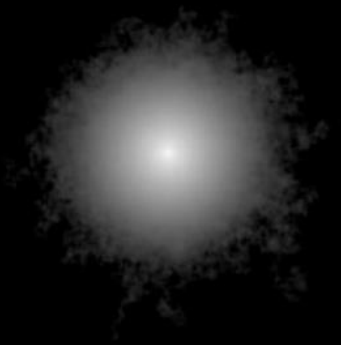

The myth of light

The myth of light

Preamble

On the first day of this story, the wizard Merlin summoned all the people of the world to a great valley. He summoned all the animals of the forest and the wild beasts. Birds and reptiles were to come. Even the fish of the sea were to attend. Not even the smallest insect was to be absent. So, Merlin sat down on a large stone bench in the valley and remained still and silent, waiting patiently for everyone to arrive. The news spread as if it were light, and by the evening of the second day, it had reached every soul that existed. The first one arrived on the eightieth page.

I. Archimedes

MERLIN'S MESSAGE

Among those summoned were two wizards named Archimedes and Democritus. Both were great wizards and, at that time, wise men were called "wizards" by everyone and, of all the wizards, the wisest was Merlin.

Democritus and Archimedes knew Merlin well, but the one who was most devoted to him was undoubtedly Archimedes. Democritus did not doubt that Merlin was the wisest of all wizards and he admired him and his work, but there was one thing about Merlin that drove Democritus completely mad. And that was his way of talking. When Merlin spoke, he always sounded as if he were formulating a riddle. No one ever understood him the first time. You had to try very hard to understand. But always, after careful thought, anyone could understand what Merlin had meant and always discovered a great truth in it.

*- Why don't you just tell us things and that's it! -*Democritus always said. Archimedes, on the other hand, loved to discover the hidden meaning in Merlin's words. It simply

amused him, and he was eager to hear what he had to say this time.

- If Merlin has summoned all the living beings in the world, it must be something important," said Archimedes. *- Sure -* answered Democritus. *- Maybe he'll do three tongue twisters and two riddles, and we'll finally understand why squaring the circle is impossible,"* he joked. That joke caused Archimedes to smirk, but suddenly he put on a serious face and said*, "Or maybe he'll explain to us how to get it! -* and Democritus replied*, "That's not even God! Ha, ha, ha, ha -* and they both laughed.

When the two friends chatted, it always seemed like they were joking or talking about silly things, but if you paid attention to what they were saying you realized that they were talking about mathematics or philosophical ideas, or other important topics. Even talking about death seemed like they were chatting about a fun topic where jokes and laughter could fit in perfectly. They used to philosophize together until late at night, drinking wine and laughing while thinking together how to calculate the volume of a cone, or why matter exists. What is being? What is essence? What is nothingness? What is eternity? Are we Soul? Are we Matter? Are we just the fruit of chance?

But the personalities of Democritus and Archimedes were, in reality, very different. Democritus was a

scholar. He had written encyclopedic volumes that brought together all the knowledge of his time. He always maintained in his works an exquisite order and his calligraphy was famous for being one of the most beautiful of all wizards. During his studies, Democritus had always been the favorite of his teachers, it was a pleasure to read his works, and he always obtained extraordinary grades. Archimedes, on the other hand, was much more careless. When he had an idea he would write it down on the first piece of paper he saw and later, when he wanted to find it, he almost always decided to go back to the beginning of the deduction because he was too lazy to search through the mountain of papers with ideas that piled up without any order on his desk.

Archimedes pretended to philosophize in a comical tone with everyone, but that made people not take him seriously. Democritus, on the other hand, was much more serious and disciplined when he was in the presence of other wizards. He managed, with firm and confident language, to persuade others when he was right on some issue. Archimedes could not convince anyone with words. He tried to find the best way to explain things and for this he always looked for exaggerated examples that showed the idea he wanted to express in the clearest way. But his words had no restraint whatsoever. He was so incredibly exaggerated that in one measly sentence in

which he said absolutely nothing he was perfectly capable of exaggerating an impressive seven times. He was so exaggerated that he had to invent new numbers in order to express the gigantic figure he had obtained by trying to calculate the number of grains of sand that fit in the universe.

The Infinite Force

One day, Archimedes had to move a large tree that had been blown down by a storm. So, he put a rock near the tree and leaned a wooden bar on the stone and tried to push it out of the way. But he could not. The tree was too heavy. Then he reached for another, longer bar and this time he managed to pull the heavy tree out of the way. Using a lever to move heavy things was something Archimedes had seen done since he was a little boy. He hadn't discovered anything new. In fact, he had done it all almost without thinking.

When he had moved the tree out of the way, he thought, *"It's a good thing I was able to move the tree out of the way with this bar, because I didn't have a longer one. If the tree had been twice as heavy, I would have needed a lever twice as long, and who knows where I would have found it?*

Because of his exaggerated way of being, he suddenly began to think - *what if the tree weighed three times as much, he would need a lever three times as long... - what if the tree weighed 10 times as much? A lever 10 times as long, of course?*

What if it were 100 times as much? What if it were 1000 times as much? - and then he *shouted*

- Eureka, no matter how heavy the tree was! If I could find a lever long enough, I could lift it! Could I lift a house with my strength? And a mountain? There is no limit to what my strength could move! I could move the whole world with the strength of my arms! Ha ha ha ha! I would only need a fulcrum for the huge lever that would be necessary! -

Then he went to his friends, among them Democritus, and said - *Give me a foothold and I will move the world! -* and all his friends began to laugh loudly. *- Archimedes! good friend! -* said Democritus *- How much wine have you drunk today? - Nothing yet! -* said Archimedes as a mischievous smile escaped him. Actually, Archimedes loved to invent such phrases and enjoyed making his friends laugh with them. As a fervent admirer of Merlin, he liked to give that mystery, to make it so that at first no one understood him. But his amusing character made it inevitable that his riddles, unlike Merlin's, would seem like jokes and no one would take them seriously.

Then Archimedes said to his friends. *- Now seriously friends. There is no limit to what we can move with the strength of our arms -* and they all laughed again *- I mean it! -* said Archimedes, now almost angry. But no one believed him. His friends saw in his face that Archimedes was not joking, but the sentence he had said in earnest

seemed as much or more of a laugh than the one he had said in jest. However, Archimedes knew that his friends were very intelligent, and he was convinced that when he slowly explained his deduction to them, they would understand it and agree with him. But they did not. He spent hours trying to convince them, and little by little his friends went home.

It was already three o'clock in the morning and the only one left drinking wine with Archimedes was Democritus, and to each argument that Archimedes used, Democritus dismantled it with a demolishing argument. *- You cannot multiply effort! -* said Democritus. *- And then how do you explain that I alone could lift that heavy tree, which not even three men would have been able to move? -*They were already repeating themselves: the same arguments and the same refutations, over and over again, over and over again. Archimedes thought he was boring Democritus and felt embarrassed and frustrated. He himself, in fact, was already bored and exhausted. He could not believe that he had not been able to convince anyone of something that was so obvious to him. He remained thoughtful, as if absent, and then Democritus said: *"Well Archimedes, my friend... it has been a pleasure..., but I'm going to sleep now, it's very late...". - Of course, my friend, take a rest -* answered Archimedes.

When Democritus had already left, an enormous feeling of helplessness came over him. He knew he had discovered something of the utmost importance, and he needed the others to believe him, but he had exhausted all his arguments, in fact, he had repeated them until exhaustion on that wine night and had failed to convince anyone. He was sure that the demonstration could no longer be improved, it was too simple, too obvious, but it seemed so magical that the others insisted on not believing it. He could find no other explanation. *- They would have to see it to believe it. I will move something that everyone thinks is impossible, something huge,* a mountain! Caaalma, Archimedes...- he said to himself with a mocking smile on his face. *- I could not. I would never find a lever so big and strong... and even if I did... it would be tremendously heavy... How could I move it? I would need a smaller lever to move the big one! ha, ha, ha! And if this one was still too big I would need an even smaller one to move the medium one and with it move the big one. Ha, ha, ha! What nonsense I have! -.* He loved logical games, and he himself was constantly getting into all sorts of absurdities. Exhausted and completely drunk, he finally went to sleep. And in his dreams, he found a small lever, with which he moved a big one, and with that one another bigger one and so on and so on, and in the end, he managed to move the whole

world and all the people believed his theory of the infinite force... He woke up and thought... - *I have to stop drinking so much wine.*

A long time passed and Archimedes had given up, He no longer told his theory of infinite force to anyone out of embarrassment. He had not stopped believing in it for a moment, but he felt ashamed when he saw how absurd it seemed to everyone else. He had already given it up as impossible to move a mountain or anything like it because the lever would be absurdly long and heavy. So he put all his efforts into getting a mathematical, rigorous demonstration of what he saw as self-evident. He then studied the law of the lever as no one had ever done before. He made hundreds of experiments and had come to understand it in a very profound way. But Archimedes was a mess, and his ideas flew out on scraps of paper every time he opened the window of the room where he studied. He needed to put his calculations in order, clean, as Democritus would do. He thought he was only missing a few minor demonstrations and he was excited, he believed he would soon prove his theory.

But one of those days, Archimedes took a trip to the north with his group of lifelong friends. They were all staying in a house with a large estate full of apple trees from which delicious cider was made. There was even a river within the grounds! Archimedes was excited. He

knew he was going to have a great time those days with those lands all to themselves. Following the course of the river he discovered that, amazingly, the river ran underneath the house! He had never seen anything like it before. He got closer and saw that, in reality, there was only a sort of hut over the river, but the hut was so integrated into the house that it was practically part of it. - *It's a mill!* - said one of Archimedes' best friends, the one who had managed to find that fantasy lodging.

Everyone was eating, drinking and laughing as they always used to do. Archimedes had never seen a mill like that and, at one point, amidst the chatter and laughter of everyone, he got up without anyone noticing and went alone to the hut. He entered with his glass of wine in his hand and the image seemed magical to him. He saw that the old mill had three equal wheels, although only one of them was turning. The three wheels were horizontal, as if they were three round tables. In each of their centers was threaded, as an axle, a long iron bar that went down under the hut to the river through a hole in the ground. At the end, the axles had blades submerged in the river, in such a way that the current moved the blades, these made the axle turn and this, therefore, made the wheel turn, which was above, inside the hut.

- *Right...* - thought Archimedes when he saw that the wheels that did not turn had broken blades. He thought

that nobody used that old mill anymore and nobody had bothered to fix them. After understanding the mechanism, he stared at the wheels and came up with an idea, probably the result of the amount of wine he had drunk. *- Using a rope... -* he thought *- he could make a big loop and thus engage one wheel with another in such a way that the one that spun would make the other one turn. And with another loop I could do the same with the third one. And so with only one wheel I could move the other two! It's just like the lever! -* he thought. *- It's the theory of infinite force, heh, heh, so I can multiply the force as much as I want! But... Why fix the broken blades then? No need to fix them! I could have 1000 wheels and only one blade! Ha ha ha ha! I'm a genius!!!! -*

But suddenly, despite not being in a good moment for reflection, he realized that what he was saying had to be nonsense.... *- I can't multiply the force just by meshing one wheel with the other.... Or can I? No. It can't be. But... isn't that what the lever does in my theory of infinite force? The blades must be fixed if you want to get triple the effort of the river. That much is clear. But, if I engage all three wheels, all three will start moving, that's also obvious! -.* Archimedes was confused, and could not find the mistake. *- Am I making the same mistake without realizing it in my theory of infinite force? -.* That spoiled his party. He could not stop thinking about the wheels of the mill, he needed to understand where he was going wrong and, above all, to know if this completely invalidated his theory.

And then he thought... *- The effort coming from the river is going to be the same, even if you hook one wheel to another. The effort will always be, the effort that the first wheel is collecting from the river. And it will stay that way no matter how many loops and counter-loops I make up here. The only thing I do with my loops is to distribute the effort of the river among the three wheels. If I want more effort, I'll have to move the wheel with my own arms. -* He suddenly smiled *- Or fixing the blades would also be a very good idea! Ha, ha, ha*.

Then he understood perfectly well that it was impossible to get effort out of nothing and that the effort he could get from the three wheels in gear had to be necessarily the same as the effort he would get from a single one when they were not, and that was precisely the effort that the blades of the river were picking up. But... did that invalidate his theory of infinite force or not? It was exactly the phrase that Democritus had repeated ad nauseam that night. *- Effort cannot be multiplied! -. - It can't be! Have I been wrong all this time? - It can't be! -* he shouted desperately (out of clear thought, otherwise everyone would think he was crazy, ha ha ha).

How was it possible to multiply the force as the lever did, if it was evident that the effort of the river was what it was and could not be multiplied no matter how many loops you made? He felt an enormous uneasiness. He was not able to understand anything.

- I've had too much to drink," he thought*, "I'm going to sleep, and if I do, I'll think about it tomorrow.... And what if I forget? Well, all the better! Ha, ha, ha -* he thought jokingly. And he fell asleep in the time it took him to close his eyes.

The next morning he had not forgotten that idea at all, besides, he got up and the first thing he saw was that damned mill. He leaned on a railing at the edge of the river, in the courtyard of the house, next to the hut, and stood thoughtfully, watching the flow of water. Suddenly something occurred to him... it was little, but it was something.... *- Am I confusing strength and effort? But... Are they different things? I had always thought that they were the same thing... Are they the same thing and I am inadvertently making this up to desperately defend the theory of infinite force... or does this really make sense to me?*

Archimedes was really in a mess. He remained in thought for a long time. And suddenly it seemed clear to him: *In the lever the effort is also the same all the time! And it does not in any way invalidate the theory of infinite force! On the contrary, now, I think it can be understood much better, don't you? Let's see..., Supposing I exert myself to the maximum, by using a longer lever I can lift more weight, that is, make more force, with the same effort! Of course they are different things! The effort is the same regardless of the length of the lever of course, it is always "all my effort", all that I am able to do! -*

He pondered on it for a few moments and suddenly thought.... *- In fact... Of course, the most effort I can make is my weight! I'll never be able to do more than my own weight.... If I tried to do it, I would lift myself off the ground, instead of lifting the tree. Or would I? No..., of course I can.... I lifted a tree that weighed much more than me. I'm confusing strength and effort again! Damn it! At least this time I realized it in time. Ha, ha, ha, ha.*

Then he locked himself in his room and kept working on it. He was so engrossed in his work that he didn't seem to hear when people talked to him. He was eating at the table with other people and his gaze seemed lost. He kept meditating day and night on the mill wheels and the lever and the theory of infinite force. But his pages were still full of erasures and he couldn't come up with a text he could teach anyone.

- It is not the time to leave my mind to its own free will, it is time to tame it, as one does with a wild colt that, although the beauty of seeing it in freedom cannot be matched, it is impossible for it to take you anywhere. At the most, if you hold on to her, she can give you a very amusing ride in which you will get to know all the surroundings at a glance. Ha, ha, ha, ha! That's the ride I've been taking all my life! Ha, ha, ha, ha. And actually, that's the most fun way to walk, it's like a random walk, like a drunkard's walk! Ha, ha, ha, ha, ha, ha, ha -. Archimedes was lying on his bed with a blank stare, but inside he

was laughing his head off. Sometimes the metaphors got out of hand.

Then he tried to do what he had set out to do. *- I will start from the beginning, slowly and with good handwriting. As Democritus would do -* he said to himself. He felt an enormous urge to keep on putting wheels, ropes and levers all over the place, but he restrained his impulses as best he could. *- What else can I do with only two wheels, and, besides, two wheels the same? Nothing at all!* And, suddenly, he shouted *Eureka!!!!! Sure enough, now I've got it!!!! -* He jumped for joy with excitement. *- What if one wheel was bigger than the other? Ha, ha, ha, ha- Eureka, eureka! Now I've got it. The big wheel is like a big lever, and the little wheel is like a little lever!* Archimedes hadn't even tamed the colt for 5 minutes and he was already jumping and leaping, and of course, his mind, was free again, again. At last! Phew... what a bad time he had had. Ha ha ha ha.

This new idea had to be the final one. He went as quickly as he could to his room, took some papers and began to draw mill wheels, some bigger and some smaller. He joined the big one with the small one and this one with another one. But he still didn't quite understand the difference between force and effort. He tried to tame the colt, but he could not. He knew he was not doing what he had to do. He was again, as usual, thinking too fast, too crazy. This way he would never prove his theory. He

couldn't believe he still didn't have it. - *But it was already done* - he thought.

He had been at it for too long and was getting desperate. - *I'm exhausted* - he thought - *I really can't do it anymore* -. Exhaustion, but above all disappointment, plunged Archimedes into a deep sadness.

Months went by and although, deep down inside, he still believed in the infinite force with all his soul, he had stopped believing in it himself. He thought he would never demonstrate it, he did not take any more papers nor put any real effort into it, and, above all, he stopped talking about it with people, and if he ever dared to comment on it he did so with fear and embarrassment, always avoiding saying those exaggerated phrases, trying by all means not to seem crazy, but then he explained it badly and even less understood.

A few months later he was talking to his brother. The two brothers often talked about mathematics. And that day Archimedes plucked up courage and told him his theory of infinite force. - *Of course your theory is correct!* - said his brother. - *It is obvious!* - It was the first time that someone had proved him right, and how! Archimedes knew that his brother was not just saying that to make him feel good. He saw clearly that he understood him and he saw, as clearly as he did, that this theory was correct. - *Prove it - he* said. - *I have tried my best, brother, but I*

can't. I don't have the mathematical knowledge to do it. I don't have the mathematical knowledge that is needed, nor the discipline necessary to achieve it. - .

- How could you prove this with mathematics? - he asked *- if it is something that is obvious! Whoever you have not convinced with what you have just told me will not be convinced with any other argument, since the problem is that they don't want to believe it. Your effort is in vain. Move something gigantic! he said, and then everyone will believe it, even if they don't want to believe it. - I have tried,"* answered Archimedes, *"but it is impossible to find a lever that big*.

- And there is no other way than using such a big lever? - said his brother. *- No, there isn't, how am I going to use the law of leverage without a lever, but then he remembered, "The big wheel is like a big lever and the small wheel is like a small lever" And suddenly it became clear, Eureka, of course I can use a lever without having a lever, thank you brother, this time I've got it, no doubt!!! I may not have a robust mathematical theory of effort, but I know how to prove to everyone the theory of infinite force. -*

Archimedes called all his friends, wizards and non-wizards. He announced like a town crier through the streets that there was going to be a formidable spectacle on the beach and that no one should miss it. When the people arrived at the beach, there was a large ship stranded on the sand. Archimedes had attached the ship to a long

rope, which then passed through a complex system of pulleys. They were like mill wheels! Big ones with small ones, connected by loops. And there was Archimedes holding the other end of the rope. When he saw that people had arrived, he began to speak to that audience. Archimedes loved the theater and, in fact, was quite theatrical. He seemed to be presenting a circus show rather than a scientific demonstration.

- Ladies and Gentlemen! What you are about to see may seem like magic, but it is not. I will move this boat until it is disentangled from the sand, just with the strength of my arms and, so that no one believes that there may be a trap, I ask this distinguished audience for 10 people to get on the boat. -

People scoffed at Archimedes, no one still considered him a wizard, and it had never occurred to anyone that Archimedes was really going to move that ship. When the 10 people had boarded, Archimedes set out to move it. The people were not paying attention, as if they were entering the theater before the performance began. *- They don't realize what I'm about to do -* he thought. Then Archimedes pulled on that rope with all his might and a great noise came from the ship, like wood creaking. It seemed as if the ship had woken up when Archimedes pulled on the rope.

- He's moved it! - shouted someone from the audience, *- but it's still in the same place! -* replied another. The people

were not sure whether Archimedes had moved the boat or not, but that noise attracted everyone's attention. Then Archimedes continued to pull on the rope. He pulled and pulled and all those millstones went round and round, but no one saw the ship move. Archimedes had been 10 minutes pulling on that rope without stopping and the people began to get bored and some of them left. *- Wait! -* said Archimedes *- The ship is moving, but so slowly that it's hard to see it! -* He let go of the rope and ran to the shore where the ship was resting. He approached and showed everyone the furrow the boat had left in the sand, thus demonstrating that it had already advanced by 10 centimeters. The people looked at that furrow and some believed it, but others did not. Then Archimedes said, *-When the ship has come unstuck and is floating in the sea you will all see that I am indeed moving it! -*

Archimedes then began to pull that rope as fast as he could. But the minutes passed and the ship was moving too slowly. People were bored and many of them had already gone home. He began to feel ashamed. *- My goodness, what a tremendous effort it is costing me to move this damned boat, with the slack in the rope! I've been pulling for half an hour now and it has barely moved a few centimeters! - If in 10 minutes pulling on the rope the boat had already advanced by 10 centimeters, and it is still separated from the water a few 40 centimeters from the water... I still have 40*

minutes pulling on this damned rope! How awful! - he thought.

He was feeling completely ridiculous pulling and pulling on the rope, sweating and exhausted. He still had half an hour to go before the ship was afloat, and on top of that, with his tiredness and absent-mindedness, he was pulling more and more slowly on that damn rope. And at that moment, in the midst of all those people, Archimedes finally saw it.

- Eureka!!! - It was only an instant, but he had seen it. He had seen the solution on the back of his wild colt, but this time he had a noose around his neck and he wasn't going to let it go. *- Every time I pull on this damn rope it's a strain for me. If I pull on it 2 times, it will be twice the effort of course, and if I pull it 3 times, three times as much.*

Each time I pull, the boat moves a little, if I double the effort, i.e. pull the rope twice, the boat will move two littles. And if I pull 1000 times, 1000 littles bit and the boat will finally reach the water! -.

He seemed to have it, but the idea struggled with all his strength. For a moment he thought it was going to slip away.

- If I hadn't gone three times overboard with the pulleys, this rope I'm pulling would be much tighter. And I would have to pull it with all my strength, twice as hard. So it would also be

twice as much effort, of course... wouldn't it? - The rope had slipped! The idea ran away, though I could still see it. She pulled so hard that the idea stumbled and was able to pick up rope.

- No! Because the boat would move forward two littles each time I pulled on the rope and I would only have to pull on it 500 *times.* 500 *times, but with twice the effort each time.*

If I pulled 1000 *times, now I could move two ships. Yes!* ...the idea was surrendering... - *and it would be the same as pulling one first and then the other.* 500 *times he would pull for each one.* - The idea no longer held and Archimedes became confident, the horse felt free, and suddenly pulled. - *Nooo! The effort to move the ship is always the same! Even if I pull* 1000 *times or pull* 500*! The effort that goes there is the same as the effort I do here.*

He couldn't believe it! The colt had already calmed down and the idea had not escaped. It was right there, at the other end of the rope, still attached by the neck and unable to escape. There, in the middle of all the people, he had just finished proving his theory of infinite force. Then he got down from his horse and approached the idea. - *But what do I see, it's an idea with three heads!* - He had never seen such an idea before. But he approached and looked at the idea in all six eyes.

Double the strength, double the effort.

Double the distance, double the effort.
Twice as many boats, twice as much effort.

And he finally got the first clean piece of paper he had ever gotten in his life.

Effort = Force × Distance

At last, the boat began to float. Archimedes had managed to uncouple it, but he was so absorbed in his thoughts that he hadn't even noticed and kept pulling the rope, and, now yes, as fast as possible. But then the people shuddered with excitement.

- He moved it! - was heard from the audience. *- Yes, he moved it! It's incredible! -* Archimedes saw that all the people were applauding and saw enormous excitement on their faces. Among the audience was his friend Democritus, who was laughing and clapping as excitedly as the others. This made Archimedes tremendously proud. *- Archimedes, the strongest man in the world! -* was heard.

- No! - said Archimedes *-You have not understood anything! I am not stronger than any of you! Anyone could have moved that ship! It is not because of my strength! It is because of the theory of infinite force! -* He shouted like a madman. But it was too late, he had already created the myth and there would be no way to stop it.

Myth and mathematics

The news spread like wildfire and in two afternoons had already reached the entire peninsula. *- The giant Archimedes! -they* said. The children dreamed of being like him, but in reality only a few, among them Democritus, had understood the theory of infinite force. *- How curious! -* thought Archimedes. *- Now everyone believes me and no one understands me, and before everyone understood me and no one believed me. Ha, ha, ha, ha.*

He received offers from all over the world to demonstrate his feat. And he did it a few times. But he had to stop doing that. Showmanship was not his thing, and his hands were already full of calluses from so much rope. He improved his pulley system a lot and the boat was already running like hell when he pulled. But he gave it all up, people believed his theory, but no one understood it. So, he decided to finish "mathematics" and it only took him two afternoons to put his ideas in order.

His work occupied only three pages. In the first, he explained his theory of infinite force. In the second, he

demonstrated it thanks to the law of effort. And, in addition, he added a third page with the design of the " block and tackle", in which he simplified that complex system of pulleys into an invention so simple and so perfect that, like the hammer or the knife, no matter how many thousands of years passed, it would never disappear. Archimedes was happy. There were only three pages, but he knew that they had nothing to envy to the encyclopedic volumes of Democritus. He could not stop thinking about the enormous amount of effort he had spared mankind, for from that day on it would no longer be necessary to carry great weights, and so it was. His invention, the block and tackle, was soon to be seen in every cargo port, in every building, and it would remain so for thousands of years. At last he was a wizard! Even if he was absent-minded, and a mess with his papers, even if he liked to drink wine and have fun with his friends. He was a wizard, and no one would ever doubt it again.

THE NUMBER Π

Archimedes was truly satisfied. And so he spent a season giving free rein to the mad colt of his thoughts. It was a time when he thought too many absurd things. Perhaps the most absurd of them was when he invented the number pi.

Archimedes was thinking about the limits of imagination. - *Imagination has no limits* - he thought. - *It is not like reality. Anything can happen in it. Well... not everything... The limit is in mathematics. You can't think of an absurdity* - he thought. - *For example... mmm ...* - and tried to think of the first absurdity that came to his mind.

- *Can I think of an odd number that is divisible by two? Ha ha ha ha! How absurd! I'll call it, "the absurd number" Ha, ha, ha, ha. No, well... poor guy... I don't want to insult him. I'll call him the "odd-even" or "perfect irrational". Ha, ha, ha, ha, or better! I'll call him simply, "pi". What incredible nonsense I can come up with* - he was laughing all by himself.

But Archimedes felt a very strange sensation. Actually, it wasn't taking him that much effort to imagine that

number. He was afraid to continue riding that wild colt. He thought that it could, perfectly well, lead him to a cliff at any moment. But curiosity got the better of him, he had to keep thinking about the number pi.

-Yes, I can imagine the number π, can't I? - He then recalled the well-known number $i$which, when squared, yielded the number -1 . *- The number i is as absurd or more absurd than the number π! Well, there it is. The number π exists and that's it. Poor, it has the same right to exist as the number "i" Ha, ha, ha*.

That would have seemed silly to anyone, but Archimedes was too attracted to the absurd. *- It's absurd, of course it is, but... Is it nonsense or not? -Then* he remembered a talk he had had with his friend, the wizard Pythagoras. Pythagoras had demonstrated in a wonderfully simple way that the diagonal of a square of side 1 must of necessity measure the square root of 2. And that had amazed Archimedes. Pythagoras lived in the mountains, in a kind of monastery with all his friends, cut off from the world, always thinking about mathematics. They were kind of strange people. They were very fond of a branch of mathematics called "Number Theory" and some of them had spent their lives doing such absurd things as studying the divisors of number

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Archimedes loved number theory, but those guys were too weird for his taste, and he didn't really get along with them. In fact, he was quite afraid of them. As he would soon learn, they had thrown a guy into the sea just for saying that the square root of two was irrational because they thought he was saying that you can't reason it, but he meant you can't ration it.

However, Pythagoras was a great friend of his. And always, at least once a year, Archimedes made a trip to the mountain to visit him.

On one of those trips, Pythagoras said to Archimedes. - *Friend, do you want me to tell you a secret?* - *Yes, of course!* - replied Archimedes. - *But you have to promise not to tell anyone* - *Sure, I promise* - he replied. Pythagoras looked around to make sure no one was listening, walked up to Archimedes and whispered in his ear. - *The square root of 2 does not exist.* - *What?!!!!* - said Archimedes. - *Shhh* - said Pythagoras - *Don't shout* - And Archimedes said whispering too.... -*What do you mean it doesn't exist? You yourself have shown that this is precisely the length of the diagonal of the square!* - *I know... but it doesn't exist. Shhh..."* Pythagoras continued whispering. -. - *I don't understand you, my dear friend.*

Then Pythagoras took out a piece of paper and in barely a minute showed Archimedes that, for the square root of 2 to exist, it was necessary that there also existed an odd

number whose square was even. And, therefore, evidently, the square root of two could not exist.

But... Wasn't that precisely the number pi? *- Wait no...! -* thought Archimedes. *- Pythagoras said: "whose square". But then, I can better define the number π, as "that odd number whose square (like the number i) is even". I am going too far in absurdity.*

Archimedes didn't feel like thinking about the number π anymore, but he was sure that Pythagoras would like to hear that story. Perhaps, after all, the square root of π did exist, even if it was absurd! He thought also that for Pythagoras' friends it might be very convenient in their demonstrations to have at hand a number that was both even and odd. At that moment he really doubted whether this was nonsense or not. But it was really strange to him that he had never heard of the number π. *- I'm going to sleep -* He said to himself *- I've had enough nonsense for today - I'm going to go to sleep.*

The number θ

It was a very crazy time. He stopped thinking so much about physics and started thinking a lot about curves and volumes. All the kids his age thought a lot about curves and volumes. But he especially liked them. Round shapes were definitely the ones he liked the most. He had drawings of curves and volumes in his room that, for some absurd reason, he hid so that no one would find them. His favorite was one that he had drawn himself and consisted of a sphere inscribed in a cylinder. For him it was the most beautiful image that could exist, but his friends only liked other types of curves and volumes and did not understand why Archimedes liked that figure so much.

To understand that figure well, it was also necessary to understand a number very well. The number that would later be called "Archimedes' constant". Whoever understood that number well knew the length of the circumference and, thanks also to Archimedes, the surface of the circle. If he also knew that both the volume and the surface of the cylinder were 3/2 of those of the sphere inscribed in it, something that Archimedes had also

demonstrated, he could find in it an enormous beauty, because, with that knowledge, at a glance, he could calculate the surface and the volume of the sphere, and in doing so it was evident that these also contained that fantastic number.

Archimedes then calculated with exquisite precision that number, for it was evident that it was that number which governed the world of round things, and, as we have already said, Archimedes had a special weakness for those forms. Everyone already knew that constant, for it was the ratio between the length of the circumference and its diameter. He did not discover it, but he studied it as no one had ever done before. And managing to calculate the area of the circle, the area and the volume of the sphere was the proudest achievement of his life. So much so that he asked for that figure to be placed on his tomb when he died.

He wanted to know all the curves and volumes, and he began to calculate as many as he could. For his love of round shapes he wanted to be able to calculate any volume of revolution, that is, the kind that a potter makes with his potter's wheel and clay. To do this he invented a method that consisted of adding infinitely many infinitely thin discs, which, strange as it may seem, was completely correct. But nobody understood this method well and nobody used it again for thousands of years.

Until someone finally invented it again, called it "integral calculus" and realized how incredibly important it was.

- How important this number is! - he said to himself. *- How can it be that it doesn't even have a name? -* And he wanted to give it a name, just like the number π. *- Which Greek letter would be the best for the number of round shapes... It must be a round letter, of course! How absurd it would be otherwise... I've got it!!! The letter θ!!! - Besides the name it looks like a "tit", Ha, ha, ha. It is very clear that this is the most appropriate letter for the number of round shapes! -* And that's what he decided to call it. Although later he was embarrassed, and since he was also embarrassed to talk about the number π, because of how absurd it was, in the end everyone made a mess, and everyone ended up calling the number θ π. And the π number was forgotten forever and he would never know if it was something important or just nonsense.

The bathtub

Archimedes liked to take long, almost endless baths, which made those around him despair. It was a place where he loved to meditate. He not only thought about curves and volumes when he was in that bathtub, he thought about philosophical, scientific and all kinds of questions. He had great ideas in that bathtub. Once, there, he discovered a very simple thing almost unintentionally.

Archimedes was about to take a bath. He put the plug in the bathtub, turned on the faucet and, while the bathtub was filling, he took the opportunity to devote himself to "other things". He was sitting there by the water, reading his magazine too quietly, when suddenly he saw that the bathtub was about to overflow. Although he was very close to it, due to a series of circumstances it took him too long to reach that damned faucet.

- Wow, man! - he thought. *- Well... it came out very little... no need to go get the mop.... -* Without thinking, he reached into the bathtub to remove the plug, as he needed to evacuate some of the water before he got in. But then, as the

bathtub was overflowing, by a very simple principle, the water ended up overflowing and soaked the floor. *- Damn it, what a fool I am! I'll have to get the mop after all! -*

Then he mopped the floor and wrung out the mop in the bucket as he had always done. When he looked at the bucket, it seemed to him that there was very little water in it. *- Wow, man, I'm not going to get the mop for that! But... how strange... -* He took a better look at the bucket and saw that the amount of water he had collected was truly ridiculous. *- There's not even half a glass of water here, damn it! It can't be -* he looked at his arm and thought *- my arm must be about 3 or 4 glasses at least, and then there are the 3 or 4 drops from the beginning*.

For a second it seemed to him that the water had magically disappeared. *- Of course -* he realized *- the water hasn't disappeared. For starters, the mop was dry and now it's wet. It's impossible to get all the water out of a mop. And the same goes for the floor and all the other places that have gotten a little wet and, oddly enough, those 4 glasses of water must be distributed among all those places. What nonsense! The volume that has fallen is the volume of my arm plus the three droplets that fell outside, even if it doesn't look like it.*

Since Archimedes was so fond of calculating volumes, he began to think about how to calculate the volume of his arm. He then imagined a long cylinder and put small

cylinders as fingers, and the palm of his hand he imagined as a disk. Since he knew the volume of all those shapes, he could calculate the volume of an arm as their sum. But suddenly he thought, *"What a fool I am, the volume of my arm is simply what is missing in the bathtub.* He took a glass, filled it with water and poured it into the bathtub, filled it again and emptied it again and so he saw that he could fill up to 4 glasses of water before the bathtub overflowed again.

- I could thus calculate the volume of the cone or the sphere! I could thus calculate the volume of anything! No matter how strange its shape may be! I made a mess of calculating volumes, so I just had to take the thing and put it in the bathtub! What a brute I am!

What strange figure could I measure the volume of right now? - And suddenly, that mischievous grin reappeared on his face. *- To hell with it, I brought the mop for a reason! -* And, as some reader may have guessed by now, Archimedes stepped into the bathtub, taking advantage of the fact that it was just overflowing and knowing full well that the dislodged water, besides having to be mopped, exactly matched his volume. And that was how Archimedes learned to measure any volume, no matter how strange it was.

One of the most important insights in physics also came to him one day in the bathtub. He was in the bathtub when he realized that he weighed less in the water than out of it. It was something he had noticed many times, of course, like everyone else, but he had not given it any importance until then, which seemed very strange to him. *- Why did I weigh less inside the water than outside? No one ever told me why such a thing happens. -* He couldn't believe He was the first one to ask that question. *- Maybe it's my fault, I'm so absent-minded... -* he thought. *- When I get out of the bathtub I'll go to investigate, I'm sure I'll find the answer quickly. -*

But Archimedes found it hard to stop thinking about something so interesting to him. *- My weight can't change, it is what it is, how the hell then do I weigh less inside than outside? It can only be that something must be pushing me up! What nonsense! -* he thought *- There is nothing underneath to push me up.... So, when I get into the water, does my weight change? My weight is what it is because my body doesn't change. It can't be by magic! -* It was exactly the kind of problem Archimedes loved to think about, he knew it couldn't be magic, but it sure seemed like it. *- What on earth is pushing me up at this very moment? The water underneath me can't be, because it's heavy and wants to fall, but.... It can't be anything else but the water underneath me! What*

else could it be, if I don't have anything else underneath me? Who else could it be? The water underneath me? - he said mockingly. *- Ha, ha, ha, ha, how absurd! -* It really was a mystery, that one....

- Oh, sure... I get it. Yes, it's the water underneath me that pushes, but it's because of the water above. It wants to go down because it is heavy. The water from above pushes down the water from below, and so, in order not to be crushed against the floor of the bathtub, it pushes me upwards... How curious... and, of course! The force that the water can do cannot be other than its own weight, therefore... The force that pushes me up is the weight of the water above! Very curious... but... Where does it start to be up and where does it start to be down? How much water pushes down?

It seemed that Archimedes had reached an impasse. He stood thinking in the bathtub for a very long time. His fingers already looked like raisins. The water in the bathtub had long since cooled and Archimedes' lips were already purple, like a child who does not want to get out of the pool even though he was shivering. When suddenly he shouted*, "Eureka, I've got it, the displaced water! Ha, ha, ha, ha My dear displaced water! When I get into the bathtub I use part of my weight to lift her up!!! It is only her that I keep up in the bathtub, and therefore she is the only one who wants to fall back in! It is only her who pushes me up as revenge for having taken her place! and for having thrown her out of the*

bathtub the other day! Ha, ha, ha, ha! Eureka! Eureka! - He felt so excited that he jumped out of the bathtub buck naked and started jumping and shouting, even singing and dancing. But, suddenly, he saw that through the window the girls on the third floor were watching him in nude, and they began to laugh loudly. Archimedes looked at himself and saw that this was not the volume he expected. And ashamed, he jumped back into the bathtub.

II. Body and Soul

Effort and work

One day Archimedes was walking along the port when he saw some waiters unloading some big boxes using his invention, "the block and tackle". When they saw him, and knowing who he was, they began to applaud him. - *The wizard Archimedes!* - shouted one. - *Thanks to you my back doesn't hurt anymore!* - said another. Archimedes blushed, but inside he was feeling a great pride. On the way back home, that pride turned into vanity. -*How much effort will I have spared mankind?* - he asked himself. He thought about doing the calculation and thought it must be a huge number, but that didn't stop him, he had already invented some gigantic numbers with which he could express the result he obtained. So he set out to do the calculation.

- *How much effort would it have cost the thousand men needed to move that ship?* - he asked himself. - *A thousand times as much at least! Ha, ha, ha.* - But suddenly he realized something he hadn't thought of.... - *The effort those thousand men would have made would have been the same as the effort I made alone! Since, as it became clear, that is, by uebos, the effort it takes to move a ship!.... It can't be!* - He thought. - *I*

haven't spared mankind even the slightest effort!!!! - Archimedes was devastated. It seemed as if this was a punishment for his vanity. But... everyone thought that his invention had spared everyone a lot of effort and now he was the only one who thought the opposite. He would look crazy if he tried to convince them of that. He didn't know what to do and decided to talk it over with his friend Democritus.

- Of course you have spared mankind an enormous effort, dear friend! -. - But that's not what my theory of effort says - answered Archimedes. *- Then your theory is wrong, and that's that! -* replied Democritus. *- Ha, ha, ha, ha. No, man, don't! -* he calmed him down *- I believe that your theory is correct but that you chose the wrong word "effort", that's all. In fact, I had already thought that the word "effort" was not the right one... -. - And why not? -* Archimedes asked. *- Well, you see, thinking that the effort is the multiplication of the force by the distance, if the distance is zero, the effort will also be zero. - Sure -* said Archimedes. *- Now imagine,"* continued Democritus, *"that you had to wait holding some shopping bags still for hours. As the bags would be still, no distance would be traveled and therefore no effort would be made. - That's true! -* said Archimedes. *- That's certainly a poor choice of word.... So... What other word should be used then? -*

The two friends stood in thought for a few moments. - *Work!* - said Democritus suddenly. - *Think, friend, that a strong and skilled man can do the same work with less effort than a weaker or less skilled man, and you are unwittingly doing the tremendous injustice of making no distinction and treating the two cases alike. You will not have spared mankind from any work, but it can now be done with much less effort. -.*

- *Of course!* - Archimedes loved it, not only because the idea restored his pride, but also because it really seemed to make a lot of sense to him. - *Work will be called from now on! But... What is effort then? How can we define it mathematically? -. - There may not be such a precise definition for that concept* - answered Democritus - *Perhaps it is just one more of many ambiguous words that exist. In fact, thinking about it, the word "work" is not the exact word either. Imagine someone hires you to hold some shopping bags for hours and then doesn't want to pay you because he says you haven't done any work. - Ha ha ha! - .* The friends laughed.

In truth, neither word seemed quite right, but "work" far outweighed "effort," of that there was no doubt. Democritus' argument was unanswerable. It is unfair to expect the same work from a strong and healthy man as from a weak or elderly one, because the effort is not the same. It is clear! - *Thank you my friend, you have saved me from a night of headaches. I am left then without knowing how*

much effort I have spared mankind. Well... that's all right. Actually, I only wanted that number for vanity.

Atoms

At that time Democritus invented a theory about the universe that fascinated Archimedes. *- Imagine... -* said Democritus *- ...you take a stone and you split it in half. You take one of the two halves and split it again. And you do the same thing again with one of the new two halves. Could you go on like that forever? -* He asked Archimedes *- I don't know.... Do you? -* he answered. *- How could you go on like that forever! -* Democritus was almost annoyed. *- Isn't it obvious that one day you would run into something that is impossible to divide any more? -.*

- Well... it does seem logical, yes. - Archimedes replied, although, in reality, he had some doubts. That approach reminded him of what is known as the "paradox of Achilles and the tortoise". In that one, Achilles and a tortoise were competing in a race. The turtle had been given the advantage. And by dividing space over and over again as Democritus did with the stone and assuming that this could be done indefinitely, you came to the conclusion that Achilles would never catch up with the tortoise. The general opinion was that no such thing could be done

with space, and so, in reality, Achilles did reach it. Even Archimedes believed that it should be so, but some argued that if time could also be divided infinitely, then there would be no contradiction and Achilles could catch up with the tortoise without any problems. Archimedes understood those arguments, but he found it hard to think that time could be divided without limit in that way; if so, the instant immediately following a given one would not exist, and it seemed to Archimedes that this would make causality impossible. Archimedes then accepted Democritus' idea, and Democritus continued with his approach.

- These very small indivisible particles, to give them a name, we will call them "atoms". Is it not evident, then, dear friend, that everything in the universe is made of atoms and not of fire or water, as some say? - Archimedes was stunned by that idea. It was one of those simple and apparently unquestionable deductions that amazed him. *- It is true! -* he answered, still staring blankly. He began to imagine everything in the world made of tiny little balls that collided with each other. To visualize it better he imagined the atoms, big as billiard balls and, therefore, everything else as incredibly gigantic. He then drew in his mind his bathtub as a pool as big as the world itself, full of spheres of which the water would be made.

Democritus continued: *"There must then be different kinds of atoms, some heavier and some lighter. -* . Archimedes then imagined himself as a giant, pouring iron balls into his Olympic bathtub filled with light balls of water. He then saw clearly how the heavy balls would drive the light balls out of the bathtub. That seemed to explain his ideas wonderfully well. But then he imagined himself getting into the bathtub, and something didn't add up. *- How are atoms held together? -* he asked *- your atoms seem to explain fluids very well. But what about solids, why don't they immediately fall apart under their weight?*

- I have meditated a lot on it and I think that there are only atoms (what is) and emptiness (what is not).

The vacuum is the space -limited- in which atoms inhabit. Atoms are eternal, immutable, and only differ from each other in their shape, size, order, position and weight. Some atoms, because of their shape, tend to be "hooked" with each other, thus forming solids, and others with shapes that do not hook only collide with each other, forming fluids.

I think the more fluid materials, gases like air, must be made of the more spherical and lighter atoms. The more viscous liquids might be made of cubes or cones that flow worse but don't get stuck. And solids must be made of shapes that tend to get stuck like tiny hooks.

And this is how all materials are formed. There will even be some atoms that are hooked with other different ones, for example, the hooks with the rings, the latter would be liquid if they were alone, but surrounded by hooks, they will inevitably end up hooked forming a mixed material with new properties, and different from those of the hooks alone or the rings. -

That theory fascinated Archimedes and he could not get it out of his head. Walking back to his house, he almost bumped into the street lamps because he was so absorbed in his thoughts. Everything seemed to make sense with Democritus' theory of atoms. And Archimedes believed it.

Body and soul

Democritus told the theory of atoms to the rest of his friends, but among them there was one who was furiously against it. His name was Plato. Plato said to Democritus: *-If your theory were correct, everything would be still, because the inert atoms, without life, do nothing but fall under their own weight and when everything would fall there it would remain. Animate beings are needed to move things. If we leave something on the table we know that it will remain there if no one moves it. -*

- What if the wind moves it? - replied Democritus. *- Is the wind an animate being, endowed with a soul, or do you believe that it is Zeus who orders the gods of the winds to move the air? You don't believe these stories for children? -* said Democritus almost mocking.

- Of course not! - replied Plato *- Animate beings such as people or animals move the air with their movement and this movement accumulates giving rise to the winds. Inert beings remain at rest if no one moves them. This is something we have all known since we were little. How can you defend the contrary? Are you out of your mind?*

- Atoms are inert, but they move by the impulse they have and by their weight! - replied Democritus. *- And, as you rightly say, I believe that at the end of time everything will be still and at rest, but until that happens motion will continue, because some things move others and these move others.*

- But then... - Archimedes asked. *- Do you really believe that only matter exists, that souls don't exist? And then... what do you think? that we are only machines that work by the impulse and by the weight they have? - I thought you agreed with me! -* protested Democritus. *- Yes, my friend -* answered Archimedes. *- Your theory has fascinated me and I am convinced that matter is made of atoms as you say and not of water or fire. But only matter, what about souls, do you really think they don't exist? -*

There was a younger friend who had learned a great deal from Democritus and believed in his theory of atoms just as Archimedes did. But he also dared to contradict master. His name was Epicurus and he was convinced and loved "free will". *- In your theory -* said Epicurus *- Everything would be determined by the laws of physics. The future would be certain and we would be bound by inevitable fate. Fatality would be the only motor of the universe. There would be no responsibility for our actions, and, therefore, there would be no point in blaming or praising anyone for anything they did, for it was already written. I am sorry to contradict you,*

master. But, by force, there must exist atoms with souls that act freely. It cannot be otherwise . - .

- All right," said Democritus, *"I am ready to admit, although I do not consider it necessary, that souls exist. But matter is made of atoms and not of fire or water, as some people maintain. Of that I am sure! -*

- But... What soul? What ghost story?!!!!! - said Nietzsche, the typical rude friend of the group. *- Don't let yourself be convinced, Democritus, of course we are only matter! The universe is dead, good and evil do not exist, and this world is a battle in which only the strongest wins. All this nonsense will only lead you to pity the weak, which will make you weak yourselves. And that will prevent you from reaching your potential and will frustrate your true desire which is the "will to power".*

Those words outraged many, and a discussion began that almost resembled a fight. Almost everyone was against what Nietzsche had said, especially an old friend named Darwin, who had once been his mentor. Although one repellent boy who always came with him stared at him like an adolescent fan. Little Adolph was his name, and he was the most motherfucking kid Archimedes had ever met. Besides, he was growing a wispy mustache that was downright embarrassing.

One of the most angry was Augustine, although Thomas was also in the fray. They started to use words they had invented themselves and Archimedes got completely lost.

And what do you think? - Archimedes asked Descartes, another great friend of his. *- Don't ask me, I only know that I think therefore I am,"* he replied. *- Oh, come on! You're so annoying with that 'methodical doubt' of yours. Say something - Well... if I have to say something... -* and then Descartes started talking about a very fat cow and another one with one leg missing... *- But what do cattle have to do with all this? I don't understand you at all. - Well... don't get angry. Summarizing.... I think there are two very different things. The Body and the Mind. - The Mind, and what is that? Isn't it the same as the Soul? - Well... more or less... -* Descartes answered.

There seemed to be no way for the friends to agree on this issue. None agreed on the Soul. But there was no discussion about the Body. Everyone seemed to understand it and no one seemed to question it . Well, Kant said something to the effect that space and time are mere "forms of intuition" that structure all experience and, therefore, while "things in themselves" ("noumenon") exist and contribute to experience, they are nevertheless distinct from the objects of experience ("phenomenon").

Our experience of the body, though limited to the phenomenon, provides us with evidence of its existence.

Archimedes understood this and replied: *"It will prove to us that it exists... But we still have no idea what it is...".*

The Wooden cousins

Some time passed and Democritus became increasingly convinced that he did not need souls to explain the world. Although he knew he was missing something. Plato's argument echoed in his head all the time. - *"If your theory were correct everything would be still" -.* He needed some other cause for motion besides weight and impulse, for inside he thought that, if there were none, the universe would come to a standstill too quickly. Everything would fall in the blink of an eye as Plato said. And yet if the initial impulse were enough to explain all the motion.... Where did it come from? He did not want to admit that this impulse must come from the souls, but he could not prove it. Nevertheless, he kept trying to prove it and defended his inert world to everyone, and

many were convinced. In fact, Archimedes himself began to doubt the existence of souls until he became as convinced as Democritus.

Archimedes had a cousin named Johann Sebastian Bach, although he always affectionately called him *"Huanse"*. And his cousin likewise called him *"Arcuinides"*. They both laughed their heads off talking in that strange way he called *"the idiomira"*. Huanse was the best musician Archimedes had ever known. He had an even greater cluelessness than his own, but he was a genius and Archimedes knew it and admired him greatly for it. He tried to make music like his cousin, but he knew that he had an innate ability that he would never have.

One day, while they were high on Mount Olympus, where their family had a wonderful summer house, Archimedes told his cousin about Democritus' theory. He presented it to him in the crudest form, totally denying the existence of souls and making his cousin understand that they were not necessary to explain the world. - *You think you are alive,"* he said*, "but it is only an illusion. Everything is made of inert atoms that move by the laws of physics and destiny is written, even if it seems to you that you act*

freely. You are a machine that sings like this guitar, but in the end you are just matter, just like it.

His cousin Huanse did not believe him at first, but the time came when Archimedes convinced him. The two cousins looked at each other and did not see two people, but each saw in the other a wooden puppet. A feeling of emptiness came over them both, as if they did not exist.

Some time passed and that feeling of emptiness did not disappear. Archimedes, like Democritus and many others proclaimed, far and wide, that souls do not exist, even ridiculing them by calling them "ghosts". And they convinced many of their mechanical universe. So much so that many of them no longer called those who believed in souls "wizards". They contemptuously called them "sorcerers", even if they were also wise and knew mathematics better than they did.

The consequences of their theory had already been warned by Epicurus. By thinking that everything was matter, the friends freed themselves from responsibility of their acts, and thought that they could do whatever they wanted, because the consequences were only suffered by the atoms. And then they were bad. At that time, both Archimedes and Democritus were cold and calculating, they made every effort to abandon morality,

to avoid even compassion, as Nietzsche demanded. For compassion had no meaning in a dead universe. There was no reason to care, much less to strive for others. At that time, they did terrible things that both would later regret forever.

The Good Fairy of the North, Jiminy Cricket and Lolo

Archimedes was still a wooden boy when he met a beautiful fairy from the north. And it was not her beauty that made Archimedes fall in love. It was above all the infinite goodness he saw in her. She seemed to shine because of her beauty. He had never met anyone so good a person. He himself was very bad compared to her and did not feel he deserved her.

It was also at that time that he met his dear friend Jiminy, who was also very good, like the fairy of the north, but certainly not as beautiful. Archimedes, as already mentioned, at that time had lost his conscience and believed that he was *"beyond good and evil"* and was about to go mad like the one who wrote that book. But Archimedes hated being a wooden boy. That feeling of emptiness consumed him inside, and deep down in his soul he was longing for someone to convince him.

Neither the good fairy nor Jiminy knew much mathematics and that seemed the only way to convince Archi-

medes of anything at that time. But, without them planning it, they convinced him. A feeling of guilt came over Archimedes for the bad things he had done to others, especially comparing himself to the fairy and Jiminy. But he tried to convince himself that nothing was wrong, for it was all matter and nothing mattered. But when he looked at the good fairy, he did not see in her a doll made of wood, plastic or silk. He saw a living person, with a soul, and could not see her as dead matter.

Then he remembered a play he saw with his grandparents when he was a child. In it, a boy went crazy and ended up locked up in an insane asylum. Two doctors looked at him through a window in the door of his room and saw how the poor boy had lost his mind and was talking to himself, convinced that he was in company and listening to the answers of his imaginary friends. It had been a long time since Archimedes had remembered that. He had wanted to forget it because of the terrible fear it provoked in him at that moment, because then he thought....

- What if I am crazy without knowing it? What if I think I am in the theater talking to my grandparents and watching a show, but in reality I am locked in a hospital room and there

are two doctors watching me and seeing that I am talking to myself and looking at an imaginary stage?

How do I know I'm not crazy!!!? - he was terrified as a child. He couldn't find a way to know and decided he would forget it. He tried his best not to think about it. Every time he saw that idea he would run away. But now that he was older and braver, he was ready to face it. He plucked up his courage, mounted his horse and decided to follow that idea wherever it might lead him. He spent several days on his horse watching that ugly idea. If it stopped, he would stop with it, and if it ran, he would follow it wherever it went. But the idea did not trust him and when Archimedes got too close, it growled at him and frightened his horse, but Archimedes no longer feared it. She led him down some scary paths, riddled with lies, that would scare anyone, but Archimedes was brave and fought them all. Archimedes did not give up and, at last, the idea came out into the open and he could see it in the light of day.

He got off his horse and not without fear, approached it. He was ready to look her in the eyes, even if it would drive him crazy. The idea hid its face by ducking its head and tucking it between its legs as if it didn't want to be seen, but Archimedes grabbed it with all his strength, risking being bitten, and finally saw his face. *- What?! It can't be! -* It was just a little dog. He looked like a beast,

but he was just a good little wolf, who was mistreated by all the lambs. That's why it growled and barked, out of fear! Because it had always been mistreated.

But then, Archimedes looked that little dog in the eyes and saw himself reflected in such a clear way that a shiver ran through his whole body at that moment. But determined to think wrong, he said to himself:

- The only thing I see in this idea is myself! What a chore! For this I would have saved myself from going through all those roads where I had to fight against the most fearful falsehoods that wanted to drive me crazy and that didn't succeed by a little.

He decided to get out of there as soon as possible but that idea seemed to have taken a liking to him because now he was the one following him. *- Get out of here! -* he said to him. *- Don't follow me! -* It turned out to be a playful little dog who wanted Archimedes to play with him and pet him. And although he was a very nasty little dog, it was now clear that he was good. So, he named him Lolo and adopted him as a pet. Although Lolo was a little dog, when Archimedes looked at him, he always saw himself and so he became very fond of him.

One day, Archimedes was taking Lolo for a walk. He took him around the field and Lolo was happy jumping

and running, he looked like a hare when he was loose. It was very comforting for Archimedes to see him so happy. And he thought... *- Lolo, even though he is a dog, also has feelings and enjoys himself. It is obvious when you see him. He is not a "something" as some people dare to say about animals. He is a "someone" and he also has a soul, just like humans. How can some people deny it?*

But how? - Then he understood. - Eureekaaa *!!!!! -* he shouted excitedly. *- Of course there are souls! In fact, that's the only thing I know! And this ugly and nasty, but good idea called Lolo makes it very clear. You only have to look into his eyes for a second and without fear.*

I may be crazy in a hospital room being watched by two doctors! But, even so, nothing and no one can deny me that I am alive and living, even if it is all the fruit of my imagination or a dream, even if it is Matrix or the trickery of a genius.

Be that as it may, I exist and I know it. It's not that I believe it or I'm very sure, it's that I know it! How stupid I've been! How could I have come to believe that I don't exist, that I'm nothing, that I don't feel or act, that I'm just little balls of dead matter colliding with each other, without feelings or sensations, without thoughts? Without soul, without life? - Archimedes felt that he was finally a real boy and knew that he would never again be a wooden boy.

Whoa, horse!

Archimedes was in the bathtub again, although this time he was taking a shower. But he was on the back of his horse, thinking about the body and, above all, the soul.

- Okay, the soul exists. Or whatever you want to call it. Most people I think mean what I mean when I use that word. But clearly others think it means something else. Because they deny it or think it's a ghost. I could call it something else... it's a dangerous word and all I get by using it is asking for trouble. Besides... Is that the word?

He then remembered when he had been terribly disappointed by calling "effort" to what he later called "work".
- I can call it "element", or better yet... "individual", or "person" directly! there are many who will not be convinced that

animals, just because they have souls, should be called "persons". Although I think those are two different words for the same thing.

I know! "Observers", I'll call them. It's a word that physicists love these days! although until recently it didn't exist for them. Now it sounds scientific, and it clearly means the same thing. Or is it not the same thing?

What I am referring to is that thing, which is not a thing, because it lives. That which we call "someone" instead of "something". At least in my language... But... Will it be the same in all languages, or will there be one in which there are no two words and for them there is no difference between one thing and the other? In that country they will all be super-democrites! Ha, ha, ha, ha. They will all believe that only "somethings" exist. - Suddenly, a very strange idea occurred to him. *- O... Will there be some language where it's the other way around, and there are only "someones" and not " somethings"? How difficult it will be for them to express themselves by referring to all things as if they were people! Ha ha ha ha! How strange! There will be only "super-platons" there and they will all think that only souls exist -*

Suddenly, Archimedes was stunned on top of his horse. Was that an idea or was it a star? Yes... it was an idea, although Archimedes had never seen a star like that. It was like a luminous sphere, and it seemed to give off, besides light, fragrances and flavors. Wonderful music

came out of it, and as you got closer you could feel a tremendously pleasant tickle. It was exactly the same as the one on the cover.

Then he asked himself. - *What if the universe is really like that and only souls exist and it is matter that does not exist?!!! It seems impossible that souls are made of matter.... But... Could it be that matter is made of souls... Whoa, horse!!!!!* -

It seemed to Archimedes to have seen a poisonous snake, or a bear, he was not sure. Still, he did not dare to go down that path and turned away. He left that beautiful idea where it was without even touching it, for fear of going crazy. Even if it was beautiful, it was too strange.

WHAT I'VE NEVER SEEN, AND NEVER WILL, IS AN ELEPHANT FLYING.

Archimedes was very confused. - *Okay... I exist. It's good to know something for sure. But... I could be crazy imagining everything in a hospital room! It's not worth much for me to exist if nothing else exists! Now, take it easy, don't go completely crazy... -* he said to himself.

At that moment he was looking at a pencil on the table. And he said to himself... - *Does this pencil exist or not? Am I just imagining it? Maybe it doesn't exist. Maybe it is only in my brain. Or maybe my brain doesn't even exist... I could, in fact, be a spherical-shaped alien whose intelligence does not reside in a brain but in some other weird thing and I think I am a human being (which is a type of being that does not exist at all and I have completely invented), but in reality I am locked in an intergalactic hospital while two other bugs ball like me, but with stethoscope, look at me through a window ... Hahaha -*

Then he saw something clear... - *No matter how much of a ball bug I am... I'm seeing a pencil, or rather, I'm seeing the image of a pencil, I know that. It's not that I believe it or I'm sure of it.* And he realized that his friend Kant had already

said that. - *I have no idea what the thing itself is, but I can know the phenomena from my experience. It is clear then, that besides me there is the image of this pencil. And I know this because I am seeing it myself. And as well as the image of the pencil there is the image of the table or the window. The sound of the birds that I am listening to right now also exists and I have no doubt about that either, even if those birds did not really exist.*

Then, in addition to me, there are my sensations. And they come in all colors and flavors, and there are already a few more things I know for sure!

- And Archimedes began to move the pencil between his fingers, and then he realized something incredible: it was undoubtedly him who was moving it! - *I don't know how I do it, but it is clear that it is me who is moving this pencil. Well... or to be more precise: I'm the one who is causing the image of the pencil I'm seeing to "move", even though the pencil itself didn't exist ...*

In addition to my sensations, there are my actions, and I know this because I am the one who acts. Even if I couldn't explain how I do it.

So, there are already three things I know for sure:

I exist, I perceive, and I act.

Just as Archimedes was celebrating that hard-won insight, a butterfly entered the room. It fluttered in

through the window, delicate and silent, and landed gently on the edge of the table—right next to the pencil. Archimedes stared at it in quiet fascination for several seconds, entranced by the color of its wings and the way it trembled, almost like it was breathing.

Then, just as calmly, the butterfly took off again and disappeared back out the window.

Archimedes blinked.

– Wait... I didn't make that happen – he whispered to himself.

It was suddenly obvious: he had not caused the butterfly to appear.

He couldn't have. No matter how hard he tried.

On impulse, half seriously and half to prove himself wrong, he frowned, focused, and tried with all his might to "see another butterfly fly in through the window." Nothing happened. Of course nothing happened. And then, smirking at his own absurdity, he said aloud, *– Sure... if I could really do that, I could just as well see an elephant come flying in right now! Hahaha!*

But then something changed in him—he paused, puzzled. He had moved the pencil. That much was certain.

But not the butterfly, and yet, the butterfly had appeared, undeniably. It moved and then flown away. — *So, if it wasn't me, who has made the butterfly move? —*

The answer became suddenly clear to Archimedes: It was the butterfly itself that had moved. Just as he moved the pencil, the butterfly had moved its wings and entered the room. Then he thought:

—So... It might be that I act upon the physical world, and it responds with sensations. But I am not directly the cause of those sensations. My actions influence the world, and the world in turn acts back on me... And the butterfly? The butterfly is another conscious being, acting too. Like me, it acts upon the physical world—which seems to serve as an intermediary between us.

And then he wondered:

Where does this "physical world" come from, anyway?

What is it made of? Atoms?

Is it a cause, or merely a neutral medium?

And most importantly... does it even exist?

For a fleeting moment, the thought occurred to him: *—Could it be that the only true cause of my sensations is... other beings like me, with their own actions and sensations?*

There it was, that idea again, the star. He felt again a kind of metaphysical vertigo, and at that moment He preferred, for now, to hold on to what he did know.

Archimedes continued to meditate, looking for things he knew for certain. Finally, he realized that he also knew for certain that his thoughts and feelings existed, since he himself was the one who thought and felt them. But he could no longer find anything else of which he was completely certain.

THE STAR

One day, Archimedes suddenly saw it.

It was that star again—the one on the cover!

But this time... it wasn't just in his mind.

The star was really there, floating in front of him, shining gently in the middle of the living room.

- But... But I'm not in the world of ideas now!!! I'm quietly in the living room, with the good fairy!!!! Ahh... phew, what a scare, I thought I was crazy...-.

Archimedes realized that this was not an idea running wild in the real world. It was Merlin's message, and that could be magic, of course it could. All the friends packed up and started their journey. But Archimedes was so excited that he started to get ahead of them and, little by little, he went faster and faster until he finally ended up running. Only Lolo was able to follow him, and so the two of them were among the first to reach the great enchanted valley.

III. The light

The great valley

A man named Archimedes and his dog named Lolo arrived in that great enchanted valley. They were among the first to arrive and they saw "little groups of wizards", the wisest ones, who had arrived before them and were chatting and laughing, telling stories, as if they had not seen each other for a long time. He approached one of those groups and suddenly realized *- But.... But they are ghosts! -* He was the only one alive, at least as far as he could see. He chatted with some of them and it turned out that besides being wise, they were all super nice.

Archimedes and Lolo saw Merlin in the center of the valley, sitting on that stone bench. Archimedes was excited, he had not seen Merlin since he was a little boy, and besides, when he saw him, he saw him from far away, or maybe it was too close...? The fact is that it had been a long time since he had seen him in person. And there was Merlin, sitting there, calm and quiet.

Archimedes was very embarrassed, but he plucked up his courage and approached Merlin.

- Archimedes! Big guy! What going on? - said Merlin. *- Do you know me?!!!! -. - Of course! What do you think? I'm Merlin, kid... I know everybody, and I know them phenomenally well.. Shhh, shut up, shut up, this is about to start, everybody's already arriving! -* Archimedes looked around and saw a lot of people. He saw giraffes, elephants and all kinds of animals. The sky was full of birds flying. There seemed to be no one missing.

- Look, your friends are arriving just now at the north entrance of the valley, they're the last ones to arrive! But you don't have time to get there now, huh? Take a good spot. And now, be quiet and shut up. -

But a bunch of monkeys were just passing by and, of course, Lolo started barking at them like crazy. *- Shut up Lolo! -* But the guy wouldn't shut up. There was no way to calm him down.

Then Merlin stood on the stone bench and raised his hand, and as he opened it, an immense white light burst forth. In an instant an absolute silence fell over the valley. Everyone stood perplexed, staring at the light. It then became clear that what Merlin was holding in his hand was a ring, and it was from this ring that the wonderful, warm light was emanating. Then Merlin began to speak.

- I propose to you, dear friends, a fantastic game. "The game of light". To play this incredibly fun game all we need is this ring, which, even if you didn't know it, you have all heard of. People know it as "the light". But don't be fooled by appearances. This ring does not really exist, even though you are seeing it with your own eyes. The light is just a myth. And yet it is the most powerful ring of all. Light is capable of creating time and space. Matter and energy. Colors, tastes, and smells. Everything that you have ever seen or heard or that has ever entered through your senses.

A great commotion broke out. *- What the hell is this guy saying! Did you understand anything? - I didn't. - Always the same! - No one can understand him!*

- And how do you play this game?!!!" someone shouted in the crowd.

- I don't need to explain how to play this game. You all already know how to play. And, moreover, once the game has started, you will have no choice, you will have to play or play.

On the other hand, it is impossible to cheat, because everything is allowed, but beware! you can play well and you can play badly, as in all games.

Well! and enough of the chitchat!

Let the game begin!

Merlin came down from the stone bench, approached Archimedes and, to the utmost expectation, handed him the ring. At that precise moment, everyone in the valley was petrlified, frozen like statues.

Only Merlin and Archimedes were still awake. The silence was absolute in the valley, the air had stopped and the sky looked like a beautiful painting of sun and clouds, with all the colors. Reddish, orange, even pinkish tones, creating shades of colors in the clouds, like those of a sunrise. The birds, still as well, were drawing the last shades of that wonderful landscape.

- What happened?! everything has stopped! -. Archimedes asked, frightened *- Calm down Archimedes... don't get nervous.... -* Merlin said. Archimedes did not know how, but those few words of his were enough to calm him down. *- And... What should I do now? -* Archimedes asked. *- I could let you guess... -* a little smile escaped Merlin's lips. *- Sooner or later you'd find out. There's nothing else you can do! - Should I give the ring to someone? - Of course, man, of course! - But to whom? - Ah... only you can decide that, and, besides, as you see, no one can do anything to force you. You can decide freely. In fact, you are obliged to be free. Don't you*

think that bad trick of tossing a coin to avoid deciding did any good!!! ha ha ha!!!!! -. Archimedes knew perfectly well what Merlin was referring to *- I already knew that, even if I thought it wasn't, I had decided it!!! ha ha ha ha!!!!! -* ... and they both laughed.

- Seriously, Merlin, what do I do? You haven't explained anything. We're all here in the valley and we don't know what for. The game has already started and we don't know how to play. I don't know what to do! I don't know anything! -. - You know you're awake!!!! And that should be enough for you. Come on, slowpoke, just choose! Or do what you want, ha?... I'm not going to boss you around.

Archimedes looked around and saw only strangers. The only one he knew nearby was Lolo. There stood his statue, looking grim-faced. The sudden halt of the universe caught him a little too eager. *- Can I give it to an animal? -* But, as he turned around, Archimedes realized that Merlin was no longer there, it was as if he had vanished. But Archimedes was sure that, one way or another, he was still watching, the fellow. Archimedes looked up at the sky and saw that there was, among all the birds, only one moving. It was an eagle, no doubt. And he could see everything, with that wondrous sight and from that height.

- I'll give it to Lolo then, let's see what happens.... -. Archimedes put the ring in Lolo's mouth and suddenly Lolo woke up. Lolo was already nervous and, as expected, he ran out with the ring in his mouth. – *Lolo! come here! -* But Lolo was running like a hare, prancing around. *- The ring!! Give me the ring, Lolo!!! Come here, little boy... pretty doggy.... -* Whistled Archimedes like a madman. But Lolo kept running around.

He lost sight of him for a moment. *- Lolo, where are you?* And suddenly, he turned around and there was Lolo, at his feet, with the ring in his mouth. Archimedes took it, and Lolo just stared at him — with a face that, if that wasn't a smile, then God himself would have to come down and check. Besides, his tongue was hanging out about half a meter. He was clearly waiting for Archimedes to toss the ring. *- Oh, little boy... you gave me such a scare! If you'd lost the ring..."*

Archimedes began to caress Lolo, but then, before his eyes and between his hands, Lolo turned back into a statue. *- What the f...! What happened? -*

Archimedes did not know what to do. Once again he was alone. He climbed up one of those statues and had a good view of the whole valley.

- My goodness, what a lot of people! So, by eye, there must be some... 6086555670238378989670371734243169622657830773351885970528324860512791691264 *souls -* Archimedes was not sure if that was the number, he had said it by pure intuition, although, in fact, his intuition told him that there must be infinitely many. In any case, there were a lot of people there. *- The north entrance to the valley must be about 10 or 15 minutes away -* he thought. *- Well... here I go! -* He hoped to find his friends there, as Merlin had told him.

- And what do I do with Lolo now? If I want to bring him back, I'll have to give him the ring again. Phew... Let's see how I do it! - There was Lolo, still with his smiling face and hanging tongue. Again, Archimedes put the ring in his mouth, and again, he woke up. And the same scene was repeated, only this time Archimedes was looking at Lolo after giving him the ring and saw clearly how Lolo suddenly disappeared and reappeared again at his feet.

- What the...! How did you do that, little boy? - Lolo, at the question, began to bark and stand up. With that smiling face, clearly asking Archimedes to throw him the ring again. And in that posture, like a little wolf howling on two legs, he froze.

Time

- How on earth did that happen? - Archimedes asked himself. He gave the light to Lolo several times and the same thing happened every time *- Lolo suddenly disappeared and reappeared at my feet again and again. Why?.... -* Archimedes didn't understand anything and then he remained like a statue, thoughtful and looking at infinity. *- I've got it! It's clear! I get frozen too!!! -*

- Every time I give the ring to Lolo I end up turning into a statue without realizing it, and that happens just when I see Lolo disappear. Then, even though I don't notice anything, Lolo will go around for a while, hovering around my statue, until he finally gets bored and ends up coming to my feet. And that's when he gives me back the ring and I wake up again - that's clearly how this game works! Only the one who receives the ring will wake up! And between giving it and receiving it, he will wait patiently, for eternity if necessary, without feeling anything, without thinking, without living. What would you live if nothing happens to you at all? That's why you don't notice that it stops, you live it as a continuum, for you, everything

that happens while you don't have the light is totally instantaneous. No time passes for you. But... how? Of course! I get it! Eureka! It's the light that creates time!!! Merlin wasn't kidding! That's funny... Merlin!!!! Merlin!!!! I got it!!!! Merlin!!!!! -.

- Shh... don't shout, man! - answered Merlin, who suddenly appeared in the crowd. *- What is it Archimedes? - I understand now! I understand how light creates time! - Really? And how does it create it? - Only the one who receives the ring will awaken, and so the light creates time as it travels among us. Time is just a chain of cause and effect where the cause or action is to give the light to another and the effect or sensation is to receive the light from another. Isn't it? -Very good, Archimedes!!! You got it very quickly. Although I have to admit that it was the easiest part... Do you know how light creates space? - I haven't the slightest idea - Ha, ha, ha! Keep thinking. You'll figure it out. -* Merlin said as he disappeared back into the crowd.

Archimedes, alone again, decided to move forward. He handed the light to Lolo and began to walk north, and soon Lolo appeared at his feet. By repeating this process, he had quickly covered almost half of the way. Then he saw a familiar statue among the people. *- Is that her? Yes, that's her. -* It was Hypatia, a former classmate of Archimedes. There stood her statue, her gaze fixed on the

stone bench. She was still watching Merlin give Archimedes the ring. - *I will wake her up* - he said to himself. And so he approached her and handed her the ring. She woke up, but seeing him so close and so suddenly handing her the ring, she was frightened and ran away. - *Wait!!!* - he shouted. But she didn't wait and got lost in the crowd. And suddenly, there was Lolo again, at his feet, bringing him the ring.

But everything had changed. Many of the statues no longer stood where they once did, nor did they face the stone bench. Some were arranged in strange ways. There were several groups around him that were in single line, forming rows, some so long that he could not see the end. *- What happened? Everything has changed! Of course... I gave the ring to Hypatia and Lolo gave it back to me. Who knows how far the light has traveled until it got from one to the other! Evidently the light has passed through all these people who have moved and who knows how many times each of them had it. In just an instant the light may have moved hundreds or thousands of times, or millions! Oh no! Did the light reach the north entrance? If so, maybe my friends are no longer there. Damn it! Why did I have to give the ring to that girl?! Well... the north entrance is still a long way away. Maybe the light didn't have time to get that far* - And Archimedes left as soon as possible, knowing that this time he wouldn't give the light to anyone but Lolo until he found them.

In a few minutes he reached the north entrance, but his friends were not there. It was clear that the light had passed that way, for many were no longer looking at the stone bench and there were rows of people there too. *- They are gone! and they may be at the other end of the valley? I will never find them. -* But suddenly the good fairy appeared in front of him, handing him the ring, and beside her the smiling statue of Lolo. *- My love! -* The two embraced*. - How did you find me? -. - Lolo found me and led me to you,"* she replied. *- What a joy to see you again! I thought I'd never find you. And the others? -They are all together a little further on, let's go! -*

The three of them were together, Lolo was a statue and the good fairy just froze. Archimedes was alone again, and he thought it would be best to give the ring to the good fairy, the two of them together would move forward and one of them should come back for Lolo when the other one froze. And so they did. And it worked. But only the first time, because the first time the good fairy came back for Lolo. But the second time it was Archimedes' turn to walk back and when he gave the ring to Lolo he ran off, getting lost in the crowd. And suddenly, there was the good fairy again. *- It looks like I'm going to have to come back every time -* She said *- If I don't come back for Lolo, I'll have to come back for you anyway... -* She was the one who carried the weight of that team. It was clear.

And in that way, quickly (for Archimedes) they arrived at the place where the friends of both of them were. There were the statues of Democritus, Plato, Epicurus... all their friends. That sculptural ensemble seemed a tribute to friendship. All of them with their backpacks that they had prepared for the trip. Some had glasses of wine in their hands and all seemed to be having a good time. - *Come on, talk to someone, but don't forget me here when I freeze, eh?* - said the good fairy to Archimedes. - *You know I'll never forget you* - Archimedes told her just before giving her a movie kiss. As already said, Archimedes was quite a movie guy. And in the middle of the kiss she froze. - *Ha ha ha ha I can't leave her in that position! She looks like she's playing limbo* - Archimedes laughed. And then he woke her up. - *Before I talk to some friend you'd better get into a normal position* - he told her - *Yes, better.* - she said. And so they did. The good fairy began to pose as if she was going to have her picture taken and waited a few seconds to freeze. - *Well, the truth is that she has become a statue beautiful ! Ha, ha, ha, ha!* -

- *I will talk to Democritus and see what he thinks of all this.* - Archimedes gave the ring to Democritus and Democritus, when he woke up, said... - *Archimedes! Dude! What a guy... you must run away to get to the valley before... you have missed a most amusing trip!* - *I know, my friend, but I couldn't*

wait. Thank goodness I found you, especially the good fairy, don't take it the wrong way! - Don't worry my friend! I know you love me almost as much as you love her, I'm just not as beautiful, I must admit it. Ha, ha, ha, ha - laughed the friends.

- Did you hear what Merlin said? - Archimedes asked him. *- Yes, I did. I don't know how, but you could hear him perfectly. - And did you understand anything? - Rather nothing. And you? - Me neither, but once the game has started, it seems easy to see how light creates time, doesn't it? - Is that so? And how? -* Democritus asked *- But man, it's clear! Only the one who receives the ring wakes up, and for the others no time passes. - But that's not time,"* Democritus answered*, "Why not? - Well, man... it may be the time in the game, but that doesn't explain the time of reality. - Why not? - But man, it's clear! -*replied Democritus. *-Because of simultaneity! - How?"* asked Archimedes. *- In reality a multitude of things can happen simultaneously, there seems to be no limit to what can happen in an instant, and in the game nothing is simultaneous. If we were in reality, they would all be moving as we speak, they could talk to each other and they wouldn't have to wait for one of us to feel like giving someone the light. In fact... That's funny! We could be talking you and I, passing the ring to each other forever and the rest of the universe would remain still for all eternity. -*

Archimedes had been delighted that time was so simple. A single chain of cause and effect, where the cause always precedes the effect and the effect occurs in the instant immediately following, seemed all very simple and easy to understand. But certainly simultaneous events would be impossible. That was undeniable. And in reality they did exist. And that was true, wasn't it...?

Space

- Merlin!!! Merlin!!!!! - shouted Archimedes once Democritus froze. *- Don't yell, please...-* answered Merlin, who appeared again in the crowd. *- Shh... you're going to wake everyone up Ha, ha, ha, ha! - Oh Merlin... always in a funny mood ! - Don't get mad, man! Let's see... What's the matter, Archimedes? - I think I've already understood the game Merlin. - Oh yes...? And what does it consist of? - It consists in solving the riddles you made at the beginning. "Light creates time," "Light creates space." They're just riddles. I thought you were explaining to us how the universe really works. - And why did you stop thinking that way? -* Merlin asked.

- Man...! because the time of this game has nothing to do with the time of reality. In the game there is no simultaneity and reality is full of simultaneous events. It cannot be the time of reality. - The truth is that I am very disappointed by what you are telling me Archimedes. I thought you understood the game much better. - But then... And how can there be simultaneous events? - Archimedes got excited thinking that Merlin would make him understand.

- Have you understood how light creates space yet? - Merlin asked. *- I haven't really given it much thought. I don't have any idea - I see? -* said Merlin. *- Do you want to see how this*

is much more than a question and answer game? Do you want to get it right? - Sure!!! - replied Archimedes. *- But then I will have to strip you of your prejudices - Do it! - You may be afraid - I am not afraid. I trust you, Merlin. - Ok then.*

Suddenly all the statues disappeared, the sky went out and it became absolute darkness. It seemed as if everything had ceased to exist. The ring had also disappeared, although its light still existed. It was an immense nothingness in which only Archimedes and Merlin could be seen. *-What have you done, Merlin!!!! - Calm down... Archimedes -* And again, those few words were enough to reassure him. *- Where are all my friends? And the valley? Where are we? - Don't be afraid, Archimedes. You just have to keep on playing. - But how can I play when there is no one and there is no ring? - The ring never existed, remember? -* said Merlin as he was lost in the darkness...

This time Archimedes felt more alone than ever. He tried to move, but not even the ground existed. It was as if he was floating in the middle of space like an astronaut. No matter how much he moved, nothing changed. He did not even notice his own weight and soon he lost his orientation and could no longer distinguish what was up and what was down.

- ...You just have to keep on playing... - How can I keep playing without the ring? Oh good fairy! I wish you were here. - And suddenly the good fairy appeared before him in the middle of that emptiness. *- My love! What a joy! I thought I would never see you again - What happened? Where is everybody? Where are we? -* she asked *- Merlin has made space disappear -* answered Archimedes. *- But it looks like we can go on playing... You just have to decide who to give the light to, even if the ring no longer exists, and magically the person you choose will appear. Or at least that's what just happened to me. -* As soon as he finished saying those words, Archimedes disappeared.

The good fairy, scared out of her wits, decided immediately and almost unwillingly to give the ring back to Archimedes, who reappeared. *- What a scare! -* said the good fairy. *- What happened? -* asked Archimedes, when he saw her frightened face. *- You suddenly disappeared. - That's how the game works now. You won't see any more statues. - And where are the others as we speak? -* asked the good fairy. *- They are nowhere. The places don't exist anymore. - So... have they ceased to exist?!!!!! - Nooo . Surely if you give the ring to any of them you will see that they still exist, it's just space that has ceased to exist. - I want to see if Lolo is okay -* she said. *- Then try giving him the light -* and when Archimedes disappeared, the good fairy gave the light to Lolo and he appeared before her. Lolo approached her as if nothing happened, looking for caresses and, in this way,

she gave him back the light and disappeared again. - *Lolo is perfectly fine* - said the good fairy to Archimedes after giving him the ring again. - *You see, everyone is fine. Although sometimes it may seem so, I don't believe that Merlin would have put us to play a horrible game, I'm sure it's the best possible game, I don't know why, but I trust him.* - *Yes, so do I.* - said the good fairy.

After the good fairy disappeared again, Archimedes thought: - *This new way of playing has its advantages, I no longer have to search the valley for anyone. I can visit whoever I want whenever I want.* - And so he began to visit the people he loved the most. He visited his parents, his siblings and many other relatives. He also visited his lifelong friends like Democritus, Epicurus, Plato and Descartes. And also some career friends like Galileo, Newton, Einstein and Bohr. Although the good fairy was still by far the one he visited the most. Everyone quickly got used to this new mode of the game, in fact, they took the opportunity to visit many old friends. The light began a much more unpredictable journey. Since the valley no longer existed, it could go from the north end to the south end in an instant.

Archimedes then remembered his friend Pythagoras. Pythagoras lived in the mountains, in a kind of monastery with all his friends, isolated from the world. Always thinking about mathematics. Those guys were too weird

for his taste and he didn't really get along with them. However, Pythagoras was a great friend of his, and always, at least once a year, Archimedes made a trip to the mountain to visit him. *- Now I can visit him whenever I want! -* As soon as he decided, Pythagoras appeared before him. But Pythagoras was so startled by the sight of him that he made such a face and gave such a shriek that Archimedes could not help but laugh out loud. *- But... What's the matter, my dear fellow! Ha, ha, ha, ha Why are you frightened? -* he asked him *- Just a moment ago Merlin was giving you the ring and, suddenly, you appear before me as if by magic! Everything is dark and I see myself floating in empty space!!! How the hell do you want me not to get scared?!!!!! -* Pythagoras answered, still with the face of someone who has just smelled and heard something equally foul and unpleasant, and both, almost, at the same time.

- So... It's the first time someone gives you the ring! All this time you were asleep, you didn't even see the statues! - What statues? - Archimedes told him how the game worked. How time stopped when you didn't have the ring and how Merlin, later on, had made space disappear. *- What a little game! And how long have you been playing without me knowing about it? -* Pythagoras asked. *- Each one has been playing for however long he's been playing. I, for example, have had about a thousand visits already. - And no one has come to visit me even once? None of my friends in the mountain*

have remembered me? - Maybe they too have not yet received the light even once. You are so far away from everyone, isolated in your monastery, in the mountain, that the light has not had time to reach here. - Suddenly something did not add up for Archimedes. *- But... there is no more the near or the far! there is no more mountain or monastery!!!*

- Euuuuuuureeekaaaaa!!! I get it! I get how light creates space!!! There is no more mountain and yet Pythagoras is still far away!!! It's not that light takes a long time to reach Pythagoras because Pythagoras is far away from me!!! It's that Pythagoras is far away from me because light takes a long time to reach him!!! The distance between us is only "the time it takes for light to reach each other"!!!!! If I start visiting him a lot, I'll change the configuration of space, like bending it! Ha ha ha ha. I will bring Pythagoras closer to me and my friends, and with him his friends and the monastery and the whole mountain! I have finally been able to move a mountain! Ha, ha, ha, ha!

- Merlíííííín!!! Merlíííííín!!!! - shouted Archimedes excitedly *-Again shouting? -* answered Merlin, who suddenly appeared. *-There's no need, man! Just call me without shouting or talk to me directly - Merlin, I understand how light creates space! - Oh yeah...? and how does it create it? - The distance between two souls is just the average time it takes for light to travel from one to the other, isn't it? - Mmm..." -* Merlin was thoughtful. *- And the distance from one to the other*

is the same as the distance from the other to the one? - he asked. *- Yes! At first I thought it wasn't, because I insisted on starting from one to get to the other. But, in fact, the correct definition is "the number of movements that the light makes divided by the number of trips it has made from one to the other by some path in that time" ... And now it does, and it is obvious, since, when light makes a trip from one to the other, it can no longer make that trip again until it makes the return trip, that is, until it makes the trip from the other to the one and, therefore, light always makes the same number of trips in both directions, and the average time it takes to make the one is the same as that of the other. - Very good, Archimedes!!! What about the mass? - What mass? - Ohhh... what a pity.... almost!!! I thought you had it all figured out, but I'm afraid you didn't take the mass into account. That distance is "distance in a vacuum". You still don't know how light creates matter? - I haven't the slightest idea. - Ha, ha, ha, ha, keep thinking, Archimedes, keep thinking... think what happens if you increase or decrease the mass.... If your distance were correct the universe would swell and deflate like crazy all the time, ha, ha, ha, ha -* said Merlin as he was lost in the darkness again.

Archimedes began to think.... *- how will light create mass? And what is mass? And what does that have to do with distance? -* Archimedes was drawing a blank. He couldn't think of anything at all and decided to discuss it with his great friend Democritus. He explained to him how light created space, even though his idea was only valid in a

vacuum. - *I like your idea!* - Democritus told him. - *Although let me think... How strange is that space of yours...* - *Why strange?* - asked Archimedes. - *Well, the first thing I find strange is that the speed of light would always be the same. It would always be equal to 1. Under any circumstances. Even if you were moving at breakneck speed, light would still go at the same speed relative to you, and obviously you could never go faster than it, could you? I find these things very strange indeed.... The space of reality I don't think it has those strange properties...* - They both remained thoughtful for a moment.

- *I've got it!* - said Democritus. - *I don't doubt, dear friend, that your space is the space in this game, mathematically your definition is indeed a metric, it fulfills all three properties and therefore defines a space. And I can't think of how else light alone could create a space, but the serious problem, the one that really makes it impossible for your space to be the space of reality, is "the dimensions".* - *The dimensions? What do you mean?* - Archimedes asked. - *Imagine, my friend, a space of only two dimensions, like a piece of paper. How many points can all be at the same distance from each other, all with each other?* - Archimedes had to think about it for a few seconds. - *Three, of course, forming an equilateral triangle!* - He answered. -*Exactly!* - said Democritus. - *And if it were in three dimensions, how many points could there be?* -*Four, and they would form a tetrahedron!* - He answered again. - *Of course, and don't you see, dear friend, that your space is not in*

three dimensions? Imagine 100 souls that all pass the light to each other equally. It is evident, by symmetry, that they would all be at the same distance from each other, all with all, wouldn't they? - again Archimedes seemed to have become a statue. - *Yes. It is clearly true. My space would need 99 dimensions if there were 100 souls* - *Exactly!* - replied Democritus. - *Well, my friend... sometimes I don't know if I love you or hate you!* - said Archimedes. And the two friends laughed.

-...mmm... Although on the surface of a sphere there are 4 equidistant ones and they are two dimensions and on a circumference 3 and it is only one... Go! In any case you would need 98 dimensions for 100 souls... Or not?

- *Wait!* - said Archimedes who was looking at his friend but, unintentionally, was thinking completely about his own... - *What if all the souls lined up?* - *I see where you are going...* - said Democritus thoughtfully. - *If they were all in a row, space would have only one dimension! Even if there were 100 souls or 1000 or infinite! Surely they could form a two-dimensional space? Of course they could! If they were placed in a grid, like a notebook. Each soul with only 4 friends and all equal friends. That would be 2 dimensions, of course... the "x" and the "y". But... they could also be placed in hexagons like a honeycomb or a brick wall... Or we can join equilateral triangles infinitely thus filling the space... How many different two-dimensional spaces could we form between us all? And*

three-dimensional ones? The 3d grid is possible, of course. Can we join tetrahedra infinitely as well? and... How much space would we fill? ... We would have to ask Hausdorff...

But... and why do souls tend to be placed in only three dimensions?!!!!

...mmm... Maybe George Pólya's random walk is the key? Because he showed that, in an infinite 2-dimensional grid, light would always come back to you, but if that grid had 3 or more dimensions, we'd all barely live, hopefully, two or three visits in our lifetime. We'd all die in 2 or 3 instants! And maybe that's an important reason for the universe to be placed only in 3, or nearly 3 dimensions.... Still... it's not clear to me... I have to think about it....

And the spaces made of a few souls...? That of one seems trivial and that of two almost as well... and that of zero I can't even tell you!... Ha, ha, ha, ha. Well, well... even if they seem trivial, we must take into account that they are "the fundamental pieces", "the elementary particles", of which all the biggest spaces are made of... so they must be important...

And what the hell has mass got to do with it! - Archimedes let out a little shout that woke up Democritus. - *Oh, sorry, my friend. I hadn't realized that you had fallen asleep... rest, with the idea you have given me, I've got plenty of time.* - And Democritus, asleep, disappeared into the void.

Nothingness does not exist

Archimedes continued to think about that strange space with so many possible shapes and dimensions. Its strange properties fascinated him. Like those of the speed of light in a vacuum, always the same and seemingly unreachable. Or that souls were not in a specific place but rather in a "cloud of probabilities", since that is the very nature of space, because in reality it does not exist. Space is only a statistical measure. A mathematical relationship between souls.

All those ideas were haunting him. But... Wouldn't it all be a waste of time? Although it was certainly a mathematical space, it seemed a very different space from the one that existed before Merlin made it disappear. Would that be the space of reality or not? On the other hand, He had no idea how light created matter. No matter how much he thought about it, he couldn't think of anything. So he continued to play. He kept visiting his friends and enjoyed their company very much. A long, long time passed. For some souls, millions of years. And Archimedes went on living life and thinking.

One day Archimedes was thinking about "the mass". He had no idea what Merlin meant by that. Although, before the game, for him mass was something like "the amount of matter". But in truth, to be honest, he never really knew what "matter" was either. Desperately in doubt, he called Merlin again. - *Merlin!!! Merlin!!!!! -*

- Don't yell, man! What a pain in the ass!!!! - Excuse me, Merlin - It's all right... we already know each other... Come on, tell me. What do you want, Archimedes? - I've been over it a million times, Merlin, and I have no idea how light creates matter. I don't know what you meant by mass. I'm really desperate.

- Wow, man! - said Merlin. *- Perhaps this way, with so much prejudice, it is still very difficult to understand? -* Merlin was thoughtful for a moment. *- Well, come on! Do you want to get it all straight? - Of course I do! - But I'll have to strip you of your last prejudices. - Do it! - But this time you'll be much more afraid. - Do it! - But a lot, a lot, huh?... - What a pain in the ass... Do it now! Oops, sorry Merlin, I didn't mean to talk to you like that. - It's all right, man! The truth is that I was getting a bit annoying already... Come on! Goodbye to the last prejudices!*

And suddenly the light went out. Archimedes could no longer see Merlin or his own body. He was in absolute

darkness and silence. - *Merlin, what have you done? Where are you? -*

- Where? - Merlin answered. - *I think, Archimedes, that by now you know that this question does not make much sense, ha, ha, ha, ha. Don't be afraid... I'm here..."* And again those few words of his were enough to calm him down.

- You have made the light disappear!!!! - Not only that Archimedes. - And suddenly Archimedes realized that he was in absolute silence. Merlin's voice did not really exist. He could only hear it in his head. He put his hands to his head and realized that... it didn't exist either!!! He had no hands anymore!!!! He had no body, no sight, no hearing at all. But he heard clearly how Merlin told him..... - *Don't be afraid Archimedes, just keep on playing....*

Archimedes clearly understood that he had to give the light to someone, even though light no longer existed, nor space, nor matter. It was clear that Merlin meant that, even though only souls existed now, he could still play.

And then, of course, he gave it to the good fairy. Immediately afterwards Archimedes noticed how the good fairy gave the light back to him, but he could no longer see her or talk to her. He could only feel her or not even that. He only had The Information. The information

that it had been she who had given him the ring. But nothing more. He was still alone, in absolute darkness. - *The good fairy must be scared to death* - he thought. And to let her know that she was not alone, Archimedes gave her back the light. And so did she. And they began to look at each other without looking at anyone else for so long that it seemed like a lifetime.

But eventually they lost their fear and started giving the light to other people. I don't know who was the first one who started doing it, but the other one realized it very quickly. Because, suddenly, he saw the light coming from somewhere else.

Now, when Archimedes looked at the good fairy, he didn't always see her. Sometimes he looked at her and saw Lolo. Sometimes, though more rarely, he saw her and his parents. And, from time to time, he would see some friends they had in common. But really, when he looked at her, he almost always saw her. And not only that. He also saw her many, many times when he hadn't given the light to her. She was the person he saw the most and, moreover, the one he looked at the most. And it was the same for her.

Since Archimedes was in such absolute darkness, in order not to get bored, he took long rides on the back of the wild horse of his thoughts. Besides, in the world of ideas there were also Jiminy and Lolo, of course. And, in their company, he did not feel so lonely.

Archimedes was learning to tame his horse. This was no longer a wild colt. It was a formidable horse and he thought... *- This horse of mine deserves a name!!!!* -. He thought about it for four days, and then suddenly he said. *-I'll call him "Emocionante"! It is clear why!!*!

And sometimes, instead of taking random walks, the four of them would walk together. Jiminy on the back of Lolo and Arquímedes on the back of his horse, "Emocionante", thus forming a wonderful picture, with the sunset in the background, traveling through the world of ideas. Archimedes felt like a lone ranger.

And he traveled through those places, riding with Emocionante. Never losing sight of Jiminy or Lolo. He visited places he had never imagined in that world, some of

them truly exciting. But he didn't stay in any of them, he kept looking, but he couldn't find it...

- What on earth does Merlin want to explain to me with all this? There is no such thing as space or matter. There is not even light. There is nothing!

Well... We still exist... but... How can reality be like this?!!! It doesn't make any sense!!! Where are all the material things? I don't see them! Now I only see the others... Well, and I don't even "see" them, I just feel them... -

Archimedes then remembered the star. So clearly that he thought he saw it. He also remembered just then a story that that little girl, Hypatia, told him when he was a child. She told him that when we die, our soul goes to heaven and there it meets all the other souls that have died. And she also told him that the place we go to is a paradise.

To Archimedes that, besides magic and fantasy, seemed horrible. *- But... if only our soul goes to heaven? We won't have a body or anything! And how will we look at each other? How will we talk to each other? How will we touch? That place doesn't look like paradise to me -* he said as a child.

And now, remembering it, he realized that this was exactly the place where he was at that very moment.

- I have to understand!!! - he shouted desperately. In thought, of course. He had no other way to do it, hahaha *- How does matter exist in this world without matter? And what is matter?*

I have only: souls and light.

Well... and not even "light". Light is just an abstraction, an imaginary particle. It doesn't even exist either. It is just an order that can be given to events due exclusively to cause and effect. And it is, however, the most powerful particle of all...

Well, I have the light! Even if it doesn't exist. And I have a space! Even if it doesn't exist either. Even if it's just a calculation. And even if it's empty, I have to find a way to fill it up! I have to try!!!! -

- I have no choice - he said to himself. *- I have to fight alone against these three giants. Mathematics, physics and metaphysics -*And so, without informing anyone of his intention and without anyone seeing him, one morning, before daylight, which was one of the hottest days of July, he armed himself with all his weapons, climbed on Emocionante, putting on his ill-composed jealousy, he put on his shield, took his spear and through the back gate of a stable, went out into the field, with great joy and exhilaration to see how easily he had given beginning to his good desire.

The poor man was trying to deduce the laws of physics that he already knew. - *If I obtain those formulas that everyone knows and knows to be true, starting from the fact that the universe is made only of souls, no one will be able to deny the evidence.* -

And began an almost incomprehensible journey that did not end until page 126.

At first he was very excited... In the early days he managed to deduce some laws known as "Kirchhoff's Laws". The electrical circuits seemed to behave just like those of souls. Instead of resistors, though, he had distances.

But he was very young and absent-minded, and in spite of that, it took him a very long time to discover that the distance he had defined was known as "resistance distance"... And reading what others already knew, he learned that it was a mathematical concept that could be defined in a random walk on a directed graph and weighted in terms of the probability of escape. And, moreover, it could be easily computed with the Moore-Penrose pseudo-inverse of the Laplacian of the graph.

This distance was widely used to calculate resistances and voltages in electrical networks, although, for that, it was assumed that the graph was "undirected" or, what is the same, that the adjacency matrix was symmetrical... That, in "the world of souls" was like saying that everyone received exactly as much as they gave.

Had he found that out earlier, perhaps, he would have gotten further. But he did not discover that until much, much later. And, moreover, he did not find then that nobody had given importance to the fact that that geometry was based on an imaginary particle that always travels, under any circumstances, at the same velocity, nor to the implications that this would have on "the movement" within that geometry. But, as has been said, at that time, this was still far from being understood.

He did realize very early on, that in addition to absolute distance, there was relative distance, which, although not quite a distance, was the only one we could see. In fact this was the first one he thought of.

- The relative distance between you and me r_{ij} is the average time you have to wait for the light to get from you to me by some path. And the absolute distance is the average total time you have to wait for that to happen -

These two distances were related by a simpler and more elementary concept than those.
Archimedes called this: the frequency, and each soul had its own. The frequency of each soul was the portion of all the light that reached each one, or what is the same, the number of times that a soul had the light, divided by the total of the movements of this one.

He sometimes also called this concept "Energy", although he later changed his mind (in part). There were, therefore, some souls that were very energetic or very hot, and others that were hardly reached by light or very cold. Energy was, evidently, a thing that neither is created nor destroyed, since the sum of the energy of the whole universe would always be equal to 1whatever you did.

Although energy could flow from one soul to another, and a very hot soul with a very cold one could end up being both temperate, of course. It was evident that that concept, whatever he called it, was central in a universe made only of souls. More central and elemental than space, certainly, and surely also more than matter. Although... *-What is matter? -*he kept asking himself.

He wanted to develop his idea of space a lot, but he came across a matrix that he did not expect. He called it the

"Action" per own time because it represented the portion of light that each one gave to each one of the others. And this matrix A turned out to be a "stochastic matrix"

He managed with it to find several methods to calculate the distance between two souls for whatever the Action of the universe was, although he always assumed that this "Action" was constant.

And the frequency coincided exactly with the equilibrium eigenvector of the stochastic process defined by A.

From it, he defined what he called the "Action" per total time matrix, which represented the total portion of light in which each soul acted upon each of the others.

With this, it was easy to obtain the matrix "sensation" that represented the portion of light that each soul received from each other.

Moreover, since A was the "transition matrix" of the stochastic process, it determined the transition of the system, or rather, the transition probability.

- ...And, therefore, the Action matrix represents the "time evolution", which, applied to the state of light at a given instant,

gives its state at the immediately following instant, Where the state represents "the probability of finding th light in every soul in the universe at an absolute instant of time t" -

Again, He was thinking too fast. *- But... isn't that vector precisely the wave function of quantum mechanics...? mmm... -* It was still too stochastic an interpretation. Among other things, that "state" added up to 1, instead of having modulus 1, and A was not a unitary operator...

There was a topic that Archimedes had forgotten half on purpose *- What about the main diagonal? A_{ii} What the hell does it mean?*

- And he believed that this must be precisely "the mass".

But it seemed very strange to him.... *- How on earth could a soul give the light to itself?!!!!* He found it hard to believe that this was possible. But he kept thinking about it...

It was obvious that if one soul could give the light to itself, the others would not notice anything at all. How could they? And that is why none of the relative distances between any of them would change either. They wouldn't be able to tell. Not only in the distances. They wouldn't be able to notice it in any observables.The universe would still have exactly the same shape for all of

them. The absolute distances would get bigger, but no one would be able to notice it, because the frequencies of all of them would decrease by exactly the same amount.

- If a soul began to give the light to itself very much... The whole universe would expand very much! Just for one soul! How absurd! One would have to "discount" those instants in the count when calculating the absolute distance so as not to cause such unpleasant swelling....

And if we discount those actions, pretending that we have not seen them...? That way the light would travel a little slower when passing through a soul with mass. But then... Can souls really give light to themselves?

Then Archimedes remembered linear algebra....

- What if I make a base change? By doing a base change, instead of souls I would be left with, as vectors of the base... mixtures made of souls!!!! -

And he thought that those "mixtures" could have "mass" or "give the light to themselves" even if the souls could not. Since on that basis, the main diagonal would no longer be zero (although it would always add up to zero), he called those "mixtures of souls" *"Bodies"*. And he thought that, perhaps, it was possible to find a concrete basis that would make the understanding much easier. Something like "the most important bodies". Those that

would make the world understand in the simplest way. Would those be "the ones with the most mass"? Would that geometry be simplified in this way?

- If those "most important bodies" were precisely the most massive ones, they would give all or almost all the light to themselves, i.e., in the base formed by them the Action matrix would be "as close as possible to a diagonal matrix".

The eigenvectors of the Action were the best candidates, and then the eigenvalues would be the masses m_i since they would be what would be left on the main diagonal of the Action matrix in the new basis... i.e., what those "Bodies" give themselves. Also good candidates were the eigenvectors of the identity minus the action, a matrix known in graph theory as the Laplacian of the graph, since these were exactly the same, of course, although the eigenvalues were somewhat different...

These resembled "the energy of the Hamiltonian's self states" Although it was clear that something was still missing....

- How funny! - Archimedes thought *- In the end, matter will be the spectrum of souls and not the other way around!!!! -*

He also calculated what he called the "Observable" matrix since, multiplied by the action of a soul, you got what that soul felt.

Each soul had its own, and it had several curious things....

It was also a stochastic matrix and was easily obtained from the action.

It was also easy to show that the diagonal of the observation that corresponds to you was the relative distance between you and me multiplied by your action on me. The distance was in the essence of the observation.

But what amazed Archimedes most was that the real part of the eigenvalues of the observation was always nonnegative.

If he had known before, that, in graph theory, the observable was, in the absence of scaling with the diagonal, "the generalized voltage"... maybe I would have gotten further...

And he also knew then that ϕ is harmonic, and is effectively the voltage in an electrical network in the traditional sense.

Archimedes thought that he had always assumed, in order not to complicate his life, that the Action matrix was constant...

- If the Action were not constant... I would change the space configuration every instant... puff... I'll leave it for later.

The seriousness of that matter was indisputable, but he thought that, for now, he would be satisfied with trying to finish "the special theory of souls" and, if that, he would generalize it later. Of course, some little things, he thought, he could not resist. He calculated, for example, how the universe would evolve if we all gave more to the one from whom we have received the most and less to the one from whom we have received the least, of course. And the result was curious. Because the universe would evolve until everyone received as much as he gave, but always keeping the frequency constant.

He also tried to calculate how it would evolve if we all gave more to the one who gave us more, but the problem seemed too complicated. Although it was clear that, in that case, everyone's frequencies would end up equalizing, since only a symmetrical action could be stable.

He made many other calculations and deductions. And there came a time when it seemed to Archimedes that he

was really arriving at "The Theory of Everything" that all physicists were looking for. And then, again, he was afraid he was crazy.

- Careful — what I'm starting to believe is textbook crazy! How can I be the one who has come up with the answer everyone has been after for so long? - But, even so, He still believed it *- I'm done thinking about it! I am not capable of proving it. I don't have the mathematical, physical or metaphysical knowledge or the discipline to do it. -*

This was too difficult for him. He needed the help of a great sage. He needed at least someone who understood him.

- Only a great sage could manage to prove it, but... How to explain it to him? -

Archimedes gave up. He stopped trying to prove "The theory of Souls". He had not stopped believing in it for a moment, but he had stopped believing in himself.

A lot of time passed. He only thought about his theory from time to time, and he hardly ever made calculations anymore. But one day he sat for a while and suddenly he saw that star. It was just a drawing he had made himself

in the world of ideas, but it made him think about it all over again for a few days. He was doing calculations and had a couple or three new ideas that cheered him up.

He solved then, although only numerically, a copy of a classical problem, that of the particle in a one-dimensional box of quantum mechanics. And he was very pleased to see the solutions. He found that all the eigenvectors were wave-shaped. If you looked at the energy of each of those eigenstates, the solution approached the classical solution, but only at low energies. At high energies there appeared effects that prevented the energy from being infinite. He discovered with the discrete Fourier transform of these eigenvectors that they were indeed plane waves. And he managed to prove it analytically. That problem was going to help him a lot. But he still didn't have it...

Then, in the midst of so much calculation, he came up with a very strange way to explain it all. It was not with mathematics, nor with physics, nor with metaphysics. It was with a story. A tale of magic and fantasy. In that story, a very nice wizard with a very long white beard and a wise but rather clueless owl explained the theory with a very, very strange game.

He told that story to three of his friends. Three very wise wizards from the world of ideas. And when he finished, before them, the star appeared, and the three wizards could see it.

After a while, Archimedes wrote them a letter asking them for a gift: to ride their camels and follow that star. If the star stopped, they were to stop with it and if it ran they were to follow it wherever it went. He was sure that the star would lead them to find that child we all have inside and they would see that he was a real child and would stop seeing him as a wooden child. Although the latter, depending on how you understand it, Archimedes was still waiting for someone to convince him.

Archimedes then began to look and be looked at without thinking too much. When the light hit him, he returned it so quickly, that in just a moment he had already looked and been looked at millions of times. It was an avalanche of actions both his towards others and others towards him.

And... Who knows how many actions in total were done in the whole Universe by all the souls in just one instant!!! Between one action and another, billions or millions or millions of millions of things could have happened, or many, many more. Even if for him, all of them had happened in the same instant. Even if for him they were all simultaneous.

Even though he was experiencing a kind of roller coaster of sensations, the good fairy was still the person he was looking at the most by far. He was looking at her so much that he almost seemed to see her. Even if it was only in his imagination. Even if it was only in the world of ideas. When he looked at her, he imagined her inside a beautiful sphere of light, with her magic wand, being good and smiling. But that's all it was: an imagination. Not an image. No?

In reality, Archimedes still saw nothing at all. He was still in absolute darkness and silence. He still had the information, though. The information of when someone was acting on him, and of course, the information of when he was acting on someone. And in the face of such an overwhelming amount of information, Archimedes could do nothing else with it but imagine, or what is the same, create images of what he was seeing, even if it was not with his eyes but with his understanding.

Those images looked like trading cards. The world looked like his imaginary sticker collection. The one of Democritus was a drawing of him, quite drunk and smiling. To each friend, Archimedes had put an image. Or an imagination, rather.

Archimedes remembered his friend Pythagoras. It had been a long time since he had visited him. The last time he had seen him was when there was still light and matter, although space no longer existed at that time. *- My God, how could I have forgotten my friend for so long? Where is my head at?* - he asked. *- Nowhere!!! Ha, ha, ha, ha. -* He answered himself.

- I'm going to visit him right now. - And he did. He began to look at Pythagoras, to give the light to him and only to him insistently and Pythagoras gave it back to him all or almost all the times, or so it seemed. But Archimedes could not remember his face well. He could not create an

imagination, a little picture of him. *- What a mess I am, I can't remember him! -* So, even if it was a small thing, Archimedes imagined him as a speck of light. Like a star in the sky that he could look at whenever he wanted and see his light shining, even though he was so incredibly far away.

And so, little by little, Archimedes forgot more and more faces. And in the end, he imagined most of them in the same way. Each soul was for him like a star in the firmament. Some far away, like Pythagoras, and others closer.

But there was one I did not forget. The closest of all. The one who looked and looked at him the most. The good fairy. She looked like a shining sun, in which inside was still her. He did not want to forget her face for anything in the world and he did not. But in the end only she remained in his memory. All the others were now just stars. He imagined the closest ones as big and the farthest ones as small. The hottest ones were red and the coldest ones blue. Or was it the other way around? The fact is that that firmament was full of stars and starspots of all colors and sizes. It looked like the drawing of a small child who had just picked up the brushes and colors for the first time.

Archimedes began to look at the good fairy, and only at her. And he saw, around her star, the stars of his friends, the souls that were closest to him and her. Each one of a

different color, thus forming a drawing of her own, unique to her. Archimedes realized that when he looked at Lolo he saw a very similar drawing. The only major difference between the two drawings was that when he looked at Lolo he was the one in the center and everyone had moved a little. It was as if he had only moved his head.

Archimedes began to look directly at a lot of people. He shone the light on them insistently and then he saw, for each one, a different image. Each one had his own, characteristic drawing, and Archimedes called this "face". He looked at the face of his friend Democritus and, although they were both drawings, this one was clearly much less beautiful than the drawing of the good fairy, but it was a nice drawing, and also, sometimes, he spent time looking at it.

Those stars were not still at all, they were moving very slowly, and the faces of the people, therefore, were also changing slowly. They were only brushstrokes of color in the starry sky of his imagination, but they had made him completely forget the darkness and silence in which he was in reality. His imaginations had become images, although he still saw them a little blurry and did not understand them well.

One of those times he stared at the fairy for a long, long time. She spent long hours staring at every detail. But

suddenly it occurred to him to do the opposite. He tried to see the drawing as a whole and not as the sum of its parts. And suddenly, like someone who looks at a painting with a thick brushstroke from too close and sees nothing but meaningless smudges, Archimedes began to move away from that painting and suddenly discovered something incredible in it.

- But... But it's the face of the good fairy!!! the one before the game started!!!! - Archimedes could not believe it. There she was with her eyes closed, as if asleep. She clearly still only saw colored stars. Archimedes looked around and saw that he was back in the great enchanted valley and people were sleeping, just like the good fairy did. *- But... What do I see? That's Lolo! -* There was Lolo, wide awake and running after a butterfly, as if nothing was happening. Archimedes looked at the sky and saw a multitude of birds flying. Everything was the same as before he played, even though he was still in the game. *-¡¡¡¡Eureee-kaaa!!!!! -* He shouted as excitedly as he had ever shouted before.

- I finally understand!!! I know how light creates matter!!! And space and time, and colors and smells!!! And everything I have ever seen or heard or that has ever come through my senses!!!!

Archimedes could not believe it. *- I finally understand how the universe works!!! Merlin!!!! Merlin!!!!! -* he shouted desperately.

Now everything was clear to him. - *Only souls exist!!! Matter does not exist, nor space. Not even time. They are only mathematical relations between us.*

And all these sensations that I have and I didn't know where the hell they come from are the drawings that I make myself mentally to easily understand what the rest of the souls of the universe do about me.

And they do it without needing any intermediary. They need neither light, nor space, nor ether, nor any other medium. They act on me, directly, just as I act on them.

I get it now, Merlin!!! The universe is made of souls!!!!! -

Archimedes couldn't see Merlin anywhere, but he was sure he heard him in his head saying:

-Very good Archimedes!!! you got it!!!

Keep playing, keep thinking, and above all try to keep enjoying yourself.

Don't be afraid because, although it may not seem like it, life is just a game.

Even if it is the most perfect, the most fun and the most realistic of all games.

Although so many times it seems an unfair game, in which some have started with an advantage.

Even if it makes you cry or suffer so much, so much, that it stops being a game and becomes something very, very serious.

Without that it would be a boring game, with no real excitement.

And this game can't be boring. It has to be the most exciting. It has to be the best of all games.

As it could not be otherwise.