

“A *veldskool* was a paramilitary *Lord of the Flies*,” Musk recalls. Elon, who was small and emotionally awkward, got beaten up twice. He would end up losing 10 pounds the first time. The 2<sup>nd</sup> time Elon went he was about to turn 16 (eventually 6’2”) and had learned some judo. So *veldskool* wasn’t so bad. South Africa in the 1980s was a violent place, with machine-gun attacks and knife killings common. His most searing experiences came at school. For a long time, he was the youngest and smallest student in his class. He was regularly picked on by bullies, who would come up and punch him in the face. “If you have never been punched in the nose, you have no idea how it affects you the rest of your life,” He says. Says his younger brother Kimbal after one beating, “When they got finished, I couldn’t even recognize his face.” Decades later, he was still getting corrective surgery to try to fix the tissues inside his nose.

But those scars were minor compared to the emotional ones inflicted by his father, Errol Musk, an engineer, rogue, and charismatic fantasist who to this day bedevils Elon. When Elon finally came home from the hospital, his father berated him. “I had to stand for an hour as he yelled at me and called me an idiot and told me that I was just worthless,” Elon recalls. The perpetrator ended up being sent to juvenile prison for it. Errol would end every tirade by telling Elon how pathetic he was. Elon would just have to stand there, not allowed to leave. Elon’s moods would cycle through light and dark, intense and goofy, detached and emotional, with occasional plunges into what those around dreaded as “demon mode.”

His first wife Justine said that this emotional shutoff valve could make him callous, but it also made him a risk-seeking innovator. He learned to shut down fear. The PTSD from his childhood also instilled in him an aversion to contentment. “Adversity shaped me,” he says. “My pain threshold became very high.” Talulah Riley his 2<sup>nd</sup> wife says, “He’s retained a childlike, almost stunted side.” Out of this cauldron, Musk developed an aura that made him seem, at times, like an alien. He developed a fervor that cloaked his goofiness, and a goofiness that cloaked his fervor. “Elon wants risk for its own sake,” says, Peter Thiel, who became his partner in the early days of PayPal. “He seems to enjoy it, indeed at times be addicted to it.” “He is a drama magnet,” says Kimbal. “That’s his compulsion, the theme of his life.”

At the beginning of 2022 and him becoming the richest man on earth Musk said, “I need to shift my mindset away from being in crisis mode, which it has been for about 14 years now, for arguably most of my life.” His mentor was Larry Ellison, founder of Oracle.

Elon’s maternal grandfather was Joshua Haldeman, born in Minnesota, bought his own farm in Canada, but lost it during the depression of the 1930s. For the next few years, he worked as a cowboy, rodeo performer, pilot, and construction hand. In 1950 he moved to South Africa, which was still ruled by a white apartheid regime. He was killed when a person he was teaching to fly hit a power line, causing the plane to crash. Haldeman imprinted that spirit onto one of his twin girls, Elon’s mother, Maye. She began working at age 15 as a model.

“Ever since I was a kid, if I start to think about something hard, then all of my sensory systems turn off,” Musk says. Compounding his social problems was his unwillingness to suffer politely those he considered fools. He used the word “stupid” often. As a result, he was lonely, very lonely, and that pain remained seared into his soul. “He was never actually diagnosed as a kid,” his mother says, “but he says he has Asperger’s, and I’m sure he’s right.” He was bad at picking up on social cues. “I took people literally when they said something,” he says, “and it was only by reading books that I began to learn that people did not always say what they really meant.” But he didn’t have the emotional receptors that produce everyday kindness and warmth and a desire to be liked. He was not hardwired to have empathy. Or, to put it in less technical terms, he could be an asshole.

His parents divorced when Elon was 8. At age 10 Elon decided to move in with his father. Four years later, Kimbal followed. The boys helped Errol build a lodge that he could rent to tourists in the Timbavati Game Reserve, a pristine stretch of bush about 300 miles east of Pretoria. Elon often accompanied visitors on hunts. Although he had only a .22 caliber rifle, it had a good scope and he became an expert shot.

After he was bullied and beaten in his public high school, his father moved him to a private academy, Pretoria Boys High School. Based on the English mode, it featured strict rules, caning, compulsory chapel, and uniforms. Reading was Musk’s psychological retreat. He was also deeply into comics. The single-minded passion of the superheroes impressed him. He read both sets of his father’s encyclopedias and became, to his doting mother and sister, a “genius boy.” To other kids, however, he was an annoying nerd. Physics could teach everything about the universe except why. He was saved by science fiction, that wellspring of wisdom for game-playing kids with intellects on hyperdrive.

Musk saw his 1<sup>st</sup> computer around the time he turned 11. He saved his money from odd jobs and bought a Commodore VIC-20, one of the earliest personal computers. At age 13 he was able to create a video game, which he named *Blaster*. The magazine *PC and Office Technology* paid him \$500 for it and he proceeded to sell it 2 other games. Thus began a lifelong addiction to video games.

At age 17, after 7 years of living with his father, Elon realized that he would have to escape. Justine says you’d want to be on Elon’s team. He can be very harsh, but at the end of the day you can trust him to find a way to prevail. He 1<sup>st</sup> tried to get US citizenship on the grounds that his mother’s father had been born in Minnesota but failed because his mother had been born in Canada and had never claimed US citizenship. So he concluded that getting to Canada might be an easier 1<sup>st</sup> step. On 6/11/1989, about 2 weeks shy of his 18<sup>th</sup> birthday, he had dinner with his father and siblings, who then drove him to the Johannesburg airport.

When Elon left South Africa, his father gave him \$2000 in traveler’s checks and his mother provided him with another \$2000 by cashing out a stock account she had opened with the money she won in a beauty contest as a teenager. When he arrived in Montreal he mainly had a list of his mother’s rela-

tives he had never met. He wandered the town marveling that people did not have bars on their windows. After a week, he bought a \$100 Greyhound Discovery Pass that allowed him to travel by bus anywhere in Canada for 6 months. He had a 2<sup>nd</sup> cousin his age, Mark Teulon, who lived in a farm in Saskatchewan, more than 1700 miles from Montreal. At one of the bus stops the driver took off with his suitcase with his traveler's checks and clothes.

The cousin showed up with his father, took him to a Sizzler steak house, and invited him to stay at their wheat farm where he was put to work cleaning grain bins and helping to raise a barn. After 6 weeks, he got back on the bus and headed for Vancouver, another 1000 miles away, to stay with his mother's half-brother. While Elon was in Vancouver, Maye Musk flew from South Africa, having decided that she wanted to move as well. Toronto, she concluded, was where they should go. Tosco, his sister, sold their house and furniture in South Africa, then joined their mother in Toronto, where Elon also moved.

In the fall of 1990 he enrolled at Queens. He met a student named Navaid Farooq, who became his 1st real and lasting friend outside of his family. He became immersed, with Farooq at his side, in the world of board and computer games. Musk tended to win, Farooq said, by being convincing in his negotiations and threats. Strategy games would become central to Musk's life. Immersing himself in these games for hours became the way he relaxed, escaped stress, and honed his tactical skills and strategic thinking for business. "I am wired for war," he told Farooq.

Kimbal moved to Canada and joined Elon as a student at Queen's. They would read the newspaper and pick out the person they found most interesting; then cold-call him. One they picked was Peter Nicholson, the executive in charge of strategic planning at Scotiabank. Nicholson was an engineer with a master's degree in physics and a PhD in math. He offered them both summer jobs, inviting Elon to work directly with him on his 3-person strategic planning team. Musk drew a lesson from his time at Scotiabank: he did not like, nor was he good at, working for other people.

Musk got bored at Queen's, and when one of his classmates transferred to the University of Pennsylvania he applied there. Penn offered him a \$14,000 scholarship plus a student loan package, so in 1992 he transferred there for his junior year. He decided to major in physics because, like his father, he was drawn to engineering. He also pursued a joint degree in business. His closest friend was Robin Ren, who had won a Physics Olympiad in his Native China before coming to Penn. "He was the only person better than me at physics," Musk says. "He kept talking about making a rocket that could go to Mars," Ren recalls. Musk also focused on electric cars and became convinced that solar power was the best path toward sustainable energy.

At Penn, he developed a 3<sup>rd</sup> mode of relaxing—a taste for partying—that drew him out of the lonely shell that surrounded him as a kid. His partner and enabler was a fun-loving social animal name Adeo Ressi. Neither of them liked following rules, so they rented a house in a sketchy part of West Philadelphia. Ressi produced a scheme to throw big monthly parties

with someone at the door to collect the \$5 entrance fee. On some nights they would draw 500 people, which would easily pay the rent for a month. Ressi later marveled that "Musk enjoyed being around a party but not fully in it. The only thing he binged on was video games."

At Penn, Musk received some internship offers from Wall Street, all lucrative, but finance did not interest him. He felt that bankers and lawyers did not contribute much to society. Instead he was drawn to Silicon Valley. By day he worked at Pinnacle Research Institute, a 20-person group that had a modest Defense Department contract to study a "supercapacitor." In the evening he worked at a small Palo Alto company called Rocket Science, which made video games. They wanted him to work fulltime, but he needed to graduate in order to get a US work visa. Musk also loved fiddling with cars. At the time, he owned a 20-year-old BMW 300i.

He had conceived by then a life vision that he would repeat like a mantra. "I thought about the things that will truly affect humanity," he says. "I came up 3: the Internet, sustainable energy, and space travel." Musk had produced an idea for an internet company during his final year at Penn, when an executive from NYNEX came to speak about the phone company's plans to launch an online version of the Yellow Pages. "Why don't we do it ourselves?" he suggested to Kimbal, and he began writing code that could combine business listings with map data.

Just before the enrollment deadline for Stanford, Musk went to Toronto to get advice from Peter Nicholson of Scotiabank. "The internet revolution only comes once in a lifetime, so strike while the iron is hot," he told Musk. He actually hedged his bets and officially enrolled at Stanford and then immediately requested a deferral. "I've written some software with the 1st internet maps and Yellow Pages directory," he told Bill Nix, the material science professor. Nix said it would not be a problem for Musk to defer his studies, but he predicted that he would never come back. He was right.

When Kimbal had a meeting at the *Toronto Star*, which published the Yellow Pages in the city, the president picked up a thick edition of the directory and threw it at him. "Do you honestly think you're ever going to replace this?" he asked. The brothers rented a tiny office in Palo Alto that had room for 2 desks and futons. For the 1st 6 months, they slept in the office and showered at the YMCA. After a few months, they rented an unfurnished apartment that stayed that way. Elon spent many nights in the office, crashing under his desk when he was exhausted from coding. They named the company Zip2. Elon was granted a patent for the "interactive network directory service."

They were soon astounded by an offer from Mohr Davidow Ventures to invest \$3 million in the company. The firm also found an immigration lawyer to help the 2 Musks get work visas and gave them each \$30,000 to purchase cars. The venture capitalists brought in adult supervision to take over, but Elon learned a lesson. He says, "I learned that you could not truly be the chief technology or product officer unless you were the CEO."

At Zip2 and every subsequent company, he drove himself relentlessly all day and through much of the night, without vacations, and he expected others to do the same. "It's not your

job to make people on your team love you,” he said at a SpaceX executive session years later. “In fact, that’s counterproductive. True product people have a compulsion to sell directly to consumers, without middlemen muddying things up.” In January 1999, less than 4 years after Zip2 launched, Compaq Computer offered \$307 million in cash for it. Elon at age 27 walked away with \$22 million and Kimbal with \$15 million. His new wealth allowed his desires and impulses to be subject to fewer restraints, but his earnest, mission-driven intensity remained intact.

“X” would become his go-to letter for naming things, from companies to kids. One of Musk’s management tactics was to set an insane deadline and drive colleagues to meet it. When it came to interface screens, “I honed it to get the fewest number of keystrokes to open an account [at X.com],” he says. One driver for growth was a feature that they originally thought was no big deal: the ability to send money. The electronic payment systems of 2 companies were folded together and marketed under the brand name PayPal. Musk restricted the company so that there was not a separate engineering department. Instead engineers would team up with product managers. It was a philosophy that he would carry through to Tesla, SpaceX and then Twitter.

PayPal went public in early 2002 and was acquired by eBay for \$1.5 billion. Musk’s payout was around \$250 million. For the 2<sup>nd</sup> time in 3 years, Musk had been pushed out of a company. Peter Theil said, “He was a visionary who didn’t play well with others.” Entrepreneurs are actually not risk takers. They’re risk mitigators. But Musk was into amplifying risk and burning the boats so we could never retreat. I think Elon understands something about risk that everybody else doesn’t.”

Soon after a vacation in South Africa, in January 2001, Musk was diagnosed with viral meningitis. But a doctor who was an expert in infectious diseases happened to walk past Musk’s bed and realized that he had malaria, not meningitis. His own doctor had treated 2 cases of falciparum malaria prior to treating Elon—both patients died. He did not fully recover for 5 months. He took 2 lessons from his near-death experience: “Vacation will kill you. South Africa is still trying to destroy me.”

Reid Hoffman a PayPal veteran would later describe his plan to send rockets to Mars. “What I didn’t appreciate is that Elon starts with a mission and later finds a way to backfill in order to make it work financially. That’s what makes him a force of nature.” Musk found it surprising—and frightening—that technological progress was not inevitable. Ancient Egyptians learned how to build the pyramids, but then that knowledge was lost. The same happened to Rome, which built aqueducts and other wonders that were lost in the Dark Ages. “Technology only improves if a lot of people work very hard to make it better.” Another motivation was that colonizing other planets would help ensure the survival of human civilization and consciousness in case something happened to our fragile planet. “The US is literally a distillation of the human spirit of exploration,” he says. That spirit needed to be rekindled in America, he felt, and the best way to do that would be to embark on a mission to colonize Mars. “We must have inspiring things in the world.” As Max Levchin drily puts it, “One of Elon’s greatest skills is the ability to pass off his vision as a mandate from

heaven.” Because of Elon’s marriage to Justine, he was eligible to become a US citizen, which he did in early 2002.

After Musk’s meetings with a group in Moscow went badly, he said, “I was pretty mad, and when I get mad I try to reframe the problem.” This led him to develop what he called an “idiot index,” which calculated how much more costly a finished product was than the cost of its basic materials. If a product had a high idiot index, its cost could be reduced significantly by devising more efficient manufacturing techniques. So on the flight home from Moscow, he said, “Hey guys, I think we can build this rocket ourselves.”

When Musk decided he wanted to start his own rocket company, his friends did what true friends do in such a situation: they stage an intervention. But the arguments about the risk served to strengthen Musk’s resolve. He liked risk. “We’ve got to give this a shot, or we’re stuck on Earth forever.” It was a rather grandiose ‘mandate from heaven’ assessment of how indispensable he was to the progress of humankind. He had the combination of motivations that would mark his career. He would do something audacious that was driven by a grand idea. But he also wanted it to be practical and profitable, so that it could sustain itself. That meant using the rockets to launch commercial and government satellites. He focused on one key metric: what it cost to get each pound of payload into orbit. That goal guided his obsession with increasing the thrust of the engines, reducing the mass of the rockets, and making them reusable. SpaceX set unrealistic timelines that transformed his wild notions from being completely insane to being merely very late.

Tom Mueller became SpaceX’s first hire, but not a founder. If you’re unwilling to invest in a company, Musk felt, you shouldn’t qualify as a founder. There’s got to be some combination of inspiration, perspiration, and risk to be a co-founder. “If you were negative or thought something couldn’t be done, you were not invited to the next meeting,” Mueller recalls. “He just wanted people who would make things happen.” Musk named the rocket they were building Falcon I, after the spacecraft from *Star Wars*.

**Musk was laser-focused on keeping down costs because cost-effectiveness was critical for his ultimate goal, which was to colonize Mars. His focus on cost, as well as his natural controlling instincts, led him to want to manufacture as many components as possible in-house, rather than buy them from suppliers.** After a few years, SpaceX was making inhouse 70% of the components of his rockets. He made engineers question all specifications. This would later become step one in a 5-point checklist/mantra. All requirements should be treated as recommendation. The only immutable ones were those decreed by the laws of physics. “I learned never to tell him no,” Mueller says. “Just say you’re going to try, then later explain why if it doesn’t work out.”

Musk insisted on setting unrealistic deadlines, even when they weren’t necessary. The sense of urgency was good for its own sake. It made his engineers engage in 1st-principles thinking. But, as Mueller points out, it was corrosive. “You demoralize the engineers. It’s Elon’s biggest weakness.” Steve Jobs did something similar. His colleagues called it his reality-distortion field. Mueller admits, “We developed the lowest-cost, most awesome rockets in history, and we would end up feeling

pretty good about it. Move fast, blow things up, repeat. It's not how well you avoid problems. It's how fast you figure out what the problem is and fix it." Because SpaceX was a private company, and Musk was willing to flout rules, it could take the risks it wanted. Elon believes that every situation is salvageable. "That taught us a lot. And it actually was fun." It also saved SpaceX months in getting its initial rocket tested. Musk's willingness to work all night at the factory pursuing an innovative idea inspired his engineers to be unafraid of trying offbeat fixes.

Musk does not like to share power. One of the few exceptions was his relationship with Gwynne Shotwell, who joined SpaceX in 2002 and eventually became its president. She has worked with Musk for more than 20 years, longer than anyone else. She has the pleasant confidence of the high-school basketball player and cheerleading captain she once was. She became the company's 5<sup>th</sup> employee. Her husband has the autism-spectrum disorder commonly called Asperger's. "People like Elon with Asperger's don't take social cues and don't naturally think about the impact of what they say on other people," she says. "Elon understands personalities very well, but as a study, not as an emotion. Part of my job is to tend to the wounded." It also helps that she is an engineer. "I listen hard, take him seriously, and try to achieve what he wants, even if it seems crazy initially." She speaks her mind to him and gets annoyed at those who don't.

In February 2004 NASA awarded a \$227 million contract, without competitive bidding to a rival private rocket company, Kistler Aerospace. Musk sued them and SpaceX ended up winning the dispute. NASA was ordered to open the project to competitive bidding. The victory was crucial not only for SpaceX but for the American space program. It promoted an alternative to the "cost-plus" contracts that NASA and the Defense Department had generally been using. Musk testified before a Senate committee and pushed a different approach. "The problem with a cost-plus system," he argued, "was that it stymied innovation." SpaceX pioneered an alternative in which private companies bid on performing a specific task or mission. **This outcomes-based, fixed-price contracting allowed the private company to control how its rockets were designed and built.** "It rewards results rather than waste," Musk says.

Jeffrey Brian Straubel connected with Musk a year after he had started SpaceX. Then he met with a Martin Eberhard, Harold Rosen, Tom Gage and Alan Cocconi who had started their own car company called Tesla Motors. The pieces thus came together for what would become the world's most valuable company.

One of the most important decisions that Elon Musk made about Tesla--the defining imprint on the auto industry--was that it should make its own key components, rather than piecing together a car with hundreds of components from independent suppliers--vertically integrated. Creating a good car was important. Even more important was creating the manufacturing processes and factories that could mass-produce them, from the battery cells to the body.

One issue with startups, especially those with multiple founders and funders, is who should be in charge. As the person who owned most of the equity, Musk had ultimate authority, and it was not in his nature to defer. When it came to engineer-

ing decisions, he became increasingly involved. As Musk began to pay more attention to Tesla, he could not refrain from getting involved in design and engineering decisions. However, he did not consider his ideas to be mere suggestions. He bristled when they were not carried out. Over the years, Musk was able to use techniques developed at SpaceX and apply them to Tesla and vice versa.

Musk had an enthusiastic but awkward attraction to publicity. A master of memes, he had a clever instinct about how to garner free publicity by courting controversy and jousting on social media. His blood boiled if anyone falsely implied that he had succeeded because of inherited wealth or claimed that he didn't deserve to be called a founder of one of the companies he helped to start. That is what happened at PayPal and Tesla, and both cases would lead to lawsuits.

An important element in launching a new product, as Steve Jobs had shown with his dramatic announcement events, is creating a buzz that transforms it into an object of desire. "Creating engineering this good is the beautiful part," Jobs said. The strategy of Tesla is to enter at the high end of the market, where customers are prepared to pay a premium, and then drive down market as fast as possible to higher unit volumes and lower prices with each successive model. Musk also propelled himself toward celebrity by giving a tour of the SpaceX factory to the actor Robert Downey Jr. and director Jon Favreau, who were making the superhero movie *Iron Man*. "My mind is not easily blown, but this place and this guy were amazing," Downey later said.

"Designing a car is easy," Musk often said. "The difficult part is manufacturing it. It's not the product that leads to success. How do you design the factory?" It was a guiding principle for Musk. "That's just about the stupidest thing I've ever heard," he said at a couple of meetings. That was a line that Steve Jobs used often. So did Bill Gates and Jeff Bezos. It was also effective in creating what Jobs called a team of A players who didn't want to be around fuzzy thinkers. Musk became the official CEO of Tesla (and the 4th with that title in about a year) in 10/2008.

After the death of their son Nevada, Justine and Elan in 2004 had twins, Griffin and Xavier. Two years later, again through IVF, they had triplets: Kai, Saxon, and Damian. They were living in a 6000 square-foot mansion in the Bel Air hills section of Los Angeles with 5 quirky boys, and a staff of 5 nannies and housekeepers. Musk was awkward socially, but he liked to go to celebrity-studded parties and hang out until dawn. Through all it, they fought. He was addicted to storm and stress, and she was swept into the turbulence. Sometimes he would call her "a moron" and "an idiot," chillingly channeling his father. "When I spent some time with Errol," Justine says, "I realized that's where he'd gotten the vocabulary. He's strong-willed and powerful, like a bear," Justine told *Esquire's* Tom Junod. "He can be playful and funny around you but in the end you're still dealing with a bear." When Musk was focused on work, he went into a zone, like he had back in grade school. Justine started going to a therapist after Nevada's death and developed a deep interest in the field. "When you're from a dysfunctional background or have a brain wired like his," she says, "**intensity takes the place of intimacy.**"

The next challenge was to have a manufacturing process that could churn out cars profitably. In the past century, only one American car company (Ford) had managed to do that without going through bankruptcy. “It was the beginning of the most painful year of my life.” As 2008 careened toward a close, it seemed that Musk would have to choose between SpaceX and Tesla. “That would be another notch in the story of ‘Electric cars don’t work.’” Nor could he abandon SpaceX. “We might then never be a multiplanetary species. This was like you’ve got 2 kids and you’re running out of food. I couldn’t bring myself to decide that one was going to die, so I decided I had to give my all to save both.”

Musk had budgeted for 3 launch attempts of the Falcon 1, and all had exploded before they could get to orbit. It was hard to see how he was going to raise money for a 4th attempt. Then a surprising group came to the rescue: his fellow cofounders of PayPal, who had ejected him from the CFO role 8 years earlier. They teamed up with 2 other PayPal alums, Ken Howery and Like Nosek, to form the Founders Fund, which invested mainly in internet startups. The fund could put in \$20 million. The investment was announced on 8/3/08, just after the 3<sup>rd</sup> launch attempt failed. It served as a lifeline that allowed Musk to declare that he was going to fund a 4<sup>th</sup> launch.

Falcon 1 made history as the 1<sup>st</sup> privately built rocket to launch from the ground and reach orbit. Musk and his small crew of just 500 employees (Boeing’s comparable division had 50,000) had designed the system from the ground up and done all the construction on its own. SpaceX had contracts to perform missions for NASA and other clients, but they would get paid only if they succeeded. There were no subsidies or cost-plus contracts. “My cortisol levels, my stress hormones, the adrenaline, they were just so high that it was hard for me to feel happy,” he says. “There was a sense of relief, like being spared from death, but no joy. I was too stressed for that.”

Like Roger Bannister beating the 4-minute mile, SpaceX made people recalibrate their sense of limitation when it came to getting to space. That led to a major change in direction for NASA. The impending end of its Space Shuttle program meant that the US would no longer have any capacity to send crews or cargo to the International Space Station. So the agency announced a competition for a contract to fly cargo missions there.

Gwynne Shotwell flew to the Houston to meet with NASA to plead their case. Musk made her president of SpaceX. He would remain the CEO, and they would divide responsibilities. “I’ll focus on engineering and product development,” he said, “and I want you to focus on customer management, human resources, government affairs, and a lot of the finance.” On 12/22 SpaceX was awarded a \$1.6 billion contract to make 12 round trips to the Space Station.

Tesla was still careening toward bankruptcy at the end of 2008. Musk enlisted his existing investors to fund a new equity round of a mere \$20 million. One investor was balking: VantagePoint Capital led by Alan Salzman. He said, “Tesla was burning the deposits made by Roadster customers, even though the cars had not been built. People thought they put down a deposit, not an unsecured loan to fund the company. Morally it was wrong.” VantagePoint ended up supporting the plan, as did

the other investors. Musk broke down in tears. “Had it gone the other way, Tesla would have been dead,” he says, “and maybe too the dream of electric cars for many years.” At the time, all of the major US car companies had quit making electric vehicles. In 6/2009 Tesla got \$465 million in interest-bearing loans from a Department of Energy program. Ford, Nissan, and Ker Automotive also got loans. Three years later, Tesla repaid its loan along with \$12 million interest. In 8/2009, even before the Department of Energy loans were approved, Daimler agreed to take a \$50 million equity stake in Tesla. “If Daimler had not invested in Tesla at the time we would have died,” Musk says.

The proportions of a sedan are hard to make pleasing. Putting the battery low made the car easier to handle and almost impossible to tip over. “We spent a lot of time shaving millimeters from the battery pack so that we could ensure that you had enough headroom without making it a bubble car,” Musk says. Straubel said, “You just have to learn how to deal with his demands. Figure out what his goal is and keep giving him information. That’s how he gets the best outcomes.” They engineered the battery pack so that it became an element of the car’s structure. True industrial design must connect the looks of a product to its engineering. **Design is the fundamental soul of a man-made creation that ends up expressing itself in successive outer layers.**

The screen turned out to be a game-changer for the auto industry. Regarding the car as a piece of software rather than just hardware allowed it to be continuously upgraded. “We were amazed at how we could add tons of functionality over the years, including more acceleration,” Musk says. “It allowed the car to get better than when you originally bought it.”

The NASA contract would require a rocket that was much more powerful than the Falcon 1. A rocket with 9 of the original Merlin s would become the Falcon 9, a rocket that would become the workhorse of SpaceX for more than a decade. SpaceX made a deal to use part of the Kennedy Space Center at Cape Canaveral. SpaceX leased Launchpad 40, which since the 1960s had been used for the Air Force’s Titan rocket launches.

Decades of cost-plus contracts had made aerospace flabby. A valve in a rocket would cost 30 times more than a similar valve in a car, so Musk constantly pressed his team to source from non-aerospace companies. SpaceX was not only privatizing space; it was upending its cost structure. Over the next decade, relying mainly on SpaceX, the US would send more astronauts, satellites, and cargo to space than any other country.

“The important thing with Elon,” Buzza says, “is that if you told him the risks and showed him the engineering data, he would make a quick assessment and let the responsibility shift from your shoulders to his.” SpaceX would not only launch an unmanned capsule into orbit but also return it to Earth safely. No private company had done that, in fact, only 3 governments had: the US, Russia, and China.

Musk’s emotional settings range from callous to needy to exuberant. Talulah Riley used to throw very theatrical parties just to keep him entertained. From their meeting in 2008 to their 2<sup>nd</sup> divorce in 2016 would end up being the longest stretch of relative stability in his life.

Between 2000 and 2010 the US lost 1/3 of its manufacturing jobs. By sending their factories abroad, American companies saved labor costs, but lost the daily feel for ways to improve their products. Musk believed that designing the factory to build a car—"the machine that builds the machine"—was as important as designing the car itself. Tesla's design-manufacturing feedback loop gave it a competitive advantage, allowing it to innovate on a daily basis. Jobs and Musk both had beneficial cases of obsessive-compulsive disorder.

Jobs loved to walk through Apple's design studio on a daily basis, but he never visited his factories in China. Musk, in contrast, spent more time walking assembly lines than the design studio. He was able to get the Toyota mothballed factory, which at one point had been worth \$1 billion, for \$42 million. In addition, Toyota agreed to invest \$50 million in Tesla. Musk put cubicles for the engineers right on the edge of the assembly lines. His own open desk was in the middle of it all, with no walls around him, and it had a pillow underneath so he could spend the night when he wanted. Tesla was the 1st IPO by an American carmaker since Ford's in 1916. Tesla's stock provided \$266 million in financing for the company. What had once been a bankrupt factory that had laid off all its workers now had 2000 employees.

In 2000 Bezos launched Blue Origin, focused on the idea of building reusable rockets. "A fully reusable rocket is the difference between being a single-planet civilization and being a multi-planet one," Musk said.

Demis Hassabis was a neuroscientist, video-game designer, and artificial intelligence researcher who cofounded a company called DeepMind. Musk invested \$5 million in it, sharing Hassabis's concern about the danger of AI. Then Google's acquisition of DeepMind was announced in 1/2014. Musk decided to cofound OpenAI. "We wanted to have something like a Linux version of AI that was not controlled by any one person or corporation," Musk says. He realized that success in the field of artificial intelligence would come from having access to huge amounts of real-world data that the bots could learn from. "Probably Tesla will have more real-world data than any other company in the world." He said. Another trove of data, he would later come to realize, was Twitter.

Musk's interest in artificial intelligence would lead him to launch an array of related projects. These include Neuralink, which aims to plant microchips in human brains; Optimus, a human-like robot; and Dojo, a supercomputer that can use millions of videos to train an artificial neural network of a simulated human brain. He founded X.AI to pursue the goal of artificial general intelligence.

Google's autopilot program, eventually named Waymo, used a laser-radar device known as LIDAR, and acronym for "light detection and ranging." It was a case of 1<sup>st</sup> principles: humans drove using only visual data; therefore machines should be able to. "To solve Full Self-Driving, you actually have to solve real-world artificial intelligence," he said.

Lyndon and Peter Rive, Musk's cousins had grown up with Elon and Kimbal. The whole clan, Peter says, followed the same maxim: "Risk is a type of fuel." In 7/2006 they launched SolarCity, with Musk as chairman of the board. It struggled to find a business model. In 2/2016 he phoned his cousins and told

them he wanted Tesla to buy SolarCity. "Tesla is not just an automotive company," Musk said when the Powerwall was announced in April 2015. "It's an energy innovation company."

Musk invested \$100 million of his own money to get The Boring Company started. "He spent a lot of time giving us lessons about the importance of deleting steps and simplifying," says Joe Kuhn, a young engineer from Chicago who designed the way vehicles would get through the tunnel. The Boring Company completed a 1.7-mile tunnel in Las Vegas in 2021 that transports riders in Teslas from the airport and through the convention center.

Professionally and emotionally, the summer of 2017 through the fall of 2018 would be the most hellacious period of his life, even worse than the crises of 2008. His way of dealing with his mental problems he says when I ask, "is just take the pain and make sure you really care about what you're doing." In times of emotional darkness, Musk throws himself into his work, maniacally. And he did so after the 7/2017 event marking the beginning of Model 3 production. He had one primary focus: ramping up production so that Tesla was churning out 5000 Model 3s per week. He had done the calculations of the company's costs, overhead, and cash flow. If it hit that rate, Tesla would survive. If not, it would run out of money.

Musk decided he had to move himself, literally, to the factory floors and lead an all-in surge. It was a tactic—personally surging into the breach 24/7 with an all-hands-on-deck cadre of fellow fanatics—that came to define the maniacal intensity that he demanded at his companies. Musk flipped from being an apostle of automation to a new mission he pursued with similar zeal: find any part of the line where there was a holdup and see if de-automation would make it go faster. The experience became a lesson that would become part of Musk's production algorithm. Always wait until the end of designing a process—after you have questioned all the requirements and deleted unnecessary parts—before you introduce automation.

Tesla's stock was hovering near its all-time high in early 2018, making it more valuable than General Motors, even though GM had sold 10 million cars for \$12 billion profit the previous year, while Tesla had sold 100,000 cars and lost \$2.2 billion. By the end of 2018 Tesla had become the most shorted stock in history. "The degree of inside information they had was insane," he said. Around that time, Musk made the opposite bet. The Tesla board granted him the boldest pay package in American history, one that would pay him nothing if the stock price did not rise dramatically but that had the potential to pay out \$100 billion or more if the company achieved an extraordinarily aggressive set of targets, including a leap in the production numbers revenue, and stock price.

Musk had come to realize that designing a good factory was like designing a microchip. It was important to create, in each patch, the right density, flow, and processes. So he paid the most attention to a monitor that showed each station on the assembly line with a green or red light indication of whether it was flowing properly. His team called it "walk to the red." "If I don't make decisions, we die," he said. "Excessive automation at Tesla was a mistake," he tweeted. In 2 weeks, they were able to complete a tented facility that was 1000 feet long and 150 feet wide, big enough to accommodate a makeshift assembly

line. Instead of robots, there were humans at each station. Just 3 weeks after Musk came up with the idea, the new assembly line was rolling Model 3 sedans out of the makeshift tent.

The algorithm: 1) Question every requirement. Know the name of the real person who made it. Then question it. Then make the requirements less dumb. 2) Delete any part or process you can. You may have to add them back later. In fact, if you do not end up adding back at least 10% of them, then you didn't delete enough. 3) Simplify and optimize. This should come after step 2. A common mistake is to simplify and optimize a part or process that should not exist. 4) Accelerate cycle time. Every process can be speeded up. But only do this after you have followed the 1<sup>st</sup> 3 steps. 5) Automate. That comes last.

A few corollaries: All technical managers must have hands-on experience. Comradery is dangerous. It makes it hard for people to challenge each other's work. It's OK to be wrong. Never ask your troops to do something you're not willing to do. Whenever there are problems to solve, meet with the level right below your managers. When hiring, look for people with the right attitude. Skills can be taught. Attitude changes require a brain transplant. A maniacal sense of urgency is our operating principle. The only rules are the ones dictated by the laws of physics. Everything else is a recommendation.

Charles Kuehmann developed an ultra-hard stainless steel alloy that was cold-rolled rather than requiring heat treatments, which Tesla patented. It was strong enough and cheap enough to use for both trucks and rockets. A steel body could serve as the load bearing structure of the vehicle, rather than making the chassis play that role. Stainless steel would favor straight planes and sharp angles.

In times of challenge, one of his refuges is to focus on a future project. SpaceX would make and launch its own communications satellites, in effect rebuilding the internet in outer space. "Internet revenue is about \$1 trillion a year," he says. "If we can serve 3%, that's \$30 billion, which is more than NASA's budget. That was the inspiration for Starlink, to fund getting to Mars. That has motivated every SpaceX decision." Starlink's goal was to eventually create a mega constellation of 40,000 satellites. In order to reach a profitable scale, they would have to make satellites at 1/10<sup>th</sup> the cost and 10 times faster. The engineer he tapped to take over was Mark Juncosa, who was already in charge of structural engineering at SpaceX. That had the advantage of integrating the design and manufacture of all SpaceX products, from the boosters to the satellites, under one manager who could mind-meld with Musk. When Juncosa took over at Starling, he threw away the existing design and started back at a 1st-principle level, questioning every requirement based on fundamental physics. The goal was to make the simplest communications satellite possible, and later add bells and whistles. By the end of the design process, Juncosa had turned a rat's nest into a simple flat satellite. Musk was now able to tweet on an internet that he owned. His reusable workhorse Falcon 9 had become the world's most efficient and reliable rocket, and he had developed his own communications satellites that would eventually produce a gusher of revenue.

"The Austin Gigafactory was built twice as fast as Shanghai per square foot, despite the regulations we face," Afshar said. Floorspace was 50% more than the Pentagon, and the

biggest factory in the world by floor area. For the Model Y we made the world's largest casting machine. It's a 6000-ton, and we'll also use a 9000-ton one for Cybertruck." The machines can spit out in just 80 seconds an entire chassis that used to contain more than 100 parts that had to be welded, riveted, or bonded together—something that is crazy and easy and fast. Musk repeatedly pushed his teams to get ideas from toys, such as robots and Legos.

Jeff Bezos and Elon Musk tangled. Their vision for privatizing launches was what propelled America, which had fallen behind China and even Russia, back into the forefront of space exploration. When it came to drilling down on the engineering, they were different. Bezos was methodical. His motif was "step by step, ferociously." Musk's instinct was to push and surge and drive people toward insane deadlines, even if it meant taking risks. Musk believed that innovation was driven by setting clear metrics, such as cost per ton lifted into orbit or average number of miles driven on Autopilot without human intervention. Musk's surges are sequential. He ordered that everyone on an installation team, even the engineers and managers, had to spend time drilling and hammering and sweating with the other workers. The business of installing solar roofs is labor-intensive and doesn't scale.

For Musk, good times are unsettling. He was buffeted by his impetuous impulses and craving for storms. Musk's theme: showing that he could be self-aware about his emotional shortcomings. When he reached the milestone of turning 50 on 6/28/21, he had just undergone a 3<sup>rd</sup> neck surgery to ease the pain from the injury that happened when he tried to take down a sumo wrestler at his 42<sup>nd</sup> birthday. There were real fireworks, because, as Kimbal explains, "in Texas you can do whatever you want."

Musk had an essential insight about himself. When things were most dire, he got energized, but when he was not in survival-or-die mode, he felt unsettled. It prompted him to launch surges, stir up drama, throw himself into battles he could have bypassed, and bite off new endeavors.

Shivon Zillis noticed that "I learned more unique lessons from Elon per minute than any other human I've met." She eventually moved into the role of top manager at Neuralink in addition to being a close personal companion to him. Zillis says, "In 6 years, Elan and I have never gotten in a fight, never argued." "People are going to have to revive the idea of having children as a kind of social duty," Musk said. "Otherwise civilization will just die." Their twins were conceived by invitro fertilization. Zillis did not tell people who the biological father was. A boy named Strider Sirius and a girl named Azure Astra Allice were given Zillis' last name. Musk ended up spending a lot of time with them and bonding with them.

Musk was liberal on social issues but with a dollop of libertarian resistance to regulations and political correctness. He went from being a fanboy and fundraiser for Barack Obama to railing against progressive Democrats. "The woke-mind virus is fundamentally antiscience, antimerit, and antihuman in general," he said. His reaction was partly triggered by his daughter Jenna's transition. He feels he lost a son who changed 1st and last names and won't speak to him anymore because of this woke-mind virus. He had become convinced that wokeness was

destroying humor. “Wokeness wants to make comedy illegal,” he contended. “At its heart wokeness is divisive, exclusionary, and hateful. It gives mean people a shield to be mean and cruel, armed with false virtue.”

His frustrations with California: “I came there when it was the land of opportunity. Now it’s the land of litigation, regulation, and taxation.” The UAW had failed to unionize Tesla’s Fremont plant, partly because its workers got stock options, not usually part of union contracts. In the last quarter of 2021, GM sold a grand total of 26 electric vehicles in the US, compared to Tesla sales of 300,000.

*Polytopia Life* lessons: Empathy is not an asset. Play life like a game. Do not fear losing. Be proactive. Optimize every turn. Double down. Pick your battles. Unplug at times. “I had to take Polytopia off my phone because it was taking up too many brain cycles.”

Russia used a massive malware attack to disable the routers of the American satellite company Viasat that provided communications and internet to Ukraine. The vice prime minister, Mykhailo Fedorov, used Twitter to urge Musk to provide connectivity. “We ask you to provide Ukraine with Starlink stations,” he pleaded. A number of Starlink kits were already allowing Ukraine Armed Forces to continue operating theater command centers. “Let’s offer to ship some field solar+battery kits,” Musk replied. “They can have some Tesla Powerwalls or Megapacks too.” Unlike every other company and even parts of the US military, they were able to find ways to defeat Russian jamming. By July there were 15,000 Starlink terminals operating in Ukraine.

Trial-by-fire has whetted the appetite of many Western militaries. Commanders have been impressed by the company’s ability, within days, to deliver thousands of backpack-sized satellite stations to the war-torn country and to keep them online despite increasingly sophisticated attacks from Russian hackers. Musk estimated its total contribution to be around \$50 million. SpaceX did not wish Starlink to be used for offensive military purposes. Shotwell also felt strongly that SpaceX should stop subsidizing the Ukrainian military operation, but she began negotiating a contract with the Pentagon and launched ways specifically designed for military use. The point of leapfrogging to a new rocket engine was to get everyone thinking boldly.

Musk has shown little interest in philanthropy over the years. He felt that the good he could do for humanity was best accomplished by keeping his money deployed in his companies that pursued energy sustainability, space exploration, and artificial intelligence safety. In 10/21 Tesla’s market value was greater than its 5 biggest rivals—Toyota, Volkswagen, Daimler, Ford, and GM—combined. In 1Q22 the value of the 4 companies he initially funded and built were: Tesla, \$1 trillion; SpaceX, \$100 billion; The Boring company \$5.6 billion; Neuralink, \$1 billion. His stock sales had left him with about \$10 billion cash

Shivon Zilis asked him, “Is it that you find greater comfort when you’re in periods of war?” “It’s part of my default settings,” he replied. Extended periods of calm are unnerving for him.

Twitter is an ideal—almost too ideal—playground for Musk. It rewards players who are impulsive, irreverent, and

unfiltered, like a flamethrower for thumbs. Over the decade to 2021 Musk composed 19,000 tweets. In early 2022 he had a swelling concern with the dangers of the “woke-mind virus” that he believed was infecting America. “He saw the direction Twitter was headed, which was that if you were on the wrong end of the spectrum you were censored,” says Birchall. His view of free speech was that the more there was, the better it would be for democracy.

“It was the ultimate irony,” Musk said, for a company that was supposed to be “the public square” to try to restrict his freedom of speech. One of Musk’s core ideas for Twitter: making people subscribe using their credit card and cell phone number would be a way to verify and authenticate their identity. The algorithm could favor those users who would probably be less likely to engage in scams, bullying, and spreading what they knew to be lies. Twitter could become a social network that supported financial transactions.

“I began to believe that Twitter was heading off a cliff and that I couldn’t save it by just being a board member,” he says. “So I thought, maybe I should just buy it, take it private, and fix it. We want to prevent a world in which people split off into their own echo chambers on social media. We want to have one place where people with different view points can interact. That would be a good thing for civilization.”

Musk wanted to own Twitter because it was fun, like an amusement park. It offered political smackdowns, intellectual gladiator matchers, dopey memes, important public announcements, valuable marketing, bad puns, and unfiltered opinions. Also, Twitter was the ultimate playground and he could own it. He tweeted, “I think there’s a distinction between freedom of speech and freedom of reach. We are simultaneously being told that gender differences do not exist and that genders are so profoundly different that irreversible surgery is the only option. Perhaps someone wiser than me can explain this dichotomy.” He wanted to run Twitter himself just as he was doing with Tesla, SpaceX, The Boring Company, and Neuralink.

“If you can create a self-driving car, which is a robot on wheels, then you can make a robot on legs as well,” Musk said. Self-driving cars, Musk believed, would do more than merely free folks from the drudgery of driving. They would, to a large extent, eliminate the need for people to own cars.

He thought of Twitter as a technology company, when in fact it was an advertising medium based on human emotions and relationships. Twitter Blue would serve many purposes. It would cut back on troll farms and bot armies because only one verified account would be permitted on any one credit card and phone. It would be a new revenue stream. And it would also get a user’s credit card information into the system.

Tim Zama led the artificial intelligence infrastructure team. “When you’re at Tesla, you’re afraid to go anywhere else, because you will become so bored. If I take a whole week off, my brain gets fried.” “He has a lot a set of grand visions, whether it’s multiplanetary humanity or renewable energy and even free speech. And he has constructed for himself a moral and ethical universe that is focused on the delivery of those big goals. I think that makes it hard to villainize him. What Elon doesn’t understand,” Roth said, “is that the rest of us do not have security people the way he does.”



“I’m a big believer that a small number of exceptional people who are highly motivated can do better than a large number of people who are pretty good and moderately motivated,” Musk said. Now it was time for him to sleep at Twitter headquarters. The engineers who stayed had to meet 3 criteria. They had to be excellent, trustworthy, and driven. The 1st round of cuts weeded out those who were not excellent. “Unfettered free speech did not extend to the workplace,” Musk said for the 2<sup>nd</sup> cut. They relied on self-selection with severance for all but those who declared they are hardcore. In the end 2492 stayed. When the dust settled about 75% of the Twitter workforce had been cut to just over 2000 by 12/22.

Musk had wrought one of the greatest shifts in corporate culture ever. Twitter had gone from being among the most nurturing workplaces, replete with free artisanal meals, yoga studio, paid rest days and concern for “psychological safety,” to the other extreme. He preferred a scrappy, hard-driven environment where rabid warriors felt psychological danger rather than comfort. Twitter began to innovate and add features faster than it ever had before.

Tim Cook, who took over Apple in 2011, was different. He was calm, coolly disciplined, and disarmingly polite. Although he could be steely when warranted, he avoided unnecessary confrontations. Cook explained that protecting the trust surrounding the Apple brand was his highest priority.

The “Twitter Files” showed that it had become a de facto collaborator with the FBI and other government agencies, giving them the power to flag large amounts of content for suggested removal. “A long list of government enforcement agencies essentially got to operate Twitter as an involuntary contractor,” Taibbi wrote. Often Twitter acted as a *voluntary* contractor. The managers seemed eager to be accommodating. More than 98% of the donations made by people at the company went to Democrats. Twitter was distrusted by half the country, Musk believed, because it had suppressed certain viewpoints. “We have a goal here, which is to clear the decks of any prior wrongdoing and move forward with a clean slate.”

“This is how civilizations decline. They quit taking risks and their arteries harden. Every year there are more referees and fewer doers. When you’ve had success for too long, you lose the desire to take risks.” Would a restrained Musk accomplish as much as a Musk unbound? Is being unfiltered and untethered integral to who he is?

Musk allowed me (Walter Isaacson) to shadow him for 2 years, invited me to sit in on his meetings, indulged scores of interviews and late-night conversations, provided emails and texts, and encouraged his friends, colleagues, family members, adversaries, and ex-wives to talk to me. He did not ask to, nor did he, read this book before it was published, and he exercised no control over it.

Musk was laser-focused on keeping down costs because cost-effectiveness was critical for his ultimate goal, which was to colonize Mars. His focus on cost, as well as his natural controlling instincts, led him to want to manufacture as many components as possible in-house, rather than buy them from suppliers. This outcomes-based, fixed-price contracting allowed the private company to control how its rockets were designed and

built. When you’re from a dysfunctional background or have a brain wired like his, intensity takes the place of intimacy. Design is the fundamental soul of a man-made creation that ends up expressing itself in successive outer layers.