Celestial Code

demo

Neural Cosmology

Mikhail Savchenko

Second edition, expanded and revised

2026

From the Author

This is “The Celestial Code.” Not a textbook. Not a manifesto. Not another book “about everything.” It’s one guy’s attempt to take the Universe apart gear by gear—and discover that the gears are staring back.

I’ve been building neural networks for twenty years. First—to find patterns in data. Then—to understand how they learn. And then I looked at the Universe—and recognized the same patterns. The same learning equations. The same architecture. Which, you’ll admit, sounds roughly like a plumber looking at Niagara Falls and saying: “There’s a pressure problem here.” Maybe he’s right. Or maybe he just sees pipes everywhere. I see pointers instead of pipes.

Vanchurin showed it formally: the world—literally—may be a neural network. Vazza and Feletti showed it empirically: the brain and the Universe are built the same way. Levin showed that the shape of living things is set by electricity, not DNA. Tononi—that consciousness is measurable. Hoffman—that we see an interface, not reality. All of these are other people’s work, published in serious journals. I just piled them together and looked around. The pile turned out to be suspiciously tidy.

The first version of this text came out in July 2024—thirty-five pages, wide eyes, too many exclamation marks. Since then I’ve built a formal model (Pointer Architecture), tested it against 175 galaxies, and added what the first version sheepishly left out: my own biography. Because the “seams in reality” this book is about—I’ve been seeing them since childhood. And for twenty years I pretended that was normal. Turns out—it is normal. Just normal for a different picture of the world. The one I’m describing here.

My biography in this book is data. Unreproducible, subjective, the kind that gives a methodology committee a migraine. But—data. First-person data. The only kind of data I have about what it’s like to *be inside* the thing I’m describing from *outside*.

The book has three levels of reliability: “verified” (other people’s papers, peer-reviewed journals), “hypothesis” (my model, which hasn’t been disproven yet but hasn’t been proven either), and “personal experience” (I lived through it, but I can’t prove it, and if you don’t believe me—that’s your right). Where the boundary falls between them—I’ll be honest: I’m not always sure myself. But I promise to always tell you which floor I’m on. So you know when you’re listening to a scientist, when to a hypothesis-spinner, and when to a guy with saucer-wide eyes telling you what he saw.

A map. Rough. Hand-drawn. With dragons in the corner.

A draft. Always—a draft.

Mikhail Savchenko
2026

Contents

Chapter 1

A Colander for Soup

Are you sure you know how the world works?

Not "roughly." Not "more or less." *Sure.* Matter — exists. The laws of physics — work. Consciousness — a byproduct of the brain. The brain — a machine made of neurons. The universe — big, cold, indifferent. You — small, warm, doomed. Questions?

If you have no questions — you don't need this book. Seriously. Close it, return it, spend the money on something useful. Because everything that follows is *questions*. Uncomfortable ones. About facts you thought were obvious. About a worldview you inherited — bulky, familiar, and cramped. Like your grandmother's china cabinet: you've accumulated more stuff, but the shelves haven't changed.

If you do have questions — let's go.

* * *

In 2020, an astrophysicist from Bologna and a neurosurgeon from Verona published a paper that shouldn't have surprised anyone. It surprised everyone.

Franco Vazza and Alberto Feletti compared two images. The first: a slice of cerebral cortex, magnified forty times. The second: a computer simulation of the large-scale structure of the universe, compressed by billions. Two scales separated by twenty-seven orders of magnitude. The distance between a neuron and a galactic cluster — that's a one followed by twenty-seven zeros.

The images were indistinguishable.

Statistically, topologically, by distribution of nodes and connections — indistinguishable. Connections per node, spectral density of fluctuations, fractal dimensionality — the same values, shifted by exactly the scale factor separating a neuron from a galactic cluster. The numbers and the table — in the next chapter. What matters here is the *point*: two systems differing in scale by a one followed by twenty-seven zeros are built on the same math.

The paper was published in *Frontiers in Physics*—a peer-reviewed scientific journal, meaning other scientists check the text for errors before publication. Not a blog, not a YouTube channel, not a "quantum awakening" course for $499. Science.

And science — had no idea what to do with it.

* * *

The problem isn't that the brain looks like the universe. Resemblance — that's pareidolia: the tendency to see faces in clouds, dogs in the outlines of countries on a map, Jesus on a burnt piece of toast. The brain is trained to find patterns even when there aren't any — which is why any neurobiologist will tell you: "Visual similarity proves nothing." And they'd be right.

The problem is something else. Vazza and Feletti didn't compare pictures by eyeballing them. They ran both structures through the same mathematical tests — measured how "complexity" is distributed across scales (spectral analysis), how connections between nodes are organized (network topology), how much the pattern "fractures" when you zoom in (fractal dimensionality). And the math said: these two systems belong to the same class. *Identical* in their structural parameters.

This is like finding matching fingerprints on an ant and an elephant. You can write off visual similarity as coincidence. Mathematical similarity — you can't. Math has no imagination. It just counts.

And what it counted was a match whose probability is too small to be chance and too large to draw a conclusion from. Because the conclusion — if you say it out loud — sounds like this: *the universe and the brain are built from the same blueprint*.

Saying this out loud in academia is roughly like standing up at a company all-hands and announcing: "Colleagues, I believe our company is a shark's dream." They won't fire you. They'll just stop inviting you to meetings.

* * *

This book is an attempt to say it out loud.

There's too much data to ignore and too little to build a theory from. We're at the point that's the most uncomfortable and the most productive in science: when the old picture can no longer contain the facts, but the new one hasn't been formulated yet.

Physicists call this a "crisis." Historians of science call it a "revolution." I prefer a more honest word: *a crack*.

A crack is where you can see that behind the wall — there's something. That the wall is the boundary of a *model*, not of the world. And that behind the model lies something we don't yet have language for, but already have data on.

* * *

Here are a few cracks. With details — because without details it's a TED talk, not science. Because in science the only currency is reproducibility.

Crack one: structure. Vazza and Feletti (2020) — the cosmic web and the brain's neural network are statistically indistinguishable. Krioukov et al. (*Scientific Reports*, 2012) — the causal network of spacetime grows by the same laws as the internet and social networks. *The same math*. The difference in scale — twenty-seven orders. The same clusters, filaments, nodes, voids. As if an architect drew one blueprint — and built *everything* from it. From a neuron to a supercluster of galaxies.

Crack two: information. In 1961, physicist Rolf Landauer proved — and in 2012 it was experimentally confirmed — that when you erase one bit of information — one "yes" or "no" — the Universe *releases heat*. Tiny — but real. If information can be turned into heat, then information is *physical*. It's not "about" reality. It *is* reality, on par with energy and mass. And physicist Bekenstein showed something even stranger: all the information about the contents of a black hole is written on its *surface*, not inside. As if the contents of your apartment — furniture, books, cat — were entirely determined by the wallpaper. Hence the "holographic principle": three-dimensional space is — possibly — a projection of two-dimensional information. A hologram.

Stephen Hawking spent thirty years arguing against this. A black hole, he said, *destroys* information. Whatever falls past the horizon — gone. In 2004 — he *conceded*. Publicly. At a conference in Dublin. He paid John Preskill the bet he'd lost — an encyclopedia of baseball. Information is *never destroyed*. Anywhere. Ever. This is a *law*. As solid as the conservation of energy. Except it's about bits, not joules.

Crack three: form. Biologist Michael Levin (Tufts University) discovered that cells know what shape to build *before* genes start working. Information about form is stored not in DNA but in electrical signals between cells — in voltage differences across their membranes. Levin grew eyes on a tadpole's tail by changing the electrical "address" of the cells, without touching a single gene. And his "xenobots" — frog cells separated from the organism — self-organized into *new life forms* that had never existed on Earth before. No instructions. No program. Where do they "know" what to build?

Even more vivid — the planarian. A flatworm, less than an inch long. Cut it in half — each half grows into a whole worm. Cut it into twenty pieces — twenty worms. Levin altered the bioelectric pattern in one fragment — and it grew into a worm *with a different species' head*. Not a mutant. Not a freak. A normal, healthy worm — but a *different one*. The DNA — the same. The form — *different*. Because form isn't dictated by DNA. Form is dictated by — *something else*.

Crack four: learning. Vitaly Vanchurin (*arXiv*, 2020; with Katsnelson and Koonin — *PNAS*, 2022): the universe is — literally, not metaphorically — a neural network, and its dynamics is a learning process. From this formalism you can derive quantum mechanics (as the fast-learning limit) and gravity (as the slow-learning limit). Evolution is a special case of learning. It *is* learning — mathematically, no metaphors.

Crack five: the observer. Neuroscientist Giulio Tononi proposed: consciousness is a fundamental property of any system whose parts work *together* rather than separately. The more the whole differs from the sum of its parts — the "more" consciousness. He even came up with a number for it — Φ (phi). And cognitive scientist Donald Hoffman mathematically proved: evolution optimizes for survival, not for understanding reality. We *don't see* the world as it is. We see an *interface* — a simplified picture optimized for not getting eaten. Like a computer desktop: the icons on the screen help you work, but they have nothing in common with what's *actually* happening inside the processor.

Five cracks. Five directions in which the standard picture of the world — "there's matter, there are laws, there's us" — *doesn't work*. "Outdated" is too soft: that word implies the new picture is ready, and it isn't. "Disproven" misses too: you disprove a theory; a worldview you just *prop up with data that won't fit inside it*.

Like a colander that won't hold soup. The holes are its design. You're just using it for the wrong purpose.

(You're thinking right now: "This is all cherry-picking. The author grabbed flashy facts from different fields and dumped them in a pile. This isn't science — it's a TED talk." Fair. For now — it *is* a TED talk. The science starts in the chapters that follow, where every crack will be backed by specific data, specific papers, and specific equations. This is the *observation deck*. You can see far from up here. But the details are down below.)

* * *

Each of these cracks — on its own — is explainable. You can say: "The similarity between the brain and the universe — that's self-organization." Or: "Information is physical — so what, energy is too." Or: "Levin works with bioelectricity — that's not some 'other layer,' it's just electrophysiology." Taken individually — every objection is *convincing*.

But five fingers together make a *fist*. And that fist is pounding on the door of the standard model of the world with a question it can't answer: *why do all five cracks point in the same direction?*

In the direction of — deeper. Beneath physics. Beneath information. Beneath form. Toward something that *generates* all of the above. The way an operating system generates an interface. The way DNA generates a protein. The way — *something* — generates — *everything*.

* * *

Here's where a reasonable reader — if they're still here — should say: "Wait. Couldn't this all just be self-organization?"

Fair question. Self-organization is one of the great words of the twentieth century. It explains how the complex arises from the simple. How order emerges from chaos. Snowflakes. Ant colonies. Traffic jams. Nobody *designs* a traffic jam — it just *happens*. From simple rules: every driver brakes when they see red lights ahead. The result — a system nobody planned.

Can all five cracks be explained by self-organization? Each one — *individually* — you can try. The brain and the universe are similar — because both are networks, and networks obey universal growth laws. Information is physical — well, so is energy, what's new. Form isn't in the DNA — it's in epigenetics (the layer on top of genes that controls which genes are switched on and which are switched off), we just haven't figured it out yet. The world as a neural net — pretty math, but a metaphor. Consciousness is fundamental — that's philosophy, not physics.

Individually — every objection works. Just like every piece of evidence individually explains why your neighbor isn't a serial killer: he has a job, he walks his dog, he waves hello. But — if there's a suspicious smell from the basement, plastic bags in the garage, and the dog is *afraid* of him — you might want to *call the police*. Because *five clues at once* — that's a pattern. A *pattern*.

A pattern isn't proof. A pattern is *grounds for investigation*. This book is the investigation.

Max Planck — the man who introduced the quantum in 1900 and launched the quantum revolution — called his discovery "an act of desperation." He didn't *want* to introduce the quantum. The quantum contradicted everything Planck knew about physics. Energy is continuous. That's what they taught. That's what everyone believed. That's how it *was* — for two hundred years.

But the data wouldn't fit. Physicists were measuring how hot objects glow — what color the light is and how much of it there is — and the results *wouldn't match* any formula. Planck tried everything — and found nothing that worked. Except for one assumption: energy doesn't flow like water. Energy comes in *portions*. In chunks. In quanta.

"An act of desperation," he wrote. "I was ready to sacrifice any of my previous convictions about physics."

From that "act of desperation" grew all of quantum mechanics. Transistors. Lasers. Computers. The internet. The entire digital civilization — from a moment when one scientist looked at data that wouldn't fit the picture — and *changed the picture*.

We — maybe — are in such a moment. The data won't fit. The picture is cracking. And someone has to commit an "act of desperation" and propose a new assumption.

The assumption is this: *information is more fundamental than matter, consciousness* *is more fundamental than physics, and reality is layered.*

Maybe this is truth. Maybe it's delusion. But the data — *points here*. And a scientist who ignores data because the conclusion is "uncomfortable" isn't a scientist. He's a bureaucrat. With a diploma.

Planck looked at the data and changed the picture. I hope I'm doing the same. Though, honestly, I'm a guy who spent twenty years building neural networks, then looked at the universe and said: "Hang on, I *know* this thing." Which, you'll admit, sounds roughly like a plumber looking at Niagara Falls and saying: "There's a pressure problem here." Maybe he's right. Or maybe he just sees pipes everywhere.

* * *

I'm an artificial intelligence researcher. Twenty years building systems that find patterns in data. And here's what I noticed: the pattern emerging through all five cracks is *the same one*.

Information is primary. Matter is secondary. Form is the *cause* of physics, not its consequence. Consciousness is a property of the very fabric of reality, woven into it from the beginning. And what we call "the physical world" is an interface. A screen. The top layer of something far deeper.

This is data. Uncomfortable, ill-fitting, annoying data — but data. With paper numbers, with peer reviews, with reproducible experiments.

Mysticism says: "Believe." Science says: "Verify." This book is about "verify." Every claim — with a citation. Every hypothesis — with a caveat. Every conclusion — with a question mark.

Because a scientist with an answer is a lecturer. A scientist with a question is a scientist.

* * *

What you're holding in your hands.

This book is a *map*. No exercises at the end of chapters. No calls to action. With memoir digressions — they're here as data, not decoration. With references — real ones, verifiable ones. Rough, incomplete, drawn by hand. A map of a territory I'm exploring — one that may *not exist*. Like the maps of medieval sailors: here's the coastline (verified), there are mountains (spotted from afar), and over here — "here be dragons" (unverified, but somebody mentioned it).

My "coastlines" — Vazza and Feletti's data, Landauer's principle, Levin's work, Vanchurin's paper in PNAS. Verified. Published. Reproducible.

My "mountains" — my own model (more on that in chapter eleven), neural-network cosmology, IIT. Visible from a distance. The math is consistent. The data is preliminary. The contours are clear; the details aren't.

My "dragons" — consciousness as the foundation of reality, debug mode, reading the archive, synchronicities. Unverified. But — *experienced*. And somebody — *mentioned it*.

You'll decide for yourself where the coastline ends, where the mountains begin, and where the dragons live. I'm just *drawing the map*. As best I can. With annotations: "here — data," "here — hypothesis," "here — personal experience." Three different levels of reliability. Where the boundary falls between them — I'll be honest: I'm not always sure myself.

* * *

The book's structure mirrors the structure I see in the data. It's the best framework I've found for organizing what we know so far. Maybe I'm wrong about the conclusions — but the order of presentation — I'm confident about.

Reality is *layered*. Beneath the physical world — a layer of information. Beneath information — a layer of form and self-organization. Beneath form — causation and learning. Beneath learning — consciousness and the observer.

A specific hypothesis, based on specific work by specific scientists, published in specific journals.

Maybe I'm wrong. Maybe in ten years this book will be cited as an example of how a smart person connected the right data in the wrong way. That's fine. Science works exactly like this: someone gets it wrong — and the mistake turns out to be more productive than the right answer nobody was looking for.

But maybe — and this is the most uncomfortable possibility — the cracks in the wall aren't defects in the wall. They're *windows*.

And behind them — it's not empty.

Strangled at Birth

I was born strangled.

Not a metaphor. Literally: umbilical cord, neck, oxygen deprivation, blue baby. The midwife handled it—here I am, writing a book. But Stanislav Grof, the Czech psychiatrist who spent half a century studying perinatal experience and altered states of consciousness, would call this an *imprint*. The first write on a blank disk. The first pattern around which everything else assembles.

Grof is an uncomfortable figure. For mainstream psychiatry, he's roughly what Vanchurin is for physicists: formally impeccable, substantively—unbearable. Over four thousand LSD sessions (legal ones—he started in the sixties, when it was still permitted). Then holotropic breathwork, once LSD was banned. Then thirty years of systematizing data that refused to fit any existing model.

The result: four "Basic Perinatal Matrices"—BPMs. Four layers of experience tied to birth. BPM-I—blissful unity with the mother (before contractions begin). BPM-II—compression, no way out, walls closing in (contractions have started, but the cervix is still closed). BPM-III—struggle, pushing through the canal, blood, pressure, suffocation. BPM-IV—emergence, light, first breath, "second birth."

I'm a BPM-III. Strangling. Cord. Struggle. And—if you buy Grof's framework—that first experience *formats* everything that follows. Formats—the way a file system formats a disk: data comes later, structure comes *now*. A person imprinted with BPM-III—according to Grof—perceives the world as *resistance*. As pressure you have to *push through*. As a wall, and behind the wall there's *something*, but the wall *won't let you pass*.

I don't know if Grof is right. Four thousand sessions—that's data. But data collected in altered states of consciousness is data that gives a methodology committee a migraine. How do you verify it? How do you reproduce it? How do you tell a "perinatal memory" from a "hallucination dressed up as a perinatal memory"?

Honest answer: for now, you can't. Grof is in "here be dragons" territory. His map is detailed, elegant, internally consistent. Awaiting verification. Like a medieval map of Africa: the coastline is accurate (someone checked), but inland—"terra incognita" and drawings of elephants.

(For the Western reader—a brief context, because without it "Grof, psychedelics, perinatal matrices" sounds like New Age, when in fact it's *legitimate science*. Michael Pollan in 2018 published "How to Change Your Mind"—a *New York Times* bestseller that later became a Netflix series. It tells the story of how the FDA in 2017 granted psilocybin "breakthrough therapy" status for treatment-resistant depression. MAPS—

the Multidisciplinary Association for Psychedelic Studies, founded by Rick Doblin in 1986—completed Phase 3 clinical trials of MDMA therapy for PTSD in 2023. Results—better than any existing PTSD therapy. FDA approval is expected—by the time you read this book, it may already have been granted. This is *not* “alternative medicine.” It is a *regulated clinical protocol* within the standard FDA pathway. Grof is—finally—being read *in serious peer-reviewed contexts*. His “perinatal matrices” are still unvalidated. But the *category*—“psychedelics as a tool for studying consciousness”—went from semi-underground to mainstream between 2015 and 2025. I witnessed this shift. Half of my “experiences” happened when this was *illegal in every respectable jurisdiction*. The other half—when they became *legal-adjacent* in Oregon, Colorado, the Netherlands. The context shifted. The data—stayed the same.)

I’m telling you about Grof not because I believe him. But because the strangled baby is *me*. And—something—he describes *accurately*. The feeling of a wall. The feeling of “there’s something behind the wall.” The feeling that the world is *not all there is*. That the visible is *incomplete*. That between things there are *gaps*.

Coincidence? Maybe. Confirmation bias? Maybe. But I’m obligated to mention it. Because a scientist who hides his biases isn’t a scientist. He’s a marketer.

* * *

I know I was always a strange kid.

“Strange” is its own category. Difficult kids are understandable: they’re loud, they fight, they don’t listen. There’s a manual for them: discipline, patience, therapist. Strange kids are different. They’re not loud. They watch. Things other kids don’t watch. Shadows. Corners. The seams between things.

I watched the seams.

No mysticism here—I didn’t see auras, didn’t chat with angels, had no visions. What I had was a *sensation*. Constant, background, indistinct: the world is *not quite* the way adults describe it. Not “different”—*not quite*. Like a photograph that’s slightly off-register: looks like the same thing, but—if you look closely—the edges don’t line up.

Specifically. I remember—I’m six or seven—sitting in the kitchen, my mom is cooking something, and suddenly—for a split second—everything *freezes*. Not “time stops” (that’s a cliché, and it’s inaccurate). More like—between one instant and the next—a *pause* becomes visible. A gap. Like between frames of film. A moment ago the world was continuous—and now—*discrete*. Assembled from separate “pieces,” with *nothing* between them. And that “nothing”—lasts. Not long—but *noticeably*.

Then—everything continues. Mom is cooking. The kitchen is still there. And I can’t explain what just happened. Because nothing happened. It’s just—for a second—you could see that the world is *assembled*. From parts. And between the parts—gaps.

This kept happening. Rarely—maybe once every few months. Randomly, no schedule. Usually in quiet moments: when there's nothing to do, when attention is scattered, when you're *not looking*. Like peripheral vision: you catch movement *to the side*—but when you turn your head—nothing's there. Direct gaze—*wrong instrument*.

* * *

Problem: a kid has nothing to compare against. A kid doesn't have a "normal" perception to use as a baseline. You don't know you see the world differently—because you've never seen another world. Like a fish doesn't know it lives in water. For a fish, water isn't the environment. Water is *everything*.

So I couldn't articulate it. Couldn't say: "Mom, I can see events assembling before they happen." I didn't see it—*clearly*. I *felt* it. The way you feel a change in barometric pressure: not with your ears, not with your eyes—with your *body*. Something's off. What exactly—unclear. But—*something*.

Once I tried. I was about ten. Told my mom: "I feel like everything around me is kind of… painted. Like there's something else behind it." My mom looked at me with an expression I later learned to recognize: alarm disguised as calm. "You just think too much," she said. "Go play outside."

I went. And didn't try to explain again. For twenty years.

Teachers said: "Head in the clouds." Parents: "Too much of a thinker." The school psychologist: "A rich inner world." Three ways of saying the same thing: *we don't understand what's going on with you*.

I didn't understand either. Twenty years—didn't understand. Then—I started to.

* * *

The first click—the kind you can name and date—happened at school. Or at my first trance party. Or the first time I was truly scared—scared enough that the world *shifted* for a second, and under the familiar picture something *else* showed through.

I don't remember exactly. And that's important. Because "seams in reality" aren't an event. They're an *accumulation*. Like a crack in a wall: you don't remember when it appeared. It was *always there*. You just *noticed* it one day.

I noticed—and couldn't stop noticing. Like a person who spots a wire sticking out of the wall in a restaurant: before that—"nice interior." After—"a set, and behind it—wires, pipes, and concrete." You can't un-see it. The wire is now part of the picture. Permanently.

* * *

Twenty years I searched for an explanation. More accurately—twenty years of *background unease* that periodically moved to the foreground. “A continuous search” would be a lie.

First attempt—psychology. Around sixteen or seventeen—Jung. *Archetypes and the Collective Unconscious*. I read it and thought: this, *this is it*. The collective unconscious—a shared layer everyone is plugged into. Archetypes—patterns that exist *before* individual experience. Mandalas, shadows, animus—*structure* that precedes content.

Beautiful. Convincing. And—*unfalsifiable*. Jung was describing a world you can’t inspect with instruments. His model is like good poetry: it resonates—but can’t be measured. For me—an AI guy, someone used to data—that wasn’t *enough*. The feeling matched. The method let me down.

Second attempt—neuroscience. Around twenty, twenty-two. Ramachandran, Sacks, Damasio. The brain as machine. Consciousness as a function of the cortex. Illusions, synesthesia, phantom limbs. A world where everything has a neural explanation. Gaps?—that’s your temporal lobe. Feeling of “unreality”—depersonalization, here’s your DSM code, here’s your SSRI. Next.

Elegant. Measurable. And still—off target. Neuroscience explained *how* I felt the gaps. But was silent on *why*. What’s the evolutionary function of a sensation that the world is assembled from parts? Why would the brain show its owner the “seams” in reality? Bug? Or—*feature*?

Neuroscience said: bug. Glitch. Noise. Treat it.

I wasn’t convinced.

Third attempt—AI. My profession. And maybe my way of building a model of what I *feel* but can’t *describe*. Neural networks. Training. Patterns. Data from which structure *emerges on its own*—without anyone designing it. You take a million photos of cats—and the network *finds* “cat” by itself. Nobody told it what a cat is. It *found it*. In the data. A pattern that *was there*—but that nobody *specified*.

And right there—something *clicked*. Not loudly. Not all at once. Clicked—*quietly*. Like a relay. Because—if a neural network finds a pattern nobody specified—maybe—I’m finding a pattern nobody specified too? Maybe the “gaps” aren’t a bug in my brain but a *pattern in the data* that my brain—like a neural network—*detects*? A pattern that *exists*—but that science hasn’t *described* yet?

Maybe. Or maybe not. And here’s the key point.

* * *

Confirmation bias is the most elegant trap evolution ever set for *smart* people.

(Doesn't work on stupid ones. Stupid people don't build theories. Don't look for patterns. Don't connect data into a picture. Confirmation bias is a disease of *those who think*. The smarter you are, the deeper the trap. Because a smart person can *justify* anything.)

Here's how it works. You *want* the world to be multi-layered. You've *felt* it since childhood. You spend twenty years looking for confirmation—and of course you *find* it. Because the brain is a neural network trained on *your* data. It filters out what doesn't fit and amplifies what does. Every "crack"—confirmation. Every objection—"well, they just can't see it."

Textbook stuff. Cognitive bias 101. Chapter two.

And—here's what I have to say: *I don't know if that's exactly what I'm doing*. Don't know if I'm assembling data into a picture I *want* to see. Don't know if this entire book is an elaborate, carefully argued, properly cited—*self-deception*.

Maybe.

But—here are three arguments against. Arguments, not proofs—the difference matters.

First: the data isn't mine. Wazza and Feletti don't know about my "gaps." Vanchurin hasn't read Grof. Levin isn't familiar with Jung. Five independent lines of research, five independent groups of scientists, none of whom set out to confirm *my* sensation. And—all five—*point in the same direction*. Confirmation bias explains why *I* connected them into one picture. But it doesn't explain why they *connect*.

Second: I'm not the first. Historian of science Thomas Kuhn described this situation in 1962: "anomalies" that accumulate within a paradigm until they reach critical mass. Planck didn't want to introduce the quantum. Einstein didn't want his equations to describe an expanding universe (he added the cosmological constant so it *wouldn't* expand; later called it his "greatest mistake"). The data forced them. Maybe here too—the data is *forcing*. Or maybe—*not*. Honestly—I don't know.

Third: I *can be wrong*. And that's *fine*. What's worse is when someone *can't* be wrong. When they have "the truth." When they *know*. I don't have the truth. I have data, a sensation, and a question. Three ingredients that sometimes produce science. And sometimes—delusion. The difference becomes clear *after*. Not before.

* * *

I'm telling you all this not for sympathy and not for "authority of the one who suffered." I'm telling you because a scientist who writes about cracks in the picture of reality is obligated to say: how does he *know* the cracks are there?

My answer: the same way a bacterium "knows" a photon is a wave. Not from a textbook. From *experience*. From the fact that I'm a strangled, strange kid who grew up to be an AI researcher and discovered that the world he'd spent twenty years sensing was "not quite right"—really *isn't quite the way* the textbooks describe it.

But that's not an answer yet. That's a *claim*. The answer will come in the following chapters. In the data. In the equations. In the paper citations.

For now—one more observation. Not scientific—*personal*.

Twenty years of searching taught me one thing. "The world is multi-layered"—that's a hypothesis, still requiring proof. "I'm special"—that's narcissism. But this—is a fact: *a sensation is not proof. But a sensation is data*. First-person data. Unreproducible, unverifiable, subjective. And—nonetheless—*data*. Which you can ignore. Or—*take under consideration*. And—see what happens.

Maybe it's bias. Confirming your own expectations. The classic trap: you *want* the world to be multi-layered—so you find evidence for it, ignoring whatever doesn't fit.

Maybe.

Or maybe—a bacterium that "feels" a photon knows more about it than the physicist who *measures* it.

I don't know.

But—I continue.

Chapter 2

Twenty-Seven Zeros

Let's start with an uncomfortable question: why does the Universe look like a brain?

Look like. Literally looks like—with all the statistical rigor modern science can muster.

Vazza and Feletti weren't the first to notice. The visual resemblance between microphotographs of neural networks and computer models of the Universe's large-scale structure had been floating around the internet for years—as a meme, as a curiosity, as a cool poster for the office of a physicist with a sense of humor. But until 2020, nobody actually *ran the numbers*.

They ran the numbers. Here's what came out.

But first—context. Because without context, numbers are just numbers.

* * *

How we found out the Universe is a web.

Until the 1980s, cosmologists assumed galaxies were distributed across the Universe more or less evenly. Like raisins in dough: random, but—on average—uniform. Then came redshift surveys—systematic three-dimensional maps of galaxy positions. The CfA Redshift Survey (1986). The Sloan Digital Sky Survey (2000s). And—the dough turned out to be a *sponge*.

Galaxies aren't scattered evenly. They're concentrated along *filaments*—long, thin structures stretched across the void. Filaments converge at *nodes*—massive clusters containing hundreds and thousands of galaxies. Between the filaments—*voids*: bubbles of emptiness containing almost nothing. The average void is 300 million to a billion light-years across. Volumes measured in trillions of cubic light-years. Emptiness.

The whole thing is called the *cosmic web*. The largest structure in the observable Universe. So large that light needs billions of years to cross it from end to end. So beautiful that when researchers at UC Santa Cruz in 2020 used an algorithm inspired by the *slime mold* Physarum polycephalum to model the cosmic web—they got a near-perfect match with observations. A slime mold—a single-celled organism with no nervous system—builds transport networks that are mathematically identical to the large-scale structure of the Universe.

(Pause. A slime mold. No brain. Builds a network. Like the Universe. You sure "consciousness" is required to create structure? Or is it enough to have—*rules*?)

The cosmic web is the large-scale structure of the Universe: *connections* between galaxies (galaxies are nodes): filaments of dark matter and gas stretched across the void, tens and hundreds of megaparsecs long. Between the filaments—voids, bubbles of emptiness hundreds of millions of light-years across. The entire observable Universe is a foam of filaments and voids, and if you could somehow look at it from outside (from where, exactly?), you'd see—a web.

A *web* in the literal sense. A three-dimensional network of filament-like structures connected by nodes, with a characteristic cell size and a power-law distribution of connections.

The brain's neural network is, roughly speaking, the same thing: a hundred billion nodes (neurons) connected by a hundred trillion links (synapses), organized into layers, columns, and modules. Between dense clusters of neurons—there are "voids" too: regions of white matter where only axons run—long "wires" connecting distant regions.

Vazza and Feletti took both datasets—cosmological simulations and microphotographs of brain slices—and applied the same analytical tools.

* * *

Results. Four tests. Here's what came out.

Test one: distribution of complexity. Imagine you're listening to music and want to know how much bass there is, how much midrange, how much treble. There's a mathematical technique for this—it breaks any signal into "layers" by scale. Physicists call it spectral analysis; all that matters for us is that it works like an X-ray: it reveals internal structure invisible to the eye.

Vazza and Feletti ran both systems through this "X-ray"—the cosmic web and the brain. Result: an *identical* spectrum. The same "frequencies" dominate. The same are suppressed. The curves are parallel, shifted by exactly the scale factor separating a neuron from a galaxy cluster.

How exactly they did it. Vazza took a computer model of the Universe—a simulation in which a computer calculates the motion of billions of particles under gravity. Feletti took photographs of brain slices under an electron microscope—so detailed you can see every individual neuron. Both datasets are three-dimensional. Both contain points and connections between them. And both were processed by *the same program*. One code. Two worlds. One result.

This matters. When you compare two images by eye—that's pareidolia (the brain sees what it wants to see). When you run both datasets through the same mathematical test—that's no longer eyes. That's mathematics. Eyes can be fooled. Mathematics cannot.

Test two: how connections are arranged. Vazza and Feletti drew both systems as diagrams: points (nodes) and lines between them (connections). And counted *how* the points are connected. How many connections per node? In the cosmos—on average 3.8–4.1. In the brain—4.6–5.4. For comparison: in New York City's road network—about 3 (intersections). On the internet—2 to 7. The brain and the Universe sit in *the same narrow corridor*. Like two cities built from the same master plan on different continents.

Test three: clustering. In both systems, nodes are gathered into dense groups connected by long "bridges." This arrangement is called a "small-world network"—you may have heard that any two people on Earth are separated by no more than six handshakes. That's it. The brain is built as a "small world." The Universe—also. The internet—also, but with different numbers.

Test four: how much fits. Vazza estimated the information capacity of both systems—how many "yes/no" answers can be encoded in them. The observable Universe stores roughly 4.3 petabytes (a petabyte is a million gigabytes, roughly two hundred thousand HD movies). The human brain—2.5 petabytes. The difference—less than twofold. Even though the difference in *size*—twenty-seven orders of magnitude.

From the press release accompanying the paper, Feletti's summary: "The connectivity within the two networks probably evolves following similar physical principles, despite the striking difference between the physical powers regulating galaxies and neurons."

Read that sentence again.

You just thought one of two things. Either: "So what, the numbers are similar, it means nothing." Or: "Wait—does that mean the Universe *remembers*?" Both reactions are reasonable. The first is safe. The second is terrifying. Terrifying—because if it's true, then every galaxy is a *record*. Every void is a *pause between records*. And what we call the "observable Universe" isn't "space with objects in it." It's *memory*. Fifty-eight billion light-years across. Whose memory—*that's a separate question*.

* * *

Now—the honest part. Because without it, this would be propaganda, not science.

What this does *not* prove.

There's another parallel floating around the internet that deserves an honest look. Seventy percent of the Universe's mass-energy is dark energy—a "passive" component accelerating expansion. Seventy percent of the brain's mass is water. The remaining thirty percent is "active" structure: galaxies (cosmos) and neurons (brain).

The numerical match is striking. But—superficial. Water in the brain actively participates in biochemistry: ion transport, osmosis, protein folding. Dark energy accelerates the expansion of the Universe. The functions are *fundamentally different*. This is a numerical coincidence, nothing more. Great for a poster. Useless for science.

I'm telling you this because *honesty* matters more than the "wow factor." There will be plenty of real "wows" in this book. We don't need fake ones.

* * *

What this *also* doesn't prove.

It doesn't prove the Universe is a brain. Doesn't prove it "thinks," "feels," or "is aware." Structural similarity doesn't mean functional similarity. The circulatory system is a network too. A tree's root system is a network. The Moscow Metro is a network. Not everything that looks like a neural network *is* a neural network.

Counterargument—and it's a serious one. Physicists Barabási and Albert showed in 1999: many complex networks—from the internet to protein interactions inside cells—are built according to the same law. Most nodes have few connections, but some have *a lot*. Like in school: most kids have five or six friends, but one kid knows a hundred people. This is a property of *self-organization*, not evidence of some unified "mind." Maybe the brain and the Universe look alike simply because both are products of self-organization. Like snowflakes resemble stars—because the physics of symmetry is the same.

The answer—and it's also serious. Vazza and Feletti compared the brain and the Universe not only to each other, but also to other networks—clouds, tree branches, water flows. The brain and the Universe turned out to be *more similar to each other* than to any of those systems. If it were just about universal laws of network growth, the similarity would be the same across all of them. It isn't. The brain and the Universe are a *special case*.

Krioukov et al. (*Scientific Reports*, 2012) went even further. They showed that the way our expanding Universe grows, and the way complex networks grow (the internet, social networks), are described by *the same equations*. Literally: plug in one set of numbers—you get the internet. Plug in another—you get spacetime. One formula—two worlds.

This is no longer pareidolia. This is a hint that self-organization itself needs explaining: it's *part of* the mystery, not its solution.

* * *

There's one more result—so strange I don't know what category to put it in. In 2020, researchers at UC Santa Cruz used a *slime mold*—Physarum polycephalum, a single-celled organism with no brain, no nervous system, no *anything* except yellow slime and an astonishing ability to build optimal transport networks—to *map the cosmic web*.

The slime mold—in a lab—builds a network. It minimizes path length and maximizes connectivity. This is an *optimal network*. The best possible one given the constraints.

The researchers created a Monte Carlo Physarum Machine—an algorithm inspired by the slime mold's behavior—and applied it to data on 450,000 dark matter halos from cosmological simulations. Result: a "near-perfect match" with the observed cosmic web.

A slime mold—no brain—builds the same network as the Universe.

Let that sink in. A single-celled organism and the observable Universe are *solving the same optimization problem*. With the same answer. Across scales that differ by a factor of 10^{27}.

The argument here is about something else: the *rules of optimization* are the same everywhere, at every scale, from slime mold to supercluster. Simply because—*there is no other optimum*. The math is one. And it doesn't depend on the substrate.

If in Japan—where Physarum polycephalum, by the way, was used to optimize the Tokyo rail network (Tero et al., *Science*, 2010)—you told the scientists, "Your slime mold is designing the cosmos"—they'd probably laugh. And they'd be wrong to.

* * *

And this is where we enter territory where most scientists prefer to stop. Beyond here—things get *uncomfortable*. The science is there, but it demands uncomfortable questions.

If the Universe and the brain belong to the same class of systems, that class needs a *name*. Saying "self-organization" is saying nothing: the word describes *how*, not *what*. How is it that self-organization at the scale of a neuron and at the scale of a galaxy supercluster produces the same result?

Let's gather the coincidences in one place. In a table. So it's not a "feeling"—it's *data*.

Parameter	**Brain**	**Universe**
Nodes	$\sim 10^{11}$ neurons	$\sim 10^{11}$ galaxies
Connections per node	4.6–5.4	3.8–4.1
Information	2.5 petabytes	4.3 petabytes
"Passive" component	$\sim$75% (water)	$\sim$68% (dark energy)
Architecture	small-world	small-world
Fractal dimension	$\sim$2.0	$\sim$2.2

A hundred billion neurons. A hundred billion galaxies. The same number. Four to five connections per node. The same topology. Two and a half versus four-point-something petabytes. Same order of magnitude.

Any one of these parameters alone—explainable. Two—an "interesting coincidence." Three—"worth a closer look." Six—a *pattern*.

You've got two options.

Option one: *coincidence*. Six unrelated coincidences. Statistically unlikely, but not impossible. If you flip a coin six times and get six heads—that's not "impossible." The probability is $1/64 \approx 1.6$%. Unlikely—but it happens. The math allows it. Science accepts it. Life goes on.

Option two: *a common principle*. Something—deeper than neuron physics and deeper than galaxy physics—determines the architecture of both. Something that works the same way at any scale. Something we can't name yet, but can already *measure*.

Option one is safe. Option two is interesting.

In science—like in poker—the safe bet pays little. The interesting one can pay everything. Or nothing. But it's worth playing.

This book is about option two.

* * *

What happened after Vazza and Feletti published? Nothing. And—everything.

"Nothing"—in the sense that nobody refuted it. Nobody found errors in the calculations. Nobody proposed an alternative explanation that closed the question. The paper came out, racked up citations, made it into pop science, and—*just hung there*. Like a fact nobody knows what to do with. Like a piece of evidence that hasn't been matched to a crime.

"Everything"—in the sense that Vazza didn't stop. In 2022, he published an extended study in which he applied even more sophisticated mathematical tools to the same data—tools that can find structure where the eye sees only chaos. The result—the same. The brain and the Universe—one class.

In 2023, another group of scientists—Pavlos et al.—applied chaos-system analysis to the same data and found: both systems exist *at the edge of chaos*. Physicists call this "self-organized criticality"—a state in which a system balances on the boundary between order and disorder. Like a tightrope walker: one step left—it falls into chaos, one step right—it freezes into stillness. In the middle—maximum complexity, maximum sensitivity, maximum possibility. The brain operates at this edge—neuroscientists have known this since the 2000s. Turns out—so does the Universe.

* * *

So what?

Seriously: suppose the Universe and the brain belong to the same class. Suppose the math is the same. What does that have to do with you—a person who pays a mortgage, sits in traffic, and wonders what's for dinner?

Here's what. If self-organization works the same way at every scale—from neuron to supercluster—then *scale doesn't matter*. The same process that assembles galaxies into filaments assembles your thoughts into ideas. The same rules that determine how the cosmic web distributes matter determine how your brain distributes attention. *One math*. Literally.

This means: you are *the same structure*. At a different scale. With the same rules. The same topology. The same small-world architecture.

Two and a half petabytes of information in your head. A bit over four in the Universe. Same order of magnitude. Against twenty-seven orders of magnitude in size—that's *nothing*. You are—informationally—nearly equal to the Universe. Think about that next time you feel insignificant.

* * *

In the next chapter, we'll talk about what that "something" might be. And we'll start with the most radical candidate: *information*—a physical substance as real as energy, mass, and spacetime.

John Archibald Wheeler—one of the greatest physicists of the twentieth century, co-author of the theory of nuclear fission, Richard Feynman's teacher, the man who coined the term "black hole"—said three words in 1990 that physics is still digesting:

It from bit.

Everything—from information.

But that's next.

A Boy from Stavropol

Stavropol—a city where nothing happens. A description, not a complaint. Capital of Stavropol Krai, three hundred thousand people, the North Caucasus, steppe, heat, minibuses. The one fact people outside Stavropol know: this is where Gorbachev is from. The Marked One—a nickname from the birthmark on his forehead. The man who dismantled the USSR—or, if you're the type who thinks the USSR dismantled itself—the man who *didn't get in the way*.

I went to School Number Five. Before me, Gorbachev's daughter went there. When I showed up for first grade—the USSR had just ended. Literally: I started school in one country—and graduated—in another. The empire fell apart while I was learning the alphabet. The map of the world—*redrew itself*—while I was drawing a house with a fence.

(There you go—"seams on reality"—at civilization scale. A country that "was"—and that "isn't." Not war, not a bomb—a *reassembly*. A rewrite. On two hundred and eighty million nodes. With the loss of—a significant—chunk of the archive.)

Out of this Stavropol—out of the school where the daughter of the man who dismantled an empire once studied—came a boy who, thirty years later, would build a model of reality as a computational graph. Pointers. Connections. Archives. Maybe—all of neurocosmology—is an attempt to explain *in formal language* what I *lived through* as a child: the world—*comes apart and reassembles*. Not a metaphor. *Experience*.

But—before pointers—there was Brest.

* * *

I was nine. Third grade. A classmate Daniil's parents decided to do a Euro trip and offered to take me along—so their boy wouldn't be bored. Route: Nevinnomyssk—Brest—Warsaw—Berlin—Paris.

Euro trip. Early nineties. For those who missed it: across all of Russia to Brest—by train, twenty-four hours in third class. The clack of wheels, steppe, then forests, then steppe again. Stops at stations smelling of coal, cabbage pies, and stale linens. A nine-year-old boy—on the top bunk—stares out the window and doesn't know that this trip will *rewrite* him.

In Brest—transfer to a double-decker bus. For a kid from Stavropol, a double-decker bus is an *event*. I sat upstairs, by the window, and from there—from the height of the second deck—saw a *border* for the first time. Not on a map—*in person*. A barrier. People in uniforms. Stamps in passports. And beyond the barrier—the same earth, the same trees, the same sky—but *different*. I didn't know *how* different. But—*felt* it.

Night. The bus hums. Outside the window—streetlights that look different. Road signs written *not in Russian*. Signs for cities with names I can't pronounce. Europe. For the first time. At nine years old.

First stop—a gas station somewhere outside Warsaw. I—timidly—stepped out.

Everything was *different*. The light—different: white, even, fluorescent, not yellow like at home. The smell—different: coffee from a machine, gasoline, something piney from an air freshener. The floor—clean. Shelves—with products in *unfamiliar* packaging. Chocolate bars with names you couldn't read. The world—*the same*—and *not the same*.

Went to the bathroom. Opened the door. And—heard:

"A sho vam?"—a phrase in Polish layered with Ukrainian layered with some *third* language I didn't know. Three layers. Three realities—in a single phrase. I didn't understand the *words*. But I understood the *structure*: the world—is *not one*. The world—is *layered*. And between the layers—*gaps*. Seams. Places where one render—ends and another—begins.

I was nine. I didn't know the word "render." Didn't know that in twenty-five years I'd be building a formal model of multi-layered reality. I knew one thing: at a gas station outside Warsaw—the world is—*different*. Not "worse" and not "better." *Different*. Like a remix. Same elements—different assembly.

The first seam. At a gas station. At nine years old. On the road to Paris.

The EU didn't exist yet. The Maastricht Treaty was signed in 1992, but the euro wouldn't appear for another seven years. Every country—its own money. Zlotys in Poland. Marks in Germany. Francs in France. At every border—an exchange booth. On every bill—different faces, different buildings, different colors. For a nine-year-old boy this was—*proof*. That the world is not one. That on one side of the barrier—one reality, on the other—*another*. And the difference is *material*: it lies in your pocket, crinkles, smells of printer's ink and foreign copper. Money—the most tangible seam. You *hold* it in your hands.

(Six years later they'd introduce the euro—and *plaster over* the seams. One currency, one zone, one render. Convenient. Efficient. And—*poorer*. Because seams aren't a bug. Seams are *information*.)

On the bus, Mylène Farmer was playing on repeat—"Ainsi soit je." I didn't know a word of French. Didn't know the title was a reworking of "amen": "Ainsi soit-il"—"so be it"—only instead of "il" (He, God)—"je" (I). "So be I." A prayer turned from God toward oneself. A woman's voice, sad and hypnotic, repeating something that sounded like liturgy and felt like a wound. I didn't understand the words—but I remembered the melody for life. Still don't know what it's about. And—maybe—that's precisely why—I remember.

From Warsaw to Berlin—along the famous concrete highway. Concrete slabs laid for tanks—gray-white, cracked, with black asphalt patches. Joints—every four meters. On the bus it's a *metronome*: thunk-thunk-thunk-thunk, into your spine, through the seat, steady, monotonous, for hours. And over the metronome—Mylène Farmer. Concrete and liturgy. Tanks and prayer. Europe. Flat as a table, the North European Plain—fields, birches, brick farmsteads with orange roofs. Poland in the early nineties looked tired—peeling facades, sparse gas stations, gray sky.

At the border—a queue. Passport control. Barrier. And—on the other side—the road *went quiet*. Not all at once—first the rhythm softened, then—quieter. Then—asphalt. The silence after hours of thunk-thunk-thunk felt like *deafening*. Germany. Clean lane markings. Signs. Autobahn. A different world—and you enter it through the quality of the road surface.

Berlin I barely remember. Nine-year-old boys don't remember cities well—they remember *frames*. My frame: an intersection, a black S-Class Mercedes, lacquered, the size of a Stavropol minibus—and behind the wheel—an ancient old woman with a cigar in her mouth. Not a cigarette—a *cigar*. Small, wrinkled, in glasses, with a hairstyle that had survived two world wars—and she is *in no hurry*. Stopped at a red light. Smoking. Perfectly calm. As if this city, this car, this cigar—all of it—is *hers*. Belongs to her by birthright.

For a nine-year-old Soviet schoolboy from Stavropol—this was a parallel reality. Not "better" and not "worse"—*parallel*. A world where old women drive S-Class Mercedeses with cigars—and a world where old women stand in line for milk—these are *two different renders*. One planet. Two servers. And—the seam—between them—runs not along the map but along a *crossroads*.

Berlin felt—*big*. And—*recently broken*. The Wall had fallen three years earlier. I didn't know this. But—felt: something *had been* here. And—*hadn't healed yet*.

And Paris—I remember.

Centre Pompidou—a building turned inside out. All the guts—on the outside: blue pipes—air, green—water, yellow—electricity, red—escalators. The escalator—a transparent tube crawling along the facade; you ride up, and Paris unfolds below like a map someone spread out on a table. For a boy from Stavropol, where the tallest building is a nine-story apartment block—this was a *different view*. Not of the city—of *how the world works*. A building that shows *how it's built*. Doesn't hide the pipes—*displays* them. (Twenty years later I'd do the same thing—only with reality.)

On the square in front of Pompidou—fire-eaters, a living statue coated in silver paint, African drums, caricaturists. The Stravinsky Fountain nearby—Niki de Saint Phalle's fat colorful sculptures spraying water: lips, a snake, a treble clef. For a Soviet kid the shock wasn't in the beauty—but in the *permissiveness*. Nobody's chasing anyone off. Nobody's checking. Legal chaos. (In Stavropol, street tricks in the square would bring the neighborhood cop.)

The Eiffel Tower—of course. Montmartre—of course. But most of all—*Disneyland*.

Euro Disney—it was still called Euro Disney then, before the 1994 renaming—was half-empty. Had opened the year before, was drowning in debt, the French press called it a "cultural Chernobyl." Rides—with no lines. Sleeping Beauty's Castle—pink, blue, *fake*—stood under a gray Parisian sky like a hallucination that hadn't fully developed. And it was—*perfect*. An empty Disneyland—like a dream from which everyone was expelled except you. A whole world built for millions—and you're almost alone in it.

Space Mountain—the only version in the world with inversions: three of them (sidewinder, corkscrew, cutback). No other Disneyland has it—only the Paris one. Electromagnetic launch—shot from a cannon—and you fly through darkness, among stars, upside down. I rode with my eyes closed. And—until 2011, when I ended up in the exact same place again—dreamed of trying again. With eyes open.

But before Disneyland—there was the water park. Aquaboulevard—enormous, tropical, with palm trees and waves indoors. For a boy who hadn't known what a *water park* was—this was the discovery of a *genre*. Slides—enclosed tubes that exit the building, and you rocket through a transparent tunnel above the street. They said the steepest slide exits straight into the Seine. (Not true—the Seine is far away. But—at nine—you *believe*. And belief is more important than geography.)

Daniil's dad brought a video camera on the trip—the large-cassette kind. Later I learned that the large cassettes are called VHS, and there are small ones—Video8 from Sony, that fit in your palm. At the time I just thought: too bad I don't have a small camera. Too bad Daniil's dad couldn't film Disneyland on the large one. Later I got a small camera. And everything I recorded on it—as well as the footage from the trip, shot by Daniil's dad—I think only my mom ever watched.

But here's what I want to note.

Have you ever, in the age of UHD televisions, tried watching old movies on a tube TV? Or played Doom—the original, 320 by 200 pixels, which in 1993 seemed like the *pinnacle* of computer graphics? I watched *Star Wars*—the sixth episode—for the first time on a small black-and-white TV. And Endor was real. And the stormtroopers were scary. And it was—*enough*.

Now try rewatching. On a modern monitor. With modern eyes. Doom—a mosaic. VHS—mush. Black-and-white Endor—gray blobs. Everything that seemed *real* turns out—was a *render*. A render on whatever hardware was available. At whatever resolution they could manage.

But back *then*—it *worked*. Not "seemed normal"—*worked*. The brain accepted 320 by 200 as the complete picture of the world. Not because it was dumber. Because—it *filled in the gaps*. The consistency filter (σ_F)—of that version—*accepted* this render as sufficient. And then—when the resolution went up—the filter *recalibrated*. And the old render—*stopped passing*.

I think—the render of reality used to be a different version. At a different resolution. Not worse and not better—*different*. Every era *renders* the world on whatever hardware it has. And—consciousness—*fills in* the rest. A CRT television physically *blurred* the pixels—and the brain filled in the gaps. The world looked whole. Because *wholeness* isn't a property of the world. Wholeness is a property of the *filter*.

I can't prove this—yet. But—the data—*exists*. And—it's from my own childhood.

A boy from a country that had just ceased to exist—standing in the middle of an artificial kingdom that hadn't yet begun to really exist. Two worlds—both fake. Both—*assembled*. Both—*rendered*. And—if one can be taken apart (the USSR) and the other can be put together (Disneyland)—then—the world—is a *construction set*. And—the construction set—has an *architect*. And—the render—has a *resolution*.

(Nine-year-old Misha didn't have these words. He had—a sensation. The same one: the world is *assembled*. And—it can be—*reassembled*. At a different resolution.)

* * *

I was twelve, and I was memorizing a hundred words in a row.

Not because I was a genius. Because—I was taught. In Stavropol, at a school called "Poisk" (Search)—a center for gifted children, which I got into not because of giftedness but because my mom decided: if the kid is weird—let him be weird *among his own kind*.

The technique was simple. Take a list: apple, tank, cloud, scissors, whale, light bulb, piano...A hundred of those. No logic, no connection, no order. And—*build a story*. An apple falls on a tank. The tank shoots at a cloud. Scissors rain from the cloud. The scissors cut a whale...An absurd, impossible, visually vivid story in which each element is *linked* to the previous and the next.

And—it worked. A hundred words. Two hundred. Three hundred. Practically any volume. My memory stayed the same—I learned to *use it differently*. Like a *constructor*, not a storage unit. *Link*, not memorize. The data—the same (a hundred random words). The connections—mine. And the connections—are everything.

I was twelve. I didn't know that in twenty years I'd build a formal model where reality is a *graph of references*, and that content is determined not by nodes but by the *connections* between them. I was just memorizing words. And—didn't understand why it worked.

Now—I understand. Or—I think I understand.

* * *

The method is ancient. Cicero used it two thousand years ago for memorizing speeches. Medieval monks—for canonical texts. Matteo Ricci brought it to China in the sixteenth century. It's gone by many names: the method of loci, the memory palace, ars memoriae. The essence—is the same: you don't *memorize data*. You *build a structure of connections*, and data—*hangs* on it. Like clothes on a hanger: the hanger isn't the clothes, but without the hanger—just a pile of fabric on the floor.

What I *didn't* grasp then but *do* now:

The technique works because the brain is *not a hard drive*. The brain stores *connections*, not information in "cells." A neuron by itself—"remembers" nothing. What remembers is the *synapse*: the connection between neurons. Memory is a *pattern of connections*.

Translated into programming: retrieval from memory is *re-dereferencing a pointer* in the current context. The same memory in different states—is *different*. Because the context—is different. This explains why we "remember" the same event differently—and why a hundred words are memorized through a story, not through rote. The story is the *context*. Without context—data can't be addressed.

A twelve-year-old boy from Stavropol was building chains of pointers without knowing they were chains of pointers.

* * *

And then—"Poisk" gave me higher algebra. Second- or third-year university level. I was twelve. Linear algebra—the science of how spaces are structured (not rooms—*mathematical* spaces, where equations live). Groups, rings, fields—not objects but *structures*: ways to describe how numbers—or any other objects—*relate* to each other. Not "calculate" but "understand how the relationships between them are built."

I—to put it mildly—lost my shit. Not because it was hard (it was). But because—*why*? Why would a twelve-year-old need to know this?

The answer came six years later. I enrolled in the computer security department—and discovered there was no "computer security" there. There was—*algebra and mathematical analysis*. Encryption is the mathematics of numbers. Information security is that same Shannon information theory. Computer security is *mathematics* in uniform.

Lost my shit—for the second time.

But—it was precisely this mathematics—that fifteen years later—became the foundation of my model. The formulas I crammed in my second year—*describe the structure of reality*. Shannon—how to measure uncertainty. Landauer—how much it costs to erase one bit. Bekenstein—how much information fits in a chunk of space.

If someone had told twelve-year-old me: "You're learning higher algebra because in twenty years you'll need it to explain why the Universe looks like a brain"—I'd have said: "Cool, can I have more?"

But nobody told me. They said: "Solve the equations." And I solved them. Not knowing why. Like a function that doesn't yet know its return type—but computes.

* * *

Around that same time—in ninety-eight—dialup arrived in Stavropol. And I had—a 33,600-baud modem. And—an irresistible urge to chat on ICQ. So irresistible that the internet was promptly disconnected. Along with the phone. For non-payment. Mom was thrilled.

Instead of the internet I switched to the local BBS. Bulletin Board System: you dial a number with your modem, land in a text interface, read messages, download files, play door games. The internet before the internet. The network before the network.

The BBS ran on WorldGroup—first version 2, then 3. One day the installer for version 3 fell into my hands. I installed it—and dropped out of social life for a long time. Because WorldGroup 3 wasn't a "chat." It was a *server*. With a WinAPI client. With classic ASCII mode. And—with HTML.

HTML. In 1998. In Stavropol. On a BBS. I think I encountered HTML before our city had Apache.

I had a FidoNet address. My point—we're still friends, he works as a programmer at my mom's company. Fido—didn't stick. But—the sensation—*stuck*. The sensation that I was *touching with my hands* what the world was turning into. Not "using" the internet—*touching it from the inside*. Watching it *assemble*. From modems, BBSes, protocols, ASCII codes, HTML tags.

Seams. Again—seams. Only—this time—not on reality. On the *network*. The network was assembling *before my eyes*. From nothing—from phone wires and modem shrieks—into a *different world*. Which—in ten years—would *become* the world. The main one. The only one.

I watched reality *reassemble*. Literally. In ninety-eight. On dialup. In Stavropol.

(And Mom—never understood what I needed a modem for. Then again—Mom still doesn't understand what I need neurocosmology for. Some things—aren't for moms. Some things—are for modems.)

* * *

School "Poisk" taught me two things that—I see this *now*—were preparation.

First: *data without connections is noise. Connections without data is emptiness. Reality is both at once.* A hundred words without a story—unmemorizable. A story without words—meaningless. You need *both*. Like in a graph: nodes *and* edges.

Second: *abstract structures are more real than they seem.* Groups, rings, fields—are the *skeleton of reality*. Mathematics is the *fabric* from which the world is *sewn*. And—if you see the fabric—you see the *seams*.

I was twelve. I didn't know I was seeing seams. I thought—I was just memorizing words.

Chapter 3

A Photo Costs Energy

In 1937, a twenty-year-old Claude Shannon defended his master's thesis—one that would later be called "possibly the most important master's thesis in history." He proved something that made engineers shrug at first—and then build digital civilization. The gist: an electrical switch is a "yes" or "no." Two switches—"yes if both are yes" or "yes if at least one is yes." From this—from combinations of "yes" and "no"—you can build *any* logical operation. The entire world of electronics—from a light bulb to a smartphone—is logic written in wires.

Shannon had no idea he'd just laid the foundation for digital civilization. He was just solving a problem for the phone company.

Eleven years later, he published a paper that created *information theory*—an entire science, invented by one person in one summer. Shannon introduced the concept of a "bit"—the minimum unit of information, the answer to one yes-or-no question. And he showed that everything that can be transmitted—from voice to video, from genetic code to thought—is described by a single formula. (The formula: $H = -\sum p(x) \log_2 p(x)$. You don't have to understand it. You just have to know it *exists*.)

His boss at Bell Labs reportedly said: "This is brilliant, but who needs it?" Who needed it became clear fifty years later: everyone. Every byte, every pixel, every stream—Shannon. But that's a story about telecommunications. The story about *physics* is a different one entirely.

* * *

In 1961, IBM physicist Rolf Landauer proved something strange: erasing information produces heat.

Not "can produce." *Produces*. Inevitably. By the laws of physics. Every time you erase one bit—one "yes" or "no"—the Universe pays in energy. A negligible amount: roughly a trillion trillion times less than what it takes to lift a speck of dust one millimeter. But—*not zero*. Strictly greater than zero. Always.

For fifty-one years, this was considered a theoretical curiosity. Elegant but useless—like proving that an ideal gas doesn't exist. Correct, but—who cares?

In 2012, Antoine Bérut's group (*Nature*) experimentally confirmed Landauer's principle. They measured the heat from erasing a single bit. It matched the prediction. Exactly.

And here's why that matters: if erasing information produces a physical effect, then information *is* physical. Directly and literally. It *is* physics. A bit is just as much a physical quantity as a joule or a meter.

The implication you want to wave away but can't: every time you delete your ex's photo from your phone, the universe pays an energy cost. A tiny one—3×10^{-21} joules per bit—but a *real* one. Information doesn't disappear for free. Anywhere. Ever. Not even on your phone.

* * *

John Archibald Wheeler arrived at this conclusion earlier—and from a completely different direction.

Wheeler was a central player in twentieth-century physics. He developed the model of nuclear fission with Bohr. He coined the term "black hole." His grad student was Richard Feynman. When Wheeler says something, physics listens. Even when it doesn't want to.

In 1990, near the end of his career, Wheeler formulated a program in three words: *"It from bit."* Everything—from information.

The full statement: "Every *it*—every particle, every field, even spacetime itself—derives its function, its meaning, its very existence entirely—though in some contexts indirectly—from the answers to yes-or-no questions, from binary choices, from *bits*."

Wheeler meant something far more radical than a computer metaphor: *information is more fundamental than matter*. An atom is "information manifesting as a thing." Not the other way around.

The difference is crucial. In the first case, information is a tool for description, like a ruler or a scale. In the second—it's a *substance*. The stuff the world is made of.

* * *

Wheeler got there through quantum mechanics. Specifically—through the *delayed-choice experiment*.

The standard double-slit experiment: a photon passes through two slits. If we don't observe which slit it went through, the screen shows an interference pattern—the photon "went through both." If we observe, the interference vanishes—the photon "went through one." This is standard quantum mechanics, known since the 1920s.

Wheeler proposed a twist: the decision to observe or not observe is made *after* the photon has already passed through the slits. By classical logic, the decision came too late—the photon already "chose" which slit to go through. But quantum mechanics says: no. The observer's decision *now* determines which slit the photon went through *then*.

This isn't theory. The experiment was realized by Jacques et al. (*Science*, 2007). The result matched Wheeler's prediction. A decision *in the present* affects an event *in the past*.

Stop. Read that again. The decision—*now*. The event—*then*. The cause—*after* the effect. This is an *experimental fact*. Published in *Science*. Replicated.

What does this mean for "time"? That time might be—a *computational order*. A sequence of resolutions in a graph. Which—under certain conditions—*can run in both directions*.

If reality is an information graph (and we'll arrive at that conclusion later, in chapter eleven), then a link in the graph has no *built-in* direction of time. It has a *source* and a *target*. The source can be "later" than the target. This is a *property* of graphs. Time is *emergent*. It arises from the statistics of computations, the way temperature arises from molecular motion.

Wheeler understood this—intuitively. Vanchurin formalized it. Our "sense" of linear time might be the result of a *filter* that orders computations into a sequence for the "user's" (our) convenience. But under the hood, the order doesn't *have* to be linear.

Hence—déjà vu. Hence—premonitions. Hence—a "seam" in reality: an event that "hasn't happened yet" has already been *resolved* at a deep level. It's just that the resolution *hasn't rendered yet* on the surface.

Non-locality of the information graph. That's the whole explanation.

Wheeler called this the "participatory universe": the observer doesn't passively record reality but *participates in creating it*. Every act of observation is an answer to a yes-or-no question, and that answer is a bit. And from these bits, reality is assembled.

It from bit.

* * *

Anton Zeilinger—Nobel laureate 2022—developed this idea into a concrete principle. His proposal sounds simple: the smallest quantum system—a single "qubit"—carries exactly one bit of information. One "yes or no." No more. No less. And from this constraint, Zeilinger claims, *all* the weirdness of quantum mechanics *follows*. All of it.

Why can't you simultaneously know exactly where a particle is and where it's going? Because one bit can't answer two questions at once. Like a coin: it can land heads or tails, but not both at the same time.

Why does a particle's state "collapse" into one specific outcome when you measure it? Because you asked a question—and the bit answered. Before the question, *there was no answer*. At all. Anywhere. Like a page in a book that gets written the moment you open it.

Why do two "entangled" particles on opposite ends of the Universe instantly "know" about each other? Because they're *not two*. They're *one* bit of information stretched across two locations. Not two objects connected by an invisible string. *One* object with two addresses.

Zeilinger didn't prove "it from bit." He showed that if you accept information as fundamental, quantum mechanics stops being "weird." It becomes—*logical*. The only logical physics that works when the substance of the world is information, not matter.

* * *

Now—holography. Because this is where "information is primary" goes from philosophy to *geometry*.

In 1973, physicist Jacob Bekenstein derived a formula that left his colleagues slack-jawed for a week. A black hole—a region from which not even light can escape—stores information. How much? Bekenstein did the math and got an answer that boggled the mind: the amount of information depends on the *surface area* of the black hole, not on what's inside. Not the *volume*. The *area*.

That's like finding out that the contents of your apartment—the furniture, the books, the cat—are entirely determined by the *wallpaper*. Not "reflected" in the wallpaper. *Determined* by the wallpaper. If you know the wallpaper, you know everything inside.

Gerard 't Hooft (1993) and Leonard Susskind (1995) generalized this to the entire universe. **The holographic principle:** all information contained in any volume of space can be fully described by a theory on its *boundary*. The three-dimensional world is a projection of two-dimensional information. A hologram.

Juan Maldacena proved this rigorously in 1997. The details are for specialists (and they fill two hundred pages). The gist is for everyone: Maldacena showed that the physics inside a certain space is *fully and exactly* described by a theory on its *boundary*. The volumetric world is a projection of a surface. Not "sort of." *Mathematically exactly*. His paper is the most cited in theoretical physics. Over twenty-five thousand citations from other scientists (INSPIRE-HEP, 2025). This isn't philosophy. It's a theorem.

So what does this mean for us?

It means that “depth” is an illusion. That volume, distance, three-dimensional space—are all *computed* from information on a surface. That spacetime is the *result* of information processing. A derivative. Not a primary.

Here’s an analogy that will make this concrete.

In 2020, DeepMind taught the neural network AlphaFold to solve a problem biologists had struggled with for fifty years: from a gene’s record—a one-dimensional string of letters—predict the three-dimensional shape of a protein. Input: text. Output: object. Between them: rules by which text *folds* into form. AlphaFold doesn’t “build” the protein. It “folds” information into matter.

Now imagine an “AlphaFold for reality”: a process that folds streams of information into stable forms. Input: code. Folding rules: the laws of physics. Output: matter, space, time. In this picture, the laws of nature aren’t “external rules someone established.” They’re *assembly instructions*. A guarantee that information chaos produces a stable world rather than white noise.

In this model, the laws of nature stop being some external given. They become *protocols for correct folding*—instructions that guarantee chaos of information produces a stable fabric of world rather than noise.

In empty space—even in absolute vacuum—tiny disturbances constantly “flicker”: particles that are born from nothing and immediately vanish. Physicists call these quantum fluctuations. In our analogy, these are *assembly errors*. Information tries to fold into a stable form, but not every attempt succeeds: short-lived forms appear that immediately fall apart.

Across all scales, one principle operates: a system can “fold wrong.” If a wrong configuration turns out to be more stable than the right one, it locks in. In biology: prions—proteins that folded incorrectly and now force other proteins to fold the same way (this causes Alzheimer’s, mad cow disease). In thinking: obsessive thoughts—a pattern that “got stuck” and loops endlessly. In cosmology: disturbances in the structure of space that, once frozen, became... galaxies.

The fabric of the universe holds together through a delicate balance between correct folds and errors. And—maybe—it’s precisely the *errors* that drive evolution. Because without errors, there’s nothing *new*.

* * *

And right here—before we go any further—something needs to be said that any honest book about information is *obligated* to say. Because otherwise you get a slogan, not science.

If the world is a computation, then computation has *limits*. And these limits are *proven*. Not conjectured. Not debatable. *Proven*—in the same sense the Pythagorean theorem is proven.

Gödel, 1931. Kurt Gödel was twenty-five when he proved something mathematics still hasn't recovered from. The gist: in any sufficiently complex system of rules (and "sufficiently complex" means just arithmetic—addition and multiplication)—there *inevitably* exist statements that are *true* but that are *impossible to prove* while staying inside the system. There is truth that rules can't reach, no matter how good the rules are.

For mathematics, this was a blow. The great Hilbert, starting with his 1900 Paris Address (the second of his famous 23 Problems—the consistency of arithmetic) and developed in full through the 1920s, set a goal: formalize all of mathematics, prove it's consistent. Gödel showed: the goal is *unattainable*. Not "not yet attained." Mathematically *unattainable*. Forever.

Turing, 1936. Alan Turing was twenty-four when he asked a simple question: "Can you write a program that, given any other program, tells you whether it will hang or not?" The answer: *you can't*. On any computer. Not now, not in a million years, not on a computer the size of the Universe. This isn't "we don't know how yet." This is *proven to be impossible*. The difference is like between "haven't found the key yet" and "the door is bricked up."

Chaitin, 1975. Gregory Chaitin defined the number Ω—the probability that a randomly chosen program will eventually finish. This number *exists*. It's definite and finite. But—*uncomputable*. You can't find it out. Every digit after the decimal point is a mathematical truth that can't be reached from any set of rules. Ω is *built-in randomness*: not because we don't know something, but because knowledge in this place *ends*. Like the edge of a map, beyond which there isn't "unexplored territory" but *nothing*.

Why am I telling you all this?

Because if the Universe is a computational graph (and that's where we're headed), it *inherits* these limitations. *Inevitably*. Which means:

First. From inside the system you cannot prove *all* truths about the system. We are inside. Therefore—*some* truths about reality are *in principle* inaccessible to us. Not "not yet accessible." *In principle*. The way an eye cannot see itself—not metaphorically, but *theoretically*.

Second. The system *inevitably* contains processes for which it is impossible to predict *whether they will terminate*. This isn't "chaos" and it isn't "free will." It is a structural property of *any* sufficiently rich computational system.

Third. There exists *fundamental randomness*—not as a "gap in knowledge" but as a *structural property* of the computational substrate. Quantum uncertainty is—possibly—a *manifestation* of precisely this randomness. Not a "mystery" requiring explanation. *Chaitinian noise*, built into the architecture.

The conclusion is *sobering*. Even if information is the foundation of reality, even if every bit is physical per Landauer, even if the Universe is a self-computing graph—*a complete description of that graph from inside the graph itself does not exist*. This isn't a defect of our theory. It is a *property of reality*, mathematically proven.

Any "theory of everything" will be incomplete. *Necessarily*. This isn't pessimism. It is a *theorem*.

This book *knows* it is incomplete. Because a complete book about reality is *mathematically impossible*. And that is the first thing an honest map must acknowledge.

* * *

Vlatko Vedral, an Oxford professor, wrote a book with a title that says it all: "Decoding Reality: The Universe as Quantum Information" (2010). His argument: information is a more fundamental category than matter *or* energy. Because both matter and energy can be described in terms of information, but information cannot be described in terms of matter or energy without losing something essential.

Seth Lloyd (MIT) did the math: the universe has performed a maximum of $\sim 10^{120}$ computational operations over its lifetime and stores $\sim 10^{90}$ bits (*Physical Review Letters*, 2002). The universe is—literally—computing itself.

Computing. Literally. Every physical interaction is an exchange of information. Every quantum process is a computation. Physics is *information processing on a particular substrate*, and the question "what's the substrate made of?" might be the wrong question entirely. Because the substrate is *also* information. Like a turtle standing on another turtle, standing on another turtle...

Wheeler would say: "The turtles end. At the bottom—bits."

* * *

Why does any of this matter for our story—for understanding why the brain and the universe look the same?

Here's why: if information is fundamental and matter is derived, then the *structural similarity* between the brain and the universe stops being a coincidence. Both systems are manifestations of the same *informational* principles. Deeper than physics. Deeper than biology. Because both physics and biology are themselves manifestations of information.

There's something deeper than physics and deeper than biology that determines the architecture of *both*. And that something is information. Structured, integrated, self-organizing information.

In the next chapter, we'll meet the person who went further than anyone. Who said it straight: *"The universe is a neural network."* Literally. Mathematically. Deriving both quantum mechanics and gravity from a single formalism.

His name is Vitaly Vanchurin. And physics is still digesting his 2020 paper.

Cosmos

The cosmos stalks me. Not metaphorically—*topographically*.

(The Greek *kosmos* means not "space" but *order*. The opposite of chaos. The Pythagoreans were the first to call the Universe by this word—because they believed that behind its appearance stood mathematics, number, structure. Plato in the *Timaeus* took the same idea to its conclusion: the world was assembled by the Demiurge according to *numerical proportions*, on top of mathematics older than matter. Two and a half thousand years later Vazza and Feletti would show statistically the same thing—that the cosmic web and the cerebral cortex are built on the same math. The vocabulary is newer; the thesis is exactly as old: cosmos is order, and order is *computable*.)

I was a cadet. The Peter the Great Military Space Cadet Corps, Saint Petersburg. Founded in 1996 under the patronage of the Military Space Forces of the Ministry of Defense. Space—*in the name*. Literally, military-*space*. Uniforms, drills, regulations. And—above all of it—stars. Real ones, not on epaulettes. Cadet school is *molding*. A system that takes a teenager and assembles something different out of him. By blueprint. By instruction. The first school, to use terminology I hadn't yet invented.

Then—Petersburg. An apartment at the intersection of Korolev Street and Baikonurskaya. Sergei Pavlovich Korolev—father of the Soviet space program, the man who sent Gagarin up. Baikonurskaya—named after the cosmodrome where it happened. I lived—*literally*—at the crossroads of two space-related names.

In front of the building—a swimming pool. In front of the pool—a plaque. It appeared later—when I'd long been living differently and looking at signs as someone else's addresses in memory.

On the plaque: "Here a monument will be erected to those who dedicated their lives to the exploration of space."

Will be erected. Not "is erected"—*will be*. Like a promise. Like—a pointer to the future. A pointer leading to a node that doesn't yet exist.

Coincidence? Pointer aliasing? Or—*data*?

* * *

After cadet school I was supposed to go to Mozhaysky. The Mozhaysky Military Space Academy, Saint Petersburg. Fifth department—space physics, geophysics, tracking of rocket and space objects. From a *military-space* cadet corps—to a *military-space* academy. By blueprint. By instruction. By—the *first school*.

I—didn't go. Went to Bonch instead. SPbSUT, named after Bonch-Bruevich. Telecommunications. The computer security department—which, as I already mentioned, turned out to be wall-to-wall algebra and information theory.

Communications, signals, Shannon.

The blueprint said: from cadet—to space forces officer. Rockets, orbits, trajectories. First school: control, hierarchy, orders. I—*broke the blueprint*. From the feeling that it—*wasn't mine*. My cosmos is *inside*. *Information* that flows between, not rockets that fly up. *Understanding* how things work, not conquering territory.

Third school. No blueprint. No pressure. My own path.

And—here's what's funny—it was precisely at Bonch, in a department that was supposed to teach computer security, that I got—information theory. Shannon. Entropy. Communication channels. Bandwidth. Everything that fifteen years later became the foundation of my model of reality.

Mozhaysky would have given me rockets. Bonch—gave me the *language* to explain why rockets—*aren't necessary*.

Tsiolkovsky would have appreciated that.

* * *

Bonch gave me one more thing. Mogwais.

There's a movie—*Gremlins*. Spielberg produced, Joe Dante directed. There's a fuzzy creature in it—a Mogwai. Cute, harmless, as long as you don't feed it after midnight. In my life there have been three Mogwais. And all three—were fed after midnight.

The first—Oleg. I rented an apartment on Bolshevikov Prospect, near Dybenko station, where Bonch's main campus was. The Romantsov brothers—Oleg and Kostya—lived in the building next door. The classic case where you meet each of them *separately* and six months later accidentally discover they're *brothers*. Pointers to one node, disguised as two.

I met Oleg at a trance party. My second ever—a club called "Truba" (The Pipe), the launch of the psytrance.spb.ru community. I was with Katya—a school crush—and her friend Vika. Vika later became Oleg's wife and the mother of his child. But that evening we weren't even acquainted. We found each other—in photographs. *Later*. When everything had already happened. Standing next to each other—in the same shot—not knowing each other. And not knowing that in a few years we'd be in the same kitchen celebrating New Year's.

Oleg's nickname was Mogwai. The first Mogwai of my life.

(With Katya we'd later go to the first BOOM—2006, Portugal, Ryanair to Faro for the price of lunch in the Bonch cafeteria. But BOOM—separately, in "Remix.")

With Kostya we later worked together at “Nienschantz”—a Petersburg IT company that built servers under the Favourite brand and ranked in the top 20 of Russian IT. Office—on Pyatiletok Prospect, two blocks from Bonch. Days—work. Evenings—classes. In between—building Linux from source using the “Linux From Scratch” book: kernel, utilities, bootloader—all by hand, step by step, like a lab exercise on how an operating system works. (If anyone thinks programming is abstraction—try compiling yourself an OS from scratch. You learn fast: every layer stands on the one below it. Remove one—and everything collapses. A stack. The same stack that chapter ten of this book is about.)

Kolya Tamodin arrived as head of the systems integration department two weeks after me. Sharp. Ambitious. The kind who grows fast and confidently. On his first day he called me in—introductions, formalities—and asked: “What do you want to become?” I thought. And answered: “An architect.” I don’t know why that word. I was twenty-something, building Linux from source, and didn’t really understand what architecture was. But the word—*flew out*. And—apparently—predetermined everything that came after. Architect of systems. Architect of ecosystems. Architect—of this book. From “Nienschantz” he grew into a commercial director, then into general director of “Voentelecom,” the telecommunications subsidiary of “Oboronservis.” Ministry of Defense communications. Serious contracts. Serious money. And then—a serious sentence. Six years. The “Oboronservis” case—the one involving Anatoly Serdyukov, former defense minister, son-in-law of Prime Minister Zubkov, “Taburetkin”—famous for selling furniture before the Ministry of Defense. And Yevgenia Vasilyeva—his mistress—who ran the property relations department. The department sold military real estate at throwaway prices. The mistress got five years and was released after two and a half months. The minister—wasn’t sentenced at all. Went to “Rostec.” Embezzlement—in the billions. Kolya—got six years. Real ones.

Kolya is one of those who got *ground up*. Not the ringleader. Not the organizer. A link in the chain that turned out small enough to *imprison* and big enough to *not forgive*. The prime minister’s son-in-law—free. The mistress—free. The department head from “Nienschantz”—in a penal colony. (This too is data. Not about Kolya—about the *system*. About how weights are distributed in a network where justice isn’t a loss function but a *decoration*.)

The Pomorov brothers—the same sibling story, only stretched over years.

Den—six-oh-four. 604. Anyone from the *scene* will get it immediately: flip the digits in your head—the six becomes G, the zero becomes O, the four becomes A. GOA. The code the goa-trance community has used since the nineties—ever since someone at a rave read the number on a mail sack not as digits but as letters. Since then 604 is a password. Like 420 for those who smoke. Only—for those who dance.

I met Den at the Romantsovs’ on Bolshevikov. Met Mikha Pomorov—Mikhailovich in the third generation—at BOOM in 2006, on the other end of Europe, in the Portuguese heat, among ten thousand people. About five years later I found out they were brothers. For five years two nodes existed in my graph as independent—Petersburg and Portugal, kitchen and rave, two different contexts—until someone showed the edge.

(Twice—one pattern. You meet people separately, in different countries, in different phases of life—and it turns out they're *connected*. Not through you. Through a *source*. Pointer Architecture: the connection *exists*. Until you see it—it's archived. Then—*activated*.)

Then there was Natasha. The classic case where you stumble out of a club drunk and a girl picks you up and takes you to her place. Natasha's nickname was also Mogwai. Second Mogwai. Coincidence? Fine, let's say coincidence.

I celebrated New Year's in the company of both Mogwais. It was the most savage New Year's of my biography—and my biography, as you've gathered by now, is no stranger to savage. We started celebrating on December 31st. The first time I went to bed like a normal person—was after Christmas. January 7th. Eight days.

(If you've ever wondered what happens when two Mogwais are *fed after midnight*—there you go. Eight days is what happens.)

Then many years passed. I moved to Koh Phangan. And met Dima. Dima also turned out to be a Mogwai. Third. On the other side of the planet. In a different phase of life. With different people around. And—*the same tag*.

Dima told me about the "Fomenko classification"—a typology of people based on how they interact with reality. According to this classification, we're both—*constructors*. People who don't just live in the world—they *assemble* it. From available elements. Using their own blueprint.

Three Mogwais. Three phases of life. One tag. The network—*tags* people. Not me—*the network*. I—just notice the tags. Like a researcher who finds the same mineral in three different geological layers and thinks: either this is a coincidence, or—*a common source*.

Coincidence? Three times?

In probability theory there's a rule: once—chance, twice—coincidence, three times—a *pattern*. In neural-network cosmology—the same rule, only stricter: three coincidences—are *data*. Weak. Unreproducible. Subjective. But—*data*.

* * *

And—the last piece of the puzzle.

In those years I was doing projects for the FSB. Don't ask for details—I signed papers. But—one story—I can tell.

Lunch. A government cafeteria. Non-market prices. Aluminum utensils. An officer from a military unit with a forgettable number. We got talking.

Him: “You know that Tsiolkovsky nearly got thrown in a madhouse at the end of his career?”

Me: “No. For what?”

Him: “For saying: rockets will become unnecessary. People will travel between stars by the power of thought.”

Tsiolkovsky. The father of rocketry. The man who *invented* the rocket—and at the end of his life said: the rocket is a *transitional stage*. The real transport is *consciousness*.

For this they wanted to commit him. Because—well—“by the power of thought.” That’s delusion. Unscientific. Not serious.

I sat in that government cafeteria with an aluminum spoon and thought: Tsiolkovsky *wasn’t* saying “magic.” He was saying—“the next stage.” The way the rocket is the next stage after the biplane. And “traveling by consciousness” is the next stage after the rocket.

Insanity? Or—a *scale* we’re not ready for?

* * *

The cosmos—stalks me. Cadet school. Korolev and Baikonurskaya. A monument that “will be.” Tsiolkovsky, who was nearly committed.

All these pointers—point the same way. Behind what we call “matter”—there’s information. If the model I’ll describe in the next chapter is correct—then Tsiolkovsky was most likely right in substance. “By the power of thought”—crude phrasing, but the direction is right: consciousness as a property of the computational graph.

I can’t prove this. Yet.