

A GAME OF CONSEQUENCES

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There were two of them in the hot room, on the day that went bad but could have been so much worse. The Mathematical Institute's air-conditioning was failing as usual to cope with heat from the angry bar of sunlight that slanted across Ceri's desktop and made the papers there too blindingly white to read. Through the window she could see an utterly cloudless sky: each last wisp of vapour had been scorched away.

Across the room where the light was kinder, Ranjit had perched on the stool and hunched himself over his beloved keyboard, rattling off initialization sequences. ? Breakthrough day today!? he said cheerily.

? You say that every bloody day,? said Ceri, moving to look over his shoulder.

? Yes, but this week we're getting something. I've been starting to feel a sort of, sort of ... resonance. That's what you want, right??

It was what she wanted. She really shouldn't feel resentful that her frail and beautiful tracery of theory needed a computer nerd to pit it against stubborn fact. A nerd and a quantum-logic supercomputer like the Cray 7000-Q, the faculty's latest toy.

Not that Ranjit was precisely a classic nerd or geek. The man was presentable enough, not conspicuously overweight or bizarrely hair-styled, thirtysomething like Ceri herself. She might yet end up sleeping with him. Among campus women there was some mild speculation that he was gay, but Ceri put that down to his one addiction, the one he was indulging now. Sinking through the now blossoming display into a world of electronic metaphor. The rapture of the deep. She found herself worrying at a line from Nietzsche: if you struggle over-much with algorithms, you yourself become an algorithm. Gaze too long into virtual spaces, and virtual spaces will gaze into you.

False colours began to bloom in the oversized display screen as the model of Nothing shuffled itself into multi-dimensioned shape. ? I like this colour palette,? he murmured. ? Reminds me of being in church.? It reminded Ceri of a smashed kaleidoscope.

Her virtual-space analogy-maybe some day to be expounded in a triumphalist paper by Ceri Evans PhD and, oh damn, Ranjit Narayan MSc-hovered on the shady side of respectable physics. Down in the spaces underneath space, so certain lines of mathematics implied, the observer and the observed melted together like Dali's soft watches. There seemed to be an entangledness, a complicity between any sufficiently detailed model and the actual dance of subatomic interaction. Then (it was her own insight, still lovingly fondled in the mind) suppose one tuned the computer model for mathematical ? sweetness", for structures whose elegant symmetry had the ring of inevitable truth: a resonance with reality, a kind of chord. And then ... what then? Maybe a digital telescope that could spy on the substrate below quantum complexity. Maybe just a vast amount of wasted computer time.

? Hey, how about a cup of coffee, Ceri??

This, of course, was what mathematical physicists were good for once they'd churned out a testable hypothesis. Making the coffee. She stalked through the cruel slash of sunlight to the hiding-place of her illicitly imported kettle.

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There had been four of them in the hot garden, more than twenty years before: Sammy and Ceri and Dai and the English boy whose name she'd forgotten. Somewhere beyond the sheltering trees was a strong clear sun, its light flickering and strobing through leaves stirred by a breeze from up the valley. Ceri remembered pointing out how momentary apertures in the foliage acted like pinhole cameras, projecting perfect little sun-discs on to flat ground. This was of some small interest, but could not compete with the afternoon's major attraction. Sammy had an air rifle.

They made paper targets and sellotaped them to the brick wall at the garden's far end. Why was it so hard to draw a freehand circle, let alone properly concentric ones? Despite that changing dapple of light, the worn old .177-inch rifle was surprisingly accurate if you held it properly, and conventional targets soon grew boring. The English boy drew a hilarious-well, once Ceri knew who it was meant to be-caricature of Mr Porter at the High School. When Porter had been well peppered and had only empty holes for eyes, other teachers got the same treatment.

? Moving targets, that's what!/? said Sammy when a trace of tedium had again set in. But woodlice could not be persuaded to crawl sportingly along the back wall. It was populated with hundreds of the tiny, tireless mites they called red spiders, but these became invisible at any decent range.

? Oh, of course. The twigs are all moving in the breeze,/? Ceri suggested, and obscurely wished she hadn't. There were cries of ? Bloody hell!/? as the four came to grips with the difficulty of holding the airgun steady while firing upward at slender, swaying pencils of wood. Eventually Dai brought down a fragment of twig- ? Gre-e-at! I'm the champ!/? -and Ceri, mostly by luck, snipped free a broad sycamore leaf that sideslipped and jinked as it drifted reluctantly groundward.

Sammy took the rifle and reloaded. ? I'll give him a fright,/? he announced, pointing to a greenfinch eyeing them from a middling-high branch.

? No,/? said Ceri.

? Just going for the branch, stupid./?

Fly away, fly away now, she thought urgently, but the bird only cocked its head to look down with the other eye. The flat clack of the airgun seemed especially loud, and there was a dreadful inevitability in the fall of the little green-brown bundle of feathers.

Afterwards, besides the private heartache and the recriminations concerning .177? holes that had appeared in the windows of quite surprisingly distant houses, the thing that rankled was that Sammy had been too fastidious to touch the bloodied finch. ? There's things crawling on it,/? he said. Worse, its eye had failed to close in the proper decorum of death, and stared emptily. The English boy scraped a hole and Ceri dropped the bird into it. It was still warm.

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The steady glare through the window had changed its angle now, and a third cup of coffee was going lukewarm beside the mouse-mat. Why did one sweat so much more than in those hot remembered days of childhood? Perhaps it was the square-cube law: more body mass, more internal heat to shed, proportionally less skin area to sweat through? Two hours of translating her mathematical intuitions into

appropriate quasi-shapes and pseudo-angles for Ranjit's algorithmic probes had left Ceri with a slight headache and a tendency to stray off into such mental byways.

Ranjit stirred slightly. ? I think ... I think we might be there. In the sort of space you specified.?

The flickering multicoloured gridwork on the screen looked no different; or was it firmer, somehow more confident? ? How do you know?? she asked.

? It feels right somehow. Locked-in. As though the simulation has picked up a kind of inertia.? A kaleidoscope whose images were hardening from randomness to a compelling pattern, to something ? real".

? Which might mean it's resonating with real-superstring phenomena, say. Sub-particles.?

? I'm bloody glad you said 'might'. We could just be looking into a mirror, seeing stuff we put there ourselves. Your neatest idea today was when you said it felt like a cellular-automata gameboard. From that angle, a lot of things clicked for me. Now that thing-? he indicated a complex node false-coloured in shifting shades of blue near the top of the monitor- ? could be a sort of stable oscillator, like you used to see in the old Life-game programs.?

Ceri nodded in mild approval. ? Which feels about right, because if particles aren't stable oscillations in the quantum field, then what are they? We're seeing the right kind of map-although, as the man said, 'the map is not the territory'. But if we can ever develop this thing to the point of pulling out information that isn't in the physics books, and if the information is good ...?

? Yes, I had begun to gather that. Over the weeks of you telling me it.?

? The shaky part of this entanglement theory is that the mapping ought to be two-way. Heisenberg's principle: you can't observe without affecting the thing observed. But the mechanism ... the scaling factors ...? She frowned and gnawed her lip. ? All right, all right, you need more coffee.?

Ranjit said slowly, ? Wait a minute. I'm going to try something. ? His brown fingers rippled over the keys.

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There had been three of them in the chem. lab, Sammy and Ceri and the girl with the harsh Cardiff accent, whose name she had long forgotten. It was another sweltering day, and the rest of the school had emptied itself into the open air at the first clang of the lunch bell. Here the reek of old reagents and spillages bit acridly at your throat, and the smell of the new stuff they were carefully filtering through big paper-lined funnels led to occasional coughs which no one could stifle.

? This is the biggest batch ever,? Sammy chortled. ? Going for the world record!? As usual, although it was Ceri who first found and read that worn Victorian volume of Amusing and Edifying Scientific Parlour Tricks, the project had become all Sammy's.

The black paste of precipitate had many uses. Once dried, it was amazingly touchy stuff. Smearred on chalkboards and left for an hour, it produced amusing crackles and bangs when Mr Whitcutt scrawled his illegible algebra workings; underfoot, it made whole classrooms (and on one glorious morning, the school assembly hall) a riot of minor explosions and puffs of purple smoke; packed into a lock, it could blast the inserted key right back into its holder's hand, often with painful force.

Then the door to the back room opened. Ceri winced. They'd counted on Mr Davies, the elderly lab technician, either going out for lunch or staying placidly put and brewing his tea as usual. White-haired Mr

Davies had seen everything that could happen in labs; his experience went back to days before ordinary benzene was declared a carcinogen, days when the pupils routinely used it to sluice organics from their hands.

? Terrible smell of ammonia in here,? he said mildly. ? Someone ought open a window.?

The Cardiff girl-Rhiannon, could it have been?-silently obeyed.

Mr Davies, looking at no one in particular, added: ? People ought to know not to make nitrogen tri-iodide in kilogram lots. That much of the stuff's unstable even if you do keep it wet. And it doesn't help anyone's career if they're short of a few fingers.? He retreated through his private door.

? That was a hint,? said Ceri.

? We've made it now,? Sammy said crossly.

? Come on. If anything goes bang anywhere this week, they're going to know who it was.?

Mumbling to himself, Sammy scraped together the precious black sludge, dumped it in the sink built into the teacher's demonstration bench, and gave it a quick flush from the tap. In another sink, Ceri carefully rinsed the soiled filter papers before binning them; the Cardiff girl splashed water over the glassware. But Sammy had a look on his face that Ceri had seen before. ? I'm just going to try something,? he muttered, and tilted a huge reagent bottle over the demo-bench sink. There was a powerful whiff of hospital-like fumes. To Ceri's silent relief, nothing happened.

When the chemistry lesson came around that afternoon, Mr Porter held up a large Erlenmeyer flask and announced, to general apathy, that he was about to perform a simple demonstration. What it was going to be remained a mystery, since when he put the glass cone in the sink to fill it there followed a sharp explosion, a dramatic cloud of purple smoke, and an upward spray of glass fragments that slashed his hands and face in a dozen places. In the echoing pause while Mr Porter stared in fascination at tattered, part-flayed fingers, Ceri realized what Sammy had poured down there: a measure of ether that had washed away the water in the sink trap and swiftly evaporated, leaving the tri-iodide bone-dry and potent. She thought for an instant of a bright globule of blood on the downy breast of a small, greenish bird.

With one awful eye-blood was streaming into the other-the chemistry master surveyed his class. He pointed unerringly at Sammy and cried ? Jones! ? Old Davies had presumably identified the explosive ringleader, but anyway one would need to be blind not to notice the outraged innocence of Sammy's expression-the body language that conveyed, ? I couldn't have known it would do that. ?

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The harsh sunlight brightened sharply; a tiny corner of Ceri's mind longed for the return of some healing cloud. Cloud? What was obscurely odd today about sun and cloud? Her critical attention, though, was focused on the computer display's fractal gridlines, and the strange pulse of activity in the node which Ranjit had indicated some minutes earlier. Now the false-colour mapping showed the shape breaking into new colours on either side of blue: a speckle of green, larger irregular blocks of indigo and violet.

? It's gone interactive,? Ranjit said. ? What you said about Heisenberg: probing it digitally is changing stuff in there. Like sending pulses into a neural-net grid.?

? We're ... changing a particle's state by measuring it??

? Isn't that exactly what your pal Herr Heisenberg said? Isn't it what you said? Tickling it in just the right

rhythm is keeping it-well-doing whatever it's doing now. Higher energy level? Spinning faster? Or something with one of the weird quantum numbers like strangeness. Hell, I don't know, but it's fun. Like keeping a yo-yo moving.?

It was too hot to think straight. Damn that lousy, feeble air conditioning. A plastic folder on the glaring desktop had curled and shrivelled as never before. Ceri had always-or at any rate since she'd been a schoolgirl-felt brilliantly sunlit days to be fraught with a sense of obscure, gathering disaster. She felt it now.

? I'm just going to try something,? said Ranjit again. ? I think I can nudge it a step further-?

It was some echo in his words, rather than the actual tone or content, that made her snap: ? No.?

? Don't be silly. I'm recording everything. We can reboot the simulation whenever-What the fuck!?

Ceri had yanked the power lead from his computer workstation, and the stained-glass complexities died from the screen.

* * * *

There had been just the two of them, Sammy and Ceri, on a blinding-hot day at the Gaer. The place was a broad hillock of grassy, bracken-infested wasteland, named for an old Roman camp whose trenches and ditches had left their scars around the summit. More attractive was the rumour, never verified, of adders somewhere in the Gaer's gorse and bracken.

A branch railway line curled around one side of this common land, separating it from a more orderly park and golf-course. Feeble attempts at fencing off the railway had, it seemed, been long abandoned. Here the wire links were neatly snapped through, there they were undermined, and in several places the whole fence had sagged to the ground under the weight of many climbers. It was the perfect spot for what Ceri, in a phrase from history lessons, called debasing the coinage. Old, brassy threepenny bits were the best, if you could find them. Place one on the nearer rail, wait five or ten or twenty minutes for the long rumble of a goods train, and a marvellously flattened, doily-edged medallion would be flung aside by the thunderous succession of iron wheels.

When coins began to pall, though, it was hard to think of interesting variations. Glass marbles (secured with a blob of chewing gum) simply burst into powder, and small stones to grit. Ceri had managed to talk Sammy out of his ? biological experiment? featuring a white mouse in a cardboard box.

Today he produced something new from his shoulder-bag: a short length of copper pipe, capped at both ends. It was quite hard to balance this on a rail, but-while Ceri kept watch for approaching trains-Sammy used angular stone fragments from the railside to wedge the thing against rolling off.

? Should be good. Better than thruppences!? he confided as they crouched in their usual hidey-hole amid yellow-flowering gorse clumps close by the line.

? What is it, Sammy? Nothing alive??

? No no no. I just thought I'd try something. Weedkiller and stuff. I can't get the compression at home.?

Ceri had a sense of distant alarms ringing. ? Weedkiller and sugar? Maybe we should-?

Her hesitant voice was lost in the approaching train's roar, and the bulk of the engine (so much huger from down here than from a station platform) blotted out the angry sun. A not very emphatic crack or bang was succeeded by the usual long rattle and squeak of two dozen or so hopper wagons. Ceri had

felt Sammy jerk and cry out, as though wasp-stung or bitten by the dread adder. He slumped forward. She shook and turned him slightly. A stone fragment, they told her later, had flown like shrapnel from the explosion. The sight of the gory ruin that had been Sammy's left eye remained too vivid a memory for too long a time, and it was no comfort to be assured again and again that for him it was instantaneous.

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There were still, after all, two of them in Ceri's office, where quite easily there might by now have been none.

? What are you waiting for?? he said again.

? Ssh.? She kept her eyes on her watch. The light striking through the window lessened in its intensity, as though a thin cloud had drifted in front of the sun.

? Iesu Grist,? Ceri whispered.

? What??

? Oh ... Welsh. Jesus Christ. I counted eight minutes and twenty seconds, which is about right. Jesus. I'd actually said it out loud, too, I said we didn't know the scaling factors.?

? How about an explanation in words of one syllable for the mere technical staff??

? How about if you make the coffee this time, Ranjit, just for a change?? Had her soft pad of scribbling paper really turned pale brown in the hot glare? ? I knew there was something wrong but I didn't know I knew it. I just had this feeling of someone walking on my grave. But that's how science officially operates, isn't it? You get an intuition and then you think back and work out why it came. You see, the sun got brighter.?

? Too bloody right it did,? said Ranjit, spooning out coffee granules. ? You're still not, um, making any actual sense.?

? Ranjit, there's not a cloud in the sky. There hasn't been all day. Clear blue everywhere, and it's way past noon. But a few minutes after you'd started interfering with that pattern in the Cray simulation, the sun suddenly got brighter.?

? Oh, come on. What a vivid imagination some people have.?

? Look. Just about eight minutes and twenty seconds from the time I pulled the plug, the sunlight dropped to normal again. That's the time the light takes to reach us across 149 million kilometres. You saw it. And there's still no cloud up there.?

A pause. ? Fuck,? he said uncertainly. ? I was just going to tweak it harder, see what the limits were.... I couldn't have known it would do that!? Ranjit pushed his lips in and out a few times, calculating, as though playing for time or pushing some bad thought away from him. ? Shouldn't the lag have been nearer seventeen minutes, sort of eight and a half each way??

? What can I say? I could talk about quantum nonlocality, but I'd only be gibbering. I'll have to think it through. The first guess is that this thing doesn't play by the Einstein rules.?

Ranjit filled and raised a coffee-cup. ? So here's to the Nobel?? The tone of voice dismayed her. It conveyed that enormity was already receding into a game, a silly hypothesis they'd entertained for a silly moment, a physicists' in-joke like that hoary ? proof? that heaven is hotter than hell. Easy with a little

Bible-juggling, she remembered. According to Revelations, hell contains an eternal lake of brimstone which must simmer below 444.6 degrees Centigrade, the boiling point of sulphur. According to one reading of Isaiah, the light of heaven is that of the sun multiplied fiftyfold, leading by simple radiation physics to a local temperature of 525 degrees C. Again ... *Iesu Grist*.

Ceri stared out of the window, thinking of a world full of eager Sammies who would be itching to take her small experiment one step further. How could anyone ever predict what might come boiling out of an innocuous-seeming theoretical bottle? There were wisps of smoke beyond the campus buildings now-flash fires, perhaps, or cars that had veered too abruptly in the sudden dazzle-and no doubt people out there with damaged retinas from looking the wrong way when things changed. For some reason she found herself picturing a small bird with bloody feathers, eyes darkened by too much light, on a long slow fall into the sun.