



**'Gripping and
brilliantly told'**
Mustafa Suleyman,
author of
The Coming Wave

The Thinking Machine

**Jensen Huang,
Nvidia, and the
world's most
coveted microchip**



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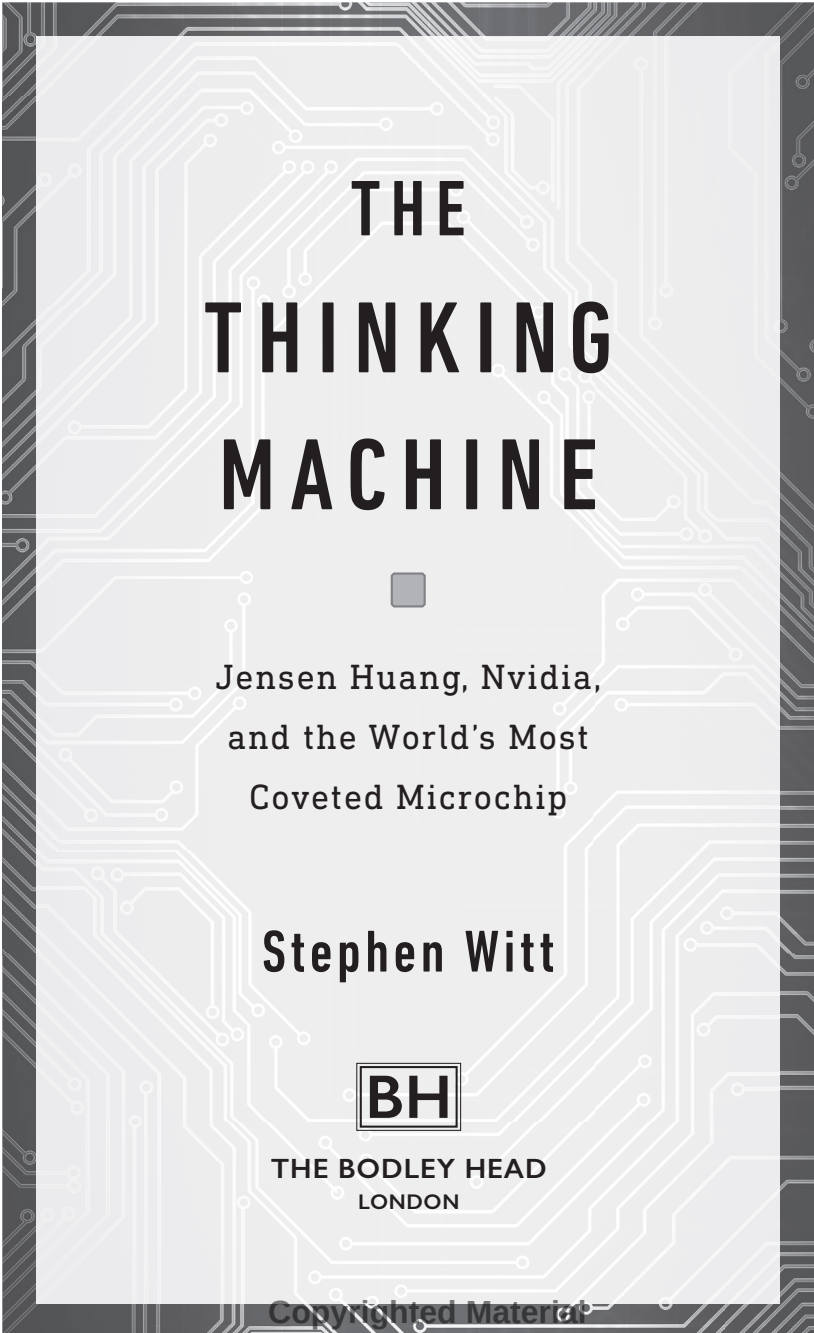
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Jensen Huang, Nvidia,
and the World's Most
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For Jane

Practice even what seems impossible.

—MARCUS AURELIUS

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INTRODUCTION

This is the story of how a niche vendor of video game hardware became the most valuable company in the world. It is the story of a stubborn entrepreneur who pushed his radical vision for computing for thirty years, in the process becoming one of the wealthiest men alive. It is the story of a revolution in silicon and the small group of renegade engineers who defied Wall Street to make it happen. And it is the story of the birth of an awesome and terrifying new category of artificial intelligence, whose long-term implications for the human species cannot be known.

At the center of this story is a propulsive, mercurial, brilliant, and extraordinarily dedicated man. His name is Jensen Huang, and his thirty-two-year tenure is the longest of any technology CEO in the S&P 500. Huang is a visionary inventor whose familiarity with the inner workings of electronic circuitry approaches a kind of intimacy. He reasons from first principles about what microchips can do today, then gambles with great conviction on what they will do tomorrow. He does not always win, but when he does, he wins big: his early, all-in bet on AI was one of the best investments in Silicon Valley history. Huang's company, Nvidia, is today worth more than \$3 trillion, rivaling both Apple and Microsoft in value.

In person, Huang is charming, funny, self-deprecating, and frequently self-contradictory. He keeps up a semicomical deadpan patter at all times. We met in 2023 for breakfast at a Denny's diner, his favorite restaurant chain. Huang had developed the business plan for Nvidia at this same restaurant thirty years earlier; chatting with our waitress, he ordered seven items, including a Super Bird sandwich and a chicken-fried steak. "You know, I used to be a dishwasher here," he told her. "But I worked hard! Like, really hard. So I got to be a busboy."

Huang, born in Taiwan, immigrated to the United States when he was ten. Denny's was the crucible of his assimilation—working there as a teenager, he ate through the entire menu. Still, he told me, he maintains an outsider's perspective. "You're always an immigrant," he said. "I'm always Chinese." He cofounded Nvidia (pronounced IN-vidia, not NUH-vidia) in 1993 when he was thirty, first targeting the nascent market for high-end video game graphics. His products were popular; his customers liked to build their own PCs, sometimes buying transparent housing to showcase their Nvidia hardware.

In the late 1990s, seeking to better render the *Quake* series of games, Nvidia made a subtle change to the circuit architecture of its processors, allowing them to solve more than one problem at a time. This approach, known as "parallel computing," was a radical gamble. "The success rate of parallel computing was zero percent before we came along," Huang said, rattling off a list of forgotten start-ups. "Literally zero. Everyone who tried to make it into a business had failed." Huang ignored this dismal record, pursuing his unconventional vision in open defiance of Wall Street for more than a decade. He looked for customers besides gamers, ones who needed a lot of computing power—weather forecasters, radiologists, deep-water oil prospectors, that sort of thing. During this time, Nvidia's stock price floundered, and he had to fend off corporate raiders to retain his job.

Huang stuck with this bet, losing money on it for years, until in 2012 a group of dissident academics in Toronto purchased two consumer video game cards to train an exotic kind of artificial intelligence called a neural network. At the time, neural networks, which mimic the structure of bio-

logical brains, were deeply out of favor, and most researchers considered them obsolete toys. But when Huang saw how fast neural networks trained on his parallel-computing platform, he staked his entire company on the unexpected symbiosis. Huang now needed two underdog technologies to work—two technologies that had always failed the test of the marketplace in the past.

When this audacious corporate parlay hit, Nvidia increased in value several hundred times. In the past decade, the company has evolved from selling \$200 gaming accessories to shipping multimillion-dollar supercomputing equipment that can fill the floor of a building. Working with pioneers like OpenAI, Nvidia has sped up deep-learning applications more than a thousand times in the last ten years. All major artificial-intelligence applications—Midjourney, ChatGPT, Copilot, all of it—were developed on Nvidia machines. It is this unprecedented increase in computing power that has made the modern AI boom possible.

With a near-monopoly on the hardware, Huang is arguably the most powerful person in AI. Certainly, he's made more money from it than anyone else. In the strike-it-rich tradition, he most closely resembles California's first millionaire, Samuel Brannan, the celebrated vendor of prospecting supplies who lived in San Francisco in 1849. Except rather than shovels, Huang sells \$30,000 AI-training chips that contain one hundred billion transistors. The wait time to purchase his latest hardware is currently more than a year, and on the Chinese black market, his chips sell for double the price.

Huang doesn't think like a businessman. He thinks like an engineer, breaking down difficult concepts into simple principles, then leveraging those principles to great effect. "I do everything I can not to go out of business," he said at breakfast. "I do everything I can not to fail." Huang believes that with AI, the basic architecture of digital computing, little changed since it was introduced by IBM in the early 1960s, is being reconceptualized. "Deep learning is not an algorithm," he said. "Deep learning is a method. It's a new way of developing software."

This new software has incredible powers. It can speak like a human,

write a college essay, solve a tricky math problem, provide an expert medical diagnosis, and cohost a podcast. It scales with the amount of computing power available to it and never seems to plateau. The evening before our breakfast, I'd watched a video in which a robot, running this new kind of software, stared at its hands in seeming recognition, then sorted a collection of colored blocks. The video had given me chills; the obsolescence of my species seemed near. Huang, rolling a pancake around a sausage with his fingers, dismissed my concerns. "I know how it works, so there's nothing there," he said. "It's no different than how microwaves work." I pressed Huang—an autonomous robot surely presents risks that a microwave oven does not. He responded that he has never worried about the technology, not once. "All it's doing is processing data," he said. "There are so many other things to worry about."

Where this will lead is anyone's guess; many technologists now worry that AI's capabilities pose a direct threat to the survival of the human species. (Among these "doomers" are the Toronto scientists who first implemented AI on Huang's platform.) Huang dismisses such pessimism. For him, AI is a pure force for progress, and he has declared that it is spurring a new industrial revolution. He doesn't permit much disagreement on this topic, and his force of personality can be intimidating. ("Interacting with Jensen is like sticking your finger in the electrical socket," one of his executives said.) Huang's employees worship him—I believe they would follow him out of the window of a skyscraper if he saw a market opportunity there.

In May 2023, hundreds of industry leaders endorsed a statement that equated the risk of runaway AI with that of nuclear war. Huang didn't sign it. Some economists have observed that the Industrial Revolution led to a relative decline in the global population of horses and have wondered if AI might do the same to humans. "Horses have limited career options," Huang said. "For example, horses can't type." As he finished eating, I expressed my concerns that, someday soon, I would feed my notes from our conversation into an intelligence engine, then watch as it produced structured, superior prose. Huang didn't dismiss this possibility, but he assured me that I had a

few years before my John Henry moment. “It will come for the fiction writers first,” he said. Then he tipped the waitress a thousand dollars and stood up from his many plates of half-eaten food.

I found Huang to be an elusive subject, in some ways the most difficult I’ve ever reported on. He hates talking about himself and once responded to one of my questions by physically running away. Before this book was commissioned, I had written a magazine profile of Huang for *The New Yorker*. Huang told me he hadn’t read it, and had no intention of ever doing so. Informed that I was writing a biography of him, he responded, “I hope I die before it comes out.”

Still, Huang offered me access to a great number of people to report this book. I spoke with almost two hundred people, including his employees, his cofounders, his rivals, and several of his oldest friends. The beloved and even somewhat goofy family man who emerged from these interviews bore little resemblance to the unapologetically carnivorous executive who made Nvidia succeed, but it is these same attachments that spur Huang’s ambition: he spoke frankly with me of his insecurities, his fear of letting his employees down, his fear of bringing shame to the family name. Some executives speak of profit as “keeping score,” but not Huang; for him, the money is only temporary insurance against some future calamity. There was something a little touching about hearing a man worth a hundred billion dollars talk in this way.

But if Huang is motivated by anxiety, he is also motivated by fascination with the seductive power his technology has unlocked. He had not set out to be an AI pioneer, not even when he’d turned his attention to parallel computing, but once it arrived, Huang became determined to push his maximalist agenda for machine intelligence as far and as fast as it could possibly go. Even the most optimistic visionaries in the field urge *some* degree of caution; the supposed mission of OpenAI, for example, is to ward off catastrophe. Huang, almost alone, believes that AI can lead only to good, and it is this belief that motivates him to work twelve to fourteen hours a day, seven days a week, even after three decades as CEO.

Of course, Huang would work hard anyway. It is in his nature. If there is

a theme to his life, it is amplification; he has executed on the same simple precepts of diligence, courage, and mastery of fundamentals again and again and again, to greater and greater effect. I was surprised to learn how much of the man he later became was present in the immigrant child arriving unaccompanied by his parents in the United States in 1973 to an environment so unconducive to flourishing that it seems a miracle he survived it. To understand Huang fully, we begin not at Denny's restaurant, nor in the giant cathedrals of technology he later commissioned, but at this tiny rural school.

PART I

ONE

The Bridge

S ometime toward the end of 1973, ten-year-old Jensen Huang rose from bed in his dormitory and set off on the perilous journey to school. Huang, born in Taiwan and raised in Thailand, had recently arrived in rural Kentucky. His path led down a sloping hillside to a floodplain situated among forested hills, and across a rickety pedestrian footbridge, which was suspended by ropes and missing many planks, through which could be seen the frigid and rushing waters of the river below.

Huang, a bright and conscientious child, had skipped a year and was in the sixth grade. He was undersized even for his age and was often the smallest boy in class. He spoke imperfect English and was the only Asian student. His classmates at Oneida Elementary were the children of tobacco farmers and coal miners. Almost all of them were white, and many were impoverished. Some had no running water in their homes.

Huang had arrived with his older brother, Jeff, in the middle of the academic year, while their parents remained in Thailand. The two lived at the Oneida Baptist Institute, a nearby boarding school, but Jensen was too young to attend OBI and was sent to Oneida Elementary instead. On his first day, the principal had put his arm around the boy and told the class to welcome

the new student, who was from a different part of the world but was also extremely intelligent. The bullying started at once. “He was a perfect target,” said Ben Bays, Huang’s classmate.

Before Huang’s arrival, Bays had been the designated victim. Like Huang, Bays was small, and also like Huang, he was a good student. The bullies honored these qualities by sealing him inside the school’s lockers, sometimes for hours. Following Huang’s arrival, their focus shifted and acquired a racial element—many of Huang’s Kentucky classmates had family members who had fought in Vietnam. “The way you described Chinese people back then was ‘Chinks,’” Huang told me, fifty years later in a sterile conference room during our first conversation. His face showed no emotion. “We were called that every day.”

The bullies targeted Huang in and out of class, at every opportunity. They shoved him in the hallways and chased him on the playground. The bridge was their favorite location. Huang had to cross it alone, a hazardous proposition in the best of conditions. Sometimes, when Huang was in the middle, the bullies would emerge from hiding on either side of the river, then grab the ropes and begin to swing, attempting to dislodge him into the river below. “Somehow it never seemed to affect him,” Bays said. “Actually, it looked like he was having fun.”

Bays and Huang were fast friends. Despite the language barrier, Huang excelled academically, supplanting Bays as the best student. He was a talented artist and had perfect penmanship, although he only wrote in capital letters. He also taught Bays how to fight. Whatever the local boys knew about Chinese culture came from the films of Bruce Lee. Huang initially ran a bluff, telling his classmates that he was a martial-arts expert. This was quickly disproven in the schoolyard, but what Huang lacked in technique, he made up for in determination. When challenged, he would always fight back, sometimes wrestling even larger boys to the ground. In Bays’s recollection, at least, Huang was never pinned. (“That’s not how I remember it,” Huang said, laughing.) Nevertheless, Huang inspired Bays to fight back as well, and after a time the bullying subsided.

Bays's own family was desperately poor. He had five siblings, and his father, a preacher, was itinerantly employed. He lived at the mouth of a small, sheltered valley known as a "holler" in a dilapidated house with pit toilets in the back. Nothing in his experience had prepared him to meet anyone like Huang, and he could only wonder about the circumstances that had delivered this precocious, unsupervised child to the Appalachian backwoods of Clay County, Kentucky, one of the poorest counties in the nation.

HUANG, THE MIDDLE OF THREE BROTHERS, had been born in Taipei, Taiwan, in February 1963. His father was a chemical engineer, and his mother had taught primary school. Huang's parents were from the city of Tainan, on the southwestern coast. They spoke the Taiwanese dialect of Hokkien natively but had lived most of their lives under foreign rule. Taiwan had been a Japanese colony until 1945; in 1949 the Chinese general Chiang Kai-shek, having lost the mainland to Mao, fled to Taiwan with his army, and soon the island was placed under martial law.

When Huang was five, his father, Shing Tai, found work at a petroleum refinery in Thailand and relocated the family to Bangkok. Huang's memories of Southeast Asia are hazy. He recalled pouring lighter fluid on top of the pool at the family home and setting it ablaze. He recalled a pet monkey that belonged to a friend. In the late 1960s, Huang's father visited Manhattan on his way to train with the air-conditioning giant Carrier, which was transforming office life with precise climate control. He was astounded by New York City and returned determined to relocate his family to the United States.

In preparation for the move, Huang's mother, Chai Shiu, began to teach the boys English. She spoke no English herself, but this was only a minor hindrance. Drawing on her experiences as a schoolteacher, each night she had her sons memorize ten new words randomly selected from the dictionary, then drilled them on the words the following day. After a year or so of this, she enrolled the three boys in an international academy, and Huang

began formal schooling in English, while continuing to speak Taiwanese with his parents.

The family's plans to relocate accelerated in 1973, when Thailand was beset by political unrest. In October of that year, half a million protestors took to the streets of Bangkok, demanding the dissolution of the country's military dictatorship. The government responded with force, and Huang recalled seeing tanks rolling through the streets. Fearing further unrest, Jensen's father sent him and Jeff to Tacoma, Washington, to live with an uncle. Jensen's parents and his younger brother stayed behind. The uncle decided the boys belonged at a boarding school and searched for an institution willing to house two unsupervised Taiwanese children, ten and twelve years old, living thousands of miles from their parents. He selected the Oneida Baptist Institute in Kentucky, perhaps mistaking it for a prestigious college-preparatory school.

In fact, OBI was a juvenile-reform academy located in a town of three hundred people. The institute had been founded in 1899 by James Anderson Burns, a Baptist preacher looking to put an end to a lethal and long-running family feud. (Burns came up with the idea for the school after he was clubbed in the head with a rifle and left in a ditch to die.) By the 1970s, despite hosting a few international students, OBI was mostly known as a last-chance institution.

Upon arrival, the brothers found the grounds of the campus littered with cigarette butts. "Every student smoked, and I think I was the only boy at the school without a pocket knife," Huang said. Jensen, ten, was placed with a seventeen-year-old roommate; on their first night together, the older boy lifted his shirt to show Jensen the numerous places where he'd been stabbed in a recent fight. Huang's roommate was illiterate; in exchange for teaching him to read, Huang said, "he taught me how to bench press. I ended up doing one hundred push-ups every night before bed." Huang would stick to a daily push-up routine the rest of his life.

The Huang brothers anglicized their names to fit in. Jen-Chieh became "Jeff," and Jen-Hsun became "Jensen." (Their younger brother, Jen-Che, would later become "Jim.") Jeff and Jensen kept in touch with their parents

in Thailand by sending audiocassettes through the international post. With each cassette, they would first listen to their parents' message, then record over it with their own. Jensen recalled only occasional homesickness. To him, the whole thing played out like some grand adventure.

During the summer, students at OBI were expected to earn their keep through manual labor. Jeff was sent to a tobacco farm; Jensen was left behind to clean the dormitory toilets. "It wasn't a punishment," Huang said. "It was just my job." Another of Huang's chores was cutting brush on the school grounds with a scythe. Bays recalled passing him on the way to church. "We was driving by the field, and he was just running around in circles, wearing a baseball shirt, cutting those weeds," he said.

By the end of his year at Oneida Elementary, Huang had all but conquered the school. He was the best student in his class, for which he was given a silver dollar at a school assembly. He had stood up to the racists and the name-callers, including, in at least one instance, a teacher. After the final school bell rang, Huang would take charge, running ahead of his classmates into forests of hickory and oak. Chasing behind him, in a friendly way, were the "rowdy boys" of Clay County, the soft Appalachian mud under their feet.

HUANG SPENT THE SUMMER of 1974 living at the dormitory. He looked forward to watching the *ABC Sunday Night Movie* with the other holdovers each week. As fall approached, he ate fresh apples from the tree outside his window. He began seventh grade at OBI, while Bays continued on the public-school track. Huang, relying on his battle-scarred roommate for protection, had few problems adjusting. A year after that, Huang's father secured employment in the United States, and the brothers left Kentucky to reunite with their family in Oregon. Bays and Huang would not see each other again for forty-four years.

In the interim, Bays became a nursing-home administrator. Huang became one of the richest people in the world. Bays was unsurprised; he told me that even as a boy, he believed that Huang was destined for greatness.

The two were reunited in 2019, when Huang returned to OBI to donate a building to the school. “He’d never forgotten me,” Bays said.

For many children, the two years in Kentucky would have been traumatic. At ten years old, Huang had been sent eight thousand miles from his parents to a foreign land where he barely spoke the language. He was bullied, isolated, made to share a room with a knife fighter, and tasked with cleaning the latrine. What did it say about him that he thrived in this environment? “Back then, there wasn’t a counselor to talk to,” Huang said. “Back then, you just had to toughen up and move on.”

Time may have softened Huang’s memories of OBI. When he donated the building, in 2019, he talked fondly of the (now gone) footbridge he had crossed every day on the way to school; he neglected to mention that the other students tried to shake him off of it. When I asked him about doing chores at the school, he told me they taught him the value of hard work. “Of course, if you’d asked me at the time, I probably would have given you a different answer,” he said. In 2020, Huang was asked to deliver a remote commencement message to the students of OBI. In his speech, he said his time at the school was one of the best things ever to happen to him.

IN 1976 HUANG matriculated at Aloha High School in the suburbs of Portland, Oregon. He dressed in denim and velour and wore his hair in the shape of a motorcycle helmet. He continued to excel academically, and his English rapidly improved. Aloha was a welcoming place, and he soon formed a close-knit clique with a few of his fellow nerds. “There were three or four of us, and we were all in the same clubs: math club, science club, computer club,” Huang said. “You know, the popular kids! I didn’t have a girlfriend.”

The computer club was of particular interest. In 1977 the school purchased an Apple II, one of the first mass-produced personal computers. Huang was enthralled by the machine, using it to shoot Klingons on a grid of text in the primitive game *Super Star Trek* and to code his own version of *Snake* in Basic.

His other extracurricular interest was table tennis. At OBI, Huang had