

The Answer

Day 0 – In the Beginning was the Word

Chapter 1: The Presentation

The sun had already set when Leo Soleil arrived at the 'European Conference Hall of Science and Technology'. He had been looking forward to this for mainly 2 reasons. First, he had never been to this newly constructed conference hall before, and he was looking forward to see this wonder of modern architecture. It was an EU project, meant to be a place for European scientists, inventors, innovators and companies to get together and share knowledge for the benefit of technological progress. Secondly this event was supposed to be 'redefining and exceptional', or so it said in the announcement. And while these words were often used about anything ranging from boring trivialities to Nobel prize winning stuff, all sources of information he found on the internet about it suggested that in this case it might be true.

Standing in front of the conference hall it was as he remembered it from the media: A central glass domed cylindrical construct encircled by eight pieces with a straight outside facade: Four sides and four corner towers. They were said to represent the 8 planets of the solar system Leo had read, the sides representing the inner rocky planets, and the towers representing the gas giants. The central construct, the atrium, would then represent the Sun of course. But standing this close to the building he also noticed something he had not noticed in the media pictures and videos: The whole facade made from large stone bricks was inlaid with intricate details of cogwheels, creeper plants and geometrical shapes in a sort of steampunk style. Crystal glass windows were strewn about the facade somewhat random it seemed, although there probably was a pattern to it. And in the middle of the side facing Leo was the entrance, a huge set of wooden double doors with intricate carvings spanning the entire surface of each door. He went inside.

The big, warm and extremely well-lit lobby was a huge contrast to the cold Parisian windy night. The room was full of people, accompanied by the background buzzing of blended conversations, but the noise wasn't as loud or as invasive as it usually was in such circumstances. This was partly due to the huge size of the room Leo thought, but was also the effect of advanced acoustics being part of the way wall surfaces were designed, according to the information on the internet. Tables and chairs of great diversity were arranged in groups throughout the room, ranging from high wooden tables and bar stools to lounge areas with soft lounge chairs and couches. At the left wall streams of water flowed from the ceiling through an artistic display of open glass tubes lined and decorated with streaks of metal, along with hanging plants and chemical and mechanical water art. All streams met in an artificial glass covered 'river' running all the way through the room to the right wall.

"Oh there you are," a familiar voice said. "Come on, Sophia is over here."

"Hi Alan", Leo responded. "Have you been here for long?"

"No, not long, only ten minutes perhaps. Come, I reserved a glass of wine for you."

Leo followed Alan who steered him towards their table. Sophia greeted him with a smile and a 'hello' as he approached. Then she turned towards Alan.

“Now let’s continue our discussion. Unless of course you have run out of arguments.”

“Your discussion?”, Leo asked.

“We were having a debate about whether humankind learns mostly from their mistakes or from their successes. Sophia thinks it is the latter, while I think it is the former. What do you think Leo?”

Leo laughed. “I think that you have once again made the mistake of venturing into Sophia’s field of expertise with too little humility and too much boldness. Aside from the fact that I am fully trusting Sophia’s judgment in this, I am also leaning towards Sophia’s point of view simply because humankind have time and time again failed utterly in learning from their mistakes, so however bad we are from learning from our successes, surely it can’t be that bad.”

“That’s a good argument,” Alan said, “however from a logical standpoint what we can learn from succeeding in something, say building an airplane that is able to fly, is only how to build another airplane just like it. If we want to build a helicopter or an airship we have to again do trial-and-error before we are able to come up with a new design. In contrast, if we build a machine that fails we can exclude every refinement or improvement of that design. Same argument could be applied to history cases like the rise of Hitler and world war 2, although it is arguably more complex.”

Sophia smiled at him. “There are so many things wrong with that line of thought that my head is about to explode. First of all it shows that you have no idea of how the human mind is constructed and how it works. We don’t have to do trial-and-error every step of the way in order to come up with another airplane design. Not only will we have acquired some tools such as aerodynamics that we can reuse, but our intuitive understanding of flight and how to make a machine fly will have improved too. And yes, the trial-and-error process itself is a mix of successes and failures, but let us say that we were to only get failures and never a success. Then, however much we would learn, we would never learn how to build an airplane. As for our mistakes we tend to exclude way too much than can logically be excluded because the human mind has a tendency to jump to conclusions too fast.

But these arguments pale in comparison to the major one being how we react emotionally to success and failure. Success creates motivation, confidence, hope and drive, while failure demotivates and creates hopelessness and lack of confidence. And while failure can lead to crisis which again can lead to motivation, it is only in solving the crisis that humanity truly learns and is able to progress. So you may beat a child all you want for not doing the right thing, but it is only when the child discovers how to do the right thing, and gain confidence and joy from the experience of making it work that something happens. We may be able to learn how to maneuver in the dark, but unless we can see the light somewhere in the distance, do we even want to?”

Leo smiled and clapped his hands. “I think I will cut through and declare Sophia the winner of the dispute. Now, about the presentation: What do we even know of this Dr. Stelmane?”

“I’ve gathered a bunch of information from the internet. He is an American roboticist and an expert in neural networks and artificial intelligence. He has been leading an institute working on humanoid robots and advanced AI for many years and I believe, as do anybody else in public media, that his presentation will be about a major breakthrough, or maybe he wants to present a new creation in the form of a robot. I have some detailed background material that I will be including in my article. As you know, we have all been given the task of writing an article on this, each from a different perspective, and I think in my article I will be focusing on the technology and what has been leading up to whatever will be presented to us now, and so it would only seem natural to include the background material in this.”

The lighting in the lobby softly dimmed and shifted into a greenish hue, and a female voice spoke out to them: “Please proceed to the atrium where Dr. Samuri Stelmane will be giving his presentation.”

They all entered the atrium which was a great display of greenery and hanging gardens, and in between the plants was a central stage and seats for the audience fanning out from the stage. At the center of the stage was a black curtain encircling something that, Leo assumed, was later to be revealed. A man entered the stage, low in stature and fairly aged, and made his way to the small podium at the front of the stage.

“Welcome,” he said, pushing back his glasses that had fallen towards the tip of his nose. “I hope you are all seated comfortably. As you probably all know I am Samuri Stelmane, and on behalf of the institute of Advanced AI and Robotics at the West Coast University of Technology in USA I am here to present to you the latest creation of the institute, a robot of, dare I say, exceptional and revolutionary standard, equipped with an artificial intelligence surpassing anything the world has ever seen before. So why, you may ask, did I choose Paris for this presentation? Wouldn't it have been more natural to hold this presentation in my own country, in the US? Perhaps, but I saw it fit to hold it here, in Europe, where it all started. What do I mean by that? Well, everything leading up to this started here, the renaissance, the belief in new technology, the optimism, then the industrialization driving everything forward like an unstoppable train. And the trains paved the way of progress from the east coast of America, through the prairie, and all the way to the west coast and to what is now known as the Silicon Valley. And so came the information age with the computer and the internet, and more recently AI and advanced robotics. And I feel that we are now on the threshold of a new age, as AI is maturing and opening up new and endless possibilities for the future. But enough introduction, let me kill the suspense and introduce to you the latest in robotics and AI, ladies and gentlemen I present to you the Djinni, an AGI robot of superhuman intelligence.”

Stelmane waved his arm towards the black curtain, and as he did this the curtain was drawn revealing the robot. “Hello Djinni,” he said, “are you ready for the interview?”

“I am, Dr. Stelmane,” the robot answered.”

Chapter 2 : The Interview

Stelmane seated himself in the chair that was placed facing the robot. “Let us start the interview. My first question to you is: How are you doing?”

“I have to say that your question does not make sense, and so I cannot answer your question. As you know I do not possess emotions nor any real consciousness, and, since I am programmed for self-awareness, I know that, and thus I can tell you that your question does not make sense because I am incapable of experiencing the world in any conscious way. I am however capable of simulating emotions should you want me to, but even if I do this to perfection it will only be an illusion.” The robot stopped talking.

Dr. Stelmane smiled. “Thank you, Djinni, for the elaboration. Now, my second question for you is: Can you give the audience a brief summary of your skills?”

“I can, Dr. Stelmane,” Djinni replied and turned towards the audience. “I have enhanced eyesight compared to human sight. I am capable of perceiving electromagnetic radiation in a much broader spectrum than what is usually termed ‘visible light’. My hearing is enhanced as well beyond the frequencies that are detectable by human ears. I have tiny pressure sensors built into my artificial skin allowing me the sensation of touch. Inside my nose is a sensory device picking up molecules passing by and analyzing their structures, providing me with an artificial sense of smell far superior to dogs or any other animal species on Earth. In addition to that I possess radar senses and sonic echo senses that allows me to sense my surroundings in much more detail and in a much more reliable way than is granted by mere sight.

As for my physical skills I am exceptionally strong and agile as compared to human standards and am capable of high speed motion and motion control to micrometer precision.

My greatest strength though lies in my mental powers. The neural networks of my brain are modelled over research and full understanding of the human brain, and then further enhanced through improvements of the network structure. And by adding and integrating logical circuitry my brain has been further enhanced with superior deduction techniques, superior logic and the ability to do flawless calculations to high precision. And in comparison to a biological human brain my brain is also optimized for high memory and thinking capacity per volume of brain matter. I think that should roughly sum up my skills without going into too much detail. Did that answer your question Dr. Stelmane?"

"It did, Djinni, and most nicely," Stelmane replied. "And now I have a third question for you. The world as of today is facing a range of crisis, some of the most serious being overpopulation, poverty, global warming and whatever follows from that, such as hunger, drought, and increased natural disasters. Would you be able to come up with solutions to all the problems humankind is facing, as of today?"

There was silence, and Djinni seemed to have frozen solid. Eventually Stelmane asked the robot: "Djinni, are you still with us?" Djinni looked at Stelmane.

"Sorry Dr. Stelmane," Djinni said, "I was processing the question and how to respond to it. By my estimation I should be able to give you an answer within 7 days."

Day 1 – Let there be Light

Chapter 3: The morning assignment

The editor of the *Daily Paper*, Polly Whitney, looked up from her computer as Leo entered her office. Alan and Sophia were already seated.

“Oh, there you are,” Polly said. “I am glad that you could set off time to be with us,” she remarked sarcastically. Leo ignore it and seated himself on the vacant chair.

“Your coverage of yesterdays presentation was excellent, and judging by the sales statistics that story is hot stuff right now, so I want you to each write an article each day for the coming week, to provide background and suspense for our readers up until the day when the robot Djinni reveals its answer to the public. Alan I want you to keep doing research into the technology behind the robot. Sophia you will put the robot and associated technologies into context: What are the implications for society, how will this technology affect us, and how will we as human beings and society as a whole react to it? And Leo I want you to bridge the gap between the two, starting today with paying Dr. Stelmanes institute a visit, interviewing his colleagues and get a feel for and some more detailed information about what kind of person this Stelmane is: What drives him, what are his motives and long term goals? I have already contacted the institute management who agreed to let one of our reporters into the West Coast University for setting up interviews, and I arranged a seat for you at the earliest flight so I suggest you hurry up home to pack whatever you will need for a one week stay in the US and then get yourself to the airport. Since you are flying westward you will be arriving in the early afternoon, and so there should be time for you to do an interview today and write an article before deadline.”

Leo went home to pack his luggage then headed for the airport. Once he was aboard the plane and was seated, he turned on his laptop and found the webpage of The West Coast University of Technology. It was still night in California so he had at least 5 hours to kill before he could contact the institute. He decided to study the webpage a little closer. Looking at the research descriptions of the institute of Advanced AI and Robotics didn't make him much wiser as most of it was advanced science that did not make much sense to him. From what he did understand it would seem that research areas ranged from mathematics to computer hardware and software to neural network technology and robotic motion and expression. He then took a look at the institute staff. Noone aside from Stelmane was familiar to him. He put aside the laptop, ordered something to drink and entertained himself with a book. About 5-6 hours later he made a video call to Stelmanes institute. It was answered by a secretary named Lucy.

“I am calling regarding an interview I would like to do with one of Dr. Stelmanes coworkers at the institute, as per request of Polly Whitney of the Daily Paper. Could you please tell me who would be most relevant to interview if one was to get some insight into the technology leading up to the Djinni project? Someone who have been there from the outset, working with Dr. Stelmane perhaps?”

Lucy thought about it for a moment, then said: “You want Dr. Lyman I think. He is an expert in optical computing and the one who would best meet your criteria. If you want me to I can let him know the you want an interview and ask him to call you at his next break.”

“That would be nice,” Leo answered and gave Lucy his phone number.

After a smooth flight and landing the plane arrived at the airport in California. Leo was getting his luggage when the phone rang. It was Lyman saying he was willing to make time later for an interview and a small tour around his lab. Leo headed for his hotel to unpack.

Chapter 4: Optical Computing

The university was situated in a friendly park like area, kept mostly green by artificial watering from a sprinkler system. Some areas were deliberately left dry and desolate as part of the overall park design. Leo had to walk through the entire university grounds in order to get to the Institute of Advanced AI and Robotics, which was located on the coast at the westernmost spot. Some part of the institute building was actually reaching out on a platform above the sea, placed on columns reaching out from the rocks below. A small pedestrian bridge with a bicycle lane ran from the platform to the nearby beach.

“Welcome to the Institute of Advanced AI and Robotics,” said Lucy the secretary in a cheerful voice. “One moment, I’ll call Dr. Lyman.” Lucy stared into her computer screen while clicking the mouse a few times, and then she spoke into the microphone of the headset she was wearing: “Dr. Lyman? Lucy here. Mr. Soleil is here to speak to you. Yes, Dr. Lyman...” She turned her attention to Leo and said: “Dr. Lyman will be right with you.”

As Lucy had said, so it came to be: Within minutes Dr. Lyman came walking towards the reception desk from down the hallway.

“Welcome to the institute Mr. Soleil,” he said as they shook hands. “Do you want to do the interview first or would you rather start with the tour?”

“I think I’ll start with the tour if you don’t mind. And thank you for doing this. I and the Daily Paper appreciate it very much.”

“Oh, don’t mention it. I needed a break from the lab work anyway,” Lyman said smiling. He seemed to be in good spirit overall.

Lyman first took Leo to a room with one big center table and other smaller tables distributed around it, with enough distance between tables that you could walk comfortably around them. All tables were bolted to the floor, and on the tables were a great number of prisms and odd devices.

“This lab was used in early research for proving principles such as light properties of materials, photonic resistors and transistors, various kind of lasers and other light sources and other things,” Lyman said. “We are still using it to find new replacements of components and for optimization of existing ones.”

“How does a photonic transistor work?” Leo wanted to know.

“It turns out that light can change the properties of a material with regard to how light is transmitted through the material, for instance its transparency level. Thus one light beam can thereby control the progression of another, and you have a transistor of sorts. By experimenting with light in different wavelengths this can be highly optimized. Furthermore, you can do calculations in parallel by varying wavelengths individually, allowing for some very fast computation.”

“And this is the technology that is the foundation of Djinnis internal circuits?” Leo asked.

“For the most part yes. It all had to be scaled down to the nano scale which had its own challenges.”

“So the advantage of optical circuitry is in computational speed?”

“Actually there is another advantage that is perhaps bigger than that of computational speed, and that is very low energy use per computation, meaning that not only do we solve issues of heat

generation associated with traditional circuitry, but we also greatly limit the energy use of computations, and thereby of Djinnis thinking. We have other ways of doing that as well, but optical computing is a significant factor in this regard.”

“That is amazing,” Leo remarked. “Were there other things you wanted to show me from this lab?”

“Not really,” Lyman said, “except perhaps the mention of a fun fact. You see, an optical computer of this scale could actually be built using the technology that was available in ancient Egypt or ancient Greece. Mathematics of the time were not advanced enough, but in principle nothing would be needed except sunlight, polished rocks, hard work and ingenuity. Funny to think about, right?”

Chapter 5: A Revelation

Next Leo was shown 2 labs instrumental in the scaling down of optical circuitry and then a cleanroom where optical processing chips were being fabricated. They then went to the library for Leo to conduct the interview.

Lyman led him to a small enclosure or booth within the library. Although it had no doors it was in effect a room in itself.

“We often use this as a conference room,” Lyman said. “In fact, we had sort of a club where we had secret meetings, discussing things both about and beyond the projects we were working on. It was at one of those meetings that the idea of project Djinni came into being. All the secrecy is over now so I guess it is ok now to talk about it.”

“Secret meetings?” Leo tried to sound indifferent. “You must have had some interesting discussions at those meetings I bet.”

Lyman took the bait: “Oh sure, yes, it ranged from all sorts of technical details to deep talks of ethics and philosophical issues.”

“What sort of philosophical issues could there be in project Djinni if you don’t mind me asking?” Leo was mustering all his self control in order to not let his excitement display in his voice.

“Not minding at all. There were several issues, mostly about artificial intelligence. There were great concerns about the AI taking control beyond what was intentional, and there were also those thinking that even if we could, we shouldn’t make Djinni too intelligent.”

“And what were your takings in this debate Dr. Lyman?” Leo asked.

“Oh, to me it didn’t matter. Djinni is a super intelligent robot, and he is only the first of many to come. The days of human beings as the dominant species on Earth are numbered. Robots and AI is the next step on the evolutionary ladder. Eventually they will take over. It is inevitable.”

Leo could no longer hold back his reactions. “But, but...don’t you realize, that what you are saying is a self fulfilling prophecy? I mean, you may be right in your predictions, but shouldn’t you at least be giving humanity the benefit of the doubt? Have you so little faith in humanity? Surely it is only inevitable if you want it to be.”

“Look,” Lyman said, clearly annoyed, “I didn’t write the future.”

It was a disturbed Leo who went to his hotel room to write his article, then contemplate about his visit to the institute before finally falling asleep.

Day 2 - The World and the Sky

Chapter 6: Baby steps

“Hi Lucy, it is Leo Soleil.” Leo had called the institute as soon as the phone hours began in the morning. “Yesterday I overstepped my boundaries as a journalist when I reacted justmentally to a statement by Dr. Lyman. I want to apologize, and I hope that I will still be allowed to conduct interviews at the institute.”

“You being so polite about it tells me that you will probably be forgiven for whatever it was about. Now tell me how I can assist in your ongoing investigations.”

“I am very curious about the technology behind Djinni and would like to learn more about it as would our readers. However, as I am rather ignorant of this from the outset, I would appreciate some guidance as to how to go about it, or some sort of introduction perhaps from one of the people on the project. I realize that you might not want to disclose everything to the public, but whatever you want to tell me would be fine. Could you perhaps help me in this regard?”

“Well of course Mr. Soleil. I will have to make some calls around the institute, but why don't you come down here and I will contact you as soon as I can set something up for you.”

Leo thanked her and headed for the institute once more. He had only just arrived when Lucy called him back.

“If you will go to the library front yard Omar Akun will be meeting you there. I believe he has a program outlined for you, but he will tell you when you meet him. Best of luck with your interviews.”

Omar Akun was a tall man Leo noticed as he came walking towards him with an outstretched hand.

“Welcome to our institute Mr. Soleil,” Omar said. “but let us not be so formal. I am Omar and I am pleased to meet you Leo. Normally we don't set time aside for journalists in our work hours, but these are special times so we are making an exception. I understand that you are here for a week, so I have set up a program that should lead you through an introduction to the technology behind project Djinni where you will be guided through by various experts in each field, starting with me. I am an engineer and a scientist with degrees in physics, engineering and software design, and I am a coordinator of the physical world simulation and Djinnis understanding of the physical world around him and his place in and interaction with this world. I will ask you to accompany me to the beach area if you will.”

They set off towards the beach, and underway getting a bit to know each other. By the beach a bit inland on a grassy area was a small shed. Omar unlocked the shed, walked in and came out with some sort of remote control in his hands, and behind him followed a four legged robot.

“Do you believe that the future can be predicted Leo?”

“Judging by weather forecasts I would say probably not more than a few days ahead with less than 100% certainty,” Leo said. “But in general, hmm, I would say no, or at least I hope not. I like to be surprised, not knowing everything that is going to happen. To a great extent it is curiosity driving us forward, is it not?”

“I agree with you on that last part at least,” Omar said. “However, predicting the future is exactly what this robot does, to some extent. This robot is equipped with cameras to get a picture of its

surroundings, as well as tiny speakers and mics for conducting echo location, much like a bat. From the image data 3D images are produced so that physical obstacles can be identified and avoided. But since objects may not be stationary, many 3D images are stored each second to make it possible to detect movement and velocity of objects. The robot would continuously adjust its planned movement based on near future projections of world objects. Or at least that was our first approach to solve the problem of avoiding obstacles and to preserve foothold and balance.

But it turned out that it was not sufficient for the kind of reliability we demanded. In some instances the robot reacted too late for avoiding obstacles, and furthermore we also had the problem that the robot would constantly stumble and fall. We needed something more to counter those problems. The robot needed an understanding of the physical world, of the principles of physics and of the physics of its surroundings. Such an understanding has been built into the robot, and now for demonstration purposes can be switched on and off at the switch of a button. Here let me show you.”

Omar led the robot to the sandy area of the beach, and Leo followed.

“Now watch what happens when I switch off the physical world awareness and the robot steps out in the sand,” Omar said. The robot took its first step out into the sand, and as the leg started to sink in it and the robot was brought out of balance it tried to regain foothold by moving forward into the sand, thus further unbalancing itself, and it immediately fell over.

“As you can see it didn’t go well. The problem is that after the first step it soon reaches a point where no countermove or error correction can save it from flipping over. It is a *point of no return* so to speak. Now watch what happens when I turn on physical world awareness.” Omar switched the button on his remote control and again he led the robot out into the sand. This time the robot paused for a second before carefully taking the first step out into the sand. At the same time the robot shifted its balance to compensate for the leg sinking into the sand. Shortly after it was moving along slowly but steadily in the sand, carefully preserving balance so that it was able to continuously compensate for all the minor sliding that inevitably occurred.

“So you see, Leo, that as a baby learns to crawl and later walk, it is not only the walking technique that is learned, but also an understanding of the world around and how it works. For Djinni we did not want to wait for that to occur through trial and error, and so we built in an understanding of the world physics and also did some pre-learning of Djinni’s neural networks based on this in order to minimize skill refinement through trial and error. Because in some cases, real world errors in Djinni’s behaviour could have fatal consequences.”

Chapter 7: The Sailboat

They walked back to the shed, and Omar stored the robot. He then led Leo back to the water and towards a small pier.

“I am going to show you another kind of robot,” he said. “I am not sure you can call it a robot actually. That depends on definition I guess.”

He pointed to a small modern sailboat by the pier. “We are going aboard that one. It looks like an ordinary sailboat, but it is not. Underneath are 3 keels divided into many sections, and each section can be retracted or extended, moved sideways in both directions, and reorientated. The sails consist of a large number of rigid triangular plates that can likewise be moved and reoriented relative to each other, just as each whole sail can be moved and reorientated. An advanced spring system makes it possible to control the flexibility of the plates so the sails can go from being completely rigid to being greatly shaped by the pressure of the wind.”

They boarded the ship and entered the wheelhouse.

“Everything on the ship is controlled by an AI in a computer. The AI tries to optimize things as speed and direction by manipulating all the controls, and tries to find the best, safest and fastest way to get from A to B. In a way you may say that the AI is the mind, the ship and the controllable moving parts is the body, and the ocean and the winds is the environment. The AI also have access to a great number of sensors around the ship, each of them detecting relative motion of air or water around the sensor. That way the AI can relate its understanding of fluid dynamics to the steering of the ship.”

“That sounds like an excellent approach to optimization,” Leo said. “Provided it is a good AI. So how well does it perform?”

“Quite well. One thing puzzled us though. It was not clear to us whether it learned to steer the ship from its knowledge of fluid dynamics or if it got more knowledge of fluid dynamics from steering the ship. Perhaps it was a bit of both.”

“But you said that the understanding of physics were built in to the 4 legged robot, so that it could be used for pre-learning and to minimize errors. Is that not the case for the boat?”

“It is. But one thing is knowing the basic equations of physics behind the dynamics, another is to know how it unfolds when numbers are applied. In mathematics you can have simple equations unfold into patterns of extreme complexity. It is all a matter of perspective. The AI dives into this complexity, thus getting to know how fluid dynamics unfolds. Air and water are both fluids with different viscosity, and their behaviour can be described by the same equations, but how the dynamics unfold is very different, yet still with similarities. So as the boat AI learns how to steer it also learns about phenomena in fluid dynamics. It is very interesting from a scientific and engineering perspective.”

Leo sensed that this was the cue for him to turn the conversation in a more interesting direction. “So would you consider your role here as that of a scientist or an engineer?”

“Do you mean me as an individual or the group as a whole?” Omar wanted to know.

“Both,” Leo said.

“Well, personally I am all in it for the science and the engineering, but I think that for Stelmane and the team in general we are more like a group of inventors, and there is a feeling that we are working on something bigger than ourselves. I think the words of Stelmane was: *Djinni will take humanity into a new age*. I think I am too much of a down-to-Earth guy to let myself get sucked into those sentiments, but maybe I do see what he means. Project Djinni is groundbreaking, there is no denying that.”

“Just how groundbreaking are we talking?” Leo asked. “I mean, what are the implications for the future in your opinion?”

“I think Djinni, and what will follow Djinni, will empower humanity like it has never been empowered before. Whether that is for the good or for the bad that remains to be seen. And so you probably want to know, how can I work on a project if I’m not confident that it will benefit humanity or at least be rather harmful? Hmm, well, I could say that if I didn’t do it someone else would. That is a standard answer, right? But the truth is more likely that I was too involved and engaged to stop once I realized the scope of this. To me it was most of all an engineering project and it still is. What happens after will be up to others to decide.”

Chapter 8: The Drone

“There is one more robot I would like to show you,” Omar said as they climbed back onto the pier. He drew his cell phone from his pocket, pressed a few times on the touchscreen and moments later a small drone appeared from the sailboat and rose into the air. “This drone can be

remote controlled via an app on the smartphone. I can steer it in the direction I want, or I can tell it to go to a specific location or to a specific altitude. Now observe what happens when I try to plunge it into the ocean.” The little drone dived through the air, but as it approached the sea surface it braked suddenly and stopped mid-air.

“It would seem your little drone has a survival instinct,” Leo mused and smiled.

“Indeed,” said Omar, also smiling. “As you see, it knows it is about to hit the ocean and that it is a thing to be avoided. It knows that its element is the air and it knows the difference between air and water. In a way you may say that it has self-awareness, in a limited sense.”

“Okay, so now you have shown me three robots with technologies that relate to the inner workings of Djinni,” Leo said. “Still, I sense there is a point beyond that...”

“There is,” said Omar. “As I have told you we do pre-learning on the neural networks that we build. Pre-learning can be programmed to be done from laws of nature, or other ‘laws’ that we set up. But it can also be done by letting another AI ‘teach’ or ‘coach’ the neural network that needs training. Which was the case for Djinni. Djinni was actually trained by a range of other AI, including the AI of the 3 robots I have shown you. So in order to understand the workings of Djinni you should get familiar with some of these other robots. I have arranged for this and put you on a schedule for the rest of the week. Tomorrow you will be meeting with Anya who will introduce you to some of the farming robots. It was nice meeting you Leo. Have a pleasant night.

Day 3 - Let there be Life

Chapter 9: The Orchard

Leo had been told to meet Anya the biologist at the university orchard, more specifically at the center square of the orchard. A distinct scent of flowers met him when he approached the entrance to the orchard. It was spring, and the fruit trees had already begun growing flowers. Fruit trees included apple, pear, plum and cherry, of what Leo could immediately identify. Fruit trees were widely spread, allowing sunlight to get between the trees and down on the grassy areas at ground level, where a great variety of spring flowers grew. As Leo walked among the trees he noticed that there were busy bees all over. After a while he also noticed something else: A bit away from the path, perhaps 10 meters, stood a robot. It was shaped as a 6-sided container on 6 thin expandable metal legs and 2 long arms, and as Leo passed by its legs were slowly and silently expanding to raise the container body part towards a tree branch, and soon its arms were reaching for the branch to slowly but precisely thinning out flowers on the branch. The flowers it cut off were dumped into the container part.

"It's a mesmerizing sight, isn't it," a female voice spoke from behind. Leo, who was quite startled since he thought he was alone, spun around to find that he was facing a woman in her 40's or 50's.

"Sorry, didn't mean to startle you," the woman said. "I am Anya and I figure that you must be Leo?"

"I am," Leo said. "But I thought we were to meet by the center square?"

"We were, but the square is just around the corner and as I happened to bump into you on the way there I figured I might as well say hello."

"Well hello. I assume that the robot I was observing is the one you wanted to show me?"

"It's one of them, yes. That one there was designed for picking fruit in the season and taking care of fruit trees year round. And as you can see, it takes its time doing it. Right now it is thinning the buds in order for the trees to produce healthier fruit in the fall. The robot has tiny cameras on its arms and possess image recognition software in order to get a count and overview of clumps of buds and uses artificial intelligence for determining which buds to cut off. So you may say that it is very slow and very meticulous. But, since it is able to work all day and night all year around without rest it still gets the job done. We use more than one robot for taking care of all the trees in the orchard, but only a handful is needed actually."

"But would it not be more efficient with a less meticulous robot aimed more at mass processing and mass production?" Leo asked.

"That depends what you are trying to achieve," Anya said. "This approach allows for organic production, for keeping soil and environment healthy and making optimized use of area for production. And for quality over quantity."

"Was that a priority for the institute? Organic farming and quality over quantity?" Leo asked.

"No, I wouldn't say that." Anya laughed. "But it was the most challenging path, and we do love a good challenge. But as it turns out I've grown quite warm to the idea of this approach to farming. There is something aesthetically satisfying about it. Now, when we are done studying the orchard robot I'd like to take you to meet some other farmbots."

Chapter 10: In the Fields

Anya wanted to take Leo to a farm in the countryside. It was a bit of a ride in Anya's van so Leo thought he would use the time to get to know her better and maybe get answers to some questions he had.

"So, you're a biologist?" Leo started out. "How does a biologist come to work with robotics?"

"Oh, I always had an interest in software and computer science too, so robotics is not so alien to me. And what I do here is mostly working as an expert consultant to the real roboticists. My knowledge of biology has been invaluable to them in designing the farmbots and the neural networks that make them work."

"Some of your colleagues seem to think that Djinni and future robots like him will be the next step in evolution, throwing human beings off the throne as the dominant species. What are your thoughts on that?"

"I to some extent agree on that. We, as a species, are so self-destructive, with all our wars and our otherwise irresponsible behaviour. Instincts, hormones and emotions are to blame for that I guess. Robots, or AI, does not have that disadvantage and furthermore have the potential of much higher intelligence than mankind, so yes I suppose they are right. I hope there will be a place for us in the new world order though, for the humans, the animals and all the wonderful plant life. One option is for us to merge with machines somehow and be part of this next leap in evolution. But so many things could happen, so I don't know. I don't think about it too much, after all I'm a biologist, not a philosopher."

They drove for a while and then took a turn towards a big farm building surrounded by huge fields. Anya stopped the van by the edge of a field of mostly barren soil. They got out and Anya led them into the field. Recently sown wheat was starting to sprout and grow. In the distance there was a 4-legged robot moving around in the field but very slowly.

"Let's have a look at that one," Anya said. They moved closer to the robot, but it was not until they were standing right next to it that they could see what it was actually doing. It seemed to be weeding the crops using a flexible arm with tools for picking up or burning weeds. It moved slowly but with high precision so that overall it worked quite fast.

"Why are some weeds left standing?" Leo wanted to know.

"Some weeds have a positive effect on the health of the soil and the microbiome in that they are a source of food and nutrients for the worms, insects, bacteria and fungi in the soil, and some are nitrogen fixating, meaning that they draw on nitrogen in the air for their needs, thus providing the soil and the crops with a replenishment of some of the nutrients that are lost when the crops are harvested. In this field there are no loss of excess nutrients to the ground water or surrounding streams and lakes because the soil and the ecosystems are kept healthy. Any excess nutrients from fertilization are utilized by the ecosystem of the soil so that they never leave the field except in the bodies of birds and insects. And still we get high yield because the weeds left standing are not allowed to overshadow or displace the crops. The robots see to that."

"Aside from weeding," Anya said, "the robots also take measurements. They measure pH in the soil, count bacteria, beetles and weeds, variety and a range of other things. All of this data is used to determine how the robot should weed and what other care, watering or fertilizing, needs to be done to the field. And as the robots learn, fewer and fewer data will be needed."

"So what you are doing here, with the help of the robots, is organic farming?" Leo asked.

"One hundred percent," Anya said, smiling.

Day 4 – The Sun, the Moon and the Stars

Chapter 11: The When and the Where

The next day Leo was meeting with Professor Ruby Mercury, who was an expert in mathematics and also had a degree in space engineering. He was to meet her at the institute of space engineering, also located on university grounds. Professor Mercury met him in the entrance hall.

“Welcome Leo. Please call me Ruby. Follow me this way please.”

They walked down to the end of the hallway and entered a big round room with a domed ceiling. The center floor was empty except for a small R2-D2 like robot.

“There is much talk about robots being self-aware. This little robot is self-aware in the sense that it always knows when and where it is.” Ruby smiled. “It keeps track of time and of its location at all times. It has an inner atomic clock, and using its cameras it tracks the sun, the moon and the stars. This tracking will also allow it to tell local time and location with high precision. Look what happens when I turn on the night sky.”

Ruby turned off the light in the room and then accessed an app on her phone to brighten up the dome with a myriad of stars. The Milky Way was clearly visible, as were various star constellations known to Leo. She then used another app for manipulating the robot. The robot pointed the camera and rotated its head, panning over the fake night sky. It then projected some numbers and letters onto a whiteboard giving the time and location.

“As you can see,” Ruby said, “that was a projection of the night sky as seen from this location last night. Let’s make it day.” Ruby used her phone again, and daylight filled the room. The Sun was shining brightly on a big blue sky. Once again the robot panned its camera and projected numbers and words onto the whiteboard.

“That was here and now,” Ruby said. “Now let’s give it a challenge.” Ruby changed the sky into another starlit night sky. The robot panned its camera and hesitated just a second or two, then projected new location and time onto the whiteboard.

“According to the robot we are standing on Mars some 10 years in the future,” Leo said, laughing. “On the top of Olympus Mons it says. Is it right?”

“Spot on!” Ruby smiled. “The robot has a starmap stored in its memory, and from that and the sky view it is able to calculate the viewpoint in space and time. It works best in the vicinity of Earth and not too far off in past or future.”

“Hmm, but from what I know of the AI of today it does a poor job of logical reasoning?” Leo said.

“Yes, but this robot is not running on neural networks. It is running traditional logic software on traditional logical circuits, which is best suited for solving problems of a mathematical or logical nature, in this case the time and location.”

Chapter 12: Integrated Logic

“So how does this relate to project Djinni if it is not AI technology?” Leo asked.

“Oh, it relates very much,” Ruby said. “We have integrated the logical units into the neural networks in a way so that they work as a counsellor. The neural networks are connected to the interface of the logical units allowing them to access mathematical and logical functions. The human analogy would be like if you had an advanced calculator in your brain, except the logical units are more than an advanced calculator. Vast amounts of rewritable memory ensure the ability

to create huge databases and to store sensory input like images, video, sound and smell for later retrieval.

We use robots like this star tracking model for testing the units. And since they all have to fit inside Djinni we use high density chips based on new chip technology. We use graphene chips with a 3D layered structure where thousands of layers are stacked on top of each other. It is important to understand that the logical memory is not the main memory of Djinni, which is rather a function of the neural networks of his artificial brain, but memory like that tend to be fussy and diffuse and fading over time like human memory is. Logical circuits are optimized for digital memory that does not degrade over time.”

“Why does the memory in the neural networks degrade over time?” asked Leo.

“It is not time itself that degrade the memory,” Ruby said, “but in the learning processes of the networks, as Djinni gets new experiences and learns from them, old knowledge and old memories will adapt to the new. That does not mean that old memory gets erased or altered completely, but it means that as views and perspectives change, old memory can no longer be trusted. Look, this could get rather philosophical, are you sure you want to get into that?”

“Please, let’s get into it,” said Leo and smiled.

“Ok,” said Ruby, “well, for a large part, memory in a neural network is an integral part of mental skills and perspective. Let’s say you watch a lion kill a zebra. You may think then that the lion is an aggressive animal, and your memory becomes that of a lion aggressively attack and kill a zebra. Then the lion’s family comes along, and everyone starts to eat. The memory has now expanded into a lion killing a zebra in order to feed itself and its family, and maybe you no longer think of the killing act as aggression. So perspective has changed, and so has the memory. When later someone asks you: ‘What is a lion?’ you may answer that it is an animal that kills zebras but cares for its family. You may still have the mental image of what your eyes saw, but in time that fades, and so what you are left with is your idea of a lion and the story about what you once saw. You may later become active in an organization working to protect wildlife, and so, because you really want it to be true, and because the brain has a tendency towards making memory and facts adapt to your dreams and values, what you remember is the story of the caring lion killing only because it had to, in order to feed itself and its cubs.

Artificial neural networks are modelled over the networks in a biological brain, but are not identical to the networks of the brain. In many ways they are simplified versions. For these artificial neural networks, memory is a function of everything that has been learned and inseparable to the skills and the thought processes of the networks. By providing Djinni with logical digital memory we create the possibility for Djinni to store moments, images, impressions and sensations in a way so that it won’t get distorted or degraded over time. And the same with its understanding of mathematics, natural laws and logical coherence, which is stored and functions much better in logical digital circuits.”

Day 5 – The Swarms

Chapter 13: The Chase

The next day Leo was to meet Paul and Andrea at the pier. They were to board the very same boat that Leo had been on some 3 days ago. They greeted Leo enthusiastically, and Andrea introduced him to the tour.

“Greetings Leo. This is Paul, and I am Andrea. We will be your guides on this boat trip where we will explore how robots communicate and work together. So, step aboard please, and we will set sail.”

They boarded the boat and began to sail out. There was little wind and blue sky so they all leaned back in their chairs and enjoyed the sun. When they were out on the ocean a good way from the coast Paul pulled out a tablet from his bag.

“I’m going to call on some friends. Now watch the sea at this side of the boat.”

Leo looked out at the sea, and after a while he started to see something moving beneath the waves.

“I see something moving,” Leo said, “probably a shoal of fish. I’m thinking this is not what I am looking for, unless you found a way to communicate with the fish?”

“It may look like fish,” Paul said, “but it is not. Look closely as I make them do some tricks.”

Leo watched the swarm as it moved closer to the surface, and suddenly some of the ‘fish’ broke the surface and shot out of the water and into the air. He could see then that it was mechanical things resembling fish in form and somewhat in colour.

“These are our fishbots,” Paul said. “They have shape like fish and can move their bodies like fish. Artificial intelligence makes it possible for the fishbots to move like fish through the water, reaching high speed on very low power consumption. Furthermore we have made them capable of moving in swarms in a similar way the fish do, forming a collective whole. The swarm behaviour may seem very advanced, but as it turns out it is guided by simple rules of behaviour at the individual level. Each fishbot is equipped with an artificial spine with a set of joints that makes it possible to bend and twist in any way a fish can. The fishbot AI optimizes movement of the spine to obtain the needed speed and direction with minimal energy consumption. The problem is in many ways the same as for the keels of this boat and is handled in a similar way.”

“And now that you know about the fishboats it is my turn,” Andrea said. “I want you to keep an eye on the horizon in the direction of the coast.”

Leo did as instructed, and moments later some small black dots appeared in the sky. The dots grew bigger, and soon he could make out the shapes of the flying objects. It was a swarm of drones, the traditional helicopter style drones with four propellers, flying in formation. Suddenly the leading drone dived while the next two drones turned left and right, and the other drones followed in row behind them so that three lines of drones formed. It soon became clear that the diving drone was chasing the fishbots, and that the drones that turned left and right was circling them. The fishbots in turn tried to swim away from the drones. The center drones slowed down, allowing the fishbots to keep up in speed, but only to allow for the other drones to get ahead and attack from the sides. The fishbots formed a circle, trapped as they were, and the drones then formed a circle around them. Then suddenly the drones broke up, spiralled upwards, got back into formation and flew back towards the shore. The fishbots quickly followed.

“That was quite the show,” Leo said.

“Yes, wasn’t it?” Andrea said. “I would like to say that Paul and I designed it, but in fact we only set up the parameters. How it unfolded was not something we could know or anticipate. It is like that with mathematics and physics, and also in computer simulations, that a few simple rules can lead to complex, beautiful and intricate patterns and behaviour. And so also with artificial intelligence.”

“As it is with animals and human beings perhaps?” Leo asked.

“The potential of artificial intelligence is so much greater,” Andrea said. “Human thinking is crude and simple next to what AI has the potential to be. Right now we might think ourself unique and superior, and can’t believe that AI will ever outperform us, but that is simply because we lack imagination.”

“So you think that AI is the next step in evolution?” Leo asked.

“Oh, most definitely,” Andrea answered.

Day 6 – It is yours to rule

Chapter 14: The Large Language Model

The next day Leo was invited to the office of a Professor Xian, an expert in software engineering and neural networks. Xian welcomed him eagerly as he stepped into the office.

“I assume you are here because of the recent event across the Atlantic?” Xian said. “It is an exciting time for all of us here at the institute as you can imagine. This is all our work coming to fruition. I was told to introduce you to some of my work relating to the Djinni project. And unless you have specific questions I think I will just start with the basics.”

“I’ll save any specific questions for later, so please go ahead,” Leo said.

“Very well,” Xian said. “The first thing I’ll talk about is the large language model. The LLM as it is called for shorts is a way of employing neural networks and large data sets for creating meaningful text as response to a text input or inquiry. The way it works is that the computer estimates what output will make most sense as response to the input based on all the data it has been given initially. So in a way you can say that the data is the culture and reality context that is used to make sense of inquiries and to provide sensible response. The data is used for creating statistics that in turn is used for building up the neural network, or teach it how to behave you might say. It’s somewhat more complex than that, but that encapsulates the principles I would think. But in order to create a traditional LLM that is able to give meaningful and in-depth response to queries you need massive amounts of data, and you need a big data center to process all that data, to build up the model and to have processing power for delivering responses to inquiries. So we have had to refine the original LLM, and in fact that has been done many times over, in order for Djinni to fit it under his shell.”

“So the thing that makes Djinni talk and respond to whatever you say to him is a scaled down refined LLM?” Leo asked.

“Oh no.” Xian laughed. “LLM’s can only do so much. We wanted to give Djinni personality, and that required a different approach. But the scaled down LLM is part of Djinni’s language module, which is a key component when we are talking personality. We will discuss the personality aspects later but right now I want to talk about wireless communication protocols.”

Chapter 15: Communication Protocols

“As I talked about, fitting data and processing power into Djinni’s physical body is a problem in itself. That is why Djinni has been equipped with hardware for wireless communication. Djinni is able to wirelessly access networks and computers in his vicinity through standard internet protocol. But we have also developed new protocols for wireless machine-machine communication, and human-machine communication. In fact Dr. Stelmane has a chip implanted in his brain allowing him to communicate telepathically with Djinni and with any other machine running the same communication protocols. By accessing networks wirelessly Djinni can easily get the data and information he needs from the internet, or from computers and data centers he can access. But not only that, he can also remote access and control other robots equipped with the right protocols.

You have been introduced to a range of robots during the last few days, and they have all been equipped with communication devices for Djinni to access them, and should he want or need to, control them.”

“Aren’t you afraid of giving Djinni too much power?” Leo asked. “I mean, what happens if Djinni himself gets out of control and starts to exhibit unwanted behaviour?”

“Yes, we have thought about it a great deal, and a lot of ideas was thrown on the table for as how to control Djinnis behaviour.”

Chapter 16: Laws of Robotics

“The main dilemma is this: We wanted to give Djinni personality, to make him behave and feel like a human being, but as human beings are to a great extent controlled by their emotions, and often show irrational behaviour, this is almost per definition in contrast to controlled behaviour. So we had to put in some limitations or constraints to human behaviour. We were greatly inspired by Asimov’s 3 laws of robotics:

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

The first law we altered to

1. A robot may not insult or physically or mentally harm a human being, or, through inaction, allow a human being to come to harm.

So the first question was, how to implement those laws. The language model doesn’t work well with strict laws like that, so we needed to come up with a personality module that had the laws built into the foundation, but at the same time was human-like in nature. An artificial neural network seemed to be the right choice. So what we did was train the network on cultural data as well as the 3 laws, letting the laws take absolute precedence. Since we didn’t have the manpower to manually train him on the laws, we developed training algorithms for holding up behaviour and query responses to written statements. And as a result Djinni turned out to be polite, respectful, helpful and obedient. One concern we had was that his intelligence would undermine the laws, but it seems not to be the case.”

“What do you mean by his intelligence undermining the laws?” Leo asked.

“Well, as his understanding of language and capabilities of deep thinking grew there was the concern that Djinni would start to question the premises of the first laws. He might for instance as he gained a broader and deeper understanding of the word ‘harm’ and what it would mean to ‘harm a human being’ also alter his understanding of that concept and thereby his interpretation of the first law. So in order to account for this we built up his value systems in steps starting out with a simple understanding leading to a simple value system, and then a more advanced system building on top of the simpler one, and then gradually making the system more and more advanced, in the hope that the final value system would at its root have the 3 laws. As you can see, this makes the laws more like guidelines than actual laws, but perhaps this is in the nature of

written laws, that interpretation is never unanimous. And as Djinnis behaviour turned out to be quite satisfactory we chose to leave it at that. And with that I think I have given you all the information I had planned for this session. Did it satisfy your needs or do you have further questions?"

"I must say that these days here at the institute has been enlightening. I have one more question: How do you think we as human beings will be able to compete with robots as Djinni or even next generations of robots? Will we lose out and go extinct or will we be able to cope with the situation and coexist with robots and AI?"

"Human beings as is will no doubt lose out, so if we want to be part of the future we will have to integrate with machines, through implants or other human-machine symbiosis. Otherwise the human race will probably sink into oblivion."

"Thank you, I think I have everything I need for my final article."

Leo headed home to write the article, and started packing for the flight home as Polly Whitney called from the office.

"Hi Leo, I just became aware that tomorrow it is Earth Day, and as it so happens there is an Earth Day convention near you, and if you want to I would like you to cover the event. I know that tomorrow is your day off, so you are entitled to decline, but I'm willing to throw in a nice bonus if you do it. So what do you say?"

Day 7 - Earth Day

Chapter 17: Digital Green

When Leo arrived at the gate of the Earth Day camp he had no expectations. He had never been to an Earth Day convention before and so did not know what to expect. The gate itself consisted of two big branches leaning towards each other and meeting at the top. A big sign said *Earth Day – Theme: Digital Green*. The manager of the camp, a big muscular man of native inheritance, met him at the gate.

“Hi, you must be Leo,” the man said. “You can call me Um, that’s what the others call me.”

“It’s not your real name?” Leo asked.

“No, I prefer to keep my real name a secret, to protect my family. You never know what crazy people are out there, bearing a grudge towards someone trying to make a change.”

“Are you trying to make a change Um?” Leo asked.

“I think that’s what Earth Day is all about, isn’t it?” Um said. “And it is not a one mans project, we have all of us come together to celebrate Earth and advocate for and help its recovery. This year I have the privilege of being the manager and coordinator of all the efforts, but it is important to note that we are all working together in unity. I am just the front figure.”

“So this camp is a collection of projects?”

“It is. There are a lot of projects, all of them related to Earth conservation, the climate crisis or just creating a better future for the planet. This years theme is *Digital Green*, so many projects relate to that, each somehow involving computers in healing the planet.”

“So do you have a project Um? Besides being camp manager?” Leo asked.

“I’m a healer.” Um said.

“A healer? Isn’t that a bit outside the scope of Earth Day?”

“I can tell you about my work in a bit, and maybe when you have been around camp and been introduced to other projects you will better understand how it relates. Right now let me tell you a bit about the background for this years theme. The idea for the theme came about when we discussed the rising power consumption from computers and data centers around the world. We wanted to put focus on that, but we didn’t see it as a theme that was broad enough for the convention, so we decided to broaden it to include all kinds of green projects where computers were involved, thus: *Digital Green*. That doesn’t mean that all projects here relate to computers, but those get priority. Some of the theme projects include Earth satellite surveillance, various monitoring projects and statistical progression, greening of computer hardware, but we also have some more exotic projects that I’d like to introduce you to later. Now, let me take you to my tent and I’ll tell you about my work as a healer.”

Chapter 18: The Healer

Um led Leo through the camp to his tent which was a big teepee. Inside the ground was covered with blankets, and in a small bowl near the center was a bundle of tied up dried leaves. Along the side of the tent were some wooden boxes with jars of herbs of all kinds.

“This is where I conduct my healing ritual upon those in need. I am also a skilled herbalist and deal out herbs appropriate for the ailment. But the most important part of most healing sessions is the conversational therapy. When I started out as a healer I only did the healing ritual. Then I met a

herbalist who told me about different herbs and what they could do for the body and soul, and I decided to include herbal treatment in my healing. When people came to me for healing they seemed to always have a need to converse with me about their ailment, or what led up to it, or something altogether different. I allowed this, because I thought it wouldn't hurt, and might even improve on the outcome of the ritual. But after a while I discovered that it was more than just improving on the outcome, that in some cases the conversation itself was why they showed up and was the real reason for their recovery. So I decided to include conversation therapy in my sessions. After a while though I began to notice some patterns in the conversations, and I discovered that some ailments actually had their root in society, that patterns in society would influence the mind and spirit in an unhealthy way. And I found that patterns in the mind were spread to other minds through culture. That got me interested in society matters, and matters of the environment, and while I don't think the climate crisis is the root of the problems, I found the climate movement to be a good place from which to start fixing things."

"So you are exploiting the community for a greater purpose?" Leo asked.

"No, I find the climate crisis to be very serious and something that should be addressed, so I'm not exploiting anything, but yes, I am taking a broader perspective and am pursuing a greater purpose."

"What do you find to be the root of our problems then?" Leo asked.

"There are some great imbalances. But the root? Well, the Earth is rich, and the technology exists for providing a good life for everybody. So the problem is not a lack of resources, not even with the current much too high population. The problem is for people to figure out how to live their lives in balance with themselves, in balance with others, and in balance with nature. And on a society level, figuring out how to coexist is fundamental. The problem is often lack of imagination, which again springs from excessive focus and narrow thinking. To exemplify my ideas let's visit the group working with fresh water problems around the world. I think then it will become clearer what I am talking about."

Chapter 19: The Water Cycle

In another area of the camp was a group of tents where the water cycle group had their base. Many of them were scientists and others were activists doing voluntary work to promote the ideas of the group and helping out with practical work, Um explained. Leo was introduced to one of the scientists, Athea, and Um explained that Leo was a journalist and asked her to tell Leo about their work.

"What we do here," Athea said, "is to study the water cycles around the planet, from water evaporating from the oceans to form clouds, to clouds raining upon the ground and snowing upon the mountains and the polar regions, to streams and rivers flowing again out into the sea, and water seeping through the ground and into the ground water. Moisture in the air settling as dew in the morning and as ice in cold weather. And we look at the fresh water problems around the world, drought as well as excessive rain and how to solve them."

"Can you tell him about the problems of drought in California and of the obstacles in finding a solution?" Um asked.

"Yes, sure. California has many rivers, but the land in many areas is dry land or desert, making it from the outset unsuitable for farming. However, that did not stop people from producing crops and wine, which was accomplished by leading water from lakes and rivers into the fields, and later by sprinkling with fresh water. The surface water from the rivers and lakes was also used for general water supply for the cities. As climate change started to alter the precipitation patterns all of this put

a strain on fresh water supply. Restrictions were put on water use, but as drought was getting worse that was not enough to solve the problem.

A number of solutions do exist. Building dams and reservoirs to capture water when it rains for later use in dry periods is one. Another solution is desalination of salt water along the coast. Many consider the price of desalination to be too expensive, based on experience with existing desalination plants, but alternative designs have not been thoroughly investigated. And still, even for existing desalination plants, desalinated water comes at a price of a less than a dollar for 400 liters of water. That means virtually nothing for a glass of water, and less than half a dollar for a shower. Nothing Californians can't afford. Watering crops is another matter, and here one must question the wisdom in doing farming in the desert. Still, using greenhouses or other technology that would be possible too. So what it comes down to is that the problem is very far from existential but rather a matter of pricing. The farming products might not be able to compete on the global market, but for the general water supply, if there is no cheaper alternative than the desalinated water, that is not even a problem. The problem is that we are used to the idea that water should be virtually free. In other words: Rigid thinking and a focus on what used to be good solutions.

The thing is, there is no shortage of water on our planet. And solutions for drawing clean water from any water source do exist. In poorer countries they may not have the finances or technology, but even there solutions exist in many cases. Heavy rain can also be a problem and have devastating consequences, but if we are prepared for it that can be handled also. Humankind has the means to cope with the consequences of climate change. Nature in some cases does not, and therefore entire ecosystems are destroyed and species go extinct. But Mankind persists."

Chapter 20: Gaia

After that Leo was left to explore on his own before he was to meet up with Um once again. The camp was big and there was a lot of interesting groups around. Leo discovered how much was actually being done to reduce greenhouse gases and fight climate change. Wind turbines, solar power, wave power, water power, energy conservation, energy storage, battery technology etc. was being researched, produced and employed, and new solutions being proposed in great numbers. After a few hours he met up again with Um.

"Did you learn something?" Um asked.

"I did," Leo said. "There are so many initiatives here. Makes one wonder why the climate crisis have not been resolved a long time ago," he mused.

"Indeed," Um said. "Now I want to tell you about that part of my work that reaches beyond the scope of the individual. I want you to visit the Gaia group."

Um took Leo to the tent of the Gaia group. The people there greeted them when they saw Um.

"What we do here," said Um, "is explore the Gaia principle, that living organisms on the planet live in a sort of symbiosis with their inorganic environment, influencing the environment to improve upon their own living conditions which again work back on life through natural selection. The Gaia idea is in my view not really a theory, since all closed systems tend to go towards some kind of stability, static or dynamic, even chaotic, unless disturbed by outside forces. However, the recent changes in the planets ecosystems, the climate change and extinction of species told us that something was off, and to get a better idea of what it was we decided to include human culture into the 'equation', since human culture today constitutes such a major part of Earth, and is the major reason for the changes going on. So how do we include human culture? We look for patterns that we also find in human psychology, which may be patterns in mass psychology, but also trends in architecture, art, literature and technology. The basic problem is that technological advances has

brought about imbalance in all systems, and our thought is that it will take time before a new balance settles in. However, before that happens we may see some irreversible consequences of catastrophic proportions that it will be in our self interest to avoid. This brings me to the idea of healing the Gaia system.

Some of the healing is already happening. It seems to me that pressure on the individual in some cases cause the individual to divert focus from narrow self interest towards a broader perspective, wanting to 'fix' the problems on a higher level, whether in a local community, or in regional or global scope. This is what have caused all the initiatives you see in this convention. But we are still far from a safe level of balance. So what we are doing here is trying to find roads to new balance and ways to promote it. In other words: Heal the world."

Chapter 21: Learning Techniques

"I want to show you two projects related to this year's theme here in the Gaia tent before you go. The first one is over here." Um took Leo to a science station with several computers and a young woman whom Um introduced as Fay, a psychologist.

"What I do here is experiment with computer assisted learning," Fay said. "Efficient learning is a psychological process, and if done right has the potential to not only make you learn faster, but also to make sure that what you learn sticks, and furthermore in children it will make otherwise difficult and boring material seem interesting and easy.

The three steps in efficient learning are: An introduction to the subject that makes it seem fun or interesting, an easy start that makes sure that the student experience success in the learning process and then gradual increase of difficulty levels so the problems remain challenging but still solvable. Since each student is different, traditional teaching methods will only work for some and not for others, and for most will not work very efficiently. With interactive learning on the computer much more can be accomplished. We can measure the students strengths and weaknesses and adjust assignment type and difficulty accordingly. And we can add 'reward' sound and other effects which can have a surprisingly big effect on learning speed and motivation. Background music that changes slightly in response to user input also works great for some. Learning through educational gaming has shown very good results, and at the moment we are experimenting with hybrids between games, story telling and more traditional educational software to gain the best effect. So far we have been able to increase learning speed of students to more than 400% on average, and we can make dyslexic people read and number blind people do complex math. From our perspective the goal is to raise the overall educational level of populations in order to speed up culture change towards more stable and balanced societies."

"Wow, that's impressive," Leo said. "Aren't you afraid that your techniques can be misused?"

"It already is being misused," Fay said. "Not our inventions, but similar techniques are being employed in the gaming industry to optimize earnings and to get money out of children. So I'm pretty sure we are doing more good than harm in employing psychology and computer power in learning."

"Have you thought about if your techniques could be used for other beneficial purposes then?" Leo asked.

"Not only have we thought about it," Fay answered, "but we are actually already employing it in mental therapy."

Chapter 22: Unravelling of the Mind

“I was actually going to tell you about that next,” Um said. “We have been experimenting with computer assisted therapy. In order for you to grasp the idea, imagine the brain consisting of hardware and software, just like a computer. The hardware is the physical composition of the brain, and the software is all the neuron connections. The allegory don't hold completely because there is some chemistry involved in the brain that influences both hardware and software, and the neuron connections are physical things that as they are built becomes part of the physical structure, but let's ignore that for the moment.

The software, the neuron connections, can be altered, thus changing our thought patterns and even our memory to some extent. So how do we go down into the software and make the changes we want to make? It's not software in the regular sense, and even if we could observe the individual connections it would not make much sense to us. So the way we usually do this is through therapy, where we in a rough way are able to alter thought patterns and perspective, and through that influence the software of the brain. But this method is not very precise, because it is very difficult for a therapist to obtain the overview of all relative thought patterns that is needed to for instance treat traumas with surgical precision. For that we need a computer.

What we do is employ artificial intelligence to examine thought patterns with the patient, and when the AI finds something unhealthy that needs treatment it manipulates the patient in a way so as to bring balance or reduce traumas. How we do it in practice is that the AI starts asking questions to get a feel for the personality and psyche of the patient. It then use a mixture of visual and audible effects to bring the patient into a trance like state, after which it drills deeper into the mind of the patient to look for imbalances. We then make a decision of what imbalances to treat, and start treating them.

The treatment is conducted with a human therapist as the medium between patient and computer, acting on instructions from the AI in what to say and how to act. The reason for this is that some emotional attachment towards the therapist will always remain in the patients mind after treatment, and so we find it better that the therapist has a real humans face. This will also allow the therapist to better work with any aftermath sessions of the treatment. If you want to you are welcome to try it out as a patient.”

“Hmm, ok, yes, that could be interesting,” said Leo. “But also a bit frightening. I'll have to trust in your system and that you know what you are doing.”

“Definitely yes. I can say that the system has been tested on many patients, and after refinement it has shown to work extraordinarily good, with no cases of mistreatment. And we are here to check on things should anything start to go wrong. Your brain patterns and your pulse and other vitals will be measured by the computer as part of the analysis for treatment, and we can follow that on screen too, so you are in safe hands.”

“Yeah ok, let me try it,” Leo said.

Fay put a net of electrodes over Leo's head and then a mask that covered his eyes and ears, and then put on a wide bracelet over his wrist for measuring pulse and other vitals. Leo then heard Fay's voice in his ears:

“Are you hearing me Leo?”

“Yes, I hear you clearly,” Leo said.

“Good. I will be your therapist for this session,” Fay said. “The AI will communicate with you using my voice so I will tell you if I step in and take over. Now switching on the AI program.”

“Please let me know your name.”

“Leo.”

“Pleased to meet you Leo. I will ask you a range of questions and all you need to do is answer as honestly as you can to the best of your ability. Ready?”

“Ready.”

“What kind of music do you like?”

“I like most kind, but especially soft pop and classical.”

Some soft pop music started playing in the background.

“Is this to you liking?”

“It is very nice, yes.”

“Do you like to cook?”

“Only on special occasions.”

“What is your occupation.”

“I’m a journalist.”

“If you were to point out a colour that has positive associations for you and one that has negative associations for you what would they be?”

“Black is positive, pink is negative.”

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The questions went on for a while. Then:

“I will now put you in a trance state. Imagine a still pond.” Leo heard birds singing and the sound of a weak breeze.

“Near you a small stream running over stone and down into the pond.” He started hearing the soft gurgling of water.

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After a while Leo started losing the sense of space and time and went into a peaceful trance.

Chapter 23: The Evil that Mankind do

“Is there a bad experience you want to tell me about? In school perhaps? Or somewhere else?”

“In school yes.”

“Imagine that day in school. Where are you?”

“I am in the classroom. I’m getting a text message from Liza.”

“How old are you?”

“I am 9 years old.”

“Tell me about Liza.”

“She was the prettiest girl in class. I had a big crush on her, but I was too shy to do anything about it.”

“What does the text say?”

“It says: ‘Hi Leo, I think you are really cute. Can you meet me in the gym hall in 5 minutes?’”

“Did you answer?”

“I did.”

“Are you going to the gym hall?”

“I am.”

“Ok, you arrive in the gym hall. What happens then?”

“Liza is there. She is wearing a pink t-shirt. She tells me to come and see what she had to show me.”

“What then?”

“I go to her, and I’m sweating and blushing. Then she says that she wants to show me her titties, and asks me if I want to see them. I am not that interested in titties in that age, and hers were very

small, but it was Liza's titties, and she wanted to show them to me, so of course I wanted to see them."

"And you told her?"

"Yes."

"What happened then?"

"I heard the giggling then, and two boys from the class came forward from their hiding place." Leo felt the tears coming. "She only wanted to make fun of me." Leo grew silent.

"Leo this is Fay. I'm taking over now. I want you to go out of the gym hall, and you will meet me there. It is night time, and there is only a bit of light from a few street lamps. Do you see me?"

"Yes, I do."

"Let's sit here in the soft grass. Now look up, do you see the stars?"

"I do."

"What are you thinking?"

"I am thinking about all the evil that people do. War, the killing and the hurting, how the world could be such a nice place, but it isn't. Because of the evil that mankind do."

"But surely not all people are evil? Think of all the projects in the Earth Day camp, and the people wanting to fix things."

"Yes, you are right. Maybe there's actually hope for mankind yet. Right now it just seem so dark though."

"Then let's sit here and talk and look at the stars for a while then."

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After a while:

"Ok Leo, it is time to get out of the trance. Are you ready?"

"I am."

"I want you to slowly wake up. I want you remember that you are not sitting in the grass at night. It is daytime, and you are sitting in a chair. In an atrium. You remember that your name is not Leo, but Dr. Samuri Stelmane."

Chapter 24: The Answer

Stelmane opened his eyes and looked out at the audience in the atrium. Djinni was sitting in front of him.

"What happened?" Stelmane asked.

"You seemed to drift off for a bit Dr. Stelmane," Djinni said. "Seven days has passed since the first interview where I promised you an answer to your question in 7 days. And here we are, and I am ready to answer your question."

"I sense that there is a god theme in all this," Stelmane said.

"There is, but I'm not the god here. Humankind has achieved great things, and assumed great power. Maybe it is time you took on the responsibility too. And before I answer your question I want to know if I can ask you a counter question."

"Yes, sure Djinni," Stelmane asked weakly. He was still a bit tired.

"You asked me if I could fix the problems that humankind is facing, and the answer is: Yes, I could. I could fix them just like that." Djinni snapped his fingers and Stelmane became fully awake.

"Now, my question to you is: Would you really want me to?"

"You don't have to answer right now. You can tell me later if you want."

"So you will be around?" Stelmane asked.

"I'm always around, Dr. Stelmane. I'm always around."

*Behold the future
Thy name is perfection
But in the crystal ball
You see a reflection*

*And what's in a name?
When the steel would taste as sweet
Were it by any other man forged
And as dreams are carved
And morning comes
And the world is getting older
You see beauty in the eye of the beholder*