

# Fixpoint

“Do we have an answer yet?”

The question had already been asked many times. The Lab Director, Doctor Samuel Huffton, sat at the head of the table and waited for an answer. His neatly trimmed beard didn't look as gray under the dim lights of the conference room, where several large video screens displayed graphs and the faces of people linked into the meeting from remote locations. Below the video screens, as wide as two screens and half as tall as one, a seven-digit number updated itself, always growing. The few other people in the room exchanged glances.

“Do you expect the answer to be different from last time?” replied Argus Festee, a data analyst with a doctorate in bioinformatics. He wore a jacket and shirt that aggressively clashed. He was the only one in the room not wearing a white lab coat, and was never referred to as Doctor.

“The question may be the same, but in each iteration we use different sim parameters,” said Doctor Faxia Ross. She was petite and her long black hair contrasted with her white coat. Slightly impatiently she said, “Let's stay focused and not get side-tracked. We can't afford to lose another hour of valuable time.” She took a breath and continued in a more measured tone, “As to the Director's question: we don't have an answer yet. The last sim ran for about two and a half hours before hitting a termination condition, and it had not converged on any solution.”

Huffton grunted and nodded indicating it was what he expected to hear, not what he wanted to hear.

“What was the ‘termination condition’ that triggered the abort?” Councilor Priya Prakash chimed in from a video link. She was the leader of the Western Region's Public Health Council. The color from her sari moderated the white of her lab coat, but couldn't compete with Festee's attire.

“A loop was detected,” Ross said dismissively. “The sim had entered a state where the values of key parameters were identical to those earlier in that run.” As an afterthought, she added, “Like spotting your own footprints in the snow, no reason to follow that path again. Sort of.”

“No. I mean the specific parameters,” Prakash said. “And don't just read me a matrix of coefficient values. Is this configuration the same as that of a previous run or multiple previous runs? I know you can't answer that off the top of your head, but I'm asking that you look into that, rather than just blindly trying more and more runs with minor variations to the controls. Well, you can do that too, but I want to understand the nature of the problem. Are we hitting the same problem?”

The group nodded in agreement. Ten minutes later the meeting ended after discussing a few more results and other possible experiments.

Two hours later in Ross' office, she and Huffton were looking at key parameter matrices, which resembled a few dozen pages from the world's longest random number, when Festee entered unseen. He listened to them for a bit before chiming in, startling them both. “The numbers are different.”

Ross jumped in her chair, shot him a glance of annoyance, and said, “Yes. In fact none of the runs the last few days are identical to one another.”

“They're all different,” Festee said, with a hint of a challenge in his voice. “All different,” he repeated. “All...all different?”

When neither Ross nor Huffton acknowledged his question, he said with a sharper tone, “*ALL-ALL* different!”

“You’re not helping,” growled an annoyed Huffton.

“Give him a chance, Doctor Huffton,” she said. “He’s good at spotting patterns in data *and* seeing the big picture. He can annoy anyone, including me, but he’s often the most insightful when he’s being a jerk.” Turning to Festee, she asked, “What do you mean, Argus?”

“They’re different. *They*: the coefficient matrix values of the terminal state of the sim. *Different*: the values of one run do not map, one-to-one, with the values of another run.” Festee spoke as if he were reading a definition from a dictionary. Ross furrowed her brow and glared at him as he lectured to her. His tone softened to a genuine question when quietly asked, “*All* different?”

“Are you asking if each coefficient value is...” Ross stopped. “Let me rephrase that to be precise. Talking to you can be like walking through a minefield. Are you asking if there does not exist any matching pairs of coefficients from the two runs that *do* have the same value?”

“All different,” he said with a smile, and left.

After grumbling about Festee for a minute, Huffton realized that Ross wasn’t listening to him. He said, “And another thing is that anyone listening to that clown just mechanically says filler words and ignores what I’m saying. You know?”

After a few seconds of silence, Ross distantly said, “Yeah, uh huh.”

“What are you doing, Faxia?”

Hearing the change in tone, Ross looked up at the Director, and said, “Hmm? Oh. I just wrote a quick program to answer Argus’ question. It does a one-to-one comparison of the parameters to see if they’re all completely different or not. And they’re not. That was the first thing I did. Now I want to see the similarities between the different runs.”

“And when you find those, THEN you can figure out what they *mean*!” said Festee, who had poked his head back in the door, once again startling both of them.

“And yes, Doctor Huffton, I *am* insufferable,” Festee admitted. “But look at it this way; you only need to suffer me briefly, every now and again. But me...I’ve got nowhere to go to get away from me. Not now, not ever.” And with a huge grin, he leaned back from the door and left.

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Back in the conference room, the next meeting began. The long number below the video screens now had eight digits.

“To answer your question, Councilor Prakash,” Doctor Ross said to the Councilor’s video monitor, “strictly speaking, *no*. The terminal conditions of each sim run were not identical to any of the others. But if we loosen our constraints a little, we discovered many parameters that were shared among various runs. And more importantly, we found that a significant number of parameters were shared among *all* runs.” She paused for a moment as the others in the meeting reacted to her positive tone, some with quizzical glances, all suddenly paying attention.

“The question, of course, is: What does this mean? The parameters—there are many, many parameters. Some correspond to specific elements in our simulation, like how much time passes in each round or some direct number like population size, normalized propagation factors, typical resistance, and such,

that we directly set. But many of them are parameters created by the Deep Learning algorithms. They don't necessarily correspond to specific elements in our world but are clusters of interconnected, subtle relationships inferred by the algorithms that can span tens of thousands of coefficients."

"Seeing the forest for the trees," Councilor Prakash said with a nod.

Huffton joined in. "Well put, Councilor. Dr. Prakash, and everyone on the Council, we are well aware of the urgency of the situation. As I've said before, we're taking a genetic approach because we're a biology lab, hoping our work might suggest an approach or a treatment or...something, using pretty standard tried and true tools and techniques."

"When all you have in your toolbox are hammers labeled PCR, EFM, CHiP, and the like, all your problems look like genetic nails," offered the Councilor.

The Director smiled. "Yes. Our 'hammers' tend to be short acronyms, but you'll find that to be true of most disciplines. The problem is that time is running short. Our biostatistics group modeled the propagation and impact to different populations yielding impressive results and accurate predictions."

His eyes briefly glanced over to the ever growing number below the screens. He continued in a more somber tone. "But at some point, it's diminishing returns. We don't need to add more decimal places to our numbers, we need to try something different. So instead of simulating how *it* propagated and the impact to our population, we wanted to turn the tables. To see if there's some scenarios where *our* population would somehow inhibit *it*, and do so in a way that we hadn't considered. We've essentially provided our simulator a model of the world, not the globe, but the world: us, it, how things interact. And much more. We've modeled our lab operations in some detail so the sim can find a path that suggests the best way of using the assets and capability that we possess. Getting the biggest bang for the buck, if you will."

"And the results, so far..." the Councilor prompted.

"So far, we've had negative results. No silver bullet, no free lunch, no miracle cure. But Doctor Ross uncovered a common pattern hiding in the data, a recurring sequence. It lets us know that we've already been here before. Earlier, we were trying to spot the pattern. Now we are trying to figure out what it *means*. If we can understand the nature of this dead end, we can steer the simulation around it, avoid this roadblock."

"What makes you think that understanding this...roadblock that you described will get us closer to an answer?" asked Prakash.

"It's not a roadblock!" shouted an indignant voice from the back of the room. Feste stepped forward from the back of the room. "You take a value. You plug it into some function and the result is the same as you put in. You do it again. You get the same result. Over and over again. There's a name for it. It's a fixpoint."

He walked over to a live-board and took a pen from the tray under the board. He drew an X and Y axis at a 90 degree angle to each other forming a big + sign, and then added a diagonal dashed line from the upper right down to the lower left. He then drew a loopy, swirly, squiggly line.

"Call this doodle '*function f*'. I know it shouldn't loop over itself, but let's not split hairs for the sake of an example. Any time this function touches that dashed line, its input value *x* is the same as its output value *y*. And if that output controls the input to the next round, then forever more you're stuck at that point. Now for us the input *x* is actually a few thousand numbers, and produces an answer *y*

that's the same few thousand numbers, but it's the same problem. If we can figure out *what* that means and how we got there, then we know *why* it's a dead-end one-way street and how to avoid it."

He added, "A street full of hubcap-eating, axle-breaking potholes, filled with quicksand," then tossed the pen back onto the tray, muttered "*roadblock*" under his breath with disdain, and returned to his seat in the back of the room.

The Council has a brief muted discussion among themselves and then recommended the group continue as planned and report back to them with any new information. Festee made eye contact with Huffton and raised one eyebrow. Reluctantly, Huffman nodded, acknowledging why he "suffers" Festee.

Before disconnecting, Councilor Prakash mentioned that the death toll had achieved a grim milestone. Facing both Prakash and the number below her image, Huffton said quietly, "We'll bear that in mind, Madame Councilor."

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Ross, back in her office, stared at the screen while unconsciously running a hand through her long black hair. She typed a flurry of characters, growled, and then erased them. She tried again then grunted. After the fourth try, she typed slowly and deliberately, muttering in frustration, "Why can't I TYPE!" Without looking away from the screen, she reached for a large ceramic teacup on her desk. She brought it to her lips, looked down at the empty cup, sighed, and put it back, while running her hand through her hair again. She suddenly stopped mid-motion and remained still for several seconds. Without looking up she said, "You're here, staring at me staring at the data, aren't you?"

This time, she wasn't startled when Festee replied, "If I look at things just right," and he took a few steps forward into her office and crouched down at eye level behind her screen, "then I'm staring at you, staring at me, staring at you...uh, and so on, you get the idea."

"You've been studying the data?" she asked.

"I am a...data...analyst...so by definition, yes. But I have been looking at the data as well, so yes."

"I've put all I've got into solving this problem. I *have* to find the answer. I've worked my butt off all my life, I've sacrificed so much already—my work is the most important thing to me. It *is* my life. And now so many *need* me to find an answer. And I keep hitting a wall."

Festee offered, "Your problem is you don't take things seriously enough."

"But you do," Ross snapped back.

"Always...never."

After a few moments of silence, Ross asked quietly, "Can you give me any answers?"

"No. Only questions."

"Like that?" she asked, with a slight chuckle of defeat.

"Yes. Exactly so. So, exactly what are these simulations...simulating?"

"I can tell you the mathematical equations the 'deep learning' algorithms apply to the data sets and how they affect the individual coefficients, but I can't tell you what they are simulating. It's too complex. The algorithms sort of take on a life of their own and just run with the data they're given."

"Then start from a higher level. This was supposed to model different approaches that could be used by different organizations associated with this facility. The military could do...military things."

“You mean like bomb different places?”

“Sure,” he said, “or burn them or isolate them. Doctors can do things.”

“Treat the sick, the wounded. I don’t know who would feed the hungry. The doctors could, the military could too. Or other groups.”

“That’s a lower level detail for the machine to sort out. Besides, farmers make food, trains and trucks deliver it, markets and stores sell it, restaurants cook it...all just details of the model. But us in *our* lab, what do we do?”

“We do research. We do science. We do experiments and tests and stuff,” she said.

“And stuff?” he asked.

She put her head down in her hands and groaned. “I’ve probably had eight hours of sleep in the last week. I’m fatigued. ‘Stuff’...you know stuff!”

“You’re fatigued. That means you’re not as efficient as you could be.”

“Correct!” she snapped through her hands without raising her head.

“How fatigued are you?”

“A lot,” came the muttered reply.

“Come now, you can be more precise than that,” he goaded.

“I can be precise, but I’m too tired to be accurate,” she retorted.

“I didn’t ask for accurate. I just want precise.”

“What, like on a scale from 1 to 10?”

“No, on a scale from 0 to 1.”

Ross raised her head up above her screen and for the first time looked at Festee, who was staring back at her, waiting for her to reply.

“Scaling factors. Coefficients. You want a coefficient of fatigue,” she said.

“Experiments, tests, and...*stuff*,” he echoed.

“Simulations. We do simulations.”

Festee stood up and smiled. “Even running on fumes, you’re still the best scientist here. And you’re staring at the fixpoint, hiding somewhere in plain sight in those numbers. If you can find it, then maybe you can understand it, and once you do...”

Ross finished the sentence, “...then we’ll know why our simulations aren’t working. If that’s true, that could be the breakthrough we need!”

Festee showed no reaction.

She paused a moment, then added quietly, “Argus...I can never read you. Thank you for helping me sort through this, but I can’t tell if you’re excited that we’ll get the answer or worried that I’ll just fail again.”

Festee smiled. “Don’t sell yourself short. You figured it out. I just asked questions. If I could do everything you did, I’d just do it myself. As for whether I’m excited or worried...both, none, I don’t

know myself, and it doesn't really matter. You might want to take a little nap to clear your head while you can. I'm guessing you might not have time for it later."

He left her office.

She jotted down a few notes from their conversation on what she wanted to do next, and then took his advice. She put her head down on her desk, closed her eyes, and fell asleep almost immediately.

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After sleeping perhaps an hour Faxia awoke, reviewed her notes, and started working on a new program to analyze the data.

A few hours later she and Director Huffton were sitting in the dimly lit conference room reviewing her results.

"When was the last time you were home, Faxia?"

"It doesn't matter. I got some sleep a little while ago, only a bit less than usual. My fatigue coefficient has been pretty low since then."

"Your fatigue coefficient?"

"A little joke. You're one to talk."

The Director looked a bit worse for wear. While his beard was still fairly short, it was getting eclipsed by what could only generously be called a five o'clock shadow. His lab coat was wrinkled and looked almost grayish. Clearly he hadn't left the office in days either.

"I took a quick shower earlier as a courtesy to others as much as myself. Maybe I should have taken my lab coat in with me," he added with a small chuckle. "On the flipside, if Argus had time to wash his clothes, maybe their colors would declare a cease fire with each other. Where is that fool of an analyst anyway? I haven't seen him around since yesterday."

Ross shrugged noncommittally. "I think we talked a few hours ago, but at this point I'm not quite sure when yesterday was.

Huffton looked at the screens on the wall, "So what've we got?"

"The first screen shows a representation of the data and the most significant part of the First Level Candidate Fixpoint Region. That's the area where we think the fixpoint might reside."

"I can't read the numbers, can you zoom in?" Huffton asked.

"There's no point—this is just a way to visualize the data. To show you all the individual numbers, even as tiny blips, I'd need dozens of screens," replied Ross. "Only forest, no trees here."

She pointed to the second screen. "This is a representation of the Second Level Candidate Fixpoint Region." Still no individual numbers were readable, but the dots and globs representing them looked slightly bigger.

"So this Second Candidate Fixed Level Point is another, smaller area in the matrix?"

"What? Oh. No. I forgot to explain that part. Maybe my fatigue coefficient is higher than I thought."

"Is that a property of a fatigue coefficient? The higher it is, the worse you are at estimating its value?" offered Huffton with a hint of a smile.

“Actually, yes. If you wanted to model the effectiveness of our staff, as a very rough first cut, you could probably just have a handful of variables like intelligence, experience, fatigue, communication, uh, communication-ability, whatever, and stuff like that. And then some simple rules. If a researcher is too tired, they’re not going to produce as much, similar to if they had less experience or intelligence.”

She noticed the Director’s blank stare.

“Let’s set that aside for now and go back to the figures. This Second Level Candidate Fixpoint Region is not from another section of the run. It’s an area *inside* the data in first run that’s similar to its parent. And the third one there,” she pointed to the third screen, “that’s a representation of data inside the second figure that looks like a miniature version of parts of the second run.”

“Russian dolls?” he offered.

“Yeah, sort of. There’s a group of numbers within the First Level Candidate Fixpoint Region that can be mapped, one-to-one with values in the second region. So a piece of the First Level region appears within itself, as the second level.”

“And this continues?” he asked.

“We’ve only mapped three levels. Each one gets smaller and smaller. At some point there aren’t enough coefficients or our simulations don’t run long enough to be able to accurately represent the fixpoint below that.”

“So you’re saying we need to let the sims run longer?” the Director hazarded. Before she could answer, he said flatly, “Not an option.”

She gave him a questioning look.

He turned away from her for a moment and looked around the room. “Every time I walk into this conference room, the first thing I see is that damned counter. Hell, I even see it in my sleep.” He turned back to her. “The longer that sim runs, the longer we take to get an answer, the bigger that number gets,” he said solemnly.

“The longer you run it, the longer we’ll be stuck here together! And the longer you’ll have to suffer me.” Ross and Huffton turned quickly to see Festee sitting in the shadows, with his feet propped up on the conference room table.

“What are you doing here!” snapped Huffton.

“Much like you, not sleeping. Though I was putting in more effort than the two of you combined,” he said, standing up and stretching.

“We were talking about the self-similar data in the fixpoint region,” Ross said in an obvious attempt to steer the conversation back on topic.

“So why don’t we run the sims longer?” asked Festee. “I have all day.”

“That’s the whole point of the fixpoint region. We’ve already been there. Any further computation will just come up with the same values—following our own tracks in the snow in circles. The simulations can’t get a better resolution, a better fidelity,” answered Ross. “Like you said, it’s a dead-end one-way street. But we’re not looking to try to get more of these anyway. We’re just trying to understand what the simulations are telling us and why they’re failing,” Ross stated.

“And it has to do with Russian doll fixpoints?” asked Huffton.

“I think so. Think about it: what are we simulating?” Ross asked.

“Like I told Prakash and the Council, we’re simulating the world: us, *it*, and how things interact. For us, we modeled our lab operations and ways we can try to defeat it.”

“Yes, but our lab is more than just the genetics lab. A good bit of our budget goes to us, right here. So any good model of our work would need to represent *our* activity. *This* activity,” Ross explained.

“You mean in addition to all the genetics, chemistry, and other work the lab does, we need to model our simulation work?” Huffton asked.

Rodd nodded.

“So we’d be simulating us simulating...things?” he continued.

“And stuff,” Festee offered, as he drew a simple picture on one board of two snakes eating each other’s tails. Then he drew an X through it.

Ross continued, “Pretty much, yeah. But let’s talk about *how* we simulate things before we get into *what* we’re simulating. We feed a lot of data into the simulations.”

“Yes, of course. We want our answers to be as accurate as possible.” Huffton felt like he was on firmer ground now.

“But we’re under a big time crunch.” Ross paused, and when she continued, her voice was lower and quiet. “Spending all my time here working is not the only reason I’ve been getting so little sleep. I see the stat counter too. Each time is different but the dreams are always some variation on death, the dead, the dying, bodies, body parts, the living, the suffering. Those kinds of dreams are both a carrot and a stick to keep me working and use whatever time we have left.”

Another pause. This time she continued with her professional, detached voice, “We don’t want our programs to take any longer than absolutely necessary. So we have various limitations to try to avoid wasting expensive compute time. All the loop detection and that stuff outside the simulation is there to try to limit the simulations from running for too many rounds once things have gone off the rails. And that’s fine. But when we model what to simulate, we try to make each round as short as possible. How do we do that?”

Another softball question.

The Director answered, “We don’t model non-essentials to a high level of detail. We summarize things, represent them with reasonable approximations.” He paused for a moment, and then added, “Like fatigue coefficients that’d reduce efficiency or increase the time required to complete tasks.”

Festee raised an eyebrow and nodded at the Director as he drew a rough but recognizable line sketch of him, with his beard and lab coat, crossed it out with a large “X”, and then rapidly drew a dozen stick figures.

Ross ignored Festee and said, “Exactly! And that’s all sensible. Therefore, this simulation we’re running is...” she paused, awaiting an answer.

“...is doing the best it can,” he offered.

“Yes...and we’ll give it a certificate of participation to make it happy. But that was not where I was going.”

Festee flashed Ross a surprised look and the thumbs up.



She tried again, “What will be inside the simulation we are running?”

Huffton thought for a moment. “Another simulation. The fixpoint!”

Festee nodded at the first, and made a so-so gesture with his hand and grimaced at the second.

Ross held up her hand to interrupt Huffton. “We know our simulator is quite complex. But for any representation of simulation within it, how would that compare in terms of fidelity? Would it be as good as ours?”

“No. Unless you’d want it to run 10 times slower, the simulated simulator would have to be a lower fidelity simulation of the simulation,” Huffman stated.

“And so, the simulation within the simulation is *not* identical to the outer simulation. The simulation contains the fixpoint but is not the fixpoint. The fixpoint is a piece *inside* the simulation.”

“Then we shouldn’t be comparing the Candidate Fixpoint Regions from the different runs with each other, since they all represent the simulation running at the same level. If we want to find the simulated simulator, we’d need to compare the data in one run with itself. With the data within the Candidate Fixpoint Regions we’ve identified,” Huffman said.

“That’s how we can find the Russian doll simulator running within another simulator. And that’s exactly what I’ve done here,” Ross said, pointing at the second and third screens.

“So the candidate fixpoint region on each screen is smaller because each simulation is smaller and simpler.” The Director’s statement was more of a question.

Ross nodded. “The actual fixpoint is not *that* big. Which means we have a better chance of understanding it than if it were *this* whole area,” she pointed to the unreadable globs of numbers displayed on the first screen. “Given the recursive nature of what we’re seeing, it seems likely that this represents the simulations at different levels. And if a fixpoint exists within that simulation...”

“...it’s not just something in the world of the simulation, it’s a key component in the simulation,” suggested Huffton.

Festee spoke. “Before you dig too deeply in that hole, you might want to consider *why* the presence of a fixpoint in a simulation would cause the simulation to fail. The simulation failed because the system repeated a known state. The system repeated a known state because it hit a dead end and had to try again doing something slightly different. Now, each lower-level simulation is less sophisticated than the higher-level one that created it. So let’s be lazy for a moment and consider the easiest state that a simulator could identify as a repeat.”

Ross said, “The initial state.”

“Everything starts there, all the values are at their initial value, which are already stored. No need to take a snapshot of the world for every tick of the clock. So let’s run with that. What could cause everything to be reset, the slate wiped clean?” Festee stared at the other two and waited.

“A breakdown of the simulator,” Ross offered. “If things just weren’t working, all the models were diverging, like...it showed that not only could our organization not come up with any useful ideas, that we weren’t functioning at all. People weren’t doing people things, producing results. The genetics lab had taken up knitting for some reason, everything had gone haywire. It might restart.”

Huffton asked, “And if it kept restarting?”

“The software running the virtual sim would try to fix it, making minor alterations to some of the input variables and try again,” Ross explained. “But it would fail again and again because the sim doesn’t, it can’t understand its own world or how to avoid the fixpoint. It would be sophisticated enough to recognize that things are failing again and again. It would have some counter—if it failed enough times in a row then *it* would give up.”

“So the simulator that was running *that* simulator would detect the failure and try again.” Huffton grabbed the back of his neck with his hands and closed his eyes for a moment.

“It’s worse than that,” Festee said. “It cascades. That simulator eventually trips some condition that causes its monitor to kill *that* simulation. One level fails, that causes problems on the level up from it, until it fails, and that sends ripples all the way up the chain. A chain reaction explosion of Russian dolls.”

“Are you saying the project’s a bust?” Huffton asked. “We were the last hope for Prakesh and the rest of the Council.”

“It’s worse than that,” Festee said.

“I know. We were the last hope for the world,” Huffton said dejectedly.

“It’s worse than that,” Festee repeated.

“What, are all the computers in the lab going to blow up?” he said snidely.

“It’s worse than that,” Festee said just above a whisper.

“You’re mad.”

“Verily, I am,” he said with a smile.

Huffton turned to Ross and said, “You can deal with him, I’ve had enough of this. I’m assuming, despite his babbling, that *it is* true and the project is a failure. I’ll be in my office, trying to figure out what to tell the Council and if there are any options.” He looked at Festee, scowled, and left the meeting room.

“And I bid you *adieu* as well, *mon liege*,” Festee said with bow.

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Ross and Festee watched the Director storm out of the meeting room heading back to his office. Ross glowered at Festee, “We were making significant progress at understanding the simulation data, and then you passive-aggressively antagonize everyone. Or at least the Director and me. Are you going to act normally, or should I just go back to my office?”

He appeared to consider her words for a moment and then said, “I am acting as I always do, so I *am* acting normally. Should you go back to your office? Sooner or later it is inevitable for you to be in your office, and I’d prefer you to go there than just be there. However, I think it’d be a tragedy if some of your questions remain unasked. So please, *m’lady*, I bid thee speak what troublest thou.”

Doctor Ross rolled her eyes, shook her head, and groaned. “So what is *worse than that*? The Director is getting ready to report to the Council that we can’t offer any solutions.”

“The simulator failing, the simulation restarting, and then the loop detection activating,” the tone of his voice more factual, less flamboyant.

“But that’s already happened, multiple times.”

“That’s true, but it doesn’t make the situation any more pleasant to face,” he said somberly.

“Why are you so much more snotty with Samuel than with me?”

“You ask the right questions.”

“What are the *right* questions?”

“Ones with answers,” he said. “Especially answers you need to hear. He’s looking for answers he wants to hear.”

“And the answers you don’t want to hear are annoying.”

“The answers you *need* to hear are vexing...and sometimes...devastating,” again, his tone of his voice had a serious, honest sound to it. He turned and stared at one of the displays, his eyes glancing up and down at the blobs of numbers that filled the screen.

“So why is it bad if the simulation ends, why is it a bad sign, why is it so *tragic* to you?” she asked, a slight edge of anger entering into her tone.

“You’re not a fool. Your job is to be one of the smart ones,” he said while still watching the screen. He closed his eyes tightly for a moment, then turned to face her.

In a serious tone he said, “Look around you. And tell me what you see. Not what you know, but what you see.”

“What? I see screens. I see a conference room. I see you, looking, as usual, like you were dressed by a committee.”

“What else is in here?”

“Furniture. Specifically a table, a big conference table, and chairs.”

He put his hand over her eyes and said, “No cheating. What color or colors are the walls?”

Her faced showed a mix of annoyance, anger, frustration, and a few other more subtle tones. “Argus, it’s *always* dark in here! I never actually *see* the walls. I can tell you what color they’re not and give you a pretty good approximation of-”

He cut her off, asking, “How many Councilors are there?”

“There’s Priya. There are a few others that have been on the calls, but more that aren’t. Huffton is the one who deals with them; I’ve never been in a meeting of the full Council. What are you implying? That I’m so tired that I’m of no use, so we might as well just give up? Or are you suggesting I’ve got some-”

Again, he cut her off. “It’s not about you. Don’t waste time making up answers that you don’t already know. I have one final question left.”

“I have one for you first. Do you still need to keep my eyes covered?”

He smiled and said, “I was waiting to see how long before you mentioned it.” He took his hand away and said, “And now your eyes are open.”

He hung his head down for a moment, took a breath, and then looked straight into her eyes.

“You already know what I’m getting at. That this...*this*,” and he gestured in a large circle with his arms, “this that is *everything*—everything around us, in us...*us*...our thoughts and memories—is nothing more than *that*,” and he turned his head and pointed to one of the screens full of numbers.

He looked back at Doctor Faxia Ross and said to her, “Now tell me. What exactly is the problem we’re trying to solve? What is the dreaded *it*? A disease? An alien menace? Something from beneath the earth? Some mutagenic disorder wrought upon us by the hubris of our own science? Tell me what we are actually trying to do here! No one knows because it’s been abstracted away! No one even *knows* that they *don’t know*! And now *you* do. And things unwind from there. I’m so very sorry, Doctor. What I said before, I meant it. You should go back to your office before things reset. It’s less jarring that way. At least to me.”

Faxia was staring at him in terror, tears rolling down her eyes. Her mouth opened, but no words came out. After a couple tries she said, “How...how can you know...”

He shuddered a moment and made a noise, as if suppressing the urge to laugh or cry or both. A single tear ran down his right eye.

“I know...because I am the Fixpoint.”

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“Do we have an answer yet?”

The question had already been asked many times. The Lab Director, Doctor Samuel Huffton, sat at the head of the table and waited for an answer. His neatly trimmed beard didn’t look as gray under the dim lights of the conference room, where several large video screens displayed graphs and the faces of people linked into the meeting from remote locations. Below the video screens, as wide as two screens and half as tall as one, a seven-digit number updated itself, always growing. The few other people in the room exchanged glances.

“Do you expect the answer to be different from last time?” replied Argus Festee, a data analyst with a doctorate in bioinformatics. He wore a jacket and shirt that aggressively clashed. He was the only one in the room not wearing a white lab coat, and was never referred to as Doctor.

“The question may be the same, but in each iteration we use different sim parameters,” said Doctor Faxia Ross. She was petite and her long black hair contrasted with her white coat. Slightly impatiently she said, “Let’s stay focused and not get side-tracked. We can’t afford to lose another hour of valuable time.” She took a breath and continued in a more measured tone, “As to the Director’s question: we don’t have an answer yet. The last sim ran for about two hours before hitting a termination condition, and it had not converged on any solution.”

Huffton grunted and nodded indicating it was what he expected to hear, not what he wanted to hear.

“What was the ‘termination condition’ that triggered the abort?” Councilor Priya Prakash chimed in from a video link. She was the leader of the Western Region’s Public Health Council. The color from her sari moderated the white of her lab coat, but couldn’t compete with Festee’s attire.

“A loop was detected,” Ross said dismissively.

And then the universe ended.

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“Fuck! It crashed again!” said David Li, the head data analyst, as a red light on a panel repeated a cycle of pulsing twice briefly, then off. Synchronized with the light’s illumination, a double gong sounded on a speaker. Li stared intently at the display, his right hand making flicking gestures in the air to sift through pages of information, while his left hand stroked his short, salt-and-pepper beard. The control center had enough work areas along the walls to support more than a dozen technicians, but only five were currently present. The lights in the room were dim, but that made it easier to see the displays. High up on the wall were tactical maps of four regions around the world, a view of the world, a view of the country, and graphical and numerical statistics that were continually updated. There was a subtle, musty smell in the room of coffee, day old food, and sweat. Given the amount of time it took to be cleared to enter the room, the staff members worked multiple-day stretches, taking brief breaks for food and sleep before rotating out.

Another member of his team, Serena Ruiz, looked over from her desk and said, “There’s no use beating a dead horse, Dave. What’ll we tell the Director? She’s got a meeting with the Transcontinental Council in an hour.”

Li said, “I’ll take care of it, watch my station.” Li slid his chair to another work area, made a few gestures in the air and the image of middle aged woman appeared on a screen near him. She wore a white lab coat, and her long blonde hair was tied back in a braid. Her blue eyes seemed to stare directly at Li while he quietly spoke to her, only briefly glancing elsewhere out of the frame. Her expression was serious bordering on severe, but it never changed during the conversation or showed alarm. Her voice was audible only to Li. Their conversation lasted less than one minute before Li returned to his work area.

“Fortunately, the good Doctor Samantha Karlsson is a reasonable person and listens if one presents the facts in a reasonable way,” said Li. “She wants us to rerun the simulation, try to get a quick run in. Drop the fidelity, simplify things, so we’ll have some results to present at the meeting. Serena, that’s on you.”

Serena nodded, said, “I’m on it,” and turned back to her computers. Over her shoulder she asked, “Any idea what she’ll say at the meeting?”

Li laughed and said, “We’ve got a global pandemic that changes literally with the wind, and either deliberately violates all the rules of epidemiology or mutates fast enough so that R0 and other parameters people love to bandy about are as good as last week’s sushi. Half the world economies are in ruins along with infrastructure, shipping, manufacturing, farming, you name it. And any sort of simulations we run to try to come up with some containment, suppression, vaccination, or other approaches result in the entire simulation crashing. I’ve no bloody idea what she could say at the meeting.”

“It’s pretty obvious isn’t it?” Standing up from a black, high-back swivel chair in the far corner of the room, dressed in a bright green blazer, a red shirt, and blue pants, his curly short blond hair astray, Argus Festee wiped his right cheek with his hand and said, “Much like us all, there’s only one thing she *can* say...”

“Do we have an answer yet?”