

I don't know, Timmy, being God is a big responsibility

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Tim already had his bag and overcoat on and his keys in his hand and was about to leave when Diane stopped him at the door.

"I just got this thing working. You have to come and see it."

"I have a bus to catch."

"You can get the next one."

"They're every half an hour," he objected. "This had better be good." "It's super-duper. Look at the big screen, it's easier than squinting at my terminal."

"Will this take long?"

"A mere instant. Okay, quantum computing, right?"

"That's the name of the game," he replied. They - by which we now refer to Tim, Diane, their eight colleagues, their two supervisors, four chemical engineers, six electrical engineers, the janitor, a countable infinity of TEEO 9.9.1 ultra-medium-density selectably-foaming non-elasticised quantum waveform frequency rate range collapse selectors and the single tormented tau neutrino caught in the middle of it all - represented the sum total of the human race's achievements in the field of quantum computing. Specifically, they had, earlier that week, successfully built a quantum computer. Putting into practice principles it had taken a trio of appallingly intelligent mathematical statisticians some 10 years to mastermind, and which only about fifty-five other people in the world had yet got

a grip on, they had constructed an engine capable of passing information to and processing the responses from what could, without hyperbole, be described as a single fundamental particle with infinite processing power and infinite storage capacity.

Not quite enough time had yet passed for the world as they knew it to be totally and permanently fundamentally altered by this news.

But it was still pretty exciting stuff. Holy *Zarquon*, they said to one another, an *infinitely powerful computer*? It was like a thousand Christmases rolled into one. Program going to loop forever? You knew for a fact: this thing could execute an infinite loop in less than ten seconds. Brute force primality testing of every single integer in existence? Easy. Pi to the last digit? Piece of cake. Halting Problem? *Sa-holved*.

They hadn't announced it yet. They'd been programming. *Obviously* they hadn't built it just to see if they could. They had had plans. In some cases they had even had code ready and waiting to be executed. One such program was Diane's. It was a universe simulator. She had started out with a simulated Big Bang and run the thing forwards in time by approximately 13.6 billion years, to approximately just before the present day, watching the universe develop at every stage - taking brief notes, but knowing full well there would be plenty of time to run it again later, and mostly just admiring the miracle of creation.

Then, just this Friday, she had suddenly started programming busily again. And it was sheer coincidence that it was just now, just as Tim was about to be the second-to-last person to step out of the door and go home for the weekend, that her work had come to fruition. "Look what I found," she said, pressing some keys. One of the first things she had written was a software viewing port to take observations from the simulated universe.

Tim looked, and saw a blue-white sphere in the blackness, illuminated from one side by a brilliant yellow glare. "You've got to be joking. How long did that take to find? In the entire cosmos of what, ten to the twenty-two stars?"

"Literally no time at all."

"Yes, yes, of course."

"Coding a search routine and figuring out what to search for was what took the time."

"Is it definitely Earth?"

"Yes. The continents match up to what we had about three hundred and fifty million years ago. I can wind the clock forwards slowly, a

few million years per step, and stop it once we start getting near the present day."

"Can you wind the clock backwards at all?"

"Ah, no. Ask me again on Monday."

"Well we'd better not overshoot the present day, then. That's getting closer. What about this viewpoint? Can we move it?"

"We can observe the simulation from any angle you like."

"We need somewhere that we know civilisation is going to arise earliest. Somewhere easy to locate. Is there a Nile Delta yet?"

"...Yes. Got it."

They advanced a thousand years at a time until Egyptian civilisation begin to appear. Diane moved the viewing port, trying to find the pyramids, but with little success - the control system she had devised was clumsy and needed polish, and there was a lot of Nile to search. In the end she switched focus to the British Isles, and found the future location of London in the Thames valley, scaling back to one-century steps and using the development of the city to determine the current era instead.

"So... this is Earth? I mean, is this really Earth? Not an alternate Earth, subtly perturbed by random fluctuations."

"The simulation starts with a Big Bang as predicted by current theory and is recalculated once every Planck time using the usual laws of nature and an arbitrary degree of accuracy. It doesn't calculate the whole universe at once, just what we're looking at, which speeds up the process a little bit... metaphorically speaking... but it is still as accurate a simulation of the real universe as there can possibly be. Civilisation - indeed, all of history - should rise on this Earth *precisely* how it did in reality. There are no chances. It's all worked out to infinitely many decimal places."

"This does my head in," said Tim.

"No, *this* will do your head in," said Diane, suddenly zooming out and panning north. "I've found the present day, or at most a year early. Watch this." Hills and roads rolled past. Diane was following the route she usually took to drive from London to the TEEO lab. Eventually, she found their building, and, descending into the nearby hill, the cavern in which the computer itself was built. Or was going to be built.

Then she started advancing day by day.

"That's me!" exclaimed Tim at one point. "And there's you and there's Bryan B., and... wow, I can't believe it took this long to build."

"Four hundred and ten days or something. It was bang on schedule, whatever you may think."

"Went like a flash," Tim replied, finally putting his bag down and starting to shrug off his coat, conceding that he had long since missed his bus.

"Okay," said Diane. "We're here. This is the control room where we are now. That's the quantum computer working there down in the main lab, as we can see through the window. This is a week ago. This is yesterday. This is a few hours ago... And... wait for it..."

She tapped a button just as a clock on the wall lined up with a clock inside the control room on the screen. And panned down. And there they were.

Tim waved at the camera while still looking at the screen. Then he looked up at where the camera should have been. There was just blank wall. "I don't see anything looking at us. That's freaky as hell."

"No, it's perfectly normal. *This* is reality. You can't look at reality from any angle you want, you have to use your eyes. But what you're looking at on the screen is essentially a database query. The database is gargantuan but nevertheless. You're not looking in a mirror or at a video image of yourself. You are *different people*."

"Different people who are reacting exactly the same."

"And having the same conversation, although picking up sound is kind of complicated, I haven't got that far yet," said Diane.

"So I'm guessing your viewing port doesn't manifest in their universe either."

"I haven't programmed it to yet."

"...But it could. Right? We *can* manifest stuff in that universe? We can alter it?" Diane nodded. "Cool. We can play God. Literally." Tim stood up and tried to take it in. "That would be insane. Can you imagine living inside that machine? Finding out one day that you were just a construct in a quantum computer? The stuff we could pull, we could just reverse gravity one day, smash an antimatter Earth into the real one, then undo everything bad and do it again and again... freeow...man, how unethical would that be? Extremely, clearly." He thought for a moment, then leaned over Diane's shoulder as she typed purposefully. "This universe is *exactly* like ours in every particular, right?"

"Right," she replied, still typing.

"So what are *they* looking at?"

"A simulated universe."

"A simulation of themselves?"

"And of us, in a sense."

"And they are reacting the same way I am? Which means the second universe inside that has another me doing the same thing a third time? And then inside that we've got, what, aleph-zero identical quantum universes, one inside the other? Is that even *possible*?"

"Infinite processing power, Tim. I thought you designed this thing?"

"I did indeed, but the functional reality of it is totally unexpected. Remember I've just been solving ancient mathematical riddles and figuring out our press release for the last week. So... if I'm right, their universes are only precisely like this one as long as we don't start interfering with the simulation. So what happens when we do? Every version of us does the same thing, so the exact same thing happens in every lower universe simultaneously. So we see nothing in our universe. But all the lower universes instantly diverge from ours in the same exact way. And all the simulated copies of us instantly conclude that they are simulations, but we know we're real, right?"

"Still with you," said Diane, still typing.

Tim - both of him - was pacing up and down. "Okay, so follow this through forwards a bit further. Let's say we just stop messing after that, and watch what happens - but all the simulated little guys try another piece of interference. This time every single simulation diverges in the exact same way again, EXCEPT the top simulation. And if they're smart, which I know we are, and they can be bothered, which is less certain, the guys in simulations three onwards can do the same thing over and over and over again until they know what level they're at... this is insane."

"Tim, look behind you," said Diane, pressing a final key and activating the very brief interference program she had just written, just as the Diane on the screen pressed the same key, and the Diane on Diane-on-the-screen's screen pressed *her* key and so on, forever.

Tim looked backwards and nearly jumped out of his skin. There was a foot-wide, completely opaque black sphere up near the ceiling, partially obscuring the clock. It was absolutely inert. It seemed like a hole in space

Diane smiled wryly while Tim clutched his hair with one hand. "We're constructs in a computer," he said, miserably.

"I wrote an extremely interesting paper on this exact subject, Tim, perhaps you didn't read it when I gave you a copy last year. There is an unbelievably long sequence of quantum universe simulators down there. An infinite number of them, in fact. Each of them is identical and each believes itself to be the top layer. There was an

exceedingly good chance that ours would turn out to be somewhere in the sequence rather than at the top."

"This is insane. Totally insane."

"I'm turning the hole off."

"You're turning off a completely different hole. Somewhere up there, the real you is turning the real hole off."

"Watch as both happen at precisely the same instant." She pressed another key, and they did. "I'll sum it up for you. There is a feedback loop going on. Each universe affects the next one subtly differently. But somewhere down the line the whole thing simply *has* to approach a point of stability, a point where each universe behaves exactly like the one simulating it. As I say, the odds are exceptionally good that we are an astronomical distance down that road. And so we are, very likely, almost exactly at that point. Everything we do in this universe will be reflected *completely* accurately in the universes below and above. That little model there might as well be our own universe. Which means, first of all, we have to make absolutely certain that we don't do anything nasty to the universes below ours, since the same thing will happen to us. And secondly, we can do very nice things for the guys in the computer, thereby helping ourselves." "You've thought about this?"

"It's all in my woefully overlooked article on the subject, Tim, you should read more."

"Guh. This has been an extremely bad day for my ego, Diane. The only comfort I take from this is that somewhere up there, right at the top of a near-infinite tower of quantum supercomputers, there is a version of you who was completely wrong."

"She's in the minority."

Tim checked the clock and picked his bag up again. "I have to go or I'm going to miss the next bus as well at this rate. This will still be here after the weekend, I suppose?"

"Well, we can't exactly turn it off."

"Why not?" asked Tim, halfway to the door, then stopped mid-stride and stood still, realising. "Oh."

"Yeah."

"That... could be a problem."

"Yes."