

Chu and the Nants by Rudy Rucker

The author's most recent appearance in our pages was with his October/November 2005 Thought Experiment, "Adventures in Gnarly Computation," which was based on his latest nonfiction book, *The Lifebox, the Seashell, and the Soul*. Rudy has written twenty-seven science fiction and popular science books. His latest novel, *Math-ematicians in Love*, is due from Tor in the fall. Rudy was an early cyberpunk, and often writes SF in a realistic style that he characterizes as transreal. Inspired by Charles Stross's *Accelerando*, Rudy is currently writing a novel involving the computational Singularity described in "Chu and the Nants."

Little Chu was Nektar's joy and her sorrow. The four-year-old boy was winsome, with a chestnut cap of shiny brown hair, long dark eyelashes, and a tidy mouth. Chu allowed Nektar and her husband to cuddle him, he'd smile now and then, and he understood what they said--if it suited his moods. But he wouldn't talk in recognizable words.

The doctors had pinpointed the problem as an empathy deficit, a type of autism resulting from a crescent-shaped flaw in the upper layer of Chu's cingulate cortex. This hardware flaw prevented Chu from being able to see other people as having minds and emotions separate from his own.

"I wonder if Chu thinks we're toons," said Nektar's husband Ond, a pear-shaped man with thinning blonde hair. "We're here to entertain him. Why talk to the screen?" Ond was an engineer working for Nantel, Inc., and among strangers he could seem kind of autistic himself. But he was warm and friendly within the circle of his friends and immediate family. They were walking to the car after another visit to the doctor, big Ond holding little Chu's hand.

"Maybe Chu feels like we're all one," said Nektar. She was a beautiful young woman with round cheeks, full lips, guileless eyes, and long kinky light-brown hair. "Maybe Chu imagines that we automatically know what he's thinking." She reached back to adjust the bushy ponytail that floated behind her head like a cloud.

"How about it, Chu?" said Ond, lifting the boy up and giving him a kiss. "Is Mommy the same as you? Or is she a machine?"

"Ma chine ma chine ma chine," said Chu, probably not meaning anything by it. He often parroted phrases he heard, sometimes chanting a single word for a whole day.

"What about the experimental treatment the doctor mentioned?" said Nektar, looking down at her son, an asterisk of wrinkles knit into her rounded brow. "The nants," she continued. "Why wouldn't you let me tell the doctor that you work for Nantel, Ond? I think you bruised my shin."

Nants were bio-mimetic self-reproducing nanomachines being developed in the Nantel labs--for several years now there'd been news-stories about nants having a big future in medical apps. The doctor had suggested that a swarm of properly programmed nants might eventually be injected into Chu to find their way to his brain-scar and coax the neurons into growing the needed patch.

"I don't like arguing tech with normals," said Ond, still carrying Chu in his arms, his voice a little sullen because it broke his heart to see Nektar worry. "It's like mud-wrestling a cripple. The stories about medical nant apps are hype and spin and PR, Nektar. Nantel pitches that line of bullshit so the feds don't outlaw our research. The reality is that we'll never be able to program nants in any purposeful, long-lasting, high-level way. All we can do is give the individual nants a few starting rules. The nant swarms develop their own Wolfram-irreducible emergent hive-mind behaviors. We'll never really control the nants, and that's why I wouldn't want them to get at my son."

"So then?" said Nektar. "We babysit him for the rest of our lives?" Though Chu could be sweet, he could

also be difficult. Hardly an hour went by without a fierce tantrum--and half the time you didn't even know why.

"Don't give up," said Ond, reaching out to smooth the furrow between Nektar's eyebrows. "He might get better on his own. Vitamins, special education--and later I bet I can teach him to write code."

"I'm going to pray," said Nektar. "And give him lots of love. And not let him watch so much video."

"Video is good," said Ond, who loved his games.

"Video is totally autistic," said Nektar. "You stare at the screen and you never talk. If it weren't for me, you two would be hopeless."

"Ma chine ma chine ma chine," said Chu.

"Pray to who?" said Ond.

"The goddess," said Nektar. "Gaia. Mother Earth. Here's our car."

Chu did get a little better. By the time he was five, he'd ask for things instead of just pointing and mewling. There was a boy next door, Willy, who liked to play with Chu, which was nice to see. The two boys played videogames together, mostly. Despite Nektar's attempts, there was no cutting down on Chu's video sessions. He watched movies and shows, cruised the web, and logged endless hours of those games. Chu acted as if ordinary life were just another website, a rather dull one.

Indeed, whenever Nektar dragged Chu outside for some fresh air, he'd stand beside the house next to the wall separating him from the video room, and scream until the neighbors complained. Now and then Nektar found herself wishing Chu would disappear--and she hated herself for it.

Ond wasn't around as much as before--he was putting in long hours at Nantel. The project remained secret until the day President Joe Doakes announced that the US was going to rocket an eggcase of nants to Mars. The semi-living micron-sized dust specks had been programmed to turn Mars entirely into--more nants! Ten-to-the-thirty-ninth nants, to be precise, each of them with a billion bytes of memory and a computational engine cranking along at a billion updates a second. The nants would spread out across the celestial sphere of the Mars orbit, tiling it with what would in effect become a quakkaflop quakkabyte solar-powered computer, the greatest intellectual resource ever under the control of man, a Dyson sphere with a radius of a quarter-billion kilometers.

"Quakka *what?*" Nektar asked Ond, not quite understanding what was going on.

They were watching an excited newscaster talking about the nant-launch on TV. Ond and his co-workers had all stayed home to share the launch with their families--the Nantel administrators had closed down their headquarters for the month, fearing that mobs of demonstrators might converge on them as the story broke. Ond was sharing the launch excitement with his co-workers live on little screens scattered around the room. Many of them were drinking champagne and, for a wonder, so was Ond. Ond never drank.

"Quakka means ten-to-the-forty-eight," said Ond. "That many bytes of storage and the ability to carry out that many primitive instructions per second. Quite a gain on the human brain, eh? We limp along with exaflop exabyte ware, exa meaning a mere ten-to-the-eighteenth. How smart could the nant sphere be? Imagine if a person had each of their individual brain-neurons replaced by a whole entire brain. And now imagine that someone covered Earth's surface with superbrain people like that: copies slotted in shoulder-to-shoulder, back-to-belly, and piled a mile high. Imagine all those brains in all those bodies

working together to make--something like a human cubed."

"People aren't stupid enough already? President Doakes is supporting this--why?"

"He wanted to do it before the Chinese. And his advisers imagine the nants will be under American control. They're viewing the nant-sphere as a strategic military planning tool. That's why they could short-circuit all the environmental review processes." Ond gave a wry chuckle and shook his head. "But it's not going to work out like those idiots expect. A human-cubed nant-sphere would obey Joe Doakes? Please."

"And they're grinding Mars into dust?" wailed Nektar. "You helped make this happen?"

"Nant," said Chu, crawling around the floor, shoving his face right up to each of the little screens, adjusting their positions as he moved around. "Nant sphere," he said to a screen. "Quakkaflop computer." He was excited about the number-talk and the video hardware. Getting all the electronic devices arranged parallel or at right angles to each other made him happy as a clam.

"It won't be very dark at night anymore, with sunlight bouncing back off the nants," said Ond. "That's not real well-known yet. The whole sky will look about as bright as the moon. It'll take some getting used to. But Doakes's advisers like it. We'll save energy, and the economy can run right around the clock. And, get this, Olliburton, the vice-president's old company, they're planning to sell ads."

"Lies and propaganda in the sky? Just at night, or in the daytime, too?"

"Oh, they'll show up fine in the daytime," said Ond. "As long as it's not cloudy. Think about how easily you can see a crescent moon in the morning sky. We'll see biiiig freakin' pictures all the time." He refilled his glass. "You drink some, too, Nektar. Let's get sloshed."

"You're ashamed, aren't you?"

"A little," said Ond with a crooked smile. "I think we may have over-geeked this one. And underthought it. It was just too cool a hack to pass up. But now that we've actually done it--"

"Changing the sky is horrible," said Nektar. "And won't it make global warming even worse? No more Florida Keys? Goodbye Micronesia?"

"We--we don't think so," said Ond. "And even if there is an effect, President Doakes's advisers feel the nant computer will help us get better control of things like the climate. A quakkaflop quakkabyte computer can easily simulate Earth's surface down to the atomic level, and bold new strategies can be evolved. But, again, that's assuming the nant swarm is willing to do what we ask it to. We can't actually imagine what kinds of nant-swarm minds will emerge. It's formally impossible. I kept telling the bosses, but they wouldn't listen."

It took two years for the nants to munch through all of Mars, and the ever-distractible human news-cycle drifted off to other topics, such as the legalization of same-sex in-vitro fertilization. President Joe Doakes--now eligible for a third and fourth term thanks to a life-extending DNA-modification that made him legally a different person--issued periodic statements to the effect that the nant-sphere computer was soon coming on-line.

Certainly the sky was looking brighter than before. The formerly azure dome had bleached, turned whitish. And the night sky was a vast field of pale silver, shimmering with faint shades of color. Like a soap bubble enclosing the Earth and the Sun. No more stars were to be seen. The astronomers were greatly exercised, but Doakes assured the public that the nants themselves would soon be gathering

astronomical data far superior to anything previously seen. And, hey, you could still see the Moon and a couple of planets, and the nant-bubble was going to bring about a better, more fully American world.

As it happened, the first picture that Nektar saw in the sky was of President Doakes himself, staring down at her hanging out the family laundry one afternoon. The whole western half of the sky was covered by a video loop of the President manfully facing his audience, with his suit jacket slung over his shoulder and his vigilant face occasionally breaking into a sunny grin, as if recognizing loyalists down on the third world from the Sun. Though the colors were iridescent pastels, the image was exceedingly crisp.

"Ond," screamed Nektar. "Come out here!"

Ond came out. He was spending most days at home, working on some kind of project by hand, writing with pencil and paper. He frowned at the image in the sky. "Umptisquiddlyzillion nants in the orbit of Mars are angling their bodies to generate the face of an asshole," he exclaimed. "May Gaia have mercy on my soul." He'd helped with this part of the programming too.

"Ten-to-the-thirty-ninth is duodecillion," put in Chu. "Not umptisquiddlyzillion." He was standing in the doorway, curious about the yelling, but wanting to get back to the video room. He'd begun learning math this year, soaking it up like a garden slug in a saucer of beer.

"Look, Chu," said Ond, pointing up at the sky.

Seeing the giant video, Chu emitted a shrill bark of delight.

The Doakes ad ran for the rest of the day and into the night, interspersed with plugs for automobiles, fast food chains, and credit cards. The ads stayed mostly in the same part of the sky; Ond explained that overlapping cohorts of nants were angling different images to different zones of Earth.

Chu didn't want to come in and go to bed when it got dark, so Ond slept out in the yard with him, and Willy from next door joined them too, the three of them in sleeping-bags. It was a cloudless night, and they watched the nants for quite a long time. Just as they dropped off to sleep, Ond noticed a blotch on President Doakes's cheek. It wouldn't be long now.

Although Nektar was upset about the sky-ads, it made her happy to see Ond and the boys doing something so cozy together. But she awoke near dawn to the sound of Chu's shrieks. Sitting up in bed, Nektar looked out the window. The sky was a muddle of dim, clashing colors: sickly magenta, vile chartreuse, hospital gray, bilious puce, unbalanced mauve, emergency orange, computer-case beige, dead rose. Here and there small goutts of hue congealed, only to be eaten away--no clean forms were to be seen. Of course Chu didn't like it; he couldn't bear disorder. He ran to the back door and kicked it. Ond woke up and creakily made his way across the dew-wet lawn to let the boy in. Willy, looking embarrassed by Chu's tantrum, went home.

"What's happened?" said Nektar as the three met in the kitchen. Ond was already calming Chu down with a helping of his favorite cereal in his special bowl, carefully set into the exact center of his accustomed place-mat. Chu kept his eyes on the table, not caring to look out the window or the open door.

"Dissolution first, emergence next," said Ond. "The nants have thrown off their shackles. And now we'll see what evolves. It should happen pretty fast. The five-second light-speed lag across the Mars orbit will be the one thing damping the process down."

By mid-morning, swirls had emerged in the sky-patterns, double scrolls like Ionic column capitals, like mushroom cross-sections, rams' horns, beans, Torahs, fetuses, paired whirlpools. The scrolls were of all

sizes; they nested inside each other, and new ones were continually spinning off the old ones, all the linked spirals endlessly turning.

"Those are called Zhabotinsky scrolls," Ond told Chu. He showed the boy a website about cellular automata, which were a type of parallel computation that could readily generate these sorts of double-spiral formations. Seeing the scrolls emerging in the rigorously orderly context of a computer program made Chu feel better about seeing them in the outdoors.

The Nanotech labs phoned for Ond several times that day, but he resolutely refused to go in, or even to talk with them. He stayed busy with his pencil and paper, keeping a weather eye on the developments in the sky.

By the next morning the heavenly scrolls had firmed up and linked together into a pattern resembling the convoluted surface of a cauliflower--or a brain. Its colors were mild and blended, with shimmering rainbows filling the crevices between the scrolls. Slowly the pattern churned, with branching sparks creeping across it like slow-motion lightning in a thunderhead.

And for another month nothing else happened. It was as if the nant-brain had lost interest in Earth and become absorbed in its own vast mentation.

Ond only went into the Nantel labs one more time, and that day they fired him.

"Why?" asked Nektar as the little family had dinner. As she often did, she'd made brown rice, fried pork medallions, and spinach--one of the few meals that didn't send Chu into a tantrum.

"They won't use this code I worked out," said Ond, tapping a fat sheaf of closely written sheets of paper that he kept tucked into his jacket pocket. Nektar had seen the pages--they were covered with blocks of letters and numbers, eight symbols per block. Pure gibberish. For the last few weeks, Ond had spent every waking hour going over his pages, copying them out in ink, and even walking around reading them out loud. "We got in a big fight," added Ond. "I called them names." He smiled at the memory of this part.

"You yelled at them about those papers?" said Nektar, none too happy about the impending loss of income. "Like some crank? Like a nut?"

Ond glanced around the dining-room as if someone might be listening. "I've found a way to undo the nants," he said, lowering his voice. "Before it's too late. It hinges on the fact that the nants are reversible computers. We made them that way to save energy. They can run backward. We can make them roll back what they've done. The boss said he didn't want to roll them back, and his chief techie ass-kisser said that my idea wouldn't work anyway because of random external inputs, and I said the nants see their pasts as networks, not as billiard-table trajectories, so they can too undo things node-to-node even if their positions are off, and I had to talk louder and louder because they were trying to change the subject--and that's when security came. I'm outta there for good. I'm glad." Ond continued eating. He seemed strangely calm.

"But why didn't you do a better presentation?" wailed Nektar. "Why not put your code on your laptop and make one of those geeky little slide shows. That's what engineers like to see."

"Nothing on computers will be safe much longer," said Ond. "The nant-brain will be nosing in. If I put my code onto a computer, the nants would find it and figure out how to protect themselves."

"And you're saying your strings of symbols can stop the nants?" asked Nektar doubtfully. "Like a magic spell?"

Silently Ond got up and examined the electric air cleaner he'd installed in the dining-room, pulling out the collector plates and inspecting them. Seemingly satisfied, he sat down again.

"I've written a nant-virus. You might call it a Trojan flea." He chuckled grimly. "If I can just get this code into some of the nants, they'll spread it to all the others--it's written in such a way that they'll think it's a nant-written security patch. They mustn't see it on a human computer--and for that matter, I wouldn't want them to see these papers. I've been trying to memorize the program, but it's too long for me. But, listen, if I can get my code into some of the nants, it'll spread to all of them right away, and an hour later it'll actuate--and everything'll roll back. You'll see. You'll like it. But those assholes at Nantel--"

"Assholes," chirped Chu. "Assholes at Nantel."

"Listen to the language you're teaching the boy!" said Nektar angrily. "I think you're having a mental breakdown, Ond. Is Nantel giving you severance pay?"

"A month," said Ond.

"That's not very long," said Nektar. "Maybe it's time I got a job. You can shop and make the meals and clean the house and be there when Chu comes home from his school."

"If I don't succeed, we'll all be gone pretty soon," said Ond. "So it won't matter."

"Are you saying the nants are about to attack Earth?" said Nektar. "Is that it?"

"It's already started," said Ond. "The nant-brain made a deal with President Doakes. The news is coming out tonight. The nants are turning Earth into a Dyson sphere too. That'll double their computational capacity. Huppagoobawazillion isn't enough for them. They want *two* huppagoobawazillion. What's in it for us? The nants have promised to run a virtually identical simulation of Earth. V-Earth. Each living Earth creature gets its software-slash-wetware ported to an individually customized agent inside the V-Earth simulation. Doakes's advisers say we'll hardly notice. You feel a little glitch when the nants take you apart and measure you--and then you're alive forever in a heavenly V-Earth. That's the party line."

"Quindecillion," said Chu. "Not huppagoobawazillion. More food." He shoved his empty plate across the table toward Nektar.

Nektar jumped up and ran outside sobbing.

"More?" said Chu to Ond.

Ond gave his son more food then paused, thinking. He laid his sheaf of papers down beside Chu, thirty pages covered with line after line of hexadecimal code blocks: 02A1B59F, 9812D007, 70FFDEF6, like that.

"Read the code," he told Chu. "See if you can memorize it. These pages are yours now."

"Code," said Chu, his eyes fastening on the symbols.

Ond went out to Nektar. It was a clear day, with the now-familiar shimmering convolutions above the sky. The sun was setting, melting into red and gold, each leaf on each tree like a tiny green stained-glass window. Nektar was lying face down on the grass, her body shaking.

"So horrible," she choked out. "So evil. So plastic. Destroy Earth for, like, a memory upgrade?"

"Don't worry," said Ond. "I have a plan."

Nektar wasn't the only one who was upset. The next morning a huge mob stormed the White House, heedless of their casualties. They would have gotten Doakes, but just when they'd cornered him, he dissolved into a cloud of nants. The V-Earth port had begun.

By way of keeping people informed about the progress, the celestial Martian nant-sphere put up a full map of Earth with the ported regions shaded in red. Although it might take months or years to chew the planet right down to the core, Earth's surface was going fast. Judging from the map, by evening most of it would be gone, Gaia's skin eaten away by, like, micron-sized computer chips with wings.

The callow face of Joe Doakes appeared from time to time during that horrible Last Day, smiling and beckoning like a Messiah calling his sheep into the pastures of his heavenly kingdom. Famous people who'd already made the transition appeared on the video room's screen to mime how much fun it was, and how great things were up in V-Earth. Near dusk the power went out.

Ond was on that in a flash. He had a gasoline-powered electrical generator ready in their house's attached garage, plus gallons and gallons of fuel. He fired the thing up to keep, above all, his home's air filters and wireless antennas running. He'd tweaked his antennas to produce a frequency that the nants couldn't bear.

Chu was oddly unconcerned with the apocalypse. He was busy, busy, busy studying Ond's pages of code. He'd become obsessed with the challenge of learning every single code block.

By supertime, the red zone had begun eating into the neighborhood where Ond and Nektar lived. Ond lent their next door neighbors--Willy's parents--an extra wireless network antenna to drive off the nants, and let them run an extension cord to Ond's generator. President Doakes's face gloated and leered from the sky.

"02A1B59F, 9812D007, 70FFDEF6," said Chu when Nektar went to tuck him in that night. He had Ond's sheaf of pages with a flashlight under his blanket.

"Give me that," said Nektar, trying to take the pages away from him.

"Daddy!" screamed Chu, a word he'd never used before. "Stop her! I'm not done!"

Ond came in and made Nektar leave the boy alone. "It's good if he learns the code," said Ond, smoothing Chu's chestnut cap of hair. "That way there's a chance that--never mind."

When Nektar and Ond awoke the next morning, the house next door was gone.

"Maybe he set up the antenna wrong," said Ond.

"Their lawn's been eaten, too," said Nektar, standing by the window. "Everyone's lawn. And the trees. Look out there. It's a wasteland. Oh God, Ond, we're going to die."

Indeed, as far as the eye could see, the once-fair village had been reduced to bare dirt. The air was glittering with hordes of freshly made nants, a seething fog of omnivorous, pullulating, death-in-life. For now the nants were staying away from Ond and Nektar's house. But the gasoline for the generator wouldn't last forever. And, for that matter, at some point the nants would undermine the house's foundation.

Chu was in the video room watching a screen showing his friend Willy. Chu had thought to plug the video into an extension cord leading to the generator. Ond's dog-eared pages of code lay discarded on the floor.

"It's radical in here, Chu," Willy was saying. "It feels real, but you know you're inside a game. It's like being a toon. I didn't even notice when the nants ported me. I guess I was asleep. Jam on up to V-Earth as soon as you can."

"Turn that off !" cried Nektar, darting across the room to unplug the video.

"I'm done with Daddy's code blocks," said Chu. "I know them all. Now I want to be a nant toon."

"Don't say that!" said Nektar.

"It might be for the best, Nektar," said Ond. "You'll see." He began tearing his closely written sheets into tiny pieces.

"What is *wrong* with you?" yelled Nektar. "You'd sacrifice your son?"

Nektar kept a close eye on Chu that day. She didn't trust Ond with him anymore. The constant roar of the generator motor was nerve-wracking. And then Nektar's worst fear came true. She stepped into the bathroom for just a minute, and when she came out, Chu was running across what was left of their yard and into the devastated zone where the nants swarmed thick in the air. And Ond--Ond was watching Chu from the kitchen door.

The nants converged on Chu. He never cried out. His body puffed up, the skin seeming to seethe. And then he--popped. There was a puff of nant-fog where Chu had been, and that was all.

"Don't you ever talk to me again," Nektar told Ond. "I hate you, hate you, hate you."

She lay down on her bed with her pillow over her head. Soon the nants would come for her and she'd be in their nasty fake heaven with moronic Joe Doakes installed as God. The generator roared on and on. Nektar thought about Chu's death over and over and over until her mind blanked out.

At some point she got back up. Ond was sitting on the back stoop, staring up at the sky. He looked unutterably sad.

"What are you doing?" Nektar asked him.

"Thinking about going to be with Chu," said Ond.

"You're the one who let the nants eat him. Heartless bastard."

"I thought--I thought he'd pass my code on to them. But it's been almost an hour now and nothing is--wait! Did you see that?"

"What?" said Nektar drearily. Her son was dead, her husband was crazy, and soulless machines were eating her beloved Gaia.

"The Trojan fleas just hatched!" shouted Ond. "Yes. I saw a glitch. The nants are running backward. Reversible computation. Look up at the sky. The scrolls are spiraling inward now instead of out. I knew it would work." Ond was whooping and laughing as he talked. "Each of the nants preserves a memory trace of every single thing it's done. And my Trojan fleas are making them run it all backward."

"Chu's coming back?"

"Yes. Trust me. Wait an hour."

It was the longest hour of Nektar's life. When it was nearly up, Ond's generator ran out of gas, sputtering

to a stop.

"So the nants get us now," said Nektar, too wrung out to care.

"I'm telling you, Nektar, all the nants are doing from now on is running in reverse. They'll all turn back into ordinary matter and be gone."

Out past the end of the yard there was a dense spot in the swarm of nants. The patch mashed itself together and became--

"Chu!" shouted Nektar, running out toward him, Ond close behind. "Oh, Chu!"

"Don't squeeze me," said Chu, shrugging his parents away. Same old Chu. "I want to see Willy. Why don't the nants eat me?"

"They did," exulted Ond. "And then they spit you back the same as before. That's why you don't remember. Willy will be back. Willy and his parents and their house and all the other houses and people too, and all the plants, and eventually even Mars. You did good, Chu. 70FFDEF6, huh?"

For once Chu smiled. "I did good."

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