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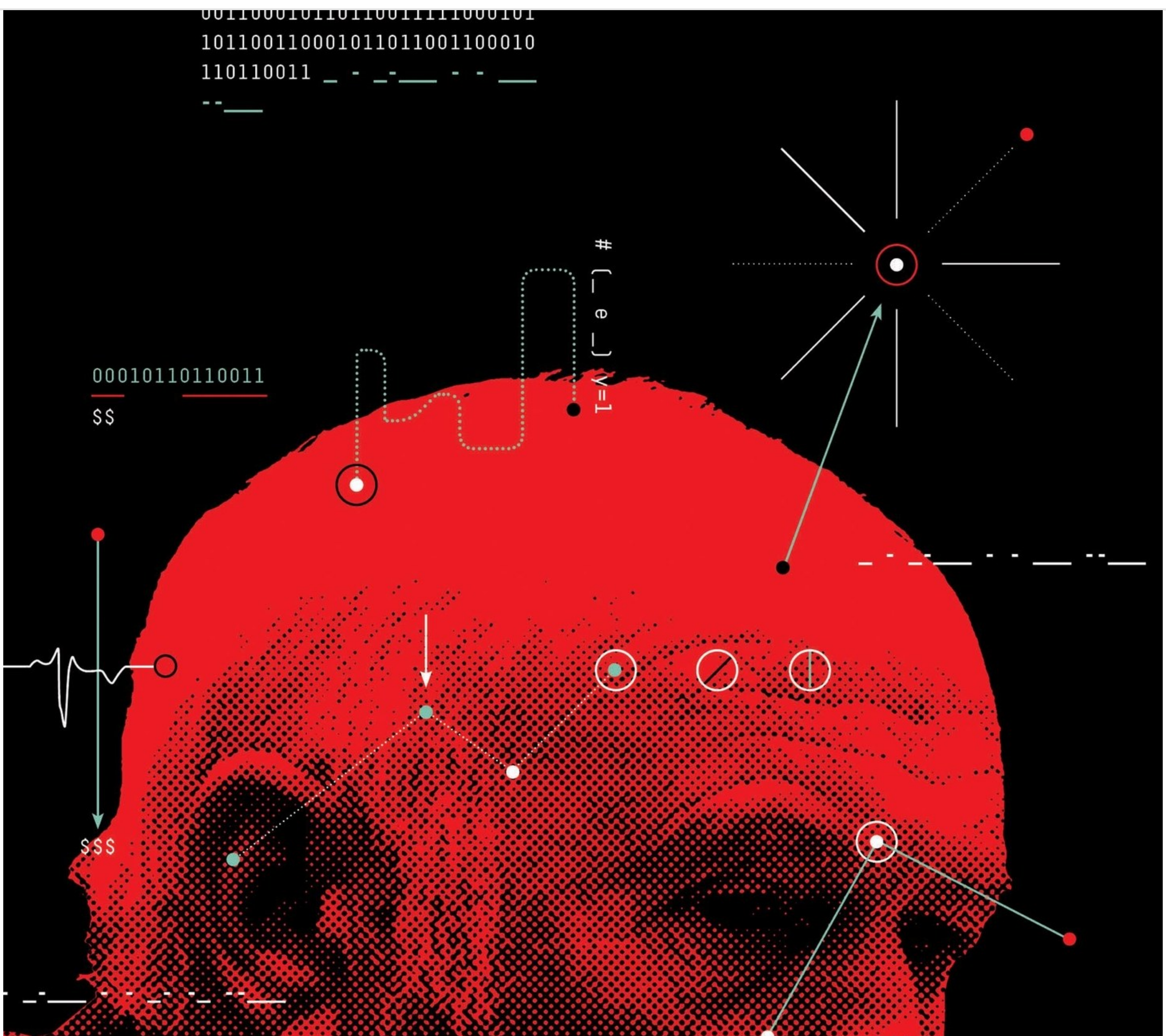
JIM SIMONS, THE NUMBERS KING

Algorithms made him a Wall Street billionaire. His new research center helps scientists mine data for the common good.

By D. T. Max



Simons is donating billions of dollars to science. But much of his fortune, long stashed offshore, has never been taxed.

Illustration by Oliver Munday; photograph by Tim Sloan / AFP / Getty

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A visit to a scientific-research center usually begins at a star professor's laboratory that is abuzz with a dozen postdocs collaborating on various experiments. But when I recently toured the Flatiron Institute, which formally opened in September, in lower Manhattan, I was taken straight to a computer room. The only sound came from a susurrating climate-control system. I was surrounded by rows of black metal cages outfitted, from floor to ceiling, with black metal shelves filled with black server nodes: boxes with small, twinkling lights and protruding multicolored wires. Tags dangled from some of the wires, notes that the tech staff had written to themselves. I realized that I'd seen a facility like this only in movies. Nick Carriero, one of the directors of what the institute calls its "scientific-computing core," walked me around the space. He pointed to a cage with empty shelves. "We're waiting for the quantum-physics people to start showing up," he said.

The Flatiron Institute, which is in an eleven-story fin-de-siècle building on the corner of Twenty-first Street and Fifth Avenue, is devoted exclusively to computational science—the development and application of algorithms to analyze enormous caches of scientific data. In recent decades, university researchers have become adept at collecting digital information: trillions of base pairs from sequenced human genomes; light measurements from billions of stars. But, because few of these scientists are professional coders, they have often analyzed their hauls with jury-rigged code that has been farmed out to graduate students. The institute's aim is to help provide top researchers across the scientific spectrum with bespoke algorithms that can detect even the faintest tune in the digital cacophony.

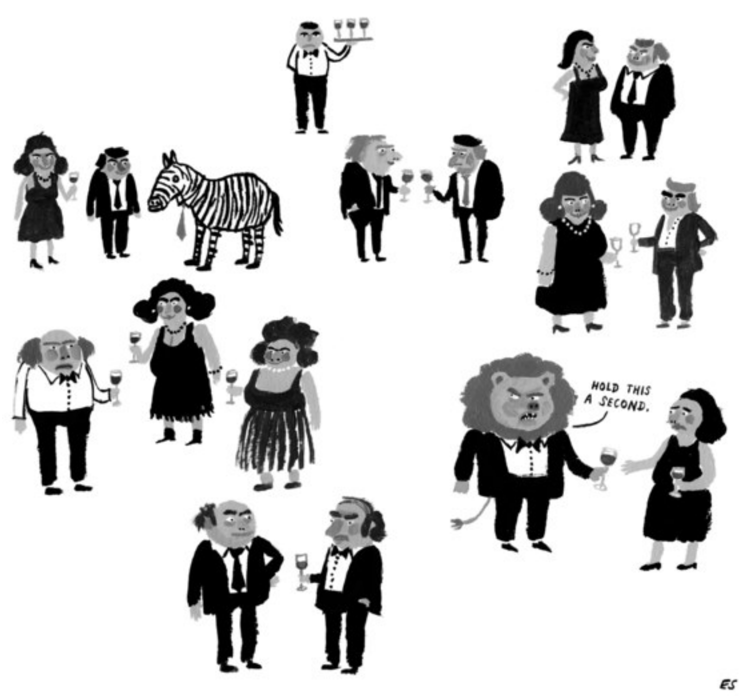
I first visited the Flatiron Institute in June. Although the official opening was still a few months away, the lobby was complete. It had that old-but-new look of expensively renovated interiors; every scratch in the building's history had been polished away. Near the entrance hangs a Chagall-like painting, "Eve and the Creation of the Universe," by Aviva Green. Green's son happened to be spending the year at the institute, as a fellow in astrophysics. "Every day, he walks into the lobby and sees his mother's picture," Jim Simons, the institute's founder, told me.

Simons, a noted mathematician, is also the founder of Renaissance Technologies, one of the world's largest hedge funds. His income last year was $1.6 billion, the highest in the hedge-fund industry. You might assume that he had to show up every day at Renaissance in order to make that kind of money, but Simons, who is seventy-nine, retired eight years ago from the firm, which he started in the late seventies. His Brobdingnagian compensation is a result of a substantial stake in the company. He told me that, although he has little to do with Renaissance's day-to-day activities, he occasionally offers ideas. He said, "I gave them one three months ago"—a suggestion for simplifying the historical data behind one of the firm's trading algorithms. Beyond saying that it didn't work, he wouldn't discuss the details—Renaissance's methods are proprietary and secret—but he did share with me the key to his investing success: he "never overrode the model." Once he settled on what should happen, he held tight until it did.

The Flatiron Institute can be seen as replicating the structure that Simons established at Renaissance, where he hired researchers to analyze large amounts of data about stocks and other financial instruments, in order to detect previously unseen patterns in their fluctuations. These discoveries gave Simons a conclusive edge. At the Flatiron, a nonprofit enterprise, the goal is to apply Renaissance's analytical strategies to projects dedicated to expanding knowledge and helping humanity. The institute has three active divisions—computational biology, computational astronomy, and computational quantum physics—and has plans to add a fourth.

Simons works out of a top-floor corner office across the street from the institute, in a building occupied by its administrative parent, the Simons Foundation. We sat down to talk there, in front of a huge painting of a lynx that has killed a hare—a metaphor, I assumed, for his approach to the markets. I was mistaken, Simons said: he liked it, and his wife, Marilyn, did not, so he had removed it from their mansion in East Setauket, on Long Island. (Marilyn, who has a Ph.D. in economics, runs the business side of the foundation, and the institute, from two floors below.) An Archimedes screw that he enjoyed fiddling with sat on a table next to a half-filled ashtray. Simons smokes constantly, even in enclosed conference rooms. He pointed out that, whatever the potential fine for doing so is, he can pay it.

Simons has an air of being both pleased with himself and ready to be pleased by others. He dresses in expensive cabana wear: delicate cotton shirts paired with chinos that are hiked high and held up by an Indian-bead belt. He grew up in the suburbs of Boston, and speaks with the same light Massachusetts accent as Michael Bloomberg, with frequent pauses and imprecisions. He sometimes uses the words "et cetera" instead of finishing a thought, perhaps because he is abstracted, or because he has learned that the intricacies of his mind are not always interesting to others, or because, when you are as rich as Simons, people always wait for you to finish what you are saying.



On a wall, Simons had hung a framed slide from a presentation on the Chern-Simons theory. He helped develop the theory when he was in his early thirties, in collaboration with the famed mathematician Shiing-Shen Chern. The theory captures the subtle properties of three-dimensional spaces—for example, the shape that is left if you cut out a complicated knot. It became a building block of string theory, quantum computing, and condensed-matter physics. "I have to point out, none of these applications ever occurred to me," he told me. "I do the math, they do the physics."

High-level mathematics is a young person's game—practitioners tend to do their best work before they are forty—but Simons continued to do ambitious mathematics work well into adulthood. In his sixties, after the death of his son Nick, who drowned in Bali in 2003, he returned to it. "When you're really thinking hard about mathematics, you're in your own world," he said. "And you're cushioned from other things." (Simons lost another son, Paul, in a bike accident, in 1996.) During these years, Simons published a widely cited paper, "Axiomatic Characterization of Ordinary Differential Cohomology," in the *Journal of Topology*. He told me about his most recent project: "The question is, does there exist a complex structure on the six-dimensional sphere? It's a great problem, it's very old, and no one knows the answer." Marilyn told me she can tell that her husband is thinking about math when his eyes glaze over and he starts grinding his jaw.

Our discussion turned to the Flatiron Institute. Renaissance's computer infrastructure, he said, had been a central part of its success. At universities, Simons said, coding tends to be an erratic process. He said of the graduate students and postdocs who handled such work, "Some of them are pretty good code writers, and some of them are not so good. But then they leave, and there's no one to maintain that code." For the institute, he has hired two esteemed coders from academia: Carriero, who had led my tour, had been recruited from Yale, where he had developed the university's high-performance computing capabilities for the life sciences; Ian Fisk had worked at CERN, the particle-physics laboratory outside Geneva. Simons offered them greater authority and high salaries. "They're the best of the breed," he said. Carriero and Fisk sometimes consult with their counterparts at Renaissance about technical matters.

Simons's emphasis on what most of us think of as back-office functions is of a piece with the distinctive computational focus of the institute. The Flatiron doesn't conduct any new experiments. Most of its fellows collaborate with universities that generate fresh data from "wet" labs—the ones with autoclaves and genetically engineered mice—and other facilities. The institute's algorithms and computer models are meant to help its fellows uncover information hidden in data sets that have already been collected: inferring the location of new planets from the distorted space-time that surrounds them; identifying links to mutations among apparently functionless parts of chromosomes. As a result, the interior of the institute looks less like a lab than like an ordinary Flatiron-district office: casually dressed people sitting all day at desks, staring at screens, under high ceilings.

Simons has amassed the same processing capacity as would normally be present in the computer hub of a mid-sized research university: the equivalent of six thousand high-end laptops. This is powerful, but not ostentatiously so. And, as Carriero conceded, it "cannot be compared to the corporate-wide resources of an Amazon or a Google." But, because there are far fewer people at the Flatiron Institute, each researcher has immediate access to tremendous computing power. Carriero said that, by supplying scientists with state-of-the-art "algorithms guidance" and "software guidance," he can help them maintain a laserlike focus on advancing science.

Simons has placed a big bet on his hunch that basic science will yield to the same approach that made him rich. He has hired ninety-one fellows in the past two years, and expects to employ more than two hundred, making the Flatiron almost as big as the Institute for Advanced Study, in Princeton, New Jersey. He is not worried about the cost. "I originally thought seventy-five million a year, but now I'm thinking it's probably going to be about eighty," he said. Given that *Forbes* estimates Simons's net worth to be $18.5 billion, supporting the Flatiron Institute is, in financial terms, a lark. "Renaissance was a lot of fun," he told me. "And this is fun, too."

The Flatiron Institute is part of a trend in the sciences toward privately funded research. In the United States, basic science has traditionally been paid for by universities or by the government, but private institutes are often faster and more focussed, and the world is awash in new fortunes. Since the nineties, when Silicon Valley began minting billionaires, private institutes have sprung up across the country. In 1997, Larry Ellison, the co-founder of Oracle, launched the Ellison Medical Foundation, in the Bay Area, to study the biology of aging. Six years later, the Allen Institute for Brain Science, in Seattle, was founded by Paul Allen, the co-founder of Microsoft. In 2010, Eric Schmidt, Google's executive chairman, founded the Schmidt Ocean Institute, in Palo Alto.

These institutes have done much good, in part by providing alternatives to sclerotic systems: the Allen Institute has helped change how neuroscience is done, speeding it up with such tools as automated microscopy. But private foundations also have liabilities. Wealthy benefactors inevitably direct their funding toward their personal enthusiasms. "The fear with these billionaire donors is that they'll fund junky science, wasting money and time," David Callahan, the editor of the online magazine Inside Philanthropy, said. Foundations are not taxed, so much of the money that supports them is money that otherwise would have gone to the government. Scientific mega-donors answer to no one but themselves. Private institutes tend to have boards chosen by their founders, and are designed to further the founders' wishes, even beyond their deaths. Rob Reich, a professor of political science at Stanford University and an expert on philanthropy, told me, "Private foundations are a plutocratic exercise of power that's unaccountable, nontransparent, donor-directed, and generously tax-subsidized. This seems like a very peculiar institutional and organizational form to champion in a democratic society."

Simons, who, according to *Forbes*, is the twenty-fifth-wealthiest person in America, could easily become the country's largest private funder of basic science. He pays for the institute through what he calls his "domestic nonprofit office," which has an endowment of nearly three billion dollars. He also maintains a much larger charitable entity in Bermuda, the Simons Foundation International. Simons mentioned this foundation to me in conversation, but it has no Web page or public presence. Details about the Bermuda entity were recently obtained by the International Consortium of Investigative Journalists, and became part of its Paradise Papers project. The investigation revealed that the Simons Foundation International has an estimated eight billion dollars in assets, none of it taxed. It also has a peculiar provenance: in the late seventies, just before Simons started Renaissance, a friend of his parents put a hundred thousand dollars into a trust for him. Simons said of the gift, with a shrug, "He liked me."

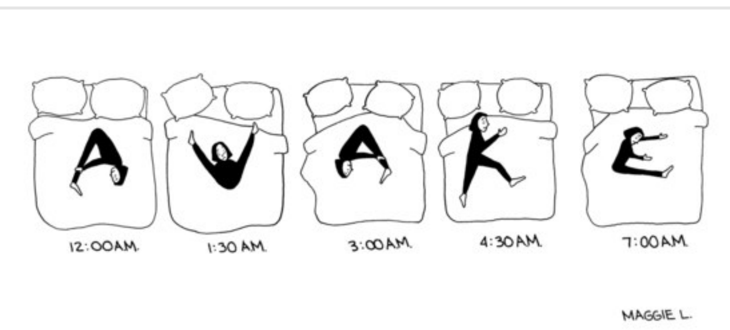
Simons intends to draw on the Bermuda fortune to fund his charitable projects as time wears on. "We're spending four hundred and fifty million a year," Simons said. "Gradually, the Simons Foundation International will take over much of the spending."

While I was meeting with him one day in November, the Paradise Papers story was breaking, and he was forced to respond to questions from two newspapers that had the scoop, the *Times* and the *Guardian*. He did not appreciate the papers' implication that he had selfishly avoided paying taxes, and suggested to me an alternate headline: "BRILLIANT MATHEMATICIAN MAKES BILLIONS AND GIVES IT ALL AWAY TO CHARITY." (The *Guardian* described offshore trusts as "ideal vehicles for concealing immense wealth.")

I asked him if he felt that he was taxed fairly. "I pay a hell of a lot of taxes," he said. "Do I think it's my share? Yes." He defended his Bermuda foundation as no different from any other asset. He said, "Suppose you started a company, and you went public and you never sold the shares, and these shares increased and increased in value. You would not be paying any taxes until you sold some of those shares. I wasn't benefitting from it until such time as I would take the money. I think that's a perfectly reasonable thing to do." What went unmentioned was the *size* of the Bermuda asset.

We also spoke about a recent Senate subcommittee investigation: Renaissance was accused of having used, in the aughts, unethical trading tricks that had lowered its capital-gains taxes by $6.8 billion. (Renaissance has maintained that it operated within the law.) Simons, who had been the firm's C.E.O. during this period, told me that he hadn't particularly been trying to avoid paying corporate taxes; he'd mostly been trying to insulate the fund's investments from risk. He said of the company's accounting tactics, "It was a way to limit loss, and it was terrific, and also it gave us quite a lot of leverage." He added, "And when I heard it also would qualify us for long-term capital gains, I said, 'O.K., maybe, but that's not what I care about.' " Senator Ron Wyden, of Oregon, the ranking Democrat on the Finance Committee, told me, in an e-mail, "The law is very clear in this area. Renaissance Technologies abused a tax shelter and pocketed billions from it."

The capital-gains matter is now in arbitration, and I asked Simons how much his net worth could be affected. "Modestly," he said. Quickly, he amended his answer: "More than modestly. I mean, it would affect me."



Edward McCaffery, a law professor and a tax-policy expert at the University of Southern California, said, in an e-mail, "Democrats like Simons, Bill Gates, and

Warren Buffett might end up giving away all or most of their wealth to charities of their choice, but they and their families still lead lives of great power and privilege, with little tax. And their charities reflect *their* values, without necessarily helping ordinary—and taxpaying—citizens." The taxes from an eight-billion-dollar fortune could fund a lot of schools.

Simons is far more apologetic about the money he makes than about the taxes he avoids paying. "I believe that the division of wealth we have in the United States has been skewed too much, and I think it would be better if it were less skewed," he said. There was, however, at least one positive outcome to this unfairness. "I'm a beneficiary of all this, but, as for philanthropy and science, I think it's a very good thing, plain and simple," he said. "We can go for things that other people can't." With only a hint of defensiveness, he added, "Originally, all science was supported by philanthropy. Galileo had his patrons."

"Well, *qué más*?" Simons asked genially.

It was July, and some of the Flatiron Institute's scientists were giving him progress reports on their activities. That day, it was the astrophysicists' and the biologists' turn; soon, the quantum physicists would come. (Their group is so new that its leader was still based in Paris.) The meetings took place, back to back, in a small conference room, with Simons praising and prodding and smoking. Three astronomers detailed their recent work on supernovas, gravitational waves, and dwarf galaxies. Simons peppered them with questions. "Does a black hole typically have a magnetic field?" he asked. (The material that surrounds a black hole generates one, he was told.) He was surprised to learn that astronomers cannot actually confirm the accuracy of their most complex models. Two different computer programs solving the same labyrinthine equation often come up with substantially different answers. Simons objected: "Well, if it's the same physics in the first place, you'd think that the code would be implementing the laws of physics, and it's not going to change from program to program!" For all of Simons's interest in coding, he is not a programmer himself. He thinks algorithmically, but on a whiteboard.

"Ideally, yes," one of the astronomers reassured him. "But in practice that is not the case." Another scientist clarified: "The underlying algorithms all are making simplifications. We're never solving the fundamental equations—we're always approximating them. And different approximations are made by different algorithms." Simons, schooled in the ideal world of mathematics, was visibly agitated.

The astronomers filed out, and the biologists filed in. A Russian-born geneticist and computer scientist, Olga Troyanskaya, who is also a professor at Princeton, told Simons about an algorithm she was developing, which would predict the effects of specific mutations within a given cell. She hoped that the program would eventually suggest possibilities for medical treatments tailored to a patient's DNA. Troyanskaya then went through a list of other projects, at whirlwind speed. She planned to mine the DNA of Neanderthals, to predict how their genes would have been expressed, and her group was also working on an algorithm that linked symptoms of autism to portions of the genome which do not encode proteins.

"So *this* is all you've done?" Simons joked.

The next to speak was Dmitri Chklovskii, a neuroscientist whom Simons recruited from the Howard Hughes Medical Institute, where he specialized in connectomes, or networks of neurons. He described mapping the connectome of an Italian miniwasp, a parasite that hatches inside the eggs of other insects. Such studies of simple species can help uncover the complexities of how the human brain computes. Simons perked up when he heard the story of the miniwasps. "How long do they live?" he asked. When told only five days, he responded, "But five *good* days."

An applied mathematician named Alex Barnett discussed several programs that the group had developed to analyze neuronal processes. One of the most promising, MountainSort, improves the parsing of brain-electrode recordings, in part by automating the interpretation of the data. The program can tell you, before a rat moves, whether it is thinking of turning right or left. The algorithm used in the program may provide insight into how the brain controls behavior. The institute has made the software available, without cost, to other labs. Simons smiled when he heard that MountainSort was being adopted by important research groups. "That's pretty good," he said. (Chong Xie, a neural engineer at the University of Texas, e-mailed me to say that MountainSort was "by far the best spike-sorting tool we have tested," and that the speed of data analysis had increased as much as a hundredfold.)

Part of the Flatiron's brief is to release coding projects such as MountainSort as quickly as possible. Scholarship is similarly fast-paced: in just a few years, Flatiron researchers have authored, or co-authored, more than two hundred and eighty scientific papers. "They're busy boys!" Simons wrote to me, in an e-mail. (Of the ninety-one fellows at the institute, twenty are women; seven of the nine group leaders are men.)

Marilyn Simons told me that her husband is an "information processor," adding, "Whatever it is, he'll chew it up." Jim Simons told me that he's more comfortable discussing astronomy than biology, because he understands the presentations better, but he seemed adept at following abstruse discussions in both fields. It was clear that he prefers application to theory, and exchanges that struck me as numbingly detailed often seemed to excite him the most. He and the astronomers spoke at length about how one might design software that could chart the orbits of a billion stars using the fewest possible lines of code. Talk of computer-language efficiency led to a discussion of the Hawaiian language, which makes do with far fewer letters than English.

According to Simons, his governing strategy is to hire brilliant, motivated people and then give them free rein. "Scientists don't want to be told what to work on," he said. But his role seemed closer to that of a newspaper editor or a sports coach, persuading, rousing, and sometimes cajoling his team to do better work. Simons has spent his career honing a particular algorithm: how to manage talented researchers in a way that feels both pleasant and creative. "I like to recruit," he told me. "My management style has always been to find outstanding people and let them run with the ball." At Renaissance, he said, he had sometimes worked on its algorithms ("There are zillions of them!"), and at the Flatiron Institute he occasionally made substantive suggestions. When Olga Troyanskaya began working on the connection between genes and autism symptoms, Simons proposed a tweak to the algorithm that she was developing, to help it map the information more efficiently. "It did," he told me. Troyanskaya offered to list him as an author on the resulting paper, but Simons prefers to stay out of the spotlight. He politely declined.

For Simons, ideas and money have always been intertwined. His cousin Richard Lourie, a writer, told me a story about their grandfather, who ran a shoe factory: on payday, he let the two boys hold piles of cash "as high as our heads." Lourie recalled, "We both loved it!" But, at other times, Simons could be so intensely withdrawn that Lourie worried that he was sick. "He would just say, 'I was thinking,' " Lourie told me. In 1955, when Simons was seventeen, he enrolled at M.I.T. and fell in love with mathematics. He received his Ph.D. at U.C. Berkeley, when he was twenty-three. Soon, he was working at the federally funded Institute for Defense Analyses, in its élite cryptography group, which is based in Princeton. "Our job was to break other countries' codes and to design our own," Simons said. "I was lucky enough to do some very good mathematics while I was there, and I enjoyed coming up with an algorithm and seeing it tested on a computer. I couldn't program to save my life, but I did solve a long-standing problem in the field." (He could not discuss that work, he said, because it remains highly classified.) He was fired from the I.D.A. in 1968, after telling a *Newsweek* reporter that he opposed the Vietnam War, and that until it was over he would work only on personal projects.

After his departure, Simons was named the head of the math department at the State University of New York at Stony Brook. His chairmanship coincided with the era of Nelson Rockefeller, the ambitious governor of New York, who wanted the school to be the "Berkeley of the East." Under Simons, the department expanded and gained in prestige. "He already was a combination of ringleader and master of ceremonies and energizer," Tony Phillips, a mathematician who worked with Simons, recalled. While Simons was at Stony Brook, he won the Veblen Prize, one of America's top math honors, for work in differential geometry, the study of surfaces and their shapes in multiple dimensions. He also collaborated with Shiing-Shen Chern on the Chern-Simons theory. "Yeah, I was a good mathematician," he said. "I wasn't the greatest in the world, but I was pretty good."

"Behind one of these doors is a ferocious tiger. Behind the other is a beautiful lady. There might also be a tiger there, too. I buy so many tigers it's basically become a storage issue at this point."

All along, Simons was thinking about how to become rich. While at Berkeley, he bought soybean futures and went to the exchange in San Francisco to watch them being traded. ("They went up!" he said. "And then they went back down.") In the late seventies, not long after he won the Veblen Prize, Simons founded a small investment firm in an office park near Stony Brook. At the time, he felt stymied by a mathematical problem involving simplexes—a simplex is the polygon with the fewest vertices in any given dimension—and he wanted a break. He tried his hand at currency trading, and then at commodities, but he didn't enjoy the experience. It was the investing equivalent of wet-lab work. "It was fundamental trading, not systematic," he said. "It was very gut-wrenching." He felt that there must be a more statistical way to make money in the market. "I looked at the price charts and analyzed them, and they didn't look random to me," he says. "They looked *kind* of random, but not completely random. I felt there had to be some anomalies in this data which could be exploited."

He hired another mathematician, whom he'd met at the I.D.A., and they began to create models that predicted the direction of currency prices. Simons told me that he staffed his "crazy hedge fund"—the company that became Renaissance Technologies—not with financiers but with physicists, astronomers, and mathematicians. He also invested heavily in computers and in the people who ran them. "If you're going to analyze data, it really has to be *clean*," he said. "Suppose it's a series of stock prices. 31¼, 62½. Wait, stocks don't double in a day—so there's an error in the data! There's all kinds of ways to get bugs out of data, and it's important, because they can really screw you up."

He encouraged interaction and debate among the researchers. "Everything was collaboration at Renaissance, or a great deal of it," he said. "It was a very open atmosphere." Former colleagues agree that Simons was an exceptional manager. He understood what scientists enjoyed, and often arranged quirky bonding exercises: at one point, Renaissance employees competed to see who could ride a bicycle along a particular path at the slowest speed without falling over.

Renaissance has had an unprecedented run. *Bloomberg Markets*, in an article last year, called the firm's signature product, the Medallion Fund, "perhaps the world's greatest moneymaking machine." For nearly three decades, it has gone up by eighty per cent annually, on average, before fees. Renaissance's other, bigger funds have done less well. Simons said that this is a consequence of their size: large amounts of money cannot be traded as quickly, and longer-term trading makes algorithms less useful. "It's like the weather," he says—the nearer in, the higher the certainty.

Simons made his first million dollars by his early forties, his first billion by his sixties. "It was fun making the money," he said. At seventy-one, he retired, turning the fund's management over to two speech-recognition experts whom he'd brought on board in 1993, Peter Brown and Robert Mercer. Simons told me that "language is very predictive," and he foresaw that Brown and Mercer could apply their skills to the markets. In an e-mail, Brown, who is now Renaissance's C.E.O., said, "Jim's genius was in seeing the possibilities for quantitative trading long before others did and in setting up a company in which he provided outstanding scientists with the resources, environment, and incentives to produce." Brown also observed, "His role was more in setting the general direction of the company than in developing the technology."

One thing that Simons did not predict is that Mercer would become one of the most divisive figures in American politics. During the 2016 election cycle, Mercer, a far-right conservative, spent more than twenty million dollars, eventually throwing his weight behind the candidacy of Donald Trump. He is likely the single biggest donor to the alt-right, supplying millions of dollars to Breitbart, the incendiary Web site run by Steve Bannon. Simons described Mercer's current politics as a transformation that has surprised him. "I've talked to him a few times, but he is just very different from me, and I can't change him," Simons said. He added, "I like him."

In October, Simons, who is the non-executive chairman of Renaissance's board, encouraged Mercer to resign from his management position at the firm. Mercer did so. Simons said that the decision was practical, not political. Mercer's growing notoriety was "not so good for morale," he explained. "One of our very best people had just said he was quitting," he noted, and "another of the very best people seemed to be on the verge." Simons checked in with the firm's members recently, and he believes that he got the data he wanted: morale has improved. "I think I was right," he said.

Simons himself contributed twenty-six million dollars in the 2016 election cycle—to liberal causes. He told me that he has always been a Democrat, because of the Party's commitment to the poor. He sees no disconnect in paying the least possible in taxes while supporting a party that would like him to pay more. "I'm happy to be one of the rich folks, but I think government ought to do as much as it can to help ordinary folks get on with their lives," he said. As adept as he is in math, he said that he was mystified by the way rich Americans had mopped up so much wealth in recent decades. "I don't know exactly why such a skewing has occurred," he said. "I'm not an economist, and I haven't studied the question, but it doesn't feel right to me to have that kind of balance—or imbalance." After some reflection, he told me that he would support a rise in the top tax bracket. I could almost hear him running numbers in his head about his net worth. "A rise from forty per cent to fifty per cent would not be a tragedy," he said. "Depending on how the government spends the money."

Although Simons seems determined to give an enormous part of his fortune away, he is not embarrassed to spend lavishly. He has a forty-eight-million-dollar apartment overlooking Central Park, and he owns a sixty-five-million-dollar jet, which he rents to others when he's not using it. (Smoking is permitted on board.) He also has a two-hundred-and-twenty-foot yacht, called the Archimedes, which he sometimes uses to take his old math friends to extraordinary places. He recently cruised through French Polynesia with two of his Stony Brook colleagues, Jeff Cheeger and Tony Phillips. "Jeff had a bee in his bonnet about Pontryagin classes," Phillips recalled, amused. "It became annoying. He kept wanting to talk about it." Simons told me that he has done a lot of thinking on yacht trips himself, noting, "I once proved a nice theorem on the boat."

Jim and Marilyn Simons became major charitable donors in the nineteen-nineties, when they launched their foundation. They have funded a math center at Stony Brook, and a center for computer science at Berkeley. The foundation has also given grants—for autism research, for a giant telescope in Chile that will hunt for gravitational waves from the big bang—that are collectively worth two and a half billion dollars. But Simons's role in these projects was relatively limited, and when he retired he found himself spending most of his time managing his charitable assets and evaluating grant applications. During this period, his loved ones sensed that he was less happy. "He likes to work," Marilyn said. Lourie, his cousin, told me, "He would say that he had lots of projects, but no *one* project."

Simons says that he was fine, thank you: he was plenty busy, and wasn't looking for a new job. But he did want to heighten the foundation's impact on the sciences. In 2012, he and Marilyn convened an informal conference at the Buttermilk Falls Hotel, in upstate New York. Participants were asked to identify collaborative, goal-driven projects that were not being funded by other sources. This was a technique that he had often used: tapping the opinions of well-informed people and then making a decision with his gut. "Taste in science is very important," Simons told me. "To distinguish what's a good problem and what's a problem that no one's going to care about the answer to anyway—*that's* taste. And I think I have good taste."

Simons's intellectual reputation insured that he would have top minds at the meeting. He's not "that billionaire guy," Cheeger said. "He's someone who's a legend in the math community." Chairing the conference was David Baltimore, the Nobel Prize winner and the former president of Caltech. The geneticist Eric Lander was also present, along with a variety of physicists, mathematicians, biologists, and astronomers.

For some participants, the gathering offered an opportunity to pitch ambitious projects to a potential patron. This represented a return to an old way of doing science. In the years before the Second World War, private institutions such as Rockefeller University, in Manhattan, and the Institute for Advanced Study, which was funded by the Bamberger's department-store heirs, came of age. But by the fifties the National Institutes of Health, the National Science Foundation, and other governmental organizations were paying for the vast majority of scientific research in America. For half a century, the government remained the dominant funder. But in the early aughts federal support began to dwindle, and philanthropy came roaring back, led by Silicon Valley billionaires. In 2015, for the first time since the Second World War, private money, including corporate contributions, provided most of the funding for basic-science research.

Governmental granting organizations, such as the National Science Foundation, tend to give money for incremental research. People with sustained track records are favored; the average age of scientists with a Ph.D. who receive their first grant from the National Institutes of Health is forty-three. Speculative projects are generally avoided. At Simons's gathering, the participants were encouraged to propose projects whose payoff might not be immediate. Baltimore proposed exploring immune-system engineering; an astronomer suggested investigating the dark-matter universe; a paleogeneticist made a case for mapping the human genome's evolution through time.

One scholar in attendance, Ingrid Daubechies, a math professor at Duke, had calculated what type of project Simons might find especially appealing. She knew how he had made his fortune, and she knew that the amount of data in the science world had exploded. Maybe, Daubechies suggested at the meeting, the foundation should fund not new research but better mechanisms for interpreting existing data. A new research center could "prospect for interesting data sets where people intuit that there's more structure than can be gotten out now, but that aren't so complicated that it's hopeless."

Scientists, Simons knew, were drowning in data. New technologies like optogenetics—using light to activate cells in living tissue—had generated a flood of information about the human brain. Infrared imaging, gravitational-wave detection devices, and radio telescopes relayed a constant stream of data about the cosmos. Researchers often acquired hundreds of terabytes of data in a single experiment. Yet, despite this revolutionary development, Daubechies said, relatively little effort had been made to refine our methods of data computation.

Her proposal resonated with Simons. He returned to New York City, and kept mulling over the idea. "The more I thought about it, the more I liked it," he told me. "And Marilyn liked it." David Baltimore was not surprised when Simons chose Daubechies's project. "I'm a life scientist, but Jim's a mathematician," he said. Daubechies had suggested that the center be situated at Duke, but the Simonses had a different idea: to establish a center near their Manhattan foundation. They asked each other, "Why not do it in-house?"

Simons hopes that the Flatiron Institute will have the expansively creative atmosphere of Bell Labs, the storied offshoot of the telephone monopoly, whose heyday lasted from the mid-forties to the eighties. Researchers there were asked to follow their passions, and the result was eight Nobel Prizes and the invention of the transistor. Simons had a similarly idyllic experience at the Institute for Defense Analyses, where he spent half his time cracking codes and the other half pursuing his own mathematical interests. When setting up Renaissance, Simons told me, he made sure that, despite the extraordinary pressure, his firm was a pleasant and stimulating place to work, with frequent lectures and outings. Peter Brown, Renaissance's C.E.O., recalled, "Working for Jim, you had the feeling that you had better produce, because he had pretty much removed every excuse for not producing."

Sharing had been an important part of Renaissance's culture. "Everyone knew what everyone else was doing," Simons said. "They could pitch in and say, 'Try that!' " He wants information to flow among groups at the Flatiron Institute, too, so there are plenty of chalkboards in the hallways, and communal areas—coffee nooks, tuffets arranged in rows—where fellows can "sit around and schmooze." He observed, "An algorithm that's good for spike sorting—some version of it might conceivably be good for star sorting, or for looking at other things in another field." One day in June, I passed a chalkboard that was covered with an equation written by David Spergel, the head of the astronomy division. It demonstrated that the way a supernova explosion drives galactic winds also captures the behavior of the movement of waves in oceans and, by implication, the movement of fluids in cells.

When I visited the institute this fall, I saw many visualizations of information on computer screens, and they underscored the commonalities among the fellows' data sets. The visual interface of a biology algorithm displayed the balloon-like amino acids of a protein, but they could have been on an astronomer's computer: the image reminded me of planets being born. An elegant pinwheel, designed to map the links among genetic mutations, looked like an old-fashioned representation of a planetary system in orbit. The program allowed you to type in the name of a gene; it then ranked the diseases most closely associated with that gene. The project, which works through machine learning, draws on fifteen thousand gene samples from patients and from laboratory cultures. The hope is to expand the set to millions of gene samples.

I sat down with Christopher Hayward, a young astronomer who has a Ph.D. from Harvard. He was working on a simulation of a crucial cosmological moment, a billion years after the creation of the universe, when smaller galaxies were cohering into larger ones. He showed me a visualization depicting that moment, which included the kind of spinning gaseous orbs that are familiar from any planetarium. Then he clicked on the algorithm behind the visuals: a torrent of incomprehensible digits in the simple typeface of Linux code. The galaxy simulation, Hayward told me, had begun two months earlier, and would continue for another two months, as he and other researchers tried to understand the feedback loop between star formation and black-hole formation. "The unique thing provided by the Flatiron is that I can start a new simulation at any time and start immediately," he said. "Even at Harvard, you're normally waiting in a queue."

Simons told me that in 2013, shortly after the Buttermilk Falls conference, he decided to start a small "in-house group" to explore "the scientific analysis of data." He soon found someone who was "stunningly qualified" to lead the group: Leslie Greengard, who had been the head of the Courant Institute of Mathematical Sciences, at N.Y.U. Greengard had a medical degree, which he had never used, and he wanted to throw himself into problems in biology. How could he do that at a math institute? Simons made him a very attractive offer, and Greengard accepted it. He quickly assembled a group that included a systems biologist, a genomics expert, a neuroscientist, and the two coders, Carriero and Fisk.

The group developed a series of software programs, including MountainSort, the program that automates the output from multielectrode recordings, and CaImAn, a machine-learning algorithm that detects the release of calcium in neurons. Simons was so happy with these results that he decided to proceed with the institute. To insure that he got top talent, he offered fellows a fifty-per-cent salary increase and the option to work only three days a week, which would help them maintain a connection to their home institutions, where lab work was done. Spergel, the astronomer, who has tenure at Princeton (and was the runner-up in its most recent selection of a president), immediately began recruiting applicants for a division of twenty people. He told prospects, "You get to shape the direction of computational astrophysics. You will be driving the field if you come here." Of the twelve offers he made to postdoctoral candidates, eight said yes. "We didn't even have a Web page yet!" he said.

In one of its opening gambits, the astronomy group has used high-powered statistical analyses to challenge existing models of the universe. A mapping project of stars in the Milky Way detected a surprising number of twin stars. This finding suggests that, contrary to what many astronomers believe, dark matter is not made up largely of black holes, because the gravitational power of the black holes would have forced many of the twin stars apart.

When Simons needed to find a leader for the quantum-physics division, he took a similar "Ocean's Eleven" approach. He held a workshop on the subject and closely observed the participants. One of them, a French physicist whom he had met several years earlier, particularly struck him. "When he opened his mouth to speak, everyone shut up to listen to what he had to say," he said. "And I was very impressed by that." The man was Antoine Georges, of the Collège de France. Simons was further excited when he learned of one of Georges's projects: research into the properties of superconductive materials. Scientists have long dreamed of creating a superconductor that works at room temperature. This might not sound like a computational problem, but it is. Analyzing the electronic properties of materials, particularly synthesized ones, "can require hugely complex algorithms and much computing," Simons explained. If this breakthrough could be achieved, many of the constraints of engineering would disappear: electricity could travel without loss, and trains that levitate instead of running on tracks would become commonplace. "It would be worth trillions and trillions of dollars in applications," Simons said.

The Flatiron Institute, Simons likes to say, is "giving everything away," but the claim sometimes seemed tentative, like an alcoholic pushing away a drink. "No, we're not in it for the money," he told me at one point. "Well, money can't hurt. But, no, we're *not* in it for the money." Superconductivity, he admitted, aroused temptation. "If you understand enough about materials, you could possibly crack that problem *and* probably make a lot of money for the foundation," he told me. Georges, for his part, seemed worried that Simons was overly focussed on an extremely difficult problem. "Such superconductivity is absolutely not something I want to promise," Georges told me, explaining that he'd be happy if his computations helped scientists to create a better magnet. Before agreeing to move to the United States, he asked Simons to make a clear commitment to computational science. Simons had the Flatiron's board pass a resolution guaranteeing to fund the institute for at least fifty years. Georges accepted the offer.

Flatiron Institute researchers don't have to teach, and they don't have to apply for grants, which can consume much of an academic's time. Nearly all the institute's senior hires come from universities, and most of these universities are nearby, leading to some resentment. "People feel we have so many resources that we're going to take over the world," Spergel said. In an e-mail, one competitor complained to Spergel that the Flatiron was "a 1000 pound gorilla," adding that, of the people he had recently been trying to recruit, all of them had "an offer from you." Another researcher pointed out that, as powerful as computational science has become, it still relies on the kind of experimental science that the institute does not fund. In an e-mail, the researcher noted, "The predictions from the computation can only ever be as good as the data that has been generated. (I think!)"

Simons's willingness to pay more than the most élite academic institutions makes many people uncomfortable. Ray Madoff, who runs the Boston College Law School Forum on Philanthropy and the Public Good, said, "It shows what a lot of people suspected, which is that the wealthy play by their own rules. The rich are running things, and we're just visiting their world." It wasn't so long ago that private foundations could be established only by an act of Congress, in part because they were considered so inimical to democracy. In 1913, Congress refused John D. Rockefeller's request to establish his foundation. He had to go to the New York State Legislature for a charter instead.

Uros Seljak, who directs U.C. Berkeley's department of astronomy and physics, warned that private foundations can be capricious. "Yes, sure, they have a lot of money and they can put in a lot of money, but they can also take it away and put it somewhere else." Tom Insel, who led the National Institute of Mental Health for more than a decade, expressed a different worry. "My concern is that the generosity of Jim Simons will let the rest of us off the hook," he said. "Will we decide that science can be supported as a private endeavor, and forfeit our commitment to use taxpayer dollars for science? Will we forget that science is an investment, not a cost?"

The Simons Foundation has channelled hundreds of millions of dollars into autism research—seventy-five million dollars this year alone. It is no coincidence that the Simonses have a family member who is on the spectrum. And, despite the importance of the research, is it not possible that these millions would be better spent on a different syndrome, either because it affects even more people or because it might be more readily solved? Simons does not think so. He trusts his taste. "We've really transformed that field," he said. Some of the work he has funded, he noted, "has employed a very mathematical approach to finding new genes."

One afternoon this fall, the heads of the institute's three divisions sat with Simons at a conference table near his office. All the participants were bald men with glasses, and the conversation was fast, lightly mocking, and remarkably well informed. You felt as though you were in the presence of exceptional minds. Simons looked in his element: he might have been back at Stony Brook or Renaissance.

The men had gathered, in part, to discuss adding a fourth division. Simons asked his lieutenants for suggestions. Spergel suggested computational epidemiology and public health. But was the field, Greengard asked, truly "Flatiron-ready"? Spergel countered that it was an area in which "some smart people could really have an impact." Simons stepped in to say that, if they couldn't find someone great to "honcho" a workshop on the topic, they should let it drop for now.

A second prospect was computational neuroscience. A prominent N.Y.U. researcher was already scheduled to make a presentation at the institute in the winter, but Simons was doubtful. "Neuroscience is this huge field," he said. "I don't know if we can make an important dent in it or not. 'How the brain works' is arguably right up there with 'How is the universe formed?' as a difficult problem." This, too, was put aside.

Next came the geosciences. Simons lit up. He liked the complexity of the problems that needed to be solved. The institute could field-test the idea with a workshop, and it could include atmospheric science and ocean science, so that there was a connection to climate-change research. "My guess is there's room to do good work there," he said. The others cautioned that thousands of researchers were already working on climate change. Simons pushed back: "Well, if you added one person who was a real atmospheric guy, eh, that wouldn't hurt." The others assented. Simons was pleased, if unsurprised, to have got his way. For all his affability, he casts the deciding vote.

On November 3rd, a "bio-geoscientist" from Caltech, John Grotzinger, came to talk to the Simonses, two of the three division heads, the computing chiefs, and a few others. He commented on the difficulty that academia has in getting new telescopes built. "It's not just Caltech," he said. "It's everyone."

Simons mentioned the telescope that he had helped fund in Chile; it will cost him about forty million dollars. "We're putting up this big observatory in the Atacama Desert—it's going to be beautiful," he said. "We're going to study the cosmic microwave background."

"Wow," Grotzinger said.

Grotzinger, who was advising, not seeking a job, elegantly guided the group through the challenges of climate modelling. Many of the problems were familiar to the Flatiron staff. "Most of the data actually gets ignored," Grotzinger explained. And there was a problem of collaboration. He was a specialist in historical climate change—specifically, what had caused the great Permian extinction, during which virtually all species died. To properly assess this cataclysm, you had to understand both the rock record and the ocean's composition, but, Grotzinger said, "geologists don't have a history of interacting with physical oceanographers." He talked about how his best collaboration had resulted from having had lunch with an oceanographer, and how rare this was. Climate modelling, he said, was an intrinsically difficult problem made worse by the structural divisions of academia. "They will grope their way to a solution probably in the next fifty years," Grotzinger said. "But, if you had it all under one umbrella, I think it could result in a major breakthrough."

Simons and his team were interested. It seemed Flatiron-ready. The scientists asked Grotzinger how many fellows, and how much computing power, such a group would need. Grotzinger estimated that a division would need at least fifty researchers to be effective.

"I would include some programmers," Simons chimed in.

After the meeting, Simons said that he hopes to have his fourth division in place by next September. I asked him: Why stop there? Why not eight units? Why not Simons University? He had the money, after all. But he insisted that four divisions was all he could handle, if he wanted both first-class work and a collaborative atmosphere. He added that he needed to manage it all, with his "light touch."

Simons understood that, whatever structure he set up, it ultimately needed to function well without his supervision. The foundation had signed a thirty-five-year lease on the institute's building, with an option to renew for fifteen more. As long as the tax laws didn't change dramatically, Simons's fortune could keep the institute going in perpetuity. But humans, he realized, were not machines. "I'm hoping this is going to last a hundred years," he told me. "But I won't see it." ♦

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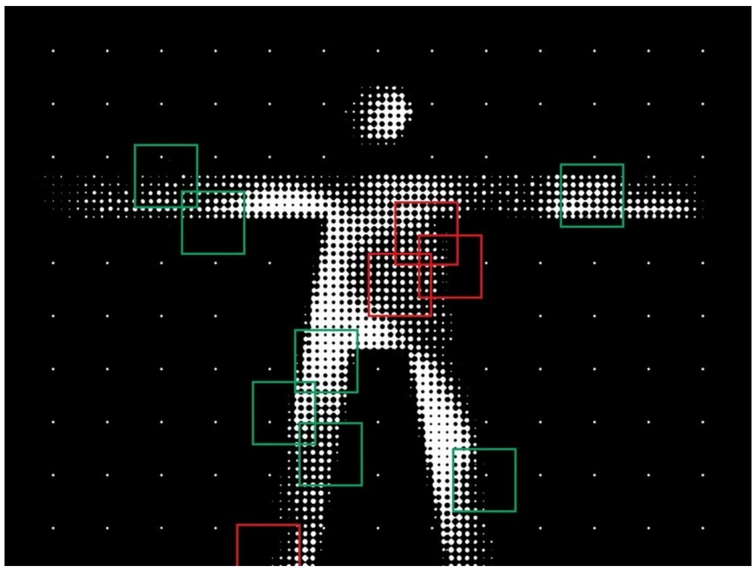

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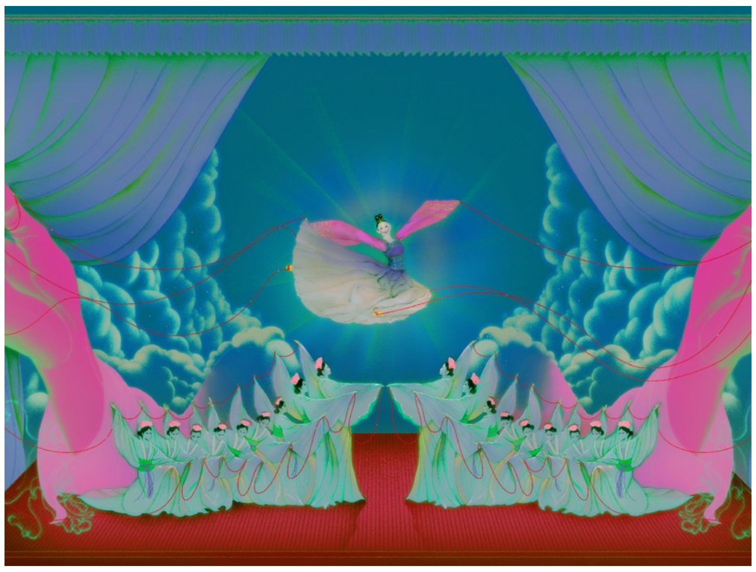

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