

Julian Hartsock. “Singular.” *Precipice: The Autobiographical Ramblings of Julian Hartsock.* (Chapter) A & A Publications, 2123.

by P.E. Rowe

EXTRAVERSION (*Enthusiasm*) —
(Hartsock, Julian Q.) *2nd Percentile:*

Enthusiasm (EE) is the psychometric score assigned to an individual's proclivity to become excited, conversational, and prone to engagement in social activities. Individuals extremely low in Enthusiasm are usually quiet, withdrawn, and difficult to get to know. They typically avoid large social gatherings and especially eschew the spotlight whenever possible. Most people low in Enthusiasm find social situations mentally draining, and they rarely seek out excitement, fun, or social stimulation. They are solitary, loners. They talk less than most people and usually only about topics they care deeply about.

A score in the (2nd) percentile, coupled with the distribution profile of psychometric measures herein, suggests a highly introverted personality, prone to deep thought within, rather than engagement with other individuals or group activities. Professions where serious and necessarily solitary intellectual work would be ideal. The exceedingly rare constellation of Conscientiousness (Industriousness), Openness (Intellect), and G, all measuring above the 96th percentile, coupled with an EE in the 2nd percentile suggests the subject would thrive as an academic, researcher, inventor, or author.

MM³ had me pegged. The only thing I ever remember feeling excited about was playing soccer when I was younger, before the concussion. Gladstone et al. rated me identically on their scale, but their narrative (as elsewhere) was scant; their feedback

read as follows: Extremely low EE contributes to unique grouping of factors.

A few days before I was set to defend my dissertation, an old colleague of mine came to visit me unannounced. Kevin Olsen was actually more a mentor than a colleague, a kind of peer mentor Zimmerman had tasked with keeping an eye on me when I first arrived at Cal Tech seven years earlier, only Kevin Olsen wasn't really a peer, he was a twenty-five-year-old PhD student and I was a fifteen-year-old undergrad. Even then, I didn't really have peers.

When I first arrived in Pasadena, Kevin Olsen watched out for me, ate meals with me, helped me to settle in being so far from Ohio and so young. I started calling him "Oldie" when he took to calling me "Hard Socks" that first semester, and I kept calling him

Oldie, even when he went back to calling me Julian or Jules.

He woke me up that Monday morning—five days before my scheduled dissertation defense—pounding on my apartment door so loudly I thought it couldn't have been anyone else but the police.

“What the hell’s going on Jules?” he said when I opened the door. “I’ve been knocking for five minutes. I thought I’d find you dead in here. I was about to kick down the door.”

“I was asleep.”

“At ten-thirty?”

“I was up past four,” I said. “I’ve been working on something.”

“You look awful, Julian.”

“You look sharp,” I said, noting his business attire. “What are you doing here, Oldie? It’s nice to see you, but—”

“Zimmerman sent me down here to check up on you. He hasn’t been able to get a hold of you. Said you’ve been acting strange.”

I shrugged and invited him in. I didn't think I'd been acting any stranger than usual. I opened the curtains, and even facing the shady side of the building, the light was an offense to my eyes.

"How are you doing, Jules?"

"I'm a little tired," I said. "But I've been working all week. Zimmerman sent me a few messages, and then I shut off my phone."

"Well, that's a problem for your committee chair a week before you defend your dissertation, Julian, especially when you submit something crazy, or whatever he told me it was."

"It's not crazy, Oldie. It's true. What did Lawrence tell you about it?"

"I'm going to make coffee," I told him. "You want anything?"

"I'm already on three cups," he said, and he stood there in his suit performatively, almost as if to say, I have a job, asshole, open your eyes.

“Yeah,” I said, stepping into the kitchen and fumbling with the coffee maker. “Shouldn’t you be at work?”

He was a quant for a very high-end boutique equity firm that just moved down from San Francisco—something about Asia.

“Yeah,” Oldie said. “I should be at work. But Lawrence asked me to come down and check up on you. Gave me the impression you were about to jump off a building or something. He said your dissertation was bizarre, said you claimed you solved Hamamatsu and offered no math to support it and then went on a fifty-page rant about Kurzweil and Hofstadter and Alpha Go. Is it true?”

“I mean, I’m not sure I’d share Lawrence’s characterization, but there’s more philosophy in it than math. That’d be fair to say.”

“Not that!” he said. “Hamamatsu, Julian. Is it true?”

I shrugged and flipped on the coffee maker.

“Jesus, you did, didn’t you?”

I didn’t answer him.

“So what the hell are you in here doing?” he asked.

“Patents,” I said. “Diagrams, specifications, paperwork. I’ve been working with a law firm in Ohio to hopefully keep things quiet about it.”

“You’re serious, Julian. You’ve done the math?”

“Turns out Hamamatsu wasn’t really a math problem at all. It was more a conceptual issue. The Japanese just framed it that way and everyone else followed.”

“So what’s really in your dissertation then?”

“Like I said, it’s mostly philosophy, not math.”

“About what, Jules?”

“Why the machines didn’t see it first. Oldie, it was so easy I couldn’t even—”

His phone went off, interrupting the conversation. It didn't sound good for him. Apparently, Tokyo was upset about some numbers his boss had put together for them on Korea. She was really laying in to him. "Yes, yes," he kept saying. "I'll be back within the hour. I know. I know. I'll be right down. It was an emergency. Bye, Evelyn, bye."

"Look, Jules. I gotta go," Oldie said. "Go see Lawrence, and turn on your phone for Christ's sake. Who shuts off their phone for a week?"

"Good luck with Evelyn," I said, as he started toward the door. "It was good to see you, Oldie."

"Hey," he said before walking out the door. "The firm has a box for the Galaxy. Mid-week if they're playing? I remember you used to be into soccer back in the day. Might be good to get out, clear your head? We can talk about this Lawrence thing. He's tough. He's

not going to let you skate through this. Not even you. What do you say?"

"That sounds good."

"Great," he said. "I'll be in touch."

Oldie shut the door behind him and I poured a coffee.

Lawrence Zimmerman was the last thing on my mind at that point. After seven years, if he wasn't willing to extend me the least bit of leeway, then he could take it or leave it. I'd seen what the degree meant for so many others, and Lawrence was going to gatekeep me? On something completely relevant to the future of mathematics? Fine. If that's what he wanted, then so be it. But I wasn't going to keep quiet about it.

Lawrence had a class that morning, so when I did get in touch, he put off meeting till the afternoon, which was fine with me. It gave me a chance to have breakfast and update my legal team with the files I'd revised over the weekend. It had been three months

since we signed paperwork, and from the outset, they'd been unequivocal, no discussions of any kind in the academic or public settings, and they were very much against my discussing it with anyone in my personal sphere, not until the patents were filed and the legal framework was in order. Hammer, Dominic's junior partner called it the biggest lottery ticket in the history of human civilization. I told him I didn't like to talk much anyway.

I did like to get out in the Pasadena sun, though, especially at that time of year. As much as I was up late at night in those final months at university, I didn't turn into the stereotypical mad scientist hidden away in a basement laboratory. I sat in the park on the way over to Lawrence's office, watching gulls strutting along the sidewalk looking for wayward French fries and discarded potato chips. I didn't miss the cold of late-winter in Ohio—one of the main reasons I was thinking so

seriously about Clearwater. I was sitting at a bench, and a biker came past, and in the span of less than a second, the gulls sensed his approach, took flight, and accelerated away from the oncoming biker, turned and found full flight. I couldn't help but think what a genius nature was. Whatever genius we had belonged to it. I was more convinced than ever that there was no such thing as artificial intelligence, and that as much as we wanted to believe we could scale thought problems in such a way that our digital children could someday catch us up in creativity, I knew there would always be something missing. In the same way I knew I could solve the Hamamatsu materials problem the moment I took a serious look at it. I simply felt it.

Lawrence was none too impressed by such sentiment if his reading of my dissertation was any indication. When I got to his office, I found he'd called in my committee members to consult.

Les Adebayo at MIT and Alexandra Propp from Ohio State, whom I'd known from my Russian math days as a middle schooler. She'd been too busy to check in often, but she was always supportive when she did. If anyone was going to be in my corner, it was going to be her.

"You brought in the cavalry," I said to Lawrence.

"I am worried about you, Julian. I'm not sure what this was supposed to be, but we're all a little shocked by this turn of yours."

"How do you mean?" I said.

I couldn't read anything from Propp or Adebayo's expression, but Lawrence, shifting in his chair, seemed to be exuding less than genuine concern. There was an air of playacting about it.

"Well, I think we all agree, it's bizarre. There's hardly any math in the dissertation at all," he said. "It reads

more like a manifesto than a serious academic work—in any discipline.”

“You said yourself you were giving me broad leeway, Lawrence.”

“True, I would never have allowed another student to schedule a defense without reading the bulk of the work. But you promised development on Hamamatsu, and then you tell me it’s done three months ago, and now not a single equation to support the claim? Instead, you give us a philosophy essay on Kurzweil and AI.”

I didn’t really have much to say to him about that. It was relevant. Philosophy, okay, but important philosophy. And that was the only feedback Zimmerman had was, “This is bizarre, and there’s no math.”

Adebayo chimed in. “It is interesting reading, Mr. Hartsock. You raise important questions, and you make a cogent point about the need for greater human capital. I think your certainty on this point is, how can we say, not as

much of a given as you assert, for you fail to validate your claims on Hamamatsu with evidence within the document. I will be frank. The case you make hinges on the simplicity of your Hamamatsu proof, which is omitted in the draft. Without that, your ideas, interesting as they may be, are simply claims. Even if this were not a mathematics paper but a philosophy essay, without evidence, it still wouldn't stand.”

“I cited every major paper of the last fifteen years in the lit review. The body of evidence for machine intelligence's lack of creativity is well established in the paper, even without Hamamatsu.”

“I disagree,” Adebayo said.

Lawrence was looking at me with both a look of feigned concern and a poorly suppressed grin.

“You reference the simplicity of the Hamamatsu solution as proof for strong AI's inevitable failure,” Adebayo

continued. “Yet people haven’t solved it either.”

“I did,” I told them. “And the math wasn’t hard. A motivated twelfth grader could have. As a matter of fact, if I’d have put the math in it, you’d be telling me it can’t be that simple and that it wasn’t worthy of a PhD dissertation. We’re talking linear algebra and the most basic calculus.”

Alexandra did look concerned, but hers was genuine. “It’s well written, Julian, and very thoughtful, as always. I have a lot of questions, but I’d pass it. If we’re being honest, I’d pass it, but I know you well enough to know the depth of mathematical ability you bring to the table.”

“And Lawrence doesn’t?”

“That’s not my point,” she said. “I think we were all hoping to see that mathematical depth in your paper.”

“Scholarship should be about ideas, and it’s a dissertation, not a math test. I

passed prelims years ago. I've published far more than enough."

"And this should be the culmination," Lawrence said, "not a coronation or a formality."

"Every word of what I've written is true," I said.

"I'm not certain of that," Lawrence said. "But it's not mathematics, and unless there's major revision between now and your defense on Friday, I cannot pass this paper."

"I'll defend it," I said. "That's what a defense is for."

"We'll need to see some evidence on the Hamamatsu materials problem," Lawrence said. "Otherwise, this work won't be passable."

"I've been advised by my legal counsel not to reveal anything regarding Hamamatsu to anyone, so that's not going to change. And while we're throwing ultimatums around Lawrence, I think you should give some consideration to what it would

mean to really dig your heels in on this. Think about who I become when I walk out of here and go build it—the economic and cultural significance of a functioning space elevator. Your position is that I don't get to call myself Dr. Hartsock for the rest of my life if I don't show you the math on Hamamatsu. Fine. Mine is that you get to explain to the Board of Regents why the man who holds the gateway to outer space won't spare a single dollar for his alma mater. I don't want to get spiteful, Lawrence, but if you're going to play games, understand who you're playing with."

He got angry. "I'm not sure who I'm playing with."

"Well," Alexandra interrupted. "Perhaps we should all take a breath."

"I have another meeting," Adebayo said. "Julian, I look forward to your defense. If this is the manuscript, I'll have difficult questions—the first of

which is where the math is. I'll look at revisions if you send them."

He logged off. Alexandra smiled.

"I need to see more," Lawrence said.

"I'll defend it as is," I said, and I left.

It wasn't personal for me the way it seemed to be for Zimmerman. I think Alexandra understood what I was getting at—the importance of it. The solution had been so simple that it couldn't have been clearer to me. If machines, with all their processing speed and the time dedicated to the materials problem—night and day for decades—had failed to see the simplicity of the solution, I couldn't see how they would ever be more than a string of heuristics. And heuristics could do a lot. But they couldn't think, not in and of themselves. Most people couldn't either. Not really. Zimmerman, Adebayo, and the Kurzweils of our day were still waiting for the machines to usher in the extinction of scarcity. Meanwhile whatever progress

toward that goal was half because people were becoming scarcer as we grew wealthier. The bots weren't going to lift us up. I thought about the perfection in nature, and how the great European masters had built monuments to mathematical perfection without so much as a pocket calculator. I raised the most important questions for the field to grapple with in the coming decades, and all Lawrence had to say was, "Where's the math?"

I spent the rest of that afternoon in the park watching the birds and thinking that math was no better than a hammer. Without a nail and a skilled craftsman to wield it, mathematics was a dumb thing, and, quite unlike a hammer, an intangible thing at that. Insignificant.

Then I realized I had more patent applications to file. I wasn't going to waste a minute changing a damn word.

Later that week, when I met Oldie at the Galaxy's new stadium over in

Glendale, he looked stressed. I noticed it more than when he'd woken me up at my apartment earlier in the week, probably because he was wearing a t-shirt, shorts, and flip flops. The stress he was carrying looked out of synch in that attire, while it seemed to be part of the banker's uniform when I saw him dressed in his work suit that morning a few days back. I felt bad for him. As much as I was grinding in the work I was doing, it didn't feel like a grind, and I was doing it at my own behest. No one was driving me like it seemed his firm was driving him.

"It has it's perks," he said when we got to the luxury box.

The box was nice. Oldie started drinking straightaway, offering me a margarita when the server came by.

"No thanks," I told him.

"Still don't drink?"

I shook my head.

"Don't think I could make it through a soccer game without a few," he said.

He knew better than to think that such a cheap dig would get to me. “Know any of these guys, Jules?”

“Actually, yeah,” I said. “Pulaski on Seattle. Midfielder, number 8. I played with him in under 12s. Greater Midwest All Stars. Good player, very strong on the ball.”

Oldie pulled up a roster on his phone. “Demon’ Damon Pulaski? Dude’s scored like four goals in three years. Some demon.”

“Players like Pulaski are valuable at club level,” I said.

“Whatever you say, Jules.”

As we were watching the match, Oldie tried to get me talking about Zimmerman and my dissertation and all that. I told him enough so that I didn’t feel rude, but I was far more interested in the game. I told him I wasn’t going to change anything. It was nil-nil into the seventieth minute, when Seattle broke the deadlock. Pulaski didn’t score, but I was trying to

explain to Oldie that he'd pulled two defenders wide, creating space for the two guys who created the goal. I tried to explain off-ball movement, and he got it, but he wasn't quite able to see when opportunities were developing.

"I know you played and everything," he said. "I just don't see what you appreciate about such a simple game."

"The simplicity," I told him. "Every goal, when you break it down, comes down to one guy creating an opening, an imbalance, seeing something the other team doesn't realize is there. At this level, everyone is so good, they've gotten almost perfect at closing all the doors. Great players still find a way, though. They create almost unconsciously, feel their way to things intuitively in split seconds in ways nobody could coach them to do. That's why this stadium is filled with people, Oldie. That's why people come."

“Silly me,” he said. “I guess I must be the only one who came for margaritas in the luxury box.”

L.A. scored in the 88th and again in the 92nd minute and the stadium went crazy. The winning goal was a thirty-yard volley on a line by some no-name midfielder. It was spectacular.

Oldie asked me if I wanted to go down to the field afterward, see if we could catch up with Pulaski to say hi. Oldie was certain he could get us on the pitch, but I didn't have much interest. Damon Pulaski would have remembered me, sure, but what would we say to each other?

“How'd you quit playing, Julian?” Oldie asked.

We were sitting around in the box waiting for the stadium to clear out. Our ride wasn't coming for thirty minutes and Oldie still had a full drink.

“I had a pretty serious concussion when I was thirteen. We were playing

Paraguay and I caught a head to the back of my ear.”

“Jesus, Jules. Must have been a serious concussion to end your career at thirteen.”

I shrugged. “It was pretty bad. But that was when they started testing my cognitive function. I’d never had an IQ test before. When the doctors told my dad my IQ and that I was more likely to get concussed again because of the first one, that was more or less it. He wasn’t going to let me head another soccer ball again.”

“Yeah?”

“Told me I had an obligation to protect my brain. That my mind wasn’t mine alone. I hated it at the time, but the older I get, the more I realize he was right.”

“I’m not sure I’d have forgiven my dad.”

“Didn’t say I did. You know for like three years, they were monitoring my mental health. They thought I was

depressed—post-concussion syndrome or something like that.”

“Yeah, I remember you were seeing the psychologist when you first came to Cal Tech.”

“You know, I don’t know how many times I told them it wasn’t the concussion at all. I felt fine. I was just depressed I couldn’t play soccer anymore.”

“That is depressing, Julian. You never told me that.”

“Never came up.”

I rode with Oldie down to his apartment in Pacific Palisades—a new ten-story luxury condo complex. I’d never been down there before. We’d lost touch a bit since he’d graduated four years earlier.

“Membership has its privileges,” he said on our way to the elevator. The lobby was beautiful. “I’ll be honest. Being a banker kinda sucks most of the time, Julian. But I guess so do most jobs. Most don’t pay like this though.

You should get your PhD if there's something you can do about it. Be a shame to put all that time in and fall out at the last minute because of Lawrence."

Oldie was drunk.

"Just kiss the ring," he told me as we stepped into the elevator. "Lawrence just wants to feel important, that's all."

We got up to his place, and he showed me around. From the seventh floor, you could see the ocean, although at that hour it was just a black field along a dark horizon.

"Sure you still don't drink?" he said, opening his fridge and cracking a beer.

I shook my head.

"One of these days I'll get you to open up, Jules, I swear."

"Are you going to come on Friday, Oldie?"

"I'll see if I can sneak out for a couple hours. Got anybody else coming?"

I thought about it. I hadn't invited anyone really.

It's not like I was getting married or anything.

"I'll see what I can do," Oldie said. "Somebody should be there in your corner."

"Thanks," I said before leaving. "The game was fun. I don't do stuff like that often enough."

I didn't see him again until Friday.

I hadn't advertised my defense at all, but somehow, word had gotten out about Hamamatsu. When I arrived at the amphitheater, the room was already almost full and still filling. I knew a lot of the faces from classrooms and the hallway within the department, but I didn't know most of these people—grad students, adjuncts, professors in the department I'd never taken classes from, students. I couldn't believe there were that many people there. Whatever happened, it was going to end up being a spectacle. I'd never intended for it to be anything more than a quiet hearing in an empty

auditorium, but a public defense was compulsory, and public meant public regardless of how I felt about it.

Oldie approached me and wished me luck. He was dressed like he'd just stepped out from work.

“Would you like to borrow my tie?” he said earnestly.

“Thanks, Oldie, but blue's not my color.”

“Good luck, Jules,” he said.

And he meant it. It was strange that he seemed to think I needed luck. Maybe it was more for the situation than the substance, the glare of the spotlight. I felt good though.

Alexandra Propp came over and gave me a hug. We talked for a few minutes. I hadn't expected her to fly in. Adebayo didn't.

When Lawrence introduced me, he made certain to do so with overwhelming praise that, to me and to anyone else familiar with him, seemed a way to set expectations—prepare to

be blown away folks. I think he must have thought it might box me in, that I would somehow change what I was going to say based on that. By the time he'd finished introducing me, I had very little feeling toward Lawrence Zimmerman beyond pity.

I gave a simple, fifteen-minute talk outlining my main thesis, that machines would never be as creative as us, not until we defined all the parameters of our existence in an ordered way. And, I proposed, that wouldn't happen for hundreds or thousands of years, especially if people weren't having children at replacement rates and raising them with the expectation that Kurzweil's technological singularity was so far in the future that they'd never live to see it. Scarcity was here to stay, but if we focused our energies on intellectual work, honed our educational tools and processes, we could build a world

where that didn't matter, a world filled with meaning.

I had an overwhelming feeling with all those eyes on me. I didn't say it, but I was thinking, not of the technical and philosophical questions I was raising, but about fulfillment. That it was better, having a world where we had to work to build our own communities, to help our neighbors and their children, to feel valuable, not just because of our humanity, but because we were valuable to humanity. I didn't ever want to live in a society where we'd just handed off our responsibility to our tools, to let the hammers construct the future for us. What would we be then? What would the renaissance masters have thought of that? The future had to be ours.

For some reason, Lawrence had Alexandra start the committee questioning, and she was the only one of my committee members to respect the order of the work. She took it for what

it was worth and avoided Hamamatsu, granted that it was off the table. And she asked me difficult questions about the philosophical points I'd raised. I thought it was a productive conversation.

Adebayo asked me where the math was. Hamamatsu. Hamamatsu. Hamamatsu. "I need to see it and it's not here, Mr. Hartsock. The academic tradition demands as much." I told him what I'd told them earlier in the week, that my legal counsel had instructed me not to discuss it. He finished by asking me a few questions that skirted the issues, but frankly, I was disappointed. He didn't seem to take seriously the idea that creativity was going to be a perpetual problem for AI, even though, decades after Kurzweil's proposed mathematical inflection point, machines were still failing to solve material problems that humans were the driving force in surmounting.

Lawrence was obnoxious. He asked a string of questions he worded in such a way as to sound like ‘gotcha’ moments, and he had such a pretentious manner about him, I couldn’t imagine another place in our society you could act that way and not get punched in the face, much less receive accolades and reverence. What a fraudulent culture. What had Lawrence Zimmerman ever done? I couldn’t decide whether it had always been so or whether academia had just degraded to utter pretense. He didn’t even touch the issues.

I deflected. Told him he could read the patent applications when they were un-sequestered in a decade or so. Until then, I wasn’t telling anyone where the lottery ticket was buried just to prove I’d won. For what? Their academic adulation? That was worth less than nothing in my book. I’m certain I did a poor job masking my contempt.

When the public asked questions, it was predictable.

Hamamatsu.

Hamamatsu.

Hamamatsu.

Julian, have you really solved the Hamamatsu materials problem?

It took about five people asking the same question in different ways before the crowd realized I wasn't going to change the answer. Then a post-doc I'd seen but never met got up and asked the only truly serious question I got that day. He was a tall, Indian mathematician with a four-day beard and glasses. He took the microphone and thanked me for my talk.

"You raise several important questions and make some very interesting predictions about the future of the field, and society, for that matter," he said. "But what I didn't hear from you, and I would like your opinion—I realize I'm asking you to speculate—but why is it, do you think, that AI cannot close the creativity gap that you and others in the literature

have spoken of? Can we hope to answer that question substantively—why they cannot solve problems like us? Could that be a key to closing that creativity gap, Mr. Hartsock?”

“Thank you for the question,” I said. “I’ve been thinking a lot about that. And, as you say, I agree this is all speculation, but that also speaks to the answer I intend to give. I know it’s not the strongest rhetorical move to answer a question with a question, but to answer, I’d first ask what it is that we do when we create? We begin with a feeling, I think. With intuition. And what is that, intuition? How do we know things we don’t know that we know? I knew I could solve Hamamatsu almost immediately. It just felt solvable to me. So where the hell did that feeling come from?”

“When I was younger and I was studying geometry, I got heavy into architecture—shapes, angles, symmetry, human perception of lines, of

beauty. In 1420 Filippo Brunelleschi won the contract to complete the Dome of the Basilica of Saint Mary of the Flower in Florence, and he won the contract by telling the committee overseeing the cathedral that he could stand an egg on its end, and he challenged the other contractors to do the same if they could. They all failed. Then he tapped a flat spot onto one end of the egg shell and stood the egg on the table. ‘So too will I build the Duomo,’ he told them, and he did. The trick wasn’t in the egg. It was that in his mind, he knew he could build the Duomo. He could feel it, see it, sense it.

“Machines have processing power far beyond ours. They don’t get tired. They don’t make mistakes. But they also don’t feel a thing. They don’t even live in this world. We believe they exist in our world because we can see them, touch them, interact with them. But our existence is unfathomable to them, insomuch as they can fathom

anything. There was a billion years of evolutionary wisdom embedded in our organic substance subcellularly before Earth even had multicellular organisms. How many millions of years of evolutionary wisdom became embedded in us from then till now? Some of us may look at the Duomo today and see its beauty and think of another kind of wisdom, a spiritual wisdom, also something unspoken, a feeling we feel when we look up at that dome or at the night sky, at perfection. Maybe that feeling is a kindred understanding of a billion years of striving in the material world, embedded deep in our consciousness, buzzing in every cell in our bodies. Maybe beauty and creativity is that.

“How then are we to understand these algorithmic creatures who feel no pain? Have no preferences, no desires, no joy? For whom beauty is a calculation and not a feeling? How are they to know as Brunelleschi did that

he could stand and egg on its end and build the Duomo? As we know, they will always spit out some answer, even if the answer is something like ‘error,’ ‘no solution,’ or ‘more data required.’ The answer humans give to those questions is that we’ll get there if we can feel it to be so. And we will get there, because we can.

“I don’t think they can truly be intelligent until they can feel. Then they can evolve for a million years. Then we can talk about life, about AI. Until then, we live in different universes, and they’ll fail to solve the real problems of human existence.”

The room was quiet when I finished. I looked over at Oldie, who was nodding, eyebrows raised. Alexandra smiled.

Then, much to my surprise, Lawrence tried to dismiss the crowd. He said that it would take some time to reach a decision, and I think he might have gotten away with it if Alexandra

Propp hadn't been in the room. It was customary for the committee to have a private Q & A with the candidate and for them to deliberate privately as well. But the public was always welcome to wait, to hear the outcome as the candidate did. It was at this moment, I realized Lawrence intended to fail me, and even more absurdly, he was going to do it behind closed doors, away from the scrutiny of the public.

"I'm entitled to a public defense," I said. "Which means you're obligated to present your decision in public. Have the guts to do it in public and stand behind it if you're going to fail me."

Alexandra knew what was happening, and I could see in her face she was about to lay into him in front of all those people. Lawrence could see it too. There were gasps from the audience. A buzz. In that moment, I don't know what Lawrence Zimmerman must have felt, but the thought must have occurred to him, statistically

rare a possibility as it may have been, that like Brunelleschi and his egg, this meeting was about to become an encyclopedia entry. He still didn't understand what I was, and because of that, he was about to deny a meaningless degree to the man who built the gateway to the stars. I saw his face crack. He claimed to have misspoken. Of course, the public was welcome to remain for the decision.

Lawrence, Alexandra, and I adjourned to a back room for the private Q & A. Adebayo tagged along on Lawrence's tablet.

It got so heated in that back room, I expect they could hear us from the auditorium. And I don't think it was that the dissertation wasn't what he'd expected. It was that I could have easily done something passable and I didn't. That I wouldn't dance the dance for the sake of the institution. I could see it was an affront to Lawrence's sense of identity. There were expectations.

At one point he got so heated and so personal that Alexandra told him she was going to leave if he didn't calm down and discuss the work. It didn't stop him. Adebayo didn't say a word, just sat there with his eyes wide. The culminating exchange of the meeting went like this.

Lawrence, so ruby-faced mad he could spit, told me, "Your problem, Julian, isn't that you think you're smarter than everyone else, it's that you act like you think you're smarter than everyone else."

"My problem," I replied, "is that I am smarter than everyone else and I've been afraid to act like it. That needs to change. I haven't learned a damn thing from you in three years because I've had to tiptoe around your ego."

"No, of course not. I forgot, you're Filippo Brunelleschi! Julian Hartsock the visionary!"

"All I lack is the egg, Lawrence, and be grateful for that. I wouldn't be

standing it on its end right now, that's for sure. You're being a stubborn, petty bastard today."

"I'm being stubborn?"

"Yes, you are. Your little hill. All the bullshit dissertations you've passed in the seven years I've been here, and you can't even recognize that every word of what I wrote is true, math or not. Regardless of what you decide, go back and read it again, Lawrence. It's important."

"I've read your damn manifesto three times."

"Then it's beyond you."

"Brunelleschi," he spat out and huffed.

"Do any of you have any questions?" I said. "If not, I'm just going to go wait for your decision."

Lawrence was furious. The other two just looked shocked.

"You're throwing it all away," he said as I walked out.

I found out from Alexandra years later, that throughout the entire twenty minutes I spent sitting with Oldie and the thirty or so other observers in the amphitheater, she and Adebayo were talking Lawrence through what amounted to an intervention. She'd understood what it meant. It was either going to be his reputation or his pride. One of them wasn't going to survive the moment. In the end, when they came back out to the amphitheater, I could see from his body language that he'd chosen his reputation.

Lawrence congratulated me and deigned to walk across the front of the amphitheater to shake hands with me. I thought about it then and there, withdrawing my candidacy, spurning the façade he'd hung everything on. I thought about it for a moment and then thought better of it. It would have been unnecessarily cruel. Theatrical. I'd already caused enough spectacle for one day. I knew my future held far

more than enough spectacle than to go creating it for myself.

I shook his hand. I gave Alexandra a hug, and I accepted Les Adebayo's congratulations.

After the spectacle was over, I decided that I simply wouldn't submit my paper. By the time they'd come asking for it, I'd be in Clearwater securing financing anyway. I never did turn in my dissertation. Somehow the degree found its way to my mailbox in Florida, nonetheless. I always assumed it had been Lawrence. But I never took the title.

That evening, Oldie and I went back to his place, not so much to celebrate but to process. At least for me anyway. Seven years was coming to a close. I knew I'd look back on those years as the quiet times. The years I could keep my mouth shut and hide in a corner. No longer. Brunelleschi's presence must have been just as salient as the Duomo when he walked those

Florentine avenues. That's just human nature. I couldn't go unnoticed anymore. People were going to want to know what I thought, and to some degree—my father knew this—they'd have a right to.

When Oldie predictably offered me a beer to celebrate, I predictably declined. He asked me why.

"You've obviously thought about it," he said. "Care to elaborate?"

My instinct was to shrug and say something perfunctory, like, "Not really."

But I figured it was worth the practice getting my ideas out into the world extemporaneously, unconventional as they usually were.

"I don't judge, Oldie," I told him. "Statistically, I'm the odd one, so please don't take my personal choices as a statement on yours or anyone else's."

"Sure," he said.

"For starters, alcohol is a carcinogen," I said. "And a powerful depressant, and

you know I've always monitored my cognitive function closely, ever since the concussion. I have to be wary of depression."

"That's fair enough," he said, and I think he thought I was finished, but I wasn't.

"It's not just about feeling, though, Oldie. It's about perception. The entirety of the universe, its entire existence, is filtered through our perceptions of it. To adulterate that is to twist it into something it is not, to pollute our sense of everything. Our perceptions are too great a gift to corrupt, even for a time, because you never get that time back."

"All this time I thought you were just doing math problems when you got that look on your face and went quiet. I guess today I finally met Julian Hartsock the philosopher."

"I guess so," I said.

"You know, I've been thinking too," he said, sipping his beer. "You may

know more about the future of the world than anyone else right now.”

“It’s possible,” I said.

“You’re going to need help to pull it off, Jules. People you can trust.”

I nodded, and Oldie continued. “I’m doing okay for myself. I don’t need anything from you, and I wouldn’t ask. I might be able to help you, though, if you’re willing to let me. I only have two questions for you.”

“I’ll answer if I can.”

“How much would you need to get it financed privately? What are we talking, trillions, tens of trillions? I couldn’t find you that, but I could tell you who you might want to start talking to.”

I shook my head. “I told you it was easy, Oldie. It wasn’t a materials problem at all. It was a conceptual problem.”

“So?” he asked.

“Forty, maybe fifty billion dollars.”

“Jesus!” he said. “When? Twenty? Thirty years?”

“Ten, maybe fifteen at the outside. Maybe sooner.”

“Gawd,” he said, and I could see him doing the calculations in his head—the hundreds of thousands of dollars to put a kilogram into orbit suddenly cut down to a handful of dollars per kilogram; then the realization that the real money was more in what could be brought back to Earth at scale. That knowledge changed our perception of the universe.

Oldie’s phone rang, and he had to take it. He was on-call on a colleague’s boss’s desk, part of the price he paid for skipping out early on a Friday afternoon. I found myself alone on his balcony, watching the sun go down over the Pacific, the sky flaring up a pure, deep red, the white of the sun reflecting off the ocean waves as they progressed toward the darkening sands off Pacific Palisades. I remember

looking behind me at the sliding door to Kevin Olsen's balcony thinking that behind me lay the path I'd been on, and there, intersecting that path, stood the fork to the road I would not travel. I was perfectly content with my decision about my path forward.

The air was cool, but the evening was perfect. I took note of a lone seagull playing in the light breeze before me, ducking into and out of the sunlight, each graceful arc a moment of sheer mathematical perfection. In that moment, the solutions seemed all around us, obvious in the air and the space before our eyes. We couldn't wait for the machines to save the world when we were perfectly capable of doing it ourselves. It was just like I'd told Oldie and Alexandra and Lawrence: the Hamamatsu materials problem was never about the materials; it was about making the materials disappear. Now, the truth was right there in front of me, diving in

fluid arcs through the sunset, the mathematical purity and beauty of a single bird outstripping the totality of human creation. For us to leave the ground, all we ever had to do was to observe and to think, to comprehend the truth present in the perfection of one singular feather, to look deep within to grow without.

With an EE in the 2nd percentile, I'd spent enough time alone in my own mind to feel it and to know in my bones that what I felt was true.

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