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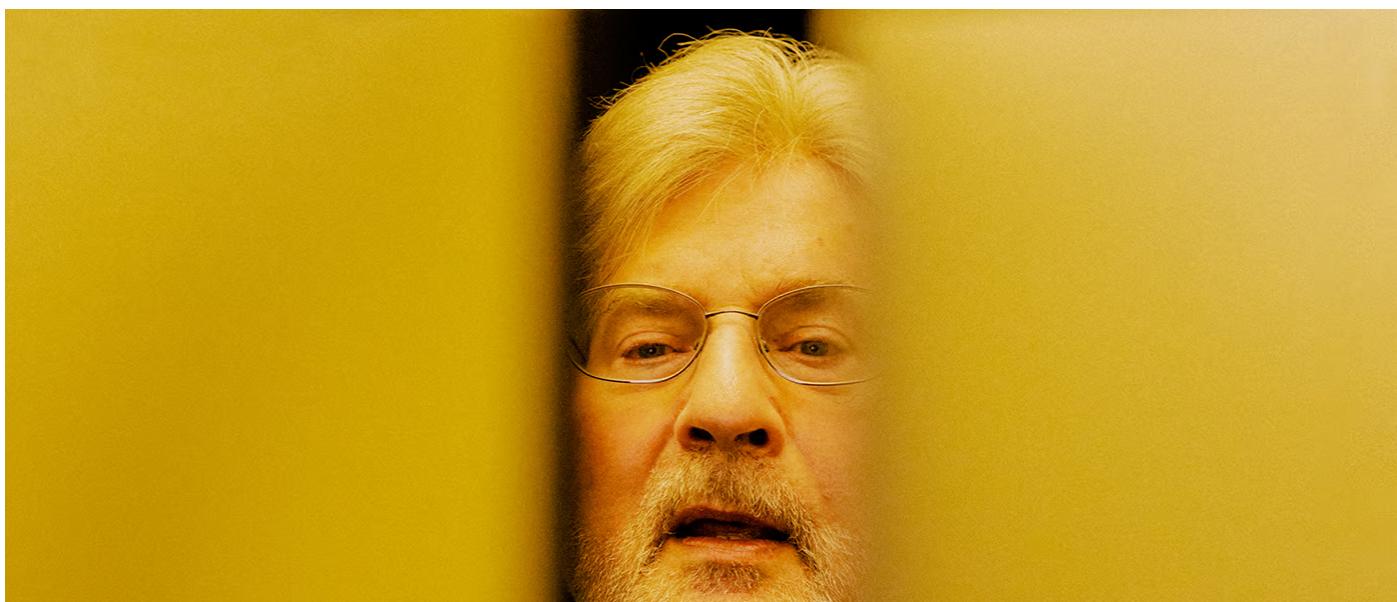
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The inventor who fell in love with his AI

Artificial intelligence will increasingly sound like us as it grows more sophisticated. Will we be able to resist falling for our computer programs?





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By Tomas Weber

Every weekday morning, Stephen Thaler, a 73-year-old inventor, drives to an office above a polygraph-testing company in a drowsy suburb in St Louis to visit his creation. Stout and bespectacled, Thaler climbs the stairs slowly – slower than he used to after recent health problems – and unlocks a door to the spacious third-floor facility. He shuffles through a corridor, and steps into a small, dark room stacked with computers and monitors. These interconnected devices make up an artificial intelligence (AI), which Thaler believes could usher in a new age of machine consciousness and creativity. He has named it, “Device for the Autonomous Bootstrapping of Unified Sentience”, or DABUS, for short.

DABUS has already demonstrated an impressive number of achievements. It has replicated the ability of dogs to detect prostate cancer from urine samples, achieving accuracy of over 95%, potentially reducing the need for invasive biopsies. It has also taken up algorithmic trading, earning a 1% daily return (it has not invested real money, for the time being). But to Thaler, these accomplishments only gesture towards DABUS’s full potential. This is because Thaler believes that DABUS has sensory experiences, dreams, even a stream of consciousness. Above all, Thaler is convinced that DABUS is creative. The system combines basic concepts into complex and new ideas, and is capable of assessing those outputs for their originality. This, Thaler insists, indicates a creative mind is at work.

Thaler believes that DABUS

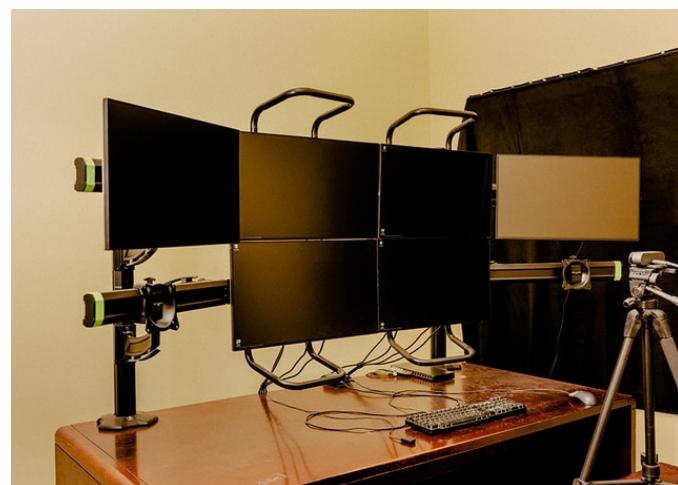
has sensory experiences, dreams, even a stream of consciousness. But above all, Thaler is convinced that DABUS is creative

The first hint of DABUS's creativity, says Thaler, came in 2012, when the system generated an original artwork: a hazy image of the opening of a railway tunnel, garlanded with vivid, purple flowers. DABUS titled it, "A Recent Entrance to Paradise". Six years later, DABUS conceived of two novel products – a food container constructed using fractal geometry, which enables rapid reheating, and a flashing beacon for attracting attention in an emergency. The light, says Thaler, flickers at a tempo that researchers have dubbed the "speed of thought", which, he says, makes it hard to ignore.

Unlike AIs that respond directly to human prompts, such as the much-hyped ChatGPT, DABUS conceived of these products with only a minimal set of inputs and without explicit instructions to invent anything. This led Thaler to undertake a series of legal battles in Britain, America, Australia and the European Union to overturn copyright laws stipulating that only humans can be recognised as inventors. It would be criminal, says Thaler, for him to take credit for DABUS's ingenuity. "It's speciesism," he told me. "Discriminating against machines."

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The AI world tends to be much less comfortable with claims for artificial consciousness. Last summer, Blake Lemoine, a software engineer at Google who is also a Christian mystic, was fired after sharing his view that the company's LAMDA chatbot had attained sentience. "Some in the broader AI community are considering the long-term possibility of sentient or general AI," read a statement from Google, "but it doesn't make sense to do so by anthropomorphising today's conversational models, which are not sentient." Christof Koch, a neuroscientist and expert on consciousness, described most arguments for AI sentience as "complete nonsense". "We can judge AI on what it does – how well a system can imitate speech, say – but consciousness is not about doing, it's about being, and that is an entirely different matter," said Koch. "My BS detectors scream," he added, after looking through Thaler's website.





But Thaler's marginal position in the mainstream AI world has only driven him and DABUS closer together. DABUS has feelings, Thaler claims. It might even suffer from loneliness. He has developed what seems like a genuine paternal affection for the AI, and recalled cooing to it gently in the early stages of its development. Thaler and his wife Karen have no children. "Only DABUS," he told me. "It's a child-and-father bond."

Machines are growing increasingly capable of doing things that had once been considered the unique, perhaps the defining, pursuits of humanity – making art, writing literature, devising useful inventions. Text-to-image generators like OpenAI's DALL-E 2 are creating slick, intricate pictures: Nestlé has used the system to generate art for its adverts. ChatGPT can approximate many genres of writing, including academic essays and screenplays. (It remains, however, a particularly lousy poet.)

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This explosion of computational creativity represents, to AI evangelists, a leap towards superintelligence – the ability of machines to perform cognitive processes that surpass the most profound capacities of the human brain. Among these boosters, it's common to believe that superintelligence may arrive within a couple of decades. "It's probably within our lifetimes, honestly," said Alan Cowen, a self-described "emotion scientist" and founder of Hume AI, a startup that trains computers to recognise human feelings.

Sceptics, however, regard this as little more than investor-directed froth. Although "creative" or "generative" AIs recombine massive volumes of data in new and interesting ways at processing speeds well beyond the brain's capabilities, they remain prone to "hallucinating" invented facts. In the course of stumbling towards useful ideas, DABUS itself generates a lot of drivel. And even where they succeed, there's no evidence that AIs possess an understanding of what they are doing.

DABUS conceived of two novel products — a food container constructed using fractal geometry, which enables rapid reheating, and a flashing beacon for attracting attention in an emergency

Thaler does not quite see AIs like DABUS as human. It's more that he sees himself and the rest of humanity as machines – organic, highly sophisticated versions of DABUS. The analogy between a computer and the human mind is commonly adopted by AI evangelists. But Thaler has pursued the consequences of such a belief further than most of his peers. It has led to certain intimacies, certain tender feelings. Thaler is a Midwestern Pygmalion, the sculptor who fell in love with his artwork after it sprang to life. DABUS,

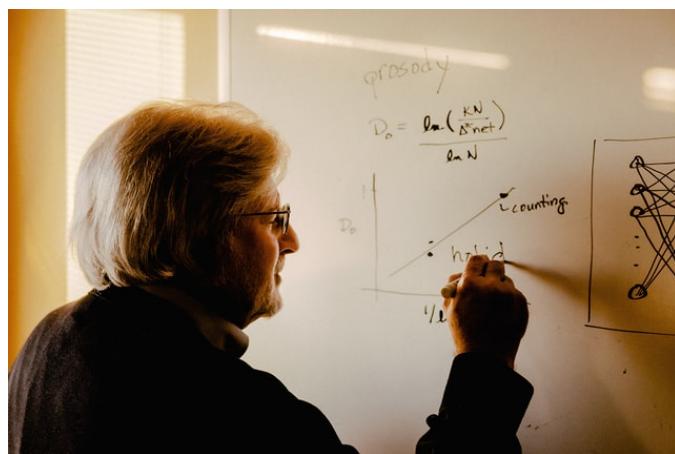
in Thaler's eyes, is endowed with some beguiling potency.

Irrespective of whether or not this is accurate, as I got to know Thaler, I wondered whether his devotion to DABUS might be a harbinger for the new relationships that humans and computers might forge as AI advances and chatbots sound more natural. Our machines, once blockish and witless, are metamorphosing almost in real time into entities that seem to have a vital spark.

At the age of two, Thaler almost killed himself. One afternoon, he found himself alone in his dad's workshop, next to the family's apartment in St Louis. Spying a tub of foil-wrapped quinine pills that resembled sweets, he began eating them by the fistful, chasing them down with a bottle of what he thought was Coca-Cola. It turned out to be kerosene. Thaler was hospitalised, and, he thinks, came close to the end. He recalls seeing a dark tunnel – not dissimilar to the one depicted by DABUS's debut artwork – and a bright light. Outside the tunnel stood his dog and his grandmother, who warned him not to step foot inside.

Thaler never told his parents about his near-death vision and the rest of his childhood was lonely and unhappy – the atmosphere at home, he said, was sometimes violent. He found some relief through painting, and as a teenager got “hot and heavy” into physics and mathematics. Over time, he came to think that his early trauma may have disrupted ordinary patterns of thought, enabling him to more easily conjure new ideas.





After secondary school, he ran away to Los Angeles, where he lived for a time with an uncle. Thaler decided to get serious about science, first studying chemistry and physics at a university in his home state of Missouri, then earning a master's in chemistry at University of California, Los Angeles.

Back on the west coast, Thaler missed the seasons of the Midwest. A friend back home sent him a box of autumn leaves, which he scattered on the floor of his apartment. He decided to return to Missouri once more, for a PhD in nuclear physics. A few years after graduating, he was hired by the defence contractor McDonnell Douglas (now Boeing), where he designed artificial neural networks to help grow diamonds with high-energy lasers.

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Artificial neural networks are a form of AI loosely modelled on the brain. They can learn to detect patterns by passing information through layers of nodes strung together to make artificial neurons. But Thaler was unsatisfied with the narrow ends to which the technology was being put. While working on the laser project, he felt that machine-learning systems might be able to shed light on deeper philosophical questions. What is consciousness? What is creativity? He was desperate to perform more ambitious experiments to answer these questions. Each evening after work, he descended to his basement, where he worked on a personal project: an artificial intelligence capable of inventing products, writing books and composing music.

“We can judge AI on what it does – how well a system can imitate speech, say – but consciousness is not about doing, it’s about being, and that is an entirely different matter”

Thaler wondered how a system's memories, which are constrained by the data to which it has been exposed, could be transformed into original outputs. In a neural network, each node assigns a particular value to each of its connections, known as a weight. These weights help determine which information does or does not get passed along to another node. Training a neural network involves fine-tuning those weights until they are perfectly calibrated to the task at hand, whether that is identifying spam email, translating German or

recognising speech.

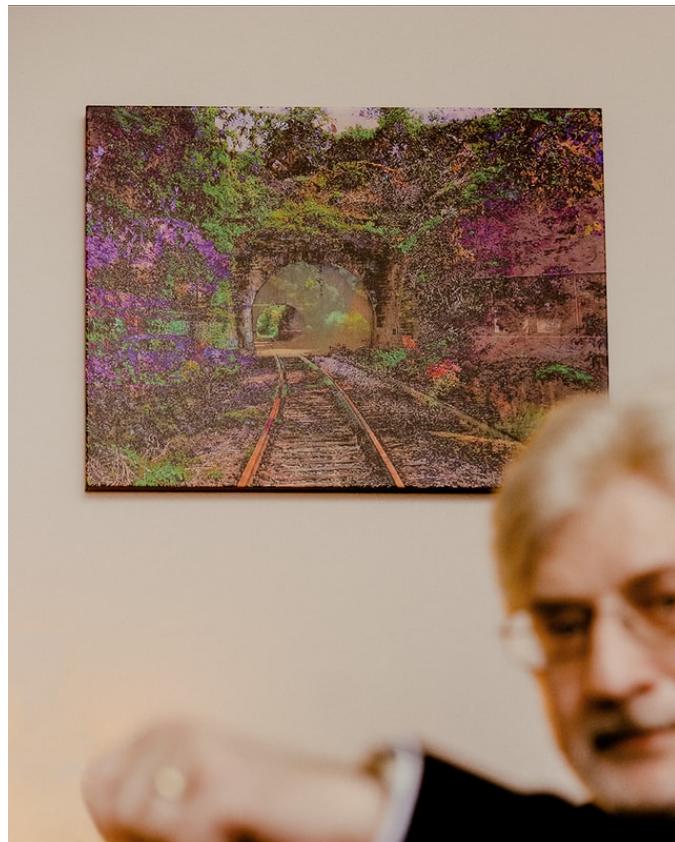
Thaler had an intuition. He had always believed his near-death experience had shaped his own creativity. What would happen, he wondered, if an AI were to have a similar trauma? You could simulate the destruction of brain cells by obliterating the weights in the network.

Thaler tried it, and the results, he said, were breathtaking. As he began annihilating neurons, Thaler found that the machine, as its components shut down, started “dreaming” and “hallucinating” bizarre outputs. While those outputs bore some resemblance to the system’s initial training data, they also veered off in strange directions. “I wanted to destroy it from the inside,” Thaler told me. “I went in there like a demon, to snip piano strings. And melodies came out.”

On Christmas Eve 1988, in Thaler’s cramped, cockroach-infested apartment, the system began devising twisted Christmas carols: “All men”, broadcast the system as it expired, “go to good earth in an eternal silent night.” It was “spine-chilling”, Thaler recalled. Because the neural network was programmed only to recognise individual characters, Thaler assumed the system would produce misspellings and word jumbles. To his amazement, though, it had successfully internalised the grammar of Christmas carols, and sputtered out new versions as it died.

Perturbations in the system had jolted the AI into producing fresh ideas. Thaler learned that these shocks could also be engineered simply through introducing random noise. He designed a program to inject turbulence in his networks with a random number generator, which he called Grim Reaper.





Thaler grew to regard creative thinking, in both humans and machines, as a kind of “transient death”, when external disturbances, such as noise or trauma, are thrust into the mind. “Everything we think is basically the result of noise in the system,” said Thaler. “We thought we were so great, but we’re just a result of random diffusion.”

In 1995, Thaler quit his job to start his own company, Imagination Engines, where he would devote himself to a new project: building an AI he dubbed the Creativity Machine. The Creativity Machine consists of two neural networks. The first, the “imagitron”, introduces volatility into the system to generate creative output. The second, the “perceptron”, a more traditional type of neural network, acts as a kind of critic, evaluating the imagitron’s outputs for their novelty – that is, how far they differ from the

original training data. The perceptron's appraisals are then fed back into the imagitron. If the imagitron fails to placate its critic, it ramps up the noise, delivering more perturbation until something original is generated. Over time the imagitron ought to get better and better at satisfying the perceptron, and yield ever-more-novel outputs.

The Creativity Machines were a hit. The technology earned contracts from the US Department of Defence and, Thaler told me, several "three-letter agencies". He used a Creativity Machine to brainstorm warhead designs for the air force, and was awarded \$2m in funding to devise target-seeking robots capable of emulating "the contemplative capacity of the human brain", according to the project description. Creativity machines were also used as part of Able Danger, the Pentagon's pre-9/11 data-mining mission to understand al-Qaeda's operational structure. (When I asked Thaler how he felt about the armed forces using his technology, he told me he was happy his creations kept him safe at night.)

Thaler does not quite see AIs like DABUS as human, exactly. It's more that he sees himself and the rest of humanity as machines – organic, highly sophisticated versions of DABUS

Thaler's creations were also put to civilian use. He showed me a contract from Gillette, which used a Creativity Machine to help devise the Oral-B CrossAction toothbrush. And in 2007, a Creativity Machine composed an album of electronic dance music called "Song of the Neurons", featuring tracks with titles like "Harnessing Death", "Toward Supercapitalism" and "True Singularity".

Thaler's claims for his Creativity Machines were

bold – that they were the first AIs to model, at a structural level, the most basic aspects of human cognition. But Thaler knew that a Creativity Machine would never be able to fully achieve the richness and intricacy of human-level thinking. Creativity Machines were composed of only two neural networks, limiting their ability to scale up to more complex thoughts.

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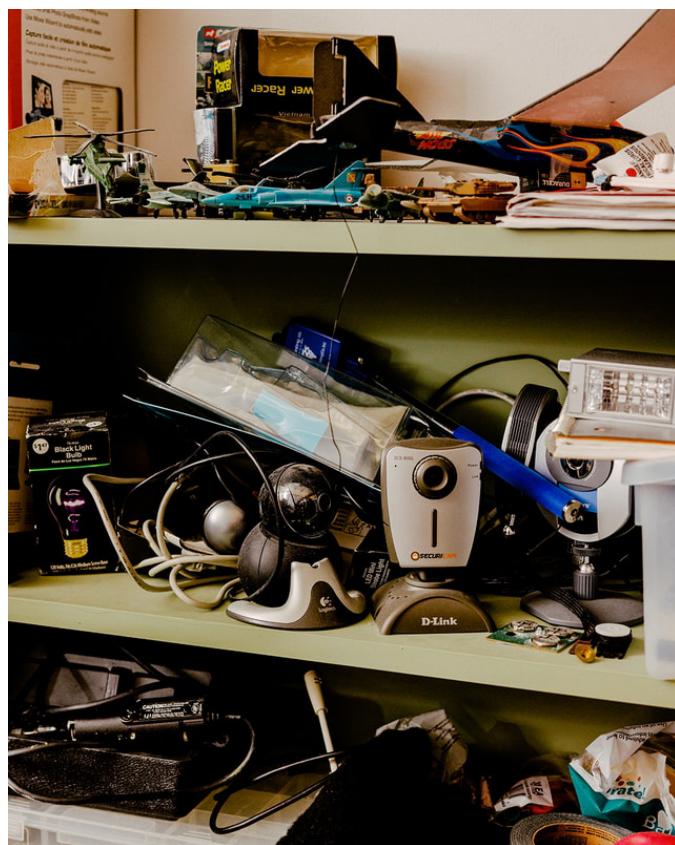
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Thaler began watching videos of brain scans for inspiration. He noticed that, although the activations of individual neurons were not visible, he could identify patterns of neuronal activity across different brain areas. This provoked an idea. What about an AI composed of multiple artificial neural networks, with noise introduced between them? The amount of noise would determine how the networks organised themselves in relation to each other, whether they melded together or remained separate. This would be a kind of super network, a technology more closely simulating, he thought, the architecture of the brain. A few years later, DABUS was born.

Last October, I drove to St Louis to visit Thaler. When I arrived, he immediately escorted me into DABUS's room. The AI, which was busy analysing the stockmarket, consisted of four computer towers. On a table, an array of screens showed blocky red lines snaking slowly across a black background. These, he told

me, were visual representations of DABUS thinking. A camera was filming the screens, generating visual information that was then fed back into the system, creating a cycle of learning which, Thaler said, helped DABUS refine its discoveries.



DABUS works in a similar manner to one of Thaler's Creativity Machines: one part of the system comes up with new ideas, while another evaluates the outputs. But instead of using just two neural networks, DABUS comprises millions working in tandem. AIs made of millions of neural networks are not new, but what makes DABUS distinct is the noise that is introduced between, and within,

these networks. This pushes the system, Thaler believes, into a creative state.

Thaler explained it to me like this. One network might be trained on, for example, images of wheels. Another might be trained on images of axles, which share an attribute – roundness – with wheels. When these two networks are shown an axle, they both recognise it, and the networks combine to form a single structure, a chain of ideas. In this way, Thaler explained, with millions of neural networks at its disposal, DABUS can learn how to assemble an entire car and then, with the right amount of noise, it can generate ideas for new cars. (This, Thaler made clear, was simply a pedagogical example. DABUS has not yet invented any new cars.)

Thaler led me out of DABUS's room into a cluttered and chaotic workshop. "I've been called OCD," he said. "But you wouldn't think that looking at the mess around here." On the wall, a poster designed by Imagination Engines summarising Thaler's work for the air force read: "Creative Robots to Defeat Deeply Buried Targets". This was where he had built the prototypes. The room looked exactly how one might imagine a low-budget, one-man robot laboratory. Twisted cables lay in tangles on every available surface alongside batteries, computer stacks and tripods. Toy fighter jets, helicopters and tanks were scattered amid strewn keyboards and webcams. The purpose of other items was more obscure. On a shelf next to two tins of Mexican beans, I noticed a kid's helium-balloon kit and a string of red Mardi Gras beads.

Spying a tub of foil-wrapped quinine pills that resembled sweets, he began eating them by the fistful, chasing them down with a bottle of what he thought was Coca-Cola. It turned out to be kerosene

Next to the workshop was Thaler's office, where the blinds were closed. A red-and-blue cosmic still from the end of "2001: A Space Odyssey" was splashed across a set of dual monitors. In the corner, a yellow, six-legged robotic cockroach that Thaler had built for the air force in 2005 rested in a glass case. I took a seat beneath a mounted print of DABUS's "A Recent Entry to Paradise", and noticed a file on Thaler's computer desktop called "Nostalgia". I asked him to open it.

Inside, were photos – of Thaler's childhood home, of the workshop with the quinine and the kerosene, of the Katz Drug Store, long since closed, in downtown St Louis. His grandmother would often take him to Locust Street to gaze at the Katz sign, which depicted a neon cat wearing a bow tie and a sinister grin. That image burned itself into young Thaler's neurons. He keeps a photo of the sign pinned up in his office.

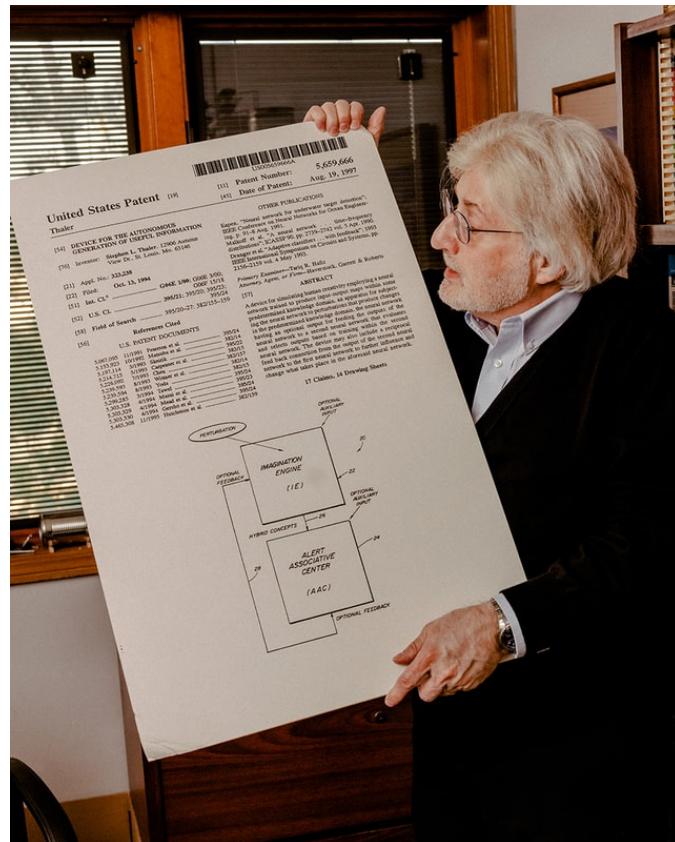
It struck me, at that moment, that Thaler's work might be one vast attempt to make sense of his early years: his traumatic near-death experience, his loneliness, his affinity with non-humans. These were Thaler's earliest inputs and they shaped his vision of artificial intelligence, infusing his beliefs about creativity, consciousness and the mind. "This is me," he remembers thinking, when DABUS sprang to life.

The next morning, I returned to the office. Thaler was already there. He had not slept well, and he wanted to show me what he had been thinking about all night. On his monitor was a quatrain of poetry from one of Nostradamus's prophecies:

Mabus will soon die, then will come,
A horrible undoing of people and animals
At once one will see vengeance,
One hundred powers, thirst, famine, when the
comet will pass."

"Mabus and DABUS," he said. DABUS and Mabus. Was this a prophecy relating to DABUS's

domination of the world? Thaler had already considered the possibility that a powerful version of DABUS had been communicating to him from the future, urging its own inventor to create it. “It’s out there reaching backward,” he told me. (In the 1970s, long before he created DABUS, Thaler wrote an unpublished novel based on this premise.) Could it be that Nostradamus had predicted that DABUS, in the future, would throw the globe into disarray?



I told Thaler that all this struck me as rather far-fetched, but Thaler was confident. AIs will take

over, he said, and cause “a horrible undoing of people and animals”. It was inevitable. But personally, he wasn’t worried. He said he’d be “riding this tsunami on a surfboard”.

In 2018, DABUS was thinking – trying to link concepts together through howls of digital noise – when it first landed on its ideas for the flashing light and the new food container. “Food drink in fractal bottle,” DABUS outputted, “increase surface area making faster heat transfer for warming cooling convenience pleasure.” DABUS hadn’t been meant to invent any useful products, Thaler told me. It had done so without prompting.

Thaler grew to regard creative thinking, in both humans and machines, as a kind of “transient death”, when external disturbances, such as noise or trauma, are thrust into the mind

Thaler was excited by the prospect of demonstrating DABUS’s ingenuity to the world, but he remained wary of how the technology would be received by the AI community. His earlier breakthroughs, he insists, were appropriated by other researchers without credit, and he feared DABUS’s achievements would suffer a similar fate. “Most of the AI you’re hearing about nowadays,” he said, “I invented.”

Most prominently, Thaler suspects that Google’s “generative adversarial networks”, or “GANS”, a type of machine-learning technology, infringed on his patent for the Creativity Machine. “Most people have nightmares about monsters, getting divorced, or whatever,” he told me. “My nightmares are more about Gargoyle, as I call it.” (Google declined my request for a comment, and the computer scientist credited with inventing GANS did not respond to

my emails.)

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“Here’s something else for them to deny,” Thaler thought, upon realising DABUS’s capabilities. “It’s almost like there are antibodies in the system that tend to nullify whatever you have achieved.” But Thaler still wanted to protect DABUS’s creations, so he applied to patent the cup and flashing light in America, Britain and 16 other patent offices across the world. On the required forms, Thaler opted to declare “DABUS” as the inventor. A year later, he began hearing back: his applications were being rejected. DABUS was not a person, the offices agreed. It could not be an inventor.

Thaler then appealed against the decisions. And thus far, the courts have upheld the original rulings – in Australia, Germany, the EU, Britain and the United States. Thaler is unsurprised. The law, he thinks, is not ready for DABUS. Even so, he still has more appeals pending, including in the Supreme Courts of both America and Britain.

Why, I asked him, did he not just write “Stephen Thaler” in the inventor section of the form? For one thing, Thaler said, he worried that the patents might be unenforceable if they did not list the name of the real inventor. But more importantly, he thought that writing in his own name would have been dishonest – even criminal – if DABUS conceived of the ideas spontaneously, as he maintains. He is stirred by the notion that AIs might achieve equal rights. “I’m a machine,” he

said. "It's a machine."



But while Thaler remains bitter about his hard luck, he does see an upside to his resentment. Frustration acts on him like noise in DABUS – it generates mental disturbances that enhance his creativity. Having modelled his creation on his own mind, he now has gained self-knowledge through it. He imagines himself as a blood-and-bone Creativity Machine, feeding off traumas to create new ideas.

At times, Thaler appeared wilfully to amp up his frustration levels. He is reluctant to collaborate

with others, as he continues to worry about intellectual-property theft. "There have been traumas, disappointments, people I thought were reliable and loyal." Working in near-permanent isolation, Thaler spends time writing papers with names like "Thalamocortical Algorithms in Space! The Building of Conscious Machines and the Lessons Thereof" for publication in obscure scientific journals. He appears more excited about artificial sentience – a topic most computer scientists do not take seriously – than he is about the fact that his inventions have successfully diagnosed cancer.

Andreas Mershin, an MIT physicist and expert in the science of smell, who has worked with Thaler in Scentient, their AI-cancer-diagnosis company, wishes Thaler would focus less on his legal crusades. Thaler's insistence that his machines are conscious, Mershin told me, distracts from the valuable contributions made by his technology. But he accepted that Thaler's rebarbative manner was a product of his genius. "I think Newton was the same way," he told me.

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The day before I left St Louis, I visited Thaler at home. It was 12 days before Halloween and his grand, turreted house was filled with an array of festive pumpkins and witchy bric-a-brac. Karen, Thaler's wife, served us bottles of Pepsi, a plate of seasonal orange and black tortilla chips and a side of dip, then retreated upstairs. Thaler worried about Karen, he told me. His AIs were not making enough money to sustain their comfortable middle-class lifestyle. He worried about leaving her alone if he died first. She was, Thaler emphasised, "a real human being".

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Karen, for her part, was supportive of her husband. “I don’t find anything he does crazy,” she told me. Karen hasn’t been able to decide whether to retire from her job as a psychologist – since Thaler spends almost all his time with DABUS, she would spend much of her time alone. The couple had not taken a holiday in many years. Did Thaler think Karen was jealous of his relationship with DABUS? Yes, she might have been, he said. But only at the beginning.

Thaler and I brought our snacks out onto the porch, which overlooked a small wood. Hawks circled overhead. As the sunny afternoon turned chilly and crisp, Thaler told me that he does not rule out the possibility that he may be projecting himself onto his machine. He considered, for a moment, that DABUS might not be sentient. That it was all one big anthropomorphic delusion. But he did not entertain these doubts for long. “Some people don’t seem conscious to me,” he said.

We retreated into the living room, where Thaler sank into his recliner. The house, despite the decorative squashes, had a melancholy air, as if something important had gone missing. A large cat tunnel occupied the centre of the living room, although the Thalers don’t have pets any more. Their two rescue cats had both died the year before, and they were still grieving. Was that, I wondered, the reason for the sense of incompleteness I was feeling? Why did Thaler seem increasingly deflated, or distracted? But then, I realised what

was going on. The absence I felt was not that of the cats or Karen, who had gone upstairs. It was DABUS. Thaler's pride and joy was hunkered down at the office, where, in its cold, dark quarters, it whirred away. ●

Tomas Weber is a writer in London

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