



# ELON MUSK

Tesla, SpaceX, and the Quest  
for a Fantastic Future

ASHLEE VANCE

# ELON MUSK

---

Tesla, SpaceX, and the Quest for a Fantastic Future

---

ASHLEE VANCE



*An Imprint of HarperCollinsPublishers*

## DEDICATION

---

*For Mum and Dad. Thanks for Everything.*

# CONTENTS

---

1. [DEDICATION](#)
2. [1 ELON'S WORLD](#)
3. [2 AFRICA](#)
4. [3 CANADA](#)
5. [4 ELON'S FIRST STARTUP](#)
6. [5 PAYPAL MAFIA BOSS](#)
7. [6 MICE IN SPACE](#)
8. [PHOTOGRAPHIC INSERT](#)
9. [7 ALL ELECTRIC](#)
10. [8 PAIN, SUFFERING, AND SURVIVAL](#)
11. [9 LIFTOFF](#)
12. [10 THE REVENGE OF THE ELECTRIC CAR](#)
13. [11 THE UNIFIED FIELD THEORY OF ELON MUSK](#)
14. [EPILOGUE](#)
  
15. [APPENDIX 1](#)
16. [APPENDIX 2](#)
17. [APPENDIX 3](#)
18. [ACKNOWLEDGMENTS](#)
19. [NOTES](#)
20. [ABOUT THE AUTHOR](#)
21. [ALSO BY ASHLEE VANCE](#)
22. [CREDITS](#)
23. [COPYRIGHT](#)
24. [ABOUT THE PUBLISHER](#)

## ELON'S WORLD

### **DO YOU THINK I'M INSANE?"**

This question came from Elon Musk near the very end of a long dinner we shared at a high-end seafood restaurant in Silicon Valley. I'd gotten to the restaurant first and settled down with a gin and tonic, knowing Musk would—as ever—be late. After about fifteen minutes, Musk showed up wearing leather shoes, designer jeans, and a plaid dress shirt. Musk stands six foot one but ask anyone who knows him and they'll confirm that he seems much bigger than that. He's absurdly broad-shouldered, sturdy, and thick. You'd figure he would use this frame to his advantage and perform an alpha-male strut when entering a room. Instead, he tends to be almost sheepish. It's head tilted slightly down while walking, a quick handshake hello after reaching the table, and then butt in seat. From there, Musk needs a few minutes before he warms up and looks at ease.

Musk asked me to dinner for a negotiation of sorts. Eighteen months earlier, I'd informed him of my plans to write a book about him, and he'd informed me of his plans not to cooperate. His rejection stung but thrust me into dogged reporter mode. If I had to do this book without him, so be it. Plenty of people had left Musk's companies, Tesla Motors and SpaceX, and would talk, and I already knew a lot of his friends. The interviews followed one after another, month after month, and two hundred or so people into the process, I heard from Musk once again. He called me at home and declared that things could go one of two ways: he could make my life very difficult or he could help with the project after all. He'd be willing to cooperate if he could read the book before it went to publication, and could add footnotes throughout it. He would not meddle with my text, but he wanted the chance to set the record straight in spots that he

deemed factually inaccurate. I understood where this was coming from. Musk wanted a measure of control over his life's story. He's also wired like a scientist and suffers mental anguish at the sight of a factual error. A mistake on a printed page would gnaw at his soul—forever. While I could understand his perspective, I could not let him read the book, for professional, personal, and practical reasons. Musk has his version of the truth, and it's not always the version of the truth that the rest of the world shares. He's prone to verbose answers to even the simplest of questions as well, and the thought of thirty-page footnotes seemed all too real. Still, we agreed to have dinner, chat all this out, and see where it left us.

Our conversation began with a discussion of public-relations people. Musk burns through PR staffers notoriously fast, and Tesla was in the process of hunting for a new communications chief. "Who is the best PR person in the world?" he asked in a very Muskian fashion. Then we talked about mutual acquaintances, Howard Hughes, and the Tesla factory. When the waiter stopped by to take our order, Musk asked for suggestions that would work with his low-carb diet. He settled on chunks of fried lobster soaked in black squid ink. The negotiation hadn't begun, and Musk was already dishing. He opened up about the major fear keeping him up at night: namely that Google's cofounder and CEO Larry Page might well have been building a fleet of artificial-intelligence-enhanced robots capable of destroying mankind. "I'm really worried about this," Musk said. It didn't make Musk feel any better that he and Page were very close friends and that he felt Page was fundamentally a well-intentioned person and not Dr. Evil. In fact, that was sort of the problem. Page's nice-guy nature left him assuming that the machines would forever do our bidding. "I'm not as optimistic," Musk said. "He could produce something evil by accident." As the food arrived, Musk consumed it. That is, he didn't eat it as much as he made it disappear rapidly with a few gargantuan bites. Desperate to keep Musk happy and chatting, I handed him a big chunk of steak from my plate. The plan worked . . . for all of ninety seconds. Meat. Hunk. Gone.

It took awhile to get Musk off the artificial intelligence doom-and-gloom talk and to the subject at hand. Then, as we drifted toward the book, Musk started to feel me out, probing exactly why it was that I wanted to write about him and calculating my intentions. When the moment presented itself, I moved in and seized the conversation. Some adrenaline released and mixed with the gin, and I launched into what was meant to be a forty-five-minute sermon about all the reasons Musk should let me burrow deep into his life and do so while getting exactly none of the controls he wanted in return. The speech revolved around the inherent limitations of footnotes, Musk coming off like a control freak and my journalistic integrity being compromised. To my great surprise, Musk cut me off

after a couple of minutes and simply said, “Okay.” One thing that Musk holds in the highest regard is resolve, and he respects people who continue on after being told no. Dozens of other journalists had asked him to help with a book before, but I’d been the only annoying asshole who continued on after Musk’s initial rejection, and he seemed to like that.

The dinner wound down with pleasant conversation and Musk laying waste to the low-carb diet. A waiter showed up with a giant yellow cotton candy desert sculpture, and Musk dug into it, ripping off handfuls of the sugary fluff. It was settled. Musk granted me access to the executives at his companies, his friends, and his family. He would meet me for dinner once a month for as long as it took. For the first time, Musk would let a reporter see the inner workings of his world. Two and a half hours after we started, Musk put his hands on the table, made a move to get up, and then paused, locked eyes with me, and busted out that incredible question: “Do you think I’m insane?” The oddity of the moment left me speechless for a beat, while my every synapse fired trying to figure out if this was some sort of riddle, and, if so, how it should be answered artfully. It was only after I’d spent lots of time with Musk that I realized the question was more for him than me. Nothing I said would have mattered. Musk was stopping one last time and wondering aloud if I could be trusted and then looking into my eyes to make his judgment. A split second later, we shook hands and Musk drove off in a red Tesla Model S sedan.

ANY STUDY OF ELON MUSK must begin at the headquarters of SpaceX, in Hawthorne, California—a suburb of Los Angeles located a few miles from Los Angeles International Airport. It’s there that visitors will find two giant posters of Mars hanging side by side on the wall leading up to Musk’s cubicle. The poster to the left depicts Mars as it is today—a cold, barren red orb. The poster on the right shows a Mars with a humongous green landmass surrounded by oceans. The planet has been heated up and transformed to suit humans. Musk fully intends to try and make this happen. Turning humans into space colonizers is his stated life’s purpose. “I would like to die thinking that humanity has a bright future,” he said. “If we can solve sustainable energy and be well on our way to becoming a multiplanetary species with a self-sustaining civilization on another planet—to cope with a worst-case scenario happening and extinguishing human consciousness—then,” and here he paused for a moment, “I think that would be really good.”

If some of the things that Musk says and does sound absurd, that’s because on one level they very much are. On this occasion, for example, Musk’s assistant had just handed him some cookies-and-cream ice cream with sprinkles on top,

and he then talked earnestly about saving humanity while a blotch of the desert hung from his lower lip.

Musk's ready willingness to tackle impossible things has turned him into a deity in Silicon Valley, where fellow CEOs like Page speak of him in reverential awe, and budding entrepreneurs strive "to be like Elon" just as they had been striving in years past to mimic Steve Jobs. Silicon Valley, though, operates within a warped version of reality, and outside the confines of its shared fantasy, Musk often comes off as a much more polarizing figure. He's the guy with the electric cars, solar panels, and rockets peddling false hope. Forget Steve Jobs. Musk is a sci-fi version of P. T. Barnum who has gotten extraordinarily rich by preying on people's fear and self-hatred. Buy a Tesla. Forget about the mess you've made of the planet for a while.

I'd long been a subscriber to this latter camp. Musk had struck me as a well-intentioned dreamer—a card-carrying member of Silicon Valley's techno-utopian club. This group tends to be a mix of Ayn Rand devotees and engineer absolutists who see their hyperlogical worldviews as the Answer for everyone. If we'd just get out of their way, they'd fix all our problems. One day, soon enough, we'll be able to download our brains to a computer, relax, and let their algorithms take care of everything. Much of their ambition proves inspiring and their works helpful. But the techno-utopians do get tiresome with their platitudes and their ability to prattle on for hours without saying much of substance. More disconcerting is their underlying message that humans are flawed and our humanity is an annoying burden that needs to be dealt with in due course. When I'd caught Musk at Silicon Valley events, his highfalutin talk often sounded straight out of the techno-utopian playbook. And, most annoyingly, his world-saving companies didn't even seem to be doing all that well.

Yet, in the early part of 2012, the cynics like me had to take notice of what Musk was actually accomplishing. His once-beleaguered companies were succeeding at unprecedented things. SpaceX flew a supply capsule to the International Space Station and brought it safely back to Earth. Tesla Motors delivered the Model S, a beautiful, all-electric sedan that took the automotive industry's breath away and slapped Detroit sober. These two feats elevated Musk to the rarest heights among business titans. Only Steve Jobs could claim similar achievements in two such different industries, sometimes putting out a new Apple product and a blockbuster Pixar movie in the same year. And yet, Musk was not done. He was also the chairman and largest shareholder of SolarCity, a booming solar energy company poised to file for an initial public offering. Musk had somehow delivered the biggest advances the space, automotive, and energy industries had seen in decades in what felt like one fell swoop.



It was in 2012 that I decided to see what Musk was like firsthand and to write a cover story about him for *Bloomberg Businessweek*. At this point in Musk's life, everything ran through his assistant/loyal appendage Mary Beth Brown. She invited me to visit what I've come to refer to as Musk Land.

Anyone arriving at Musk Land for the first time will have the same head-scratching experience. You're told to park at One Rocket Road in Hawthorne, where SpaceX has its HQ. It seems impossible that anything good could call Hawthorne home. It's a bleak part of Los Angeles County in which groupings of rundown houses, rundown shops, and rundown eateries surround huge, industrial complexes that appear to have been built during some kind of architectural Boring Rectangle movement. Did Elon Musk really stick his company in the middle of this dreck? Then, okay, things start to make more sense when you see one 550,000-square-foot rectangle painted an ostentatious hue of "Unity of Body, Soul, and Mind" white. This is the main SpaceX building.

It was only after going through the front doors of SpaceX that the grandeur of what this man had done became apparent. Musk had built an honest-to-God rocket factory in the middle of Los Angeles. And this factory was not making one rocket at a time. No. It was making many rockets—from scratch. The factory was a giant, shared work area. Near the back were massive delivery bays that allowed for the arrival of hunks of metal, which were transported to two-story-high welding machines. Over to one side were technicians in white coats making motherboards, radios, and other electronics. Other people were in a special, airtight glass chamber, building the capsules that rockets would take to the Space Station. Tattooed men in bandanas were blasting Van Halen and threading wires around rocket engines. There were completed bodies of rockets lined up one after the other ready to be placed on trucks. Still more rockets, in another part of the building, awaited coats of white paint. It was difficult to take in the entire factory at once. There were hundreds of bodies in constant motion whirring around a variety of bizarre machines.

This is just building number one of Musk Land. SpaceX had acquired several buildings that used to be part of a Boeing factory, which made the fuselages for 747s. One of these buildings has a curved roof and looks like an airplane hangar. It serves as the research, development, and design studio for Tesla. This is where the company came up with the look for the Model S sedan and its follow-on, the Model X SUV. In the parking lot outside the studio, Tesla has built one of its recharging stations where Los Angeles drivers can top up with electricity for free. The charging center is easy enough to spot because Musk has installed a white and red obelisk branded with the Tesla logo that sits in the middle of an infinity pool.

It was in my first interview with Musk, which took place at the design studio, that I began to get a sense of how he talked and operated. He's a confident guy, but does not always do a good job of displaying this. On initial encounter, Musk can come off as shy and borderline awkward. His South African accent remains present but fading, and the charm of it is not enough to offset the halting nature of Musk's speech pattern. Like many an engineer or physicist, Musk will pause while fishing around for exact phrasing, and he'll often go rumbling down an esoteric, scientific rabbit hole without providing any helping hands or simplified explanations along the way. Musk expects you to keep up. None of this is off-putting. Musk, in fact, will toss out plenty of jokes and can be downright charming. It's just that there's a sense of purpose and pressure hanging over any conversation with the man. Musk doesn't really shoot the shit. (It would end up taking about thirty hours of interviews for Musk to really loosen up and let me into a different, deeper level of his psyche and personality.)

Most high-profile CEOs have handlers all around them. Musk mostly moves about Musk Land on his own. This is not the guy who slinks into the restaurant. It's the guy who owns the joint and strides about with authority. Musk and I talked, as he made his way around the design studio's main floor, inspecting prototype parts and vehicles. At each station, employees rushed up to Musk and disgorged information. He listened intently, processed it, and nodded when satisfied. The people moved away and Musk moved to the next information dump. At one point, Tesla's design chief, Franz von Holzhausen, wanted Musk's take on some new tires and rims that had come in for the Model S and on the seating arrangements for the Model X. They spoke, and then they went into a back room where executives from a seller of high-end graphics software had prepared a presentation for Musk. They wanted to show off new 3-D rendering technology that would allow Tesla to tweak the finish of a virtual Model S and see in great detail how things like shadows and streetlights played off the car's body. Tesla's engineers really wanted the computing systems and needed Musk's sign-off. The men did their best to sell Musk on the idea while the sound of drills and giant industrial fans drowned out their shtick. Musk, wearing leather shoes, designer jeans, and a black T-shirt, which is essentially his work uniform, had to don 3-D goggles for the demonstration and seemed unmoved. He told them he'd think about it and then walked toward the source of the loudest noise—a workshop deep in the design studio where Tesla engineers were building the scaffolding for the thirty-foot decorative towers that go outside the charging stations. "That thing looks like it could survive a Category Five hurricane," Musk said. "Let's thin it up a bit." Musk and I eventually hop into his car—a black Model S—and zip back to the main SpaceX building. "I think there are

probably too many smart people pursuing Internet stuff, finance, and law,” Musk said on the way. “That is part of the reason why we haven’t seen as much innovation.”

## MUSK LAND WAS A REVELATION.

I’d come to Silicon Valley in 2000 and ended up living in the Tenderloin neighborhood of San Francisco. It’s the one part of the city that locals will implore you to avoid. Without trying very hard, you can find someone pulling down his pants and pooping in between parked cars or encounter some deranged sort bashing his head into the side of a bus stop. At dive bars near the local strip clubs, transvestites hit on curious businessmen and drunks fall asleep on couches and soil themselves as part of their lazy Sunday ritual. It’s the gritty, knife-stabby part of San Francisco and turned out to be a great place to watch the dotcom dream die.

San Francisco has an enduring history with greed. It became a city on the back of the gold rush, and not even a catastrophic earthquake could slow San Francisco’s economic lust for long. Don’t let the granola vibes fool you. Booms and busts are the rhythm of this place. And, in 2000, San Francisco had been overtaken by the boom of all booms and consumed by avarice. It was a wonderful time to be alive with just about the entire populace giving in to a fantasy—a get-rich-quick, Internet madness. The pulses of energy from this shared delusion were palpable, producing a constant buzz that vibrated across the city. And here I was in the center of the most depraved part of San Francisco, watching just how high and low people get when consumed by excess.

Stories tracking the insanity of business in these times are well-known. You no longer had to make something that other people wanted to buy in order to start a booming company. You just had to have an idea for some sort of Internet thing and announce it to the world in order for eager investors to fund your thought experiment. The whole goal was to make as much money as possible in the shortest amount of time because everyone knew on at least a subconscious level that reality had to set in eventually.

Valley denizens took very literally the cliché of working as hard as you play. People in their twenties, thirties, forties, and fifties were expected to pull all-nighters. Cubicles were turned into temporary homes, and personal hygiene was abandoned. Oddly enough, making Nothing appear to be Something took a lot of work. But when the time to decompress arrived, there were plenty of options for total debauchery. The hot companies and media powers of the time seemed locked in a struggle to outdo each other with ever-fancier parties. Old-line companies trying to look “with it” would regularly buy space at a concert venue

and then order up some dancers, acrobats, open bars, and the Barenaked Ladies. Young technologists would show up to pound their free Jack and Cokes and snort their cocaine in porta-potties. Greed and self-interest were the only things that made any sense back then.

While the good times have been well chronicled, the subsequent bad times have been—unsurprisingly—ignored. It’s more fun to reminisce on irrational exuberance than the mess that gets left behind.

Let it be said for the record, then, that the implosion of the get-rich-quick Internet fantasy left San Francisco and Silicon Valley in a deep depression. The endless parties ended. The prostitutes no longer roamed the streets of the Tenderloin at 6 A.M. offering pre-commute love. (“Come on, honey. It’s better than coffee!”) Instead of the Barenaked Ladies, you got the occasional Neil Diamond tribute band at a trade show, some free T-shirts, and a lump of shame.

The technology industry had no idea what to do with itself. The dumb venture capitalists who had been taken during the bubble didn’t want to look any dumber, so they stopped funding new ventures altogether. Entrepreneurs’ big ideas were replaced by the smallest of notions. It was as if Silicon Valley had entered rehab en masse. It sounds melodramatic, but it’s true. A populace of millions of clever people came to believe that they were inventing the future. Then . . . poof! Playing it safe suddenly became the fashionable thing to do.

The evidence of this malaise is in the companies and ideas formed during this period. Google had appeared and really started to thrive around 2002, but it was an outlier. Between Google and Apple’s introduction of the iPhone in 2007, there’s a wasteland of ho-hum companies. And the hot new things that were just starting out—Facebook and Twitter—certainly did not look like their predecessors—Hewlett-Packard, Intel, Sun Microsystems—that made physical products and employed tens of thousands of people in the process. In the years that followed, the goal went from taking huge risks to create new industries and grand new ideas, to chasing easier money by entertaining consumers and pumping out simple apps and advertisements. “The best minds of my generation are thinking about how to make people click ads,” Jeff Hammerbacher, an early Facebook engineer, told me. “That sucks.” Silicon Valley began to look an awful lot like Hollywood. Meanwhile, the consumers it served had turned inward, obsessed with their virtual lives.

One of the first people to suggest that this lull in innovation could signal a much larger problem was Jonathan Huebner, a physicist who works at the Pentagon’s Naval Air Warfare Center in China Lake, California. Huebner is the *Leave It to Beaver* version of a merchant of death. Middle-aged, thin, and balding, he likes to wear a dirt-inspired ensemble of khaki pants, a brown-striped

shirt, and a canvas khaki jacket. He has designed weapons systems since 1985, gaining direct insight into the latest and greatest technology around materials, energy, and software. Following the dot-com bust, he became miffed at the ho-hum nature of the supposed innovations crossing his desk. In 2005, Huebner delivered a paper, “A Possible Declining Trend in Worldwide Innovation,” which was either an indictment of Silicon Valley or at least an ominous warning.

Huebner opted to use a tree metaphor to describe what he saw as the state of innovation. Man has already climbed past the trunk of the tree and gone out on its major limbs, mining most of the really big, game-changing ideas—the wheel, electricity, the airplane, the telephone, the transistor. Now we’re left dangling near the end of the branches at the top of the tree and mostly just refining past inventions. To back up his point in the paper, Huebner showed that the frequency of life-changing inventions had started to slow. He also used data to prove that the number of patents filed per person had declined over time. “I think the probability of us discovering another top-one-hundred-type invention gets smaller and smaller,” Huebner told me in an interview. “Innovation is a finite resource.”

Huebner predicted that it would take people about five years to catch on to his thinking, and this forecast proved almost exactly right. Around 2010, Peter Thiel, the PayPal cofounder and early Facebook investor, began promoting the idea that the technology industry had let people down. “We wanted flying cars, instead we got 140 characters” became the tagline of his venture capital firm Founders Fund. In an essay called “What Happened to the Future,” Thiel and his cohorts described how Twitter, its 140-character messages, and similar inventions have let the public down. He argued that science fiction, which once celebrated the future, has turned dystopian because people no longer have an optimistic view of technology’s ability to change the world.

I’d subscribed to a lot of this type of thinking until that first visit to Musk Land. While Musk had been anything but shy about what he was up to, few people outside of his companies got to see the factories, the R&D centers, the machine shops, and to witness the scope of what he was doing firsthand. Here was a guy who had taken much of the Silicon Valley ethic behind moving quickly and running organizations free of bureaucratic hierarchies and applied it to improving big, fantastic machines and chasing things that had the potential to be the real breakthroughs we’d been missing.

By rights, Musk should have been part of the malaise. He jumped right into dot-com mania in 1995, when, fresh out of college, he founded a company called Zip2—a primitive Google Maps meets Yelp. That first venture ended up a big, quick hit. Compaq bought Zip2 in 1999 for \$307 million. Musk made \$22