

## Merely Human? That's So Yesterday

The Singularity movement sees a time when human beings and machines will merge and overcome illness and perhaps death.



ON a Tuesday evening this spring, [Sergey Brin](#), the co-founder of [Google](#), became part man and part machine. About 40 people, all gathered here at a [NASA](#) campus for a nine-day, \$15,000 course at Singularity University, saw it happen.

While the flesh-and-blood version of Mr. Brin sat miles away at a computer capable of remotely steering a robot, the gizmo rolling around here consisted of a printer-size base with wheels attached to a boxy, head-height screen glowing with an image of Mr. Brin's face. The BrinBot obeyed its human commander and sputtered around from group to group, talking to attendees about Google and other topics via a videoconferencing system.

The BrinBot was hardly something out of "Star Trek." It had a rudimentary, no-frills design and was a hodgepodge of loosely integrated technologies. Yet it also smacked of a future that the [Singularity University](#) founders hold dear and often discuss with a techno-utopian bravado: the arrival of the Singularity — a time, possibly just a couple decades from now, when a superior intelligence will dominate and life will take on an altered form that we can't predict or comprehend in our current, limited state.

At that point, the Singularity holds, human beings and machines will so effortlessly and elegantly merge that poor health, the ravages of old age and even death itself will all be things of the past.

Some of Silicon Valley's smartest and wealthiest people have embraced the Singularity. They believe that technology may be the only way to solve the world's ills, while also allowing people to seize control of the evolutionary process. For those who haven't noticed, the Valley's most-celebrated company — Google — works daily on building a giant brain that harnesses the thinking power of humans in order to surpass the thinking power of humans.

[Larry Page](#), Google's other co-founder, helped set up Singularity University in 2008, and the company has supported it with more than \$250,000 in donations. Some of Google's earliest employees are, thanks to personal donations of \$100,000 each, among the university's "founding circle." (Mr. Page did not respond to interview requests.)

The university represents the more concrete side of the Singularity, and focuses on introducing entrepreneurs to promising technologies. Hundreds of students worldwide apply to snare one of 80 available spots in a separate 10-week "graduate" course that costs \$25,000. Chief executives, inventors, doctors and investors jockey for admission to the more intimate, nine-day courses called executive programs.

Both courses include face time with leading thinkers in the areas of nanotechnology, artificial intelligence, energy, biotech, robotics and computing.

On a more millennialist and provocative note, the Singularity also offers a modern-day, quasi-religious answer to the Fountain of Youth by affirming the notion that, yes indeed, humans — or at least something derived from them — can have it all.

“We will transcend all of the limitations of our biology,” says [Raymond Kurzweil](#), the inventor and businessman who is the Singularity’s most ubiquitous spokesman and boasts that he intends to live for hundreds of years and resurrect the dead, including his own father.

“That is what it means to be human — to extend who we are.”

But, of course, one person’s utopia is another person’s dystopia.

In the years since the Unabomber, [Theodore J. Kaczynski](#), violently inveighed against the predations of technology, plenty of other more sober and sophisticated warnings have arrived. There are camps of environmentalists who decry efforts to manipulate nature, challenges from religious groups that see the Singularity as a version of “Frankenstein” in which people play at being gods, and technologists who fear a runaway artificial intelligence that subjugates humans.

A popular network television show, “[Fringe](#),” playfully explores some of these concerns by featuring a mad scientist and a team of federal agents investigating crimes related to the Pattern — an influx of threatening events caused by out-of-control technology like computer programs that melt brains and genetically engineered chimeras that go on killing sprees.

Some of the Singularity’s adherents portray a future where humans break off into two species: the Haves, who have superior intelligence and can live for hundreds of years, and the Have-Nots, who are hampered by their antiquated, corporeal forms and beliefs.

Of course, some people will opt for inadequacy, while others will have inadequacy thrust upon them. Critics find such scenarios unnerving because the keys to the next phase of evolution may be beyond the grasp of most people.

“The Singularity is not the great vision for society that Lenin had or [Milton Friedman](#) might have,” says Andrew Orłowski, a British journalist who has [written extensively on techno-utopianism](#). “It is rich people building a lifeboat and getting off the ship.”

Peter A. Thiel, a co-founder of PayPal and a major investor in [Facebook](#), is a Singularity devotee who offers a “Singularity or bust” scenario.

“It may not happen, but there are a lot of technologies that need to be developed for a whole series of problems to be solved,” he says. “I think there is no good future in which it doesn’t happen.”

### **‘Transcendent Man’**

In late August, Mr. Kurzweil will begin a cross-country multimedia road show to promote “[Transcendent Man](#),” a documentary about his life and beliefs. Another of his projects, “[The Singularity Is Near: A True Story About the Future](#),” has also started to make its way around the film festival circuit.

Throughout “Transcendent Man,” Mr. Kurzweil is presented almost as a mystic, sitting in a chair with a shimmering, circular light floating around his head as he explains his philosophy’s basic tenets. During one scene at a beach, he is asked what he’s thinking as he stares out at a beautiful sunset with waves rolling in and wind tussling his hair.

“Well, I was thinking about how much computation is represented by the ocean,” he replies. “I mean, it’s all these water molecules interacting with each other. That’s computation.”

Mr. Kurzweil is the writer, producer and co-director of “The Singularity Is Near,” the tale of Ramona, a virtual being he builds that gradually becomes more human, battles hordes of microscopic robots and taps the lawyer [Alan M. Dershowitz](#) for legal advice and the motivational guru Tony Robbins for guidance on personal interactions.

With his glasses, receding hairline and lecturer's ease, Mr. Kurzweil, 62, seems more professor than thespian. His films are just another facet of the Kurzweil franchise, which includes best-selling books, lucrative speaking engagements, blockbuster inventions and a line of health supplements called [Ray & Terry's](#) (developed with the physician Terry Grossman).

Mr. Kurzweil credits a low-fat, vegetable-rich diet and regular exercise for his trim frame, and says he conquered diabetes decades ago by changing what he ate and later reprogramming his body with supplements. He currently takes about 150 pills a day and has regular intravenous procedures. He is also co-writer of a pair of health books, "[Fantastic Voyage: Live Long Enough to Live Forever](#)" and "[Transcend: Nine Steps to Living Well Forever](#)."

Mr. Kurzweil routinely taps into early memories that explain his lifelong passion for inventing. "My parents gave me all these construction toys, and sometimes I would put things together, and they would do something cool," he says. "I got the idea that you could change the world for the better with invention — that you could put things together in just the right way, and they would have transcendent effects.

"That was kind of the religion of my family: the power of human ideas."

A child prodigy, he [stunned television audiences](#) in 1965, when he was 17, with a computer he had built that composed music. A couple of years later, in college, he developed a computer program that would seek the best college fit for high school students. A New York publishing house bought the company for \$100,000, plus royalties.

"Most of us were going to school to get knowledge and a degree," says Aaron Kleiner, who studied with Mr. Kurzweil at the [Massachusetts Institute of Technology](#) and later became his business partner. "He saw school as a tool that let him do what he needed to do."

Some of Mr. Kurzweil's better-known inventions include the first print-scanning systems that converted text to speech and allowed the blind to read standard texts, as well as sophisticated electronic keyboards and voice-recognition software. He has made millions selling his inventions, and his companies continue developing other products, like software for securities traders and e-readers for digital publications.

He began his march toward the Singularity around 1980, when he started plotting things like the speed of chips and memory capacity inside computers and realized that some elements of information technology improved at predictable — and exponential — rates.

"With 30 linear steps, you get to 30," he often says in speeches. "With 30 steps exponentially, you get to one billion. The price-performance of computers has improved one billion times since I was a student. In 25 years, a computer as powerful as today's smartphones will be the size of a blood cell."

His fascination with exponential trends eventually led him to construct an elaborate philosophy, illustrated in charts, that provided an analytical backbone for the Singularity and other ideas that had been floating around science-fiction circles for decades.

As far back as the 1950s, John von Neumann, the mathematician, is said to have talked about a "singularity" — an event in which the always-accelerating pace of technology would alter the course of human affairs. And, in 1993, Vernor Vinge, a science fiction writer, computer scientist and math professor, wrote a research paper called "[The Coming Technological Singularity: How to Survive in the Post-Human Era](#)."

"Within 30 years, we will have the technological means to create superhuman intelligence," Mr. Vinge wrote. "Shortly after, the human era will be ended."

In "The Singularity Is Near," Mr. Kurzweil posits that technological progress in this century will be 1,000 times greater than that of the last century. He writes about humans trumping biology by filling their bodies with nanoscale creatures that can repair cells and by allowing their minds to tap into super-intelligent computers.

Mr. Kurzweil writes: “Once nonbiological intelligence gets a foothold in the human brain (this has already started with computerized neural implants), the machine intelligence in our brains will grow exponentially (as it has been doing all along), at least doubling in power each year.

“Ultimately, the entire universe will become saturated with our intelligence,” he continues. “This is the destiny of the universe.”

The underlying premise of the Singularity responds to people’s insecurity about the speed of social and technological change in the computer era. Mr. Kurzweil posits that the computer and the Internet have changed society much faster than electricity, phones or television, and that the next great leap will occur when industries like medicine and energy start moving at the same exponential pace as I.T.

He believes that this latter stage will occur when we learn to manipulate DNA more effectively and arrange atoms and have readily available computers that surpass the human brain.

In 1970, well before the era of nanobot doctors, Mr. Kurzweil’s father, Fredric, died of a heart attack at his home in Queens. Fredric was 58, and Ray was 22. Since then, Mr. Kurzweil has filled a storage space with his father’s effects — photographs, letters, bills and newspaper clippings. In a world where computers and humans merge, Mr. Kurzweil expects that these documents can be combined with memories harvested from his own brain, and then possibly with Fredric’s DNA, to effect a partial resurrection of his father.

By the 2030s, most people will be able to achieve mental immortality by similarly backing up their brains, Mr. Kurzweil predicts, as the Singularity starts to come into full flower.

Despite such optimism, some Singularitarians aren’t all that fond of Mr. Kurzweil.

“I think he’s a genius and has certainly brought a lot of these ideas into the public discourse,” says James J. Hughes, the executive director of the Institute for Ethics and Emerging Technologies, a nonprofit that studies the implications of advancing technology. “But there are plenty of people that say he has hijacked the Singularity term.”

Mr. Kurzweil says that he is simply trying to put analytical clothing on the concept so that people can think more clearly about the future. And regardless of any debate about his intentions, if you’re encountering the Singularity in the business world and elsewhere today, it’s most likely his take.

### **Bursts of Innovation**

Peter H. Diamandis, 49, is a small man with a wide, bright smile and a thick mound of dark hair. He routinely holds meetings by cellphone and can usually be found typing away on his laptop. He went to medical school to make his mother happy but has always dreamed of heading to outer space.

He is also a firm believer in the Singularity and is a technoc celebrity in his own right, primarily through his role in commercializing space travel. At a recent Singularity University lunch, he hopped up to make a speech peppered with passion and conviction.

“My target is to live 700 years,” he declared.

The students chuckled.

“I say that seriously,” he retorted.

The NASA site, the [Ames Research Center](#), houses an odd collection of unusual buildings, including a giant wind tunnel, a huge supercomputing center and a flight simulator facility with equipment capable throwing people 60 feet into the air.

Today, the government operates NASA Ames as a bustling, public-sector-meets-private-sector technology bazaar. Start-ups, universities and corporations have set up shop here, and Google plans to build a new campus here over the next few years that will include housing for workers.

A nondescript structure, Building 20, is the Singularity University headquarters, and most students stay in nearby apartments on the NASA land. Mr. Kurzweil set up the school with Mr. Diamandis, who, as chief executive of the [X Prize Foundation](#), doled out \$10 million in 2004 to a team that sent a private spacecraft 100 kilometers above the earth. Google has offered \$30 million in rewards for an [X Prize](#) project intended to inspire a private team to send a robot to the moon. And a \$10 million prize will go to the first team that can sequence 100 human genomes in 10 days at a cost of \$10,000 or less each — which, in theory, would turn an expensive, complex lab exercise into an ordinary affair.

Mr. Diamandis champions the idea that large prizes inspire rapid bursts of innovation and may pave a path to that 700-year lifetime.

“I don’t think it’s a matter of if,” he says. “I think it’s a matter of how. You and I have a decent shot, and for kids being born today, I think it will be a matter of choice.”

For the most part, Mr. Kurzweil serves as a figurehead of Singularity University, while Mr. Diamandis steers the institution. He pitches the graduate student program as a way to train young, inspired people to think exponentially and solve the world’s biggest problems — to develop projects that will “change the lives of one billion people,” as the in-house mantra goes.

Mr. Diamandis hopes that the university can create an unrivaled network of graduates and bold thinkers — a Harvard Business School for the future — who can put its ideas into action. Along with that goal, he’s considering creating a [venture capital](#) fund to help turn the university’s big ideas into big businesses. As some of their favored student creations, school leaders point to a rapid disaster alert-and-response system and a venture that lets individuals rent their cars to other people via cellphone.

[Devin Fidler](#), a former student, is in the midst of securing funding for a company that will build a portable machine that squirts out a cement-like goop that allows builders to erect an entire house, layer by layer. Such technology could almost eliminate labor costs and bring better housing to low-income areas.

Mr. Diamandis has certainly built a selective institution. More than 1,600 people applied for just 40 spots in the inaugural graduate program held last year. A second, 10-week graduate program will kick off this month with 80 students, culled from 1,200 applicants.

One incoming student, [David Dalrymple](#), is an 18-year-old working on his doctorate from M.I.T.. He says he plans to start a research institute someday to explore artificial intelligence, medicine, space systems and energy. (He met Mr. Kurzweil at a White House dinner, and at the age of 8 accepted the offer to have Mr. Kurzweil serve as his mentor.)

During the spring executive program, about 30 people — almost all of them men — showed up for the course, which is something of a mental endurance test. Days begin at dawn with group exercise sessions. Coursework runs until about 9 p.m.; then philosophizing over wine and popcorn goes until midnight or later. A former Google chef prepares special meals — all of which are billed as “life extending” — for the executives.

The meat of the executive program is lectures, company tours and group thought exercises.

Day 4 includes test drives of [Tesla Motors](#) electric sports cars and a group genetic test, thanks to a company called [deCODEme](#). By Day 6, people are annoyed by the BrinBot, which is interrupting lectures with its whirs and sputters. Someone tapes a pair of paper ears on it to try to humanize it. One executive sullenly declines to participate in another robot design exercise because no one in his group will consider making a sexbot.

However much the Singularity informs the environment here, a majority of the executives attending the spring course expressed less interest in living forever and more in figuring out their next business venture or where they wanted to invest.

Robin Tedder, a Scottish baron who lives in Australia and divides his time among managing a personal fortune, racing a yacht and running a vineyard, says he read about Singularity University in an investor newsletter and checked out the Web site.

“What really convinced me to pay the 15 grand was that I didn’t think it was some kind of hoax,” Mr. Tedder said in an interview after he completed the executive program. “I looked at the people involved and thought it was the real deal. In retrospect, I think it’s a very good value.”

Like a number of other participants, Mr. Tedder is contemplating business ventures with his classmates and points to high-octane networking as the school's major benefit.

Attendees at the spring session came from all over the globe and included John Mauldin, a best-selling author who writes an investment newsletter; Stephen Long, a research director at the Defense Department; Fernando A. de la Viesca, C.E.O. of the Argentinean investment firm TPCG Financial; Eitan Eliram, the new-media director for the prime minister's office in Israel; and Guy Fraker, the director of trends and foresight at State Farm Insurance.

"We end up cleaning up the mess of unintended consequences," says Mr. Fraker of his company's work. He says it makes sense for him to gauge technological trends in case humans can one day gain new tools for averting catastrophes. For example, he's confident that in the future people will have the ability to steer [hurricanes](#) away from populated areas.

Executives in the spring program also heard that some young people had started leaving college to set up their own synthetic biology labs on the cheap. Such people resemble computer tinkerers from a generation earlier, attendees note, except now they're fiddling with the genetic code of organisms rather than software.

"Biology is moving outside of the traditional education sphere," says Andrew Hessel, a former research operations manager at [Amgen](#), during a lecture here. "The students are teaching their professors. This is happening faster than the computer evolved. These students don't have newsletters. They have Web sites."

[Daniel T. Barry](#), a Singularity University professor, gives a lecture about the falling cost of robotics technology and how these types of systems are close to entering the home. Dr. Barry, a former astronaut and "Survivor" contestant with an M.D. and a Ph. D., has put his ideas into action. He has a robot at home that can take a pizza from the delivery person, pay for it and carry it into the kitchen.

"You have the robot say, 'Take the 20 and leave the pizza on top of me,'" Dr. Barry says. "I get the pizza about a third of the time."

Other lecturers talk about a coming onslaught of biomedical advances as thousands of people have their genomes decoded. Jason Bobe, who works on [the Personal Genome Project](#), an effort backed by the Harvard Medical School to establish a huge database of genetic information, points to forecasts that a million people will have their genomes decoded by 2014.

"The machines for doing this will be in your kitchen next to the toaster," Mr. Bobe says.

Mr. Hessel describes an even more dramatic future in which people create hybrid pets based on the body parts of different animals and tweak the genetic makeup of plants so they resemble things like chairs and tables, allowing us to grow fields of everyday objects for home and work. Mr. Hessel, like Mr. Kurzweil, thinks that people will use genetic engineering techniques to grow meat in factories rather than harvesting it from dead animals.

"I know in 10 years it will be a junior-high project to build a bacteria," says Mr. Hessel. "This is what happens when we get control over the code of life. We are just on the cusp of that."

Christopher deCharms, another Singularity University speaker, runs [Omneuron](#), a start-up in Menlo Park, Calif., that [pushes the limits](#) of brain imaging technology. He's trying to pull information out of the brain via sensing systems, so that there can be some quantification of people's levels of depression and pain.

"We are at the forefront today of being able to read out real information from the human brain of single individuals," he tells the executives.

## **Preparing to Evolve**

[Richard A. Clarke](#), former head of counterterrorism at the [National Security Council](#), has followed Mr. Kurzweil's work and written a science-fiction thriller, "[Breakpoint](#)," in which a group of terrorists try to halt the advance of technology. He sees major conflicts coming as the government and citizens try to wrap their heads around technology that's just beginning to appear.

“There are enormous social and political issues that will arise,” Mr. Clarke says. “There are vast groups of people in society who believe the earth is 5,000 years old. If they want to slow down progress and prevent the world from changing around them and they engaged in political action or violence, then there will have to be some sort of decision point.”

Mr. Clarke says the government has a contingency plan for just about everything — including an attack by Canada — but has yet to think through the implications of techno-philosophies like the Singularity. (If it’s any consolation, Mr. Long of the Defense Department asked a flood of questions while attending Singularity University.)

Mr. Kurzweil himself acknowledges the possibility of grim outcomes from rapidly advancing technology but prefers to think positively. “Technological evolution is a continuation of biological evolution,” he says. “That is very much a natural process.”

To prepare for any rocky transitions from our benighted present to the techno-utopia of 2030 or so, a number of people tied to the Singularity movement have begun to build what they call “an education and protection framework.”

Among them is Keith Kleiner, who joined Google in its early days and walked away as a wealthy man in 2005. During a period of personal reflection after his departure, he read “The Singularity Is Near.” He admires Mr. Kurzweil’s vision.

“What he taught me was ‘Wake up, man,’ ” Mr. Kleiner says. “Yeah, computers will get faster so you can do more things and store more data, but it’s bigger than that. It starts to permeate every industry.”

Mr. Kleiner, 32, founded a Web site, [SingularityHub.com](http://SingularityHub.com), with a writing staff that reports on radical advances in technology. He has also given \$100,000 to Singularity University.

Sonia Arrison, a founder of Singularity University and the wife of one of Google’s first employees, spends her days writing a book about longevity, tentatively titled “100 Plus.” It outlines changes that people can expect as life expectancies increase, like 20-year marriages with sunset clauses.

She says the book and the university are her attempts to ready people for the inevitable.

“One day we will wake up and say, ‘Wow, we can regenerate a new liver,’ ” Ms. Arrison says. “It will happen so fast, and the role of Singularity University is to prepare people in advance.”

Despite all of the zeal behind the movement, there are those who look askance at its promises and prospects.

Jonathan Huebner, for example, is often held up as Mr. Kurzweil’s foil. A physicist who works at the Naval Air Warfare Center as a weapons designer, he, like Mr. Kurzweil, has compiled his own cathedral of graphs and lists of important inventions. He is unimpressed with the state of progress and, in 2005, published in a scientific journal a paper called “[A Possible Declining Trend for Worldwide Innovation](#).”

Measuring the number of innovations divided by the size of the worldwide population, Dr. Huebner contends that the rate of innovation peaked in 1873. Or, based on the number of patents in the United States weighed against the population, he found a peak around 1916. (Both Dr. Huebner and Mr. Kurzweil are occasionally teased about their faith in graphs.)

“The amount of advance in this century will not compare well at all to the last century,” Dr. Huebner says, before criticizing tenets of the Singularity. “I don’t believe that something like artificial intelligence as they describe it will ever appear.”

William S. Bainbridge, who has spent the last two decades evaluating grant proposals for the [National Science Foundation](#), also sides with the skeptics.

“We are not seeing exponential results from the exponential gains in computing power,” he says. “I think we are at a time where progress will be increasingly difficult in many fields.

“We should not base ideas of the world on simplistic extrapolations of what has happened in the past,” he adds.

## **'Deus ex Machina'**

Last month, a biotech concern, Synthetic Genomics, **announced** that it had created a bacterial genome from scratch, kicking off a firestorm of discussion about the development of artificial life. **J. Craig Venter**, a pioneer in the human genome trade and head of Synthetic Genomics, hailed his company's work as "the first self-replicating species we've had on the planet whose parent is a computer."

Steve Jurvetson, a director of Synthetic Genomics, is part of a group of very rich, very bright Singularity observers who end up somewhere in the middle on the philosophy's merits — optimistic about the growing powers of technology but pessimistic about humankind's ability to reach a point where those forces can actually be harnessed.

Mr. Jurvetson, a venture capitalist and managing director of the firm Draper Fisher Jurvetson, says the advances of companies like Synthetic Genomics give him confidence that we will witness great progress in areas like **biofuels** and vaccines. Still, he fears that such technology could also be used maliciously — and he has a pantry filled with products like Spam and honey in case his family has to hunker down during a viral outbreak or attack.

"Thank God we have a swimming pool," he says, noting that it gives him a large store of potentially potable water.

Mr. Orlowksi, the journalist, sees the Singularity as a grand, tech-nerd dream in which engineers, inventors and innovators of every stripe create the greatest of all reset buttons. He says the techies "seem to want a deus ex machina to make everything right again."

They certainly don't want any outside interference, and are utterly confident that they will realize the Singularity on their own terms and with their own wits — all of which fits with Silicon Valley's strong libertarian traditions. Google and **Microsoft** employees trailed only members of the military as the largest individual contributors to **Ron Paul's** 2008 presidential campaign.

The Valley's wizards also prefer to avoid any confrontation with Washington.

"Dealing with politics means having to compromise and convince people of things and form alliances with people who don't always agree with you," Mr. Orlowski says. "They're not wired for that."

## **Increasing Acceptance**

Mr. Kurzweil is currently consulting for the Army on technology initiatives, and says he routinely talks with government and business leaders. **Bill Gates**, the Microsoft co-founder, appears in Mr. Kurzweil's books and often on the back flaps with celebratory quotations.

Mr. Kurzweil and Mr. Page of Google created a renewable-energy plan for the National Academy of Engineering, advising that **solar power** will one day soon meet all of the world's energy needs.

Mr. Kurzweil's 31-year-old son, Ethan, says his father has always been ahead of the curve. The family had the first flat-screen television and car phone on the block, as well as a phone that could fax photos.

"We also had this thing where you put on a hat that had sensors and it would create music to match your brain waves and help you meditate," Ethan says. "People would come over and play with it."

Ethan previously worked for Linden Lab, the company behind the virtual world Second Life. These days he's a venture capitalist at Bessemer Venture Partners. A section of the bookshelves in his office has been reserved for multiple copies of his father's works.

"A lot of what he has predicted has happened, and it's interesting to see what he's been saying become more mainstream," says Ethan, who looks very much like a younger version of his father. "He has a certain world view that he feels strongly about that he thinks is absolutely coming to pass. The data so far suggests it is. He's incredibly thorough with his research, and I have confidence his critics haven't thought things through on the same level."

Indeed, Ethan says, his father is almost, well, accepted. "He is seen as less weird now," he says. "Much less weird."