said. "Quantum physics as a form of statistical approximation—a solution to the storage problem of reality. Matter behaves like a frequency domain. Why resolve the data fields nobody is looking at?"

Satish put the sheets down and rubbed his eyes.

"There are schools of mathematical thought which assert that a deeper, implicate order is enfolded just below the surface of our lives."

"We have a name for this, too," Satish said. He smiled. "We call it Brahman. We've known about it for five thousand years."

"I want to try something," I said.

We ran the test again. I printed up the results, being careful not to look at them. We turned off the equipment.

I folded both pages in half and slid them into manila envelopes. I gave Satish the envelope with the screen results. I kept the detector results. "I haven't looked at the detector results yet," I told him. "So right now the wavefunction is still a superposition of states. Even though the results

are printed, they're still un-observed and so still part of the indeterminate system. Do you understand?"

"Yes."

"Go in the next room. I'm going to open my envelope in exactly twenty seconds. In exactly thirty seconds, I want you to open yours."

Satish walked out. And here it was: the place logic bleeds. I fought an irrational burst of fear. I lit the nearby Bunsen burner and held my envelope over the open flame. The smell of burning paper. Black ash. A minute later Satish was back, his envelope open.

"You didn't look," he said. He held out his sheet of paper. "As soon as I opened it, I knew you didn't look."

"I lied," I said, taking the paper from him. "And you caught me. We made the world's first quantum lie detector—a divination tool made of light." I looked at the paper. The interference pattern lay in dark bands across the white surface. "Some mathematicians say there is either no such thing as free will, or the world is a simulation. Which do you think is true?"

"Those are our choices?"

I crushed the paper into a ball. Something slid away inside of me; something snapped, and I opened my mouth to speak but what came out was different from what I intended.

I told Satish about the breakdown, and the drinking, and the hospital. I told him about the eyes in the mirror, and what I said to myself in the morning.

I told him about the smooth, steel erase button I put against my head—a single curl of an index finger to pay for everything.

Satish nodded while he listened, the smile wiped clean from his face. When I finished speaking, Satish put his hand on my shoulder and looked me in the eye. "So then you are crazy after all, my friend."

"It's been thirteen days now," I told him. "Thirteen days sober."

"Is that good?"

"No, but it's longer than I've gone in two years."

We ran the experiment. We printed the results.

If we looked at the detector results, the screen showed the particle pattern. If we didn't, it showed an interference pattern.

We worked through most of the night. Near morning, sitting in the semi-darkness of the lab, Satish spoke. "There once was a frog who lived in a well," he said.

I watched his face as he told the story.

Satish continued. "One day a farmer lowered a bucket into the well, and the frog was pulled up to the surface. The frog blinked in the bright sun, seeing it for the first time. 'Who are you?' the frog asked the farmer.

"The farmer was amazed. He said, 'I am the owner of this farm.'

" 'You call your world "farm"?' the frog said.

" 'No, this is not a different world,' the farmer said. 'This is the same world.'

"The frog laughed at the farmer. He said, 'I have swum to every corner of my world. North, south, east, west. I am telling you, I am sure this is a different world.' "

I looked at Satish and said nothing.

"You and I," Satish said. "We are still in the well." He closed his eyes. "Can I ask you a question?"

"Go ahead."

"You do not want to drink?"

"No."

"I am curious, what you said with the gun, that you'd shoot yourself if you drank . . ."

"Yeah."

"You did not drink on those days you said that?"

"No."

Satish paused as if considering his words carefully. "Then why did you not just say that every day?"

"That is simple," I said. "Because then I'd be dead now."

Later, after Satish had gone home, I ran the experiment one final time. I put the results in two envelopes without looking at them. On the first envelope, I wrote the words "detector results." On the second, I wrote "screen results."

I drove to the hotel. I took off my clothes. I stood naked in front of the mirror.

I put the enveloped marked "detector" up to my forehead. "I will never look at this," I said. "Not ever, unless I start drinking again." I stared in the mirror. I stared at my own gray eyes and saw that I meant it.

I glanced down at the other envelope. The one with the screen results. My hands shook.

I laid the envelope on the desk, stared at it. Will I drink again? The question had a pressure, a turgidity. Those envelopes knew the answer.

One day, I would either open the detector results, or I wouldn't.

Inside the other envelope there was either an interference pattern, or there wasn't. A yes or a no. The answer was in there. It was already in there.

I waited in Satish's office until he arrived in the morning. He put his briefcase on his desk. He looked at me, at the clock, then back at me.

"What are you doing?" he asked.

"Waiting for you."

"How long have you been here?"

"Since 4:30."

He glanced around the room. I leaned back in his chair, fingers laced behind my head.

Satish just watched me. Satish was bright. He waited.

"Can you rig the detector to an indicator light?" I asked him.

"How do you mean?"

"Can you set it up so that the light goes off when the detector picks up an electron at the slit?"

"It shouldn't be hard. Why?"

"I want to define, exactly, the indeterminate system."

Point Machine watched the test. He studied the interference pattern.

"You're looking at one-half the wave particle duality of light," I said.
"What's the other half look like?"
I turned the detectors on. The banded pattern diverged into two distinct clumps on the screen.
"This."
"Oh," Point Machine said.

Standing in Point Machine's lab. Frogs swimming.
"They're aware of light, right?" I asked.
"They do have eyes."
"But, I mean, they're aware of it?"
"Yeah, they respond to visual stimuli. They're hunters. They have to see to hunt."
"But, I mean, aware?"

"What did you do before here?"
"Quantum research."
"I know that," Point Machine said. "But what did you do?"
I tried to shrug him off. "There were a range of projects. Solid state photonic devices, *Fourier transforms,* liquid NMR."
"*Fourier transforms*?"
"They're complex equations that can be used to translate visual patterns into the language of waves."
Point Machine looked at me, dark eyes tightening. He said again, very slowly, enunciating each word, "What did you do, *exactly*?"
"Computers," I said. "We were trying to build a computer. Quantum information processing extending up to twelve qubits. We used the *Fourier transforms* to convert information into waves and back again."
"Did it work?"
"Kind of. We reached a twelve-coherence state and decoded it using nuclear magnetic resonance."
"Why only kind of? So then it *didn't* work?"
"No, it worked, it definitely worked. Especially when it was turned off." I looked at him. "Kind of."

It took Satish two days to rig up the light.
Point Machine brought the frogs in on a Saturday. We separated the healthy from the sick, the healthy from the monsters. "What is wrong with them?" I asked.
"The more complex a system, the more ways it can go wrong."
Joy was next door, working in her lab. She heard our voices and stepped into the hall.
"You work weekends?" Satish asked her.
"It's quieter," Joy said. "I do my more sensitive tests when there's nobody here. What about you? So you're all partners now?"
"Eric has the big hands on this project," Satish said. "My hands are small."
"What are you working on?" she said. She followed Satish into the lab.
He shot me a look, and I nodded.

So Satish explained it the way only Satish could.

"Oh," she said. She blinked. She stayed.

We used Point Machine as a control. "We're going to do this in real-time," I told him. "No record at the detectors, just the indicator light. When I tell you, stand there and watch for the light. If the light comes on, it means the detectors picked up the electron. Understand?"

"Yeah, I get it," Point Machine said.

Satish hit the button. I watched the screen, interference pattern materializing before my eyes—a now-familiar pattern of light and dark.

"Okay," I told Point Machine. "Now look in the box. Tell me if you see the light."

Point Machine looked in the box. Before he even spoke, the interference pattern disappeared. "Yeah," he said. "I see the light."

I smiled. Felt that edge between known and unknown. Caressed it.

I nodded at Satish, and he hit the switch to kill the gun. I turned to Point Machine. "You collapsed the probability wave by observing the light, so we've established proof of principle." I looked at the three of them. "Now let's find out if all observers were created equal."

Point Machine put a frog in the box.

And here it was, the stepping-off point. A view into the implicate—a place where objective and subjective reality remained undefined. I nodded to Satish. "Fire the gun."

He hit the switch and the machine hummed. I watched the screen. I closed my eyes, felt my heart beating in my chest. Inside the box, I knew a light had come on for one of the two detectors; I knew the frog had seen it. But when I opened my eyes, the interference pattern still showed on the screen. The frog hadn't changed it at all.

"Again," I told Satish.

Satish fired the gun again. Again. Again.

Point Machine looked at me. "Well?"

"There's still an interference pattern. The probability wave didn't collapse."

"What does that mean?" Joy asked.

"It means we try a different frog."

We tried six. None changed the result.

"They're part of the indeterminate system," Satish said.

I was watching the screen closely, and the interference pattern vanished. I was about to shout, but when I looked up, I saw Point Machine peeking into the box.

"You looked," I said.

"I was just making sure the light worked."

"I could tell."

We tried every frog in his lab. Then we tried the salamanders.

"Maybe it's just amphibians," he said.

"Yeah, maybe."

"How is it that we affect the system, but frogs and salamanders can't?"

"Maybe it's our eyes," Point Machine said. "It has to be the eyes—quantum effects in the retinal rod-rhopsin molecules. Our optic nerves only present measured information to the brain."

Ted Kosmatka

"Why would that matter?"

"Can I try?" Joy interrupted.

I nodded. We ran the experiment again, this time with Joy's empty eyes pointed at the box. Again, nothing.

The next morning, Point Machine met Satish and me in the parking lot before work. We climbed into my car and drove to the mall.

We went to a pet store.

I bought three mice, a canary, a turtle, and a squish-faced Boston terrier puppy. The sales clerk stared at us.

"You pet lovers, huh?" He looked suspiciously at Satish and Point Machine.

"Oh, yes," I said. "Pets."

The drive back was quiet, punctuated only by the occasional whining of the puppy.

Point Machine broke the silence. "Perhaps it takes a more complex nervous system."

"Why would that matter?" Satish said. "Life is life. Real is real."

I gripped the steering wheel. "What's the difference between mind and brain?"

"Semantics," said Point Machine. "Different names for the same idea."

Satish regarded us. "Brain is hardware," he said. "Mind is software."

The Massachusetts landscape whipped past the car's windows, a wall of ruined hillside on our right—huge, dark stone like the bones of the earth. A compound fracture of the land. We drove the rest of the way in silence.

Back at the lab, we started with the turtle. Then the mice, then the canary, which escaped, and flew to sit atop a filing cabinet. None of them collapsed the wave.

The Boston terrier looked at us, google-eyed.

"Are its eyes supposed to look like that?" Satish said. "In different directions?"

I put the puppy in the box. "It's the breed, I think. But all it has to do is sense the light. Either eye will do." I looked down at man's best friend, our companion through the millennia—and I harbored a secret hope. This one, I told myself. This species, certainly, of all of them. Because who hasn't looked into the eyes of a dog and not sensed something looking back?

The puppy whined in the box. Satish ran the experiment. I watched the screen.

Nothing. There was no change at all.

That night I drove to Joy's. She answered the door. Waited for me to speak.

"You mentioned coffee?"

She smiled, and there was another moment when I felt sure she saw me.

Hours later, in the darkness, I told her it was time for me to go. She ran a hand along my bare spine.

"There is no such thing as time," she said. "Only now. And now." She put her lips on my skin. "And now."

The next day, I had James come by the lab.

"You've made a finding?" he asked.

"We have."

James watched us run the experiment. He looked in the box. He collapsed the wavefunction himself.

Then we put the puppy in the box and ran the experiment again. We showed him the interference pattern.

"Why didn't it work?" he asked.

"We don't know."

"But what's different?"

"Only one thing. The observer."

"I don't think I understand."

"So far, none of the animals we've tested have been able to alter the quantum system."

He brought his hand to his chin. His brow furrowed. He was silent for a long time, looking at the setup. "Holy shit," he said finally.

"Yeah," Point Machine said.

I stepped forward. "We want to do more tests. Work our way up through every phylum, class, and order—primates being of particular interest, because of their evolutionary connection to us."

His eyes went far away. "As much as you want," he said. "As much funding as you want."

It took ten days to arrange. We worked in conjunction with the Boston Zoo.

Transporting large numbers of animals can be a logistical nightmare, so it was decided that it would be easier to bring the lab to the zoo than to bring the zoo to the lab. Vans were hired. Technicians were assigned. Point Machine put his own research on hold and assigned a technician to feed his amphibians in his absence. Satish's research also went on hiatus. "It suddenly seems less interesting," he said.

James attended the experiment on the first day. We set up in one of the new exhibits under construction—a green, high-ceilinged room that would one day house muntjacks. For now, though, it would house scientists. Satish worked the electronics. Point Machine liaisoned with the zoo staff. I built a bigger wooden box.

The zoo staff didn't seem particularly inclined to cooperate until the size of Hansen's charitable donation was explained to them by the zoo superintendent.

The following Monday we started the experiment. We worked our way through representatives of several mammal lineages: Marsupialia, Afrotheria, and the last two hold-outs of Monotremata—the platypus and the echidna. The next day we tested species from Xenartha and Laurasiatheria. The fourth day, we tackled Euarchontogliries. None of them collapsed the wavefunction; none carried the spotlight. On the fifth day, we started on the primates.

We began with the primates most distantly related to humans.

We tested lemuriforms and New World monkeys. Then Old World monkeys. Finally, we moved to the anthropoid apes. On the sixth day, we did the chimps.

"There are actually two species," Point Machine told us. "Pan paniscus, commonly called the bonobo, and Pan troglodytes, the common chimpanzee. They look so similar that by the time scientists first realized they were different species in the 1930's, they'd already been hopelessly comingled in zoos." Zoo staff maneuvered two juveniles into the room, holding them by their hands. "But during World War II, we found a way to separate them again," Point Machine continued. "It happened at a zoo outside Hellabrun, Germany. A bombing destroyed most of the town but left the zoo intact. When the zookeepers returned, they found that only the common chimps had survived. The bonobos had all died of fright."

We tested both species. The machine hummed. We double-checked the results, then triple-checked, and the interference pattern did not budge. Even chimps didn't cause wavefunction collapse.

"We're alone," I said. "Totally alone."

Later that night, Point Machine paced the lab. "It's like tracing any characteristic," he said. "You look for homology in sister taxa. You organize clades, catalogue synapomorphies, identify the outgroup."

"And who is the outgroup?"

"Who do you think?" Point Machine stopped pacing. "The ability to cause wavefunction collapse is apparently a derived characteristic that arose in our species at some point in the last several million years."

"And before that?" I said.

"What?"

"Before that the Earth just stood there as so much un-collapsed reality? What, waiting for us to show up?"

Writing up the paper took several days. I signed Satish and Point Machine as co-authors.

Species and Quantum Wavefunction Collapse

Eric Argus, Satish Gupta, Mi Chang. Hansen Labs, Boston MA.

Abstract

Multiple studies have revealed the default state of quantum systems to be a superposition of both collapsed and un-collapsed probability wavefunctions. It has long been known that subjective observation by a mind or consciousness is a requirement for wavefunction collapse. The goal of this study was to identify the higher-order taxa capable of causing wavefunction collapse through observation and to develop a phylogenetic tree to clarify the relationships between these major animal phyla. Species incapable of wavefunction collapse can be considered part of the larger indeterminate system. The study was carried out at the Boston Zoo on multiple orders of mammalia. Here we report that humans were the only species tested which proved capable of exerting wavefuncion collapse onto the background superposition of states, and indeed, this ability appears to be a uniquely derived human characteristic. This ability most likely arose sometime in the last six million years after the most recent common ances-

tor of humans and chimpanzees.

James read the abstract. He came to my office.

"But what do the results *mean*?"

"They mean whatever you think they mean."

Things moved fast after that. The paper was published in *The Journal of Quantum Mechanics*, and the phone started ringing. There were requests for interviews, peer review, and a dozen labs started replication trials. It was the interpretations that got crazy, though. I stayed away from interpretations. I dealt with the facts. I turned down the interviews.

Satish worked on perfecting the test itself. He worked on downsizing it, minimizing it, digitizing it. Turning it into a product. It became the Hansen double-slit, and when he was done, it was the size of a loaf of bread—with an easy indicator light and small, efficient output. Green for yes, and red for no. I wonder if he knew then. I wonder if he already suspected what they'd use it for.

"It's not about what is known," he said. "But what is knowable."

He abandoned his gate arrays. Above his work station I found a quote taped to the wall, torn from an old book.

> *Can animals be just a superior race of marionettes, which eat without pleasure, cry without pain, desire nothing, know nothing, and only simulate intelligence?*
>
> —Thomas Henry Huxley, 1859

In the spring, a medical doctor named Robbins made his interest in the project known through a series of letters. The letters turned into phone calls. The voices on the other end belonged to lawyers, the kind that come from deep pockets. Robbins worked for a consortium with a vested interest in determining exactly, once and for all, when consciousness first arises during human fetal development.

Hansen Labs turned him down flat until the offer grew a seventh figure.

James came to me. "He wants you there."

"I don't care."

"Robbins asked for you specifically."

"I don't give a damn. I don't want any part of it, and you can fire me if you want to."

James grew a weary smile. "Fire you? If I fired you, my bosses would fire me." He sighed. "This guy Robbins is a real prick, do you know that?"

"Yeah, I know. I've seen him on TV."

"But that doesn't mean he's wrong."

"Yeah, I know that, too."

Hansen provided technicians for the testing. The week before the tests were going to occur, I got the call. I'd been expecting it. Robbins himself.

"Are you sure we can't get you to come?"

"No, I don't think that's possible."

"If the issue is monetary, I can assure you—"

"It's not."

There was a pause on the line. "I understand," he said. "All the same, I wanted to personally thank you. It's a great thing you've accomplished. Your work is going to save a lot of lives."

I was silent. "How did you get the mothers?"

"They're committed volunteers, each one. Special women. We're a large, national congregation, and we were able to find several volunteers from each trimester of pregnancy—though I don't expect we'll need more than the first one to prove the age at which a baby is ensouled. Our earliest mother is only a few weeks along."

I chose my next words carefully. "You're fine with them taking the risk?"

"We have a whole staff of doctors attending, and medical experts have already determined that the procedure carries no more risk than amniocentesis. The diode inserted into the amniotic fluid will be no larger than a needle."

"One thing I never understood about this . . . a fetus's eyes are closed."

"I prefer the word baby," he said, voice gone suddenly tight as a drum. "A *baby's* eyelids are very thin, and the diode is very bright. We have no doubt they'll be able to sense it. Then we have merely to note wavefunction collapse, and we'll finally have the proof we need to change the law and put a stop to the plague of abortions that has swept across this land."

I put the phone down. I looked at it. Plague of abortions. I've never trusted people who think they have all the answers. Fanaticism, on either side of an issue, has always seemed dangerous to me. I picked the phone up again. "You think it's as simple as that?"

"I do. When is a human life a human life? That is always what this particular argument has been about, has it not? Now we'll finally be able to prove that abortion is murder, and who could argue? I sense that you don't like me very much."

"I like you fine. But there's an old saying, 'Never trust a man with only one book.'"

"One book is all a man needs if it's the right book."

"Have you considered what you'll do if you're proven wrong?"

"What do you mean?"

"What if wavefunction collapse doesn't occur until the ninth month? Or the magical moment of birth? Will you change your mind?"

"That's not going to happen."

"Maybe," I said. "But I guess now we find out, don't we."

The night before the experiment, I called Point Machine. It was call or drink. And I didn't want to drink. Because I knew if I drank again, even a single sip, I'd never stop. Not ever.

He picked up on the fifth ring. Faraway voice.

"What's going to happen tomorrow?" I asked.

There was a long pause. Long enough that I wondered if he'd heard me. "Not sure," he said. The voice on the other end was coarse and weary. It was a voice that hadn't been sleeping well. "Entogeny reflects phylogeny,"

he said. "Look early enough in gestation and we've got gills, a tail. The roots of the whole animal kingdom. You climb the phylogenetic tree as the fetus develops, and the newer characteristics get tacked on last. What Robbins is testing for is only found in humans, so my gut tells me he's wrong, and it comes late. Real late."

"You think it works that way?"

"I have no idea how it works."

The day of the experiment came and went.

The first hint that something went wrong came in the form of silence. Silence from the Robbins group. Silence in the media. No press conferences. No TV interviews. Just silence.

The days turned to weeks.

Finally, a terse statement was issued by the group which called their results inconclusive. Robbins came out a few days later, saying bluntly that there had been a failure in the mechanism of the tests.

The truth was something stranger, of course. And of course, that came out later, too.

The truth was that some of the fetuses *did* pass the test. Just like Robbins hoped. Some did trigger wavefunction collapse—but others didn't. And gestational age had nothing to do with it.

Two months later, I received the call in the middle of the night. "We found one in New York." It was Satish.

"What?" I rubbed my eyes, trying to make sense of the words.

"A boy. Nine years old. He didn't cause wavefunction collapse."

"What's wrong with him?"

"Nothing. He's normal. Normal vision, normal intelligence. I had a conversation with him. We tested him five times, but the interference pattern didn't budge."

"What happened when you told him?"

"We didn't tell him. He stood there staring at us."

"Staring?"

"It was like he already knew. Like he knew the whole time it wouldn't work."

Summer turned to fall. The testing continued.

Satish traveled the country, searching for that elusive, perfect cross-section and a sample size to fit the chi-square. He collected data points, faxed copies back to the lab for safekeeping.

In the end, it turned out that there were a lot of people who couldn't collapse the wavefunction—a certain consistent percentage of the population who looked like us, and acted like us, but lacked this fundamental quality of humanity. Though Satish was careful not to use the term "soul," we heard it in the gaps between the words he spoke during his late night phone calls. We heard it in the things he didn't say.

I pictured him on the other end of the line, sitting in some dark hotel room, fighting a growing insomnia, fighting the growing loneliness of what he was doing.

Point Machine sought comfort in elaborately constructed phylogenies, retreated into his cladograms. But there was no comfort for him there. "There's no frequency distribution curve," he told me. "No geographical epicenter, no disequilibrium between ethnographic populations, nothing I can get traction on."

He pored over Satish's data, looking for the pattern that would make sense of it all.

"It's almost random," he said. "It doesn't act like a trait."

"Then maybe it's not."

He shook his head. "Then who are they, some kind of empty-set? Non-player characters in the indeterminate system? Part of the game?"

Satish had his own ideas.

"Why none of the scientists?" I asked him one night. "If it's random, why none of us?"

"If they're part of the indeterminate system, why would they become scientists?"

"What do you mean?"

"It's like a virtual construct," Satish said. "You write the code, a series of response algorhythms. Wind them up and let 'em go."

"This is crazy."

"I didn't make the rules."

"Do they even know what you're testing them for, when they look at your little light? Do they know they're different?"

"One of them," he said. He was silent for a moment. "One of them knew."

And then, days later, the final call. From Denver. The last time I'd ever speak to him.

"I don't think we're supposed to do this," he said, his voice strangely coarse.

I rubbed my eyes, sitting up in bed.

"I don't think we're supposed to build this kind of test," he said. "The flaw in reality that you talked about . . . I don't think we were expected to use it this way. To make a test."

"What are you talking about?"

"I saw the boy again. The boy from New York." And with that, he hung up.

Ten days later, Satish disappeared, along with his special little box. He got off a plane in Boston, but didn't make it home. I was at the lab when I got the call from his wife.

"No," I said. "Not for days." Then, "Yeah, I'll call the minute I hear something."

She was crying into the phone.

"I'm sure he's fine," I lied.

When I hung up, I grabbed my coat and headed for the door. Bought a fifth of vodka and drove to the hotel.

Stared in the mirror.

Eyes gray like storm clouds, gray like gunmetal.

I spun the cap off the bottle and smelled the burn. Music filtered through the thin walls, a soft melody, a woman's voice. I imagined my life

different. I imagined that I could stop here. Not take the first drink.

My hands trembled.

The first sip brought tears to my eyes. Then I upended the bottle and drank deep. I tried to have a vision. I tried to picture Satish happy and healthy in some bar somewhere working on a three-day binge, but the image wouldn't come. That was me, not Satish. Satish didn't drink. I tried to picture him coming home again. I couldn't see that either.

Do they know they're different, I'd asked him.

One of them, he'd said. *One of them knew*.

When the bottle was half empty, I walked to the desk and picked up the envelope marked "screen results." Then I looked at the gun. I imagined what a .357 round could do to a skull—lay it open wide and deep. Reveal that place where self resides—expose it to the air where it would evaporate like liquid nitrogen, sizzling, steaming, gone. A gun could be many things, including a vehicle to return you to the implicate. The dream within a dream.

The more complex the system, the more ways it can go wrong. Point Machine had said that.

And things go wrong. That spotlight. Little engines of wavefunction collapse. Humans can never see reality as it is: we observe it into existence. But what if you could control that spotlight, dilate it like the pupil of an eye, stare deep into the implicate order. What would you see? What if you could slide between the sheaths of subjective and objective? What then? Maybe there have always been people like that. Mistakes. People who walk among us, but are not us. Only now there was a test to point them out.

And maybe they didn't want to be found.

I pulled the sheet of paper out of the envelope. I unfolded it and spread it out flat on the desk. I looked at the results—and in so doing, finally collapsed the probability wave of the experiment I'd run all those months ago. Though of course the results had been there all along.

I stared at what was on the paper, a series of shaded semi-circles—a now familiar pattern of light and dark. ❍