

The Power Law Venture Capital and the Art of Disruption

**'Sweeping
and authoritative'**
FINANCIAL TIMES



**'A gripping
fly-on-the-wall story'**
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**Sebastian
Mallaby**



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The Power Law

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‘Venture capital has influenced the American economy for over half-a-century now, and finally we have a book of exceptional reporting, analysis and storytelling to bring that history to life. What makes Sebastian Mallaby’s *The Power Law* a classic is how deeply it takes us into VC’s defining successes and failures – which are much harder to get anyone to talk frankly about. I’m not sure this is the book of VCs’ dreams, but it’s what the rest of us have been waiting for’ Charles Duhigg

‘*The Power Law* is essential and entertaining reading for anyone who aspires to invest fruitfully’ Martin Vander Weyer, *Literary Review*

‘Sebastian Mallaby is the master of unspooling human drama from financial systems. Here, the venture capitalists are the protagonists. Whether it’s financiers scrambling to court a pajama-wearing young Mark Zuckerberg or venture capitalist Bill Gurley’s efforts to oust Uber founder Travis Kalanick from the company, the stories are almost Shakespearean in their depictions of ambition, jealousy and ego’ *NPR Books*

‘*The Power Law* is a remarkable book. It takes us inside venture capital from its origins with a handful of restless risk-takers to today’s powerhouses that reshape our world. Both a formidable researcher – he has gotten key players to talk with amazing candor – and a gifted storyteller, Mallaby captures the drama and clashes of an extraordinary gallery of people who – with insight and instincts, appetite for risk and tolerance for failure, unforgiving ego and relentless ambition – make big bets in the face of huge uncertainty. It is destined to be of wide impact and lasting influence’

Daniel Yergin, Pulitzer Prize-winning author of *The Prize* and *The New Map*

‘In his well-researched book, leavened by lively portraits of leading figures, Mr Mallaby explores the history of the VC industry and the reasons for its vitality’

John Thornhill, *Economist*

‘Mallaby, an astute chronicler of modern capitalism, writes with humour and historical sweep . . . His account is immensely enriched by interviews with most if not all of the rainmakers in venture capital’ Lionel Barber, *Prospect*

‘Sebastian Mallaby sets off on the world of venture capital and the strange bunch of financiers behind some of the most successful companies. It’s a tale of triumphs but also major failures, hubris and jaw-dropping eccentricity’ *Financial Times*,
‘Books to look out for in 2022’

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‘A fascinating journey through the tightly networked world of the venture capitalists who make Silicon Valley tick, from the scrappy dealmakers of the 1960s to the high-flying global investors of today. Filled with eye-opening case studies and vivid personalities, frank in its analysis of the industry’s greatest strengths and most dangerous blind spots, *The Power Law* is essential reading for understanding our tech-driven economy and where it might go next’

Professor Margaret O’Mara, University of Washington

‘An absorbing new history of startup investing’ Liam Proud, Reuters

‘As we face urgent man-made existential challenges from climate change to economic inequality, Sebastian Mallaby shows that the capitalists of Silicon Valley are shaping the future in ways few understand. In *The Power Law* he takes us inside their rarified world, showing the possibilities and shortcomings of their big egos and big bets. Mallaby’s deep access enables us to get a rare and unsettling look inside a subculture of unparalleled influence’ Jane Mayer, Chief Washington Correspondent, *The New Yorker*

‘If you can read only one book on venture capital, this is the one. *The Power Law* narrates the evolution of venture capital from its origins in Silicon Valley to its emergence in China by following the ambitious and often idiosyncratic investors who finance risky new ventures while recognizing that success is rare, but transformative. The book is a fascinating read’ Professor AnnaLee Saxenian

‘Mallaby brings his trademark mixture of exhaustive research and clear analysis to his most interesting subject so far’ Adrian Wooldridge, Bloomberg

‘This book is a powerful combination of careful research and great storytelling. Sebastian Mallaby portrays many of the world’s most successful venture capitalists but also shows how the industry has evolved and why it has become a major source of innovation in our economies. Highly informative and fun to read’ Baroness Minouche Shafik, Director of the London School of Economics and Political Science

‘Heavyweight and richly detailed, *The Power Law* is both a careering ride through the chaos of startup culture and a sober assessment of how the relationship between founders and their financiers has evolved’ Mike Jakeman, Strategy+Business

‘A gripping fly-on-the-wall story of the rise of this unique and important industry based on extensive interviews with some of the most successful venture capitalists . . . Mr. Mallaby writes a fast-paced narrative. He also has a journalist’s eye for revealing details’ Daniel Rasmussen, *Wall Street Journal*

ABOUT THE AUTHOR

Sebastian Mallaby is the author of several books, including the bestselling *More Money Than God* and *The Man Who Knew: The Life and Times of Alan Greenspan*, the winner of the 2016 Financial Times/McKinsey Business Book of the Year Award. A former *Financial Times* contributing editor and two-time Pulitzer Prize finalist, Mallaby is the Paul A. Volcker Senior Fellow for International Economics at the Council on Foreign Relations. He lives with his family in London.

SEBASTIAN MALLABY

The Power Law

Venture Capital and the Art of Disruption



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Most people think improbable ideas are unimportant. The only thing that's important is something that's improbable.

—VINOD KHOSLA

Silicon Valley is gripped by the cult of the individual. But those individuals represent the triumph of the network.

—MATT CLIFFORD

The great challenge at venture partnerships is that the principals must refrain from killing each other.

—MICHAEL MORITZ

Spend as little as you can, because every dollar of the investor's money you get will be taken out of your ass.

—PAUL GRAHAM

John, venture capital, that's not a real job. It's like being a real estate agent.

—INTEL'S ANDY GROVE,
ADDRESSING JOHN DOERR

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Introduction

UNREASONABLE PEOPLE



Not far from the headquarters of Silicon Valley's venture-capital industry, which is clustered along Palo Alto's Sand Hill Road, Patrick Brown strode out into his yard on the Stanford University campus. Atop a little hill behind his house, Brown got down on his hands and knees, a shaggy fifty-four-year-old professor in a T-shirt, peering at the vegetation through rounded glasses. Proceeding delicately, like a detective collecting samples that might yield a vital clue, Brown began digging out the roots of some wild clover plants.¹ It might impress the ordinary gardener to know that those roots would soon yield \$3 million.

Brown was one of the world's leading geneticists. In 1995, his lab had published pioneering work on DNA microarrays, which help distinguish between normal and cancerous tissue. He had been elected to the National Academy of Sciences and the National Academy of Medicine. He was the recipient of a Howard Hughes award, which guaranteed no-strings-attached research funding. But his objective on that hilltop had nothing to do with genetics. The year was 2010, and Brown was using a sabbatical to plot the downfall of the meat-industrial complex.

A friend had set him on this path by means of a stray comment. Possessed of a keen environmental conscience, Brown had been worrying that animal husbandry occupied one-third of the world's land, causing significant

greenhouse gas emissions, water degradation, and a loss of biodiversity. The planet was clearly going to need a better kind of food for the growing population of the twenty-first century. Then Brown's friend mentioned that if you could make a vegetarian burger that tasted better than a beef burger, the free market would magically take care of the problem. Adventurous restaurants would serve it, and then McDonald's would serve it, and pretty soon you could eliminate meat from the food system.²

The more Brown pondered this, the more he grew agitated. *If you could make a yummier vegetarian burger? Of course you could make a yummier vegetarian burger!* Why was nobody treating this as a solvable problem? "People just figured we have this insanely destructive system and it's just never going to go away," Brown fumed. "They thought, 'Bummer, but there you are.'"

In most places and at most points in human history, Brown's epiphany would have been inconsequential. But, as Brown himself reflected later, he had "the very good fortune of living in the epicenter of venture capital."³ Because Stanford sat at the heart of Silicon Valley, its golf course laid out along the edge of Sand Hill Road, Brown was digging up his yard with a clear purpose. Those clover roots contained heme, an iron-carrying molecule found in hemoglobin, which gives blood its red color. If Brown could show how this plant molecule could mimic the properties of bloody meat, there was a good chance that a venture capitalist would fund a plantburger company.

Brown dissected the clover roots with a razor blade and blended them up to extract and culture the juices. Pretty soon, he had what he needed to fashion a vegetarian burger that smelled and sizzled and dripped and squished like 100 percent Grade A beef. "I got to a point where, though I didn't have much data, I'd enough to go and talk to some venture-capital companies—of which there are a ridiculous number in Silicon Valley—and hit them for some money."

A scientist friend mentioned that Vinod Khosla, a venture capitalist who ran the eponymous Khosla Ventures, was interested in environmentally friendly, "cleantech" projects. What he didn't mention was that Khosla was also a preacher of the Valley's most bracing creed: the belief that most

social problems can be ameliorated by technological solutions, if only inventors can be goaded to be sufficiently ambitious. "All progress depends upon the unreasonable man," the "creatively maladjusted," Khosla declared, borrowing eclectically from George Bernard Shaw and Martin Luther King Jr.⁴ "Most people think improbable ideas are unimportant," he loved to add, "but the only thing that's important is something that's improbable." If you were going to pitch Khosla an invention, it had better not fall into the incremental category he called "one sheet of toilet paper, not two."⁵ Khosla wanted radical dreams, the bolder and more improbable the better.

Brown rode a bicycle to Khosla's office, a sleek designer building of glass and wood. He had prepared a slide deck that he admitted "in retrospect was ridiculous."⁶ The first slide laid out his goal: rendering the entire meat industry redundant. Those rounded glasses—the John Lennon, Steve Jobs, visionary look—seemed altogether appropriate.

Khosla has large eyes and chiseled features and thick, cropped gray hair. He fixed his visitor with an impish stare.

"That's impossible!" he said, delightedly.

Silently, Khosla was thinking to himself, "If there is a one-in-a-hundred chance that this works, this is a shot worth taking."⁷

Brown explained how he proposed to out-beef the beef industry. He would break the challenge down into its component parts: how to replicate the smell, the consistency, the taste, and the appearance of a real beef burger. Once you analyzed each question separately, an apparently impossible ambition became a set of soluble problems. For example, the clover-root juices would drip like blood onto hot coals; they would turn from red to brown as they sizzled on a barbecue. Dr. Frankenstein had met Ray Kroc. Nobody would eat ground cow flesh again.

Khosla ran through a test that he applied to supplicants. The onus was not on Brown to prove that his idea would definitely work. Rather, the question was whether Khosla could come up with a reason why it obviously could not work. The more Khosla listened to his visitor, the less he could rule out that he was onto something.

Next, Khosla sized up Brown as a person. He was fond of proclaiming a Yoda approach to investing: empower people who feel the force and let

them work their magic.⁸ Brown was evidently brilliant, as his credentials as a geneticist demonstrated. He was gate-crashing a new field, which meant he was unburdened by preconceptions about what conventional wisdom deemed possible. Moreover, Brown was clearly as determined as he was bright: he was ready to leave his academic perch—the prestige of a Stanford professorship, the blank check from the Howard Hughes foundation. All in all, Brown fitted Khosla's archetype of the ideal entrepreneur. He had the dazzling intellect, the willingness to put his own neck on the line, the glorious hubris and naïveté.⁹

There was one last test that Khosla cared about. If Brown managed to produce a yummy plantburger, would he generate profits that would be commensurately succulent? Khosla routinely put capital behind moon shots with a nine-in-ten chance of failure. But the low probability of a moon landing had to be balanced by the prospect of a large payout: if the company thrived, Khosla wanted to reap more than ten times his investment—preferably, much more than that. There was no point gambling for success unless the success was worth having.

Brown had gotten to his final slide, where he stuck all the mundane market data that failed to interest a scientist. He noted matter-of-factly that “it’s a trillion-and-a-half-dollar global market being served by prehistoric technology.”¹⁰

Khosla latched on. If plant patties could reproduce the properties of beef—the taste, the consistency, the browning, and the bleeding as you flipped the burger on the grill—the potential was cosmic.

Brown looked Khosla in the eyes. “I promise to make you even more insanely rich than you already are, if you give me this money,” he told him.¹¹

At that, Khosla bet \$3 million on Impossible Foods, as Brown fittingly named his company.¹² Recounting this story in 2018, Khosla happily noted Impossible's progress since 2010: the company would soon have more than \$100 million in annual revenues, and the Impossible Whopper would be served at Burger King. But the main message that Khosla emphasized transcended dollars and even the food system. “You can imagine, if Pat fails, the hubris of saying he could eliminate animal husbandry; he’ll be mocked for that,” Khosla observed. But, he continued, the mockery would be misplaced.

Which is better: to try and fail, or to fail to try?¹³ Reasonable people—well-adjusted people, people without hubris or naïveté—routinely fail in life’s important missions by not even attempting them; the way Khosla saw things, Brown should be hailed as a hero, whatever happened to his company. Truly consequential changes are bound to seem outrageous when they are first imagined by messianic inventors. But there is no glory in projects that will probably succeed, for these by definition won’t transform the human predicament.

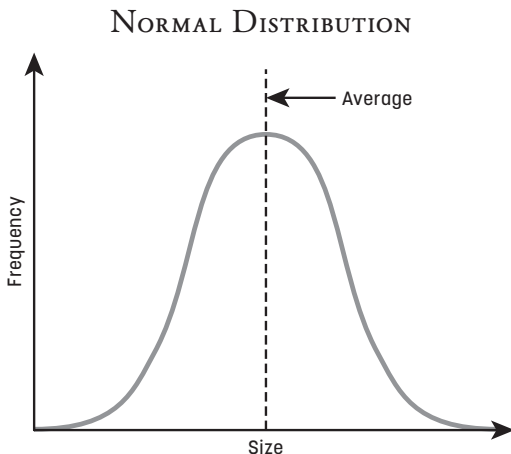


Khosla was himself an unreasonable man, creatively maladjusted. As a boy in his native India, he rebelled against his parents’ religion, declined to follow his father into the army, and refused an arranged marriage. On his wedding day, he set his watch alarm, declaring that the religious portion of the ceremony had to be done inside thirty minutes. As soon as he earned an engineering degree, he left for the United States, where he studied more engineering at Carnegie Mellon University. After that, he set his sights on Stanford Business School; learning that he needed two years’ work experience to qualify for admission, he did two jobs at once and declared after one year that he had met the requirement. In 1982, after completing his business degree, Khosla teamed up with three computer scientists to found Sun Microsystems, whose powerful workstations stamped their mark on the evolution of computing. Cocky and obnoxious, Khosla was soon fired. He became a venture capitalist.

Joining the storied venture partnership of Kleiner Perkins, Khosla discovered his true métier. His unreasonable impatience—his determination that anything might be possible and everything should work his way—made him one part tyrant, two parts visionary. In later life, he bought a village with forty-seven cottages on the California coast and fought a series of losing court cases to block public access to the beach, even though he never found time to spend the night there—not once, ever. But he channeled his contempt for conventional thinking into a series of dazzling investments, frequently losing his money and sometimes generating bonanzas. By the time he met Patrick Brown, everything about Khosla—his risk appetite, his

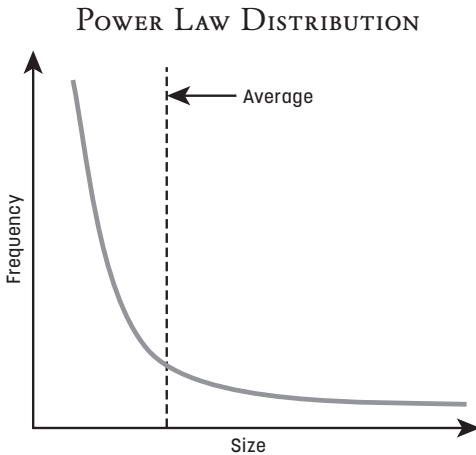
love of hubris, his quest for improbable ideas—made him the living embodiment of the power law, the most pervasive rule in venture capital.¹⁴

Many phenomena in life are normally distributed: nearly all the observations in a data set cluster around the average. For example, the average height of an American man is five feet ten inches, and two-thirds of American men are within three inches of that average. When you plot height on an x axis and the probability that a man will have that height on a y axis, what you see is a bell curve: the greatest probability is that a man's height will be the average height, and the probabilities decline as you move away from that midpoint. The chances of meeting a man whose height is ten inches from the average—that is, less than five feet or more than six feet eight—are exceedingly small. Further away from the mean, the thin tails of the curve taper toward zero.



Not all phenomena follow this pattern, however. A chart showing the wealth of Americans rather than their height looks very different. People who are richer than the median are sometimes vastly richer, so the far right side of the wealth chart features an extended fat tail between the curve and the x axis. Because the very rich are numerous enough and wealthy enough to impact the average for the whole nation, the average is pulled to the right: unlike in a normal distribution, the mean is higher than the median. In a

normal distribution, moreover, you can remove the biggest outlier from a sample without affecting the average: if a seven-foot NBA star walks out of a cinema, the average height of the remaining ninety-nine movie-watching men falls from five feet 10 inches to five feet 9.9 inches. In a non-normal, skewed distribution, in contrast, the outliers can have a dramatic effect. If Jeff Bezos walks out of the cinema, the average wealth of those who stay behind will plummet.



This sort of skewed distribution is sometimes referred to as the 80/20 rule: the idea that 80 percent of the wealth is held by 20 percent of the people, that 80 percent of the people live in 20 percent of the cities, or that 20 percent of all scientific papers earn 80 percent of the citations. In reality, there is nothing magical about the numbers 80 or 20: it could be that just 10 percent of the people hold 80 percent of the wealth, or perhaps 90 percent of it. But whatever the precise numbers, all these distributions are examples of the power law, so called because the winners advance at an accelerating, exponential rate, so that they explode upward far more rapidly than in a linear progression. Once Jeff Bezos achieves great riches, his opportunities for further enrichment multiply: the more a scientific paper is cited, the better known it is and the more likely it is to attract further citations. Anytime you have outliers whose success multiplies success, you switch from the

domain of the normal distribution to the land ruled by the power law—from a world in which things vary slightly to one of extreme contrasts. And once you cross that perilous frontier, you better begin to think differently.

The rethinking required is especially pronounced in finance. Investors who focus on currencies, bonds, and stock markets generally assume a normal distribution of price changes: values jiggle up and down, but extreme moves are unusual. Of course, extreme moves are possible, as financial crashes show. But between 1985 and 2015, the S&P 500 stock index budged less than 3 percent from its starting point on 7,663 out of 7,817 days; in other words, for fully 98 percent of the time, the market is remarkably stable.¹⁵ Because the distribution of price changes in these widely traded markets approaches normal, speculators concentrate on harvesting profits from the modest fluctuations that occur on most days.¹⁶ Like the seven-foot NBA star in the cinema, unexpectedly large price jumps are rare enough and moderate enough that they do not affect the average.

Now consider the returns in venture capital. Horsley Bridge is an investment company with stakes in venture funds that backed 7,000 startups between 1985 and 2014. A small subset of these deals, accounting for just 5 percent of the total capital deployed, generated fully 60 percent of all the Horsley Bridge returns during this period.¹⁷ (To put that in context, in 2018 the top-performing 5 percent of subindustries in the S&P 500 accounted for only 9 percent of the index's total performance.)¹⁸ Other venture investors report even more skewed returns: Y Combinator, which backs fledgling tech startups, calculated in 2012 that three-quarters of its gains came from just 2 of the 280 outfits it had bet on.¹⁹ "The biggest secret in venture capital is that the best investment in a successful fund equals or outperforms the entire rest of the fund," the venture capitalist Peter Thiel has written.²⁰ "Venture capital is not even a home-run business," Bill Gurley of Benchmark Capital once remarked. "It's a grand-slam business."²¹

What this means is that venture capitalists *need* to be ambitious. The celebrated hedge-fund stock picker Julian Robertson used to say that he looked for shares that might plausibly double in three years, an outcome he would view as "fabulous."²² But if venture capitalists embarked on the same quest, they would almost guarantee failure, because the power law generates rel-

atively few startups that merely double in value. Most fail completely, in which case the value of their equity rounds to zero—an unthinkable catastrophe for a stock market investor. But each year brings a handful of outliers that hit the proverbial grand slam, and the only thing that matters in venture is to own a piece of them.²³

When today's venture capitalists back flying cars or space tourism or artificial intelligence systems that write film scripts, they are following this power-law logic. Their job is to look over the horizon, to reach for high-risk, huge-reward possibilities that most people believe to be unreachable. "We could cure cancer, dementia, and all the diseases of age and metabolic decay," Peter Thiel enthuses, dripping with disdain for incrementalism. "We can invent faster ways to travel from place to place over the surface of the planet; we can even learn how to escape it entirely and settle new frontiers."²⁴ Of course, investing in what is categorically impossible is a waste of resources. But the more common error, the more human one, is to invest too timidly: to back obvious ideas that others can copy and from which, consequently, it will be hard to extract profits.



Which brings us back to Vinod Khosla. In the two decades he spent at Kleiner Perkins before starting his own venture firm, he learned not to worry about the bets that went to zero. All he could lose was one times his money.²⁵ What Khosla cared about were the bets that did pay off, and in the mid-1990s he fastened on an especially audacious and contrarian notion: that, with the coming of the internet, consumers would not be satisfied with a mere doubling or tripling in the capacity of traditional phone lines. Rather, they would clamor for a step change in bandwidth, involving routers that handled data flows a thousand times larger. While the telecom establishment snickered at this sci-fi babble, Khosla set out to kick-start the companies that would make the step change possible.

The startups that Khosla backed are largely forgotten names: Juniper, Siara, Cerent. But they illustrate what venture capitalists do best and how they generate both wealth and progress. While incumbent telecom companies planned incremental upgrades, Khosla wagered on the idea of a big leap,

even though he had no precise vision of what people would do with all the extra bandwidth. Nobody yet imagined social media or YouTube; digital photography was little more than a concept. But Khosla had witnessed what had happened with other breakout technologies. After the invention of the semiconductor, or after the invention of the Ethernet cables that hooked personal computers together, usage picked up gradually and then exploded upward in an exponential curve; this was the innovation power law that underlay the financial one observed in venture-capital portfolios. Khosla was willing to bet that the internet would follow a similar pattern: steady adoption in the first half of the 1990s, a breathtaking acceleration as the power-law curve went almost vertical.

The result was a set of Khosla companies that did more than just succeed. By inventing a new generation of bandwidth-boosting hardware and software, they captured huge chunks of an exploding market. Khosla's first jackpot, Juniper Networks, built internet routers: he invested \$5 million and reaped an extraordinary \$7 billion for Kleiner's fund—multiplying his initial stake by an astonishing 1,400 and generating, at the time, the greatest venture-capital bonanza ever.²⁶ Khosla put another few million into a network equipment company, Siara Systems, and reaped \$1.5 billion.²⁷ In the case of Cerent, he invited the dominant router giant, Cisco, to co-invest with him: among other things, Cerent would facilitate the handling of voice data. When Cisco refused, calling Cerent too much of a long shot, Khosla went ahead alone, investing \$8 million, recruiting the first engineers, serving as chief executive.²⁸ And then he exacted sweet revenge. As soon as Cerent's technology proved workable, Cisco made two offers for the firm: \$300 million in December 1998; \$700 million the following April. But Khosla, believing in the power law, knew that winners often carry on winning: he took the risk of turning Cisco down and watched Cerent's revenues take off exponentially. Four months later, in August 1999, Khosla was informed that Cisco had prepared another bid, this time for \$7 billion. The news reached him when he was vacationing at Machu Picchu, twenty-five hundred meters up in the Peruvian Andes. Khosla boarded a helicopter, then a plane, and shook hands on the deal over breakfast in San Jose the next morning.

Khosla was by some calculations the top venture capitalist in the Val-

ley, and he had no objection to vast riches.²⁹ He conducted a worldwide search for an architect for his home near Stanford and lavished money on the vineyard surrounding it.³⁰ But what really animated Khosla was the contrarianism he had exhibited in youth: Why did his parents go to the temple, why couldn't he choose where to work and whom to love, why couldn't everything be different? And, just as Patrick Brown wanted nothing less than to eliminate the entire meat industry, so Khosla made extraordinary claims for his work. Venture capital was not merely a business; it was a mindset, a philosophy, a theory of progress. Seven hundred million people enjoyed the lifestyle that seven billion wanted, he liked to say. Bold innovators goaded by even bolder venture capitalists offered the best shot at satisfying human aspirations.³¹



Venture capitalists often fail to live up to this hype, as we will see shortly. But you don't have to swallow all of Khosla's riff to agree that it's important. The venture-capital approach of high-risk, high-reward experiments does represent a distinctive way of coming at the world, one that people outside Silicon Valley might learn from. To illustrate, a huge amount of energy in government, financial houses, and corporations is spent on forecasting the future, mostly by running statistical analyses on patterns from the past; without a clear forecast, committing resources would seem irresponsible. But the way venture capitalists see things, the disciplined calibrations of conventional social scientists can be a blindfold, not a telescope. Extrapolations from past data anticipate the future only when there is not much to anticipate; if tomorrow will be a mere extension of today, why bother with forecasting? The revolutions that will matter—the big disruptions that create wealth for inventors and anxiety for workers, or that scramble the geopolitical balance and alter human relations—cannot be predicted based on extrapolations of past data, precisely because such revolutions are so thoroughly disruptive. Rather, they will emerge as a result of forces that are too complex to forecast—from the primordial soup of tinkerers and hackers and hubristic dreamers—and all you can know is that the world in ten years will be excitingly different. Mature, comfortable societies, dominated by people

who analyze every probability and manage every risk, should come to terms with a tomorrow that cannot be foreseen. The future can be *discovered* by means of iterative, venture-backed experiments.³² It cannot be *predicted*.

What type of experiment is likely to be fruitful? Here, too, people outside innovation hubs can learn something from Khosla. Most of us might assume that experts in each field will advance the frontiers of knowledge. But, as we have seen from Khosla's bet on Patrick Brown, that is much too sensible. Experts may be the most likely source of incremental advances, but radical rethinks tend to come from outsiders. "If I'm building a health-care company, I don't want a health-care CEO," Khosla says. "If I'm building a manufacturing company, I don't want a manufacturing CEO. I want somebody really smart to rethink the assumptions from the ground up." After all, he continues, retail innovation did not come from Walmart; it came from Amazon. Media innovation did not come from *Time* magazine or CBS; it came from YouTube and Twitter and Facebook. Space innovation did not come from Boeing and Lockheed; it came from Elon Musk's SpaceX. Next-generation cars did not come from GM and Volkswagen; they came from another Musk company, Tesla. "I can't think of a single, major innovation coming from experts in the last thirty, forty years," Khosla exclaims. "Think about it, isn't that stunning?"

If the future is best discovered by means of maverick moon shots, another insight follows. Thanks to the work of the Nobel laureate Ronald Coase, the economics profession has long recognized two great institutions of modern capitalism: markets, which coordinate activity via price signals and arm's-length contracts; and corporations, which do so by assembling large teams led by top-down managers. But economists have focused less on the middle ground that Khosla inhabits: the venture-capital networks that lie somewhere between markets and corporations. And yet networks of venture capitalists deserve closer attention. By means of Khosla-style maverick experiments, they have delivered more progress in applied science than any kind of rival: more than centralized corporate R&D units, more than isolated individuals tinkering in garages, and more than government attempts to pick technological winners. Because VC-backed startups have proved so fertile, they have changed how people work, socialize, shop,

and entertain themselves; how they access information, manipulate it, and arrive at quiet epiphanies—how they think.

Venture capitalists have achieved this disproportionate impact because they combine the strengths of the corporation with the strengths of the market. They channel capital, talented employees, and large customers to promising startups; in this way, they replicate the team formation, resources, and strategic vision to be found in corporations.³³ But at the same time, because their network is fluid and amorphous, they have the flexibility of the market. The rainmakers of Sand Hill Road can get behind a startup with a fresh business idea or a scientific breakthrough; they can shape it, expand it, murmur its name into the right ears. But when a round of venture funding is exhausted, it is time to put the startup to a market test. If there are no enthusiastic buyers for the next tranche of the startup's equity, the price signal will do its work: the venture capitalists will close it down, avoiding the waste of resources that comes from backing speculative R&D beyond the point at which success appears impossible. Because of this periodic submission to the discipline of price signals, venture capitalists are good at recognizing failure and good at doubling down on early indicators of success. Their blend of corporate strategizing and respect for the market represents a third great institution of modern capitalism, to be added to the two that Ronald Coase emphasized.

The underappreciated significance of venture-capital networks has become especially glaring in the past few years as the industry has expanded in three dimensions. First, it has spread beyond its historical stronghold in Silicon Valley, building thriving outposts in Asia, Israel, and Europe as well as in major U.S. cities.³⁴ Second, the industry has spread sectorially, colonizing new industries as venture-backed technologies reach ever more widely, touching everything from cars to the hotel business. Third, venture capital is spreading beyond the startup phase of a company's existence as Silicon Valley has sprouted multibillion-dollar corporations that have delayed raising capital from public shareholders. Back in 1997, Amazon went public three years after launch, when it was worth just \$438 million. As of this writing in 2020, more than 480 "unicorns" boast a valuation of more than \$1 billion yet seem in little hurry to go public.³⁵ Many of the world's most

dynamic and disruptive companies are owned—and therefore governed or misgoverned—by venture capitalists and other private technology investors.

This book has two broad purposes. The first is to explain the venture-capital mindset. There are dozens of histories of Silicon Valley focusing on the inventors and entrepreneurs; there have been fewer efforts to get under the skin of the people who finance and often shape their companies. Through careful reconstruction of celebrated transactions—from Apple and Cisco to WhatsApp and Uber—the story in these pages shows what happens when venture capitalists and startups connect, and why venture is so different from other types of finance. Most financiers allocate scarce capital based on quantitative analysis. Venture capitalists meet people, charm people, and seldom bother with spreadsheets.³⁶ Most financiers value companies by projecting their cash flows. Venture capitalists frequently back startups before they have cash flows to analyze. Other financiers trade millions of dollars of paper assets in the blink of an eye. Venture capitalists take relatively small stakes in real companies and hold them. Most fundamentally, other financiers extrapolate trends from the past, disregarding the risk of extreme “tail” events. Venture capitalists look for radical departures from the past. Tail events are all they care about.

This book’s second purpose is to evaluate venture capital’s social impact. VCs themselves frequently assert that “they are making the world a better place.” This is certainly true sometimes: Impossible Foods is an example. On the other hand, video games and social media promote screen addiction and fake news, even as they entertain, inform, and allow Grandma to admire pictures of her distant grandchildren. The gap between VC rhetoric and VC practice is easily mocked. In April 2020, in the throes of the coronavirus pandemic, the venture capitalist Marc Andreessen proclaimed that it was “time to build.” “Where are the high-speed trains, the soaring monorails, the hyperloops, and yes, the flying cars?” he demanded.³⁷ The following month Andreessen’s partnership invested in Clubhouse, an invitation-only social-media app. Meanwhile, the venture industry’s expansive pronouncements stand in contrast to the narrowness of its monoculture. Women are badly underrepresented: as of 2020, they account for 16 percent of investing partners. Racial diversity is even more limited: only about 3 percent of

partners at venture-capital firms are Black.³⁸ Precisely because venture capital does so much to shape society, it must become more diverse, both in terms of the investors it hires and the startups it finances. Finally and most tellingly—since this lies at the heart of what the industry presents as its core function—venture capitalists must reckon with their record as the stewards of tech companies. VCs have a proud tradition of building fledgling startups. They are less successful at governing multibillion-dollar unicorns such as the office-rental company, WeWork, or the ride-hailing giant, Uber.

In short, venture capitalists are far from perfect. Yet even as the public mood has turned against the tech-industrial complex, the positive case for venture capital has grown more compelling. Until relatively recently, economists explained why some geographies grow wealthier than others by examining country-level differences: successful nations benefit from sound rule of law, stable prices, educated people, and so on. Lately, however, the more pressing question is why some regions within countries leave other regions so far behind as innovation hubs and generators of prosperity. It has long been obvious that one area can outperform others, as Silicon Valley has done; but the rule of law and price stability cannot explain why the Valley is more innovative than Montana or Michigan.³⁹ To understand the Valley's secret, we need to update Ronald Coase's framework: we must study venture-capital networks as deeply as we study markets and corporations. In a world of intensifying geoeconomic competition, the countries with the most creative innovation hubs are likely to be the most prosperous and ultimately the most powerful. In a world of intensifying income inequality, the countries that can foster greater regional diversity in the locations of those hubs will be happier and more stable. Even as they seek to regulate Big Tech, governments must do everything possible to foster technology startups—a policy challenge to which we will return presently.

For now, it is enough to say one thing about this challenge. Whatever the failings of venture capitalists, they are an essential ingredient of dynamic startup clusters. On any given day in Silicon Valley, hundreds of VCs are chasing youths in T-shirts: they are schmoozing people, connecting people, vouching for one startup as it seeks to hire a wary programmer,

assuring a skeptical customer that another startup's product is reliable. It is the contention of this book that this frenzy of activity explains much of the variation in creativity across regions: by forging connections among entrepreneurs, ideas, customers, and capital, venture capitalists transform a mere agglomeration of smart people into an inventive network. The traditional accounts of economic growth need to make space for this phenomenon, which also explains China's emergence as a top-flight technology power. Indeed, if the United States risks falling behind China in today's technology race, this is precisely because Valley-inspired venture capital has kick-started China's digital economy. Moreover, the Chinese venture industry has an advantage over its U.S. rival. It is more open to women.

But that is to jump to the end of our story. To understand venture capitalists—to grasp how they think and why they matter—we must begin at the beginning. For, without this strange tribe of financiers, the orchards of the Santa Clara valley might never have been linked to silicon, and a staggering amount of wealth might never have been created.

Chapter One

ARTHUR ROCK AND LIBERATION CAPITAL



Success has many fathers, and Silicon Valley is no exception. Searching for the origins of this miraculously innovative region, some fasten on 1951, when Fred Terman, the engineering dean at Stanford, created the university's famous research park. Others begin the story five years later, when William Shockley, the father of the semiconductor, abandoned the East Coast to launch a company on Terman's campus, bringing silicon to the Valley for the first time. But the most compelling origin story—the one that aims the spotlight squarely at the force that makes the Valley so distinctive—begins in the summer of 1957, when eight of Shockley's young PhD researchers rose up in revolt and went out on their own. Shockley's seniority, his fame, and even his Nobel Prize did nothing to deter the rebels; the "Traitorous Eight" were fed up with Shockley's heavy-handed leadership and resolved to find a different home. It was that act of defection that created the magic culture of the Valley, shattering traditional assumptions about hierarchy and authority and working loyally for decades until you retired with a gold watch.

The defection of 1957 was made possible by a new form of finance, originally dubbed adventure capital. The idea was to back technologists who were too dicey and penurious to get a conventional bank loan but who promised the chance of a resounding payoff to investors with a taste for

audacious invention. The funding of the Traitorous Eight and their company, Fairchild Semiconductor, was arguably the first such adventure to take place on the West Coast, and it changed the history of the region. After Fairchild got its \$1.4 million in financing, it became evident that any team in the Valley possessed of grand ideas and stiff ambition could spin itself out, start itself up, and generally invent the organizational form that best suited its fancy. Engineers, inventors, hustlers, and artistic dreamers could meet, combine, separate, compete, and simultaneously collaborate, all courtesy of this new finance. Adventure capital could sometimes be defection capital, or it could be team-building capital, or almost just experimental capital.¹ But whichever way you looked at it, talent had been liberated. A revolution was afoot.

The invention of this new liberation capital explained more than most people still realize. The rival theories of what established the Valley's preeminence—that it was home to Stanford University, that it benefited from military contracts, that it had a certain West Coast, countercultural irreverence—have never been especially persuasive. After all, Stanford was no more distinguished than the Massachusetts Institute of Technology, which in turn was located a short drive from Harvard, creating a research cluster more powerful than anything that Silicon Valley could muster in its early days.² Similarly, it was true that Stanford benefited from military research dollars; that film from U-2 spy planes was processed at the nearby NASA Ames Research Center; and that the Lockheed Missiles and Space Division built submarine-launched weapons at its campus in the Valley.³ But the famous military-industrial complex of the 1950s was primarily an East Coast alliance between the Pentagon and Cambridge, Massachusetts. The personification of that axis, Vannevar Bush, was dean of the MIT School of Engineering, founder of the Cambridge-based defense contractor Raytheon, and Franklin Roosevelt's top science administrator during World War II. Millions of dollars in federal funding flowed to the Pentagon-backed research centers around Boston, and by the end of the 1960s more than a hundred tech startups had spun out of these labs.⁴ If military ties had determined the location of applied science, in other words, Cambridge should have been the center of the universe.⁵

If neither Stanford nor defense contracts explain Silicon Valley's rise to preeminence, what of the theory that the region was distinguished by that West Coast counterculture, which freed people to imagine technologies as yet unborn? Doug Engelbart of the Augmented Human Intellect Research Center in Palo Alto, who conceived the early versions of the computer mouse and the graphical user interface, was involved in LSD experiments and hijacked Pentagon funding to explore the personal-growth training method known as est. The young Steve Jobs was similarly enthralled by eastern mysticism; he went about barefoot, rinsed his feet in the company toilet, and maintained that his fruitarian diet rendered regular washing obsolete. "The people who invented the twenty-first century were pot-smoking, sandal-wearing hippies from the West Coast like Steve, because they saw differently," observed Bono, the rock musician and friend of Steve Jobs's; and some version of this story is widely accepted in the Valley, whose denizens like to think of themselves as cool as well as rich and powerful. The hippies' anticorporate vibe drove them to share ideas rather than run to the nearest patent lawyer, according to this narrative. Their egalitarianism ensured that they were open to any unkempt upstart who might see something, sense something—something with the potential to change everything.

You can still see traces of this counterculture in the Valley: in the sandals, even if next-gen nylon has displaced frayed leather; in the left-liberal, sometimes libertarian politics; in the conviction that your productivity can be augmented by micro-dosing LSD. But the trouble with the cultural explanation for West Coast exceptionalism is that the rest of the world has never been as buttoned up as the Valley's boosters imagine. The hacker ethic, championed by communalist nerds who obsessed over code and declined on principle to monetize it, actually originated at MIT—with the Tech Model Railroad Club, a group of MIT undergrads enthralled by the technology behind model trains before their attention was diverted to the TX-0 computer.⁶ (The TX-0 was so captivating that the authorities at MIT considered getting rid of it. "People stopped washing, stopped eating, stopped their social life, and, of course, stopped studying," according to one account.)⁷ Similarly, Tim Berners-Lee, the British-born and Geneva-based inventor of the World Wide Web, combined creative imagination with an antimaterialist

disdain for business. "If you're interested in using the code, mail me," he wrote in a public announcement, refusing to profit from his invention. In Finland, not the sort of place where Bono played a lot of gigs, Linus Torvalds created the bare bones of the Linux operating system and gave it away freely. In short, there was no lack of inventiveness outside Silicon Valley, and no lack of countercultural antibusiness prejudice, either.

The truth is that the distinguishing genius of the Valley lies not in its capacity for invention, countercultural or otherwise.⁸ The first transistor was created in 1947, not in Silicon Valley, but at Bell Labs in New Jersey. The first personal computer was the Altair, created in New Mexico. The first precursor of the worldwide web, the network-management software Gopher, was from Minnesota. The first browser was developed by Marc Andreessen at the University of Illinois. The first search engine, Archie, was invented by Alan Emtage at McGill University in Montreal. The first internet-based social-networking site was SixDegrees.com, launched by Andrew Weinreich in New York City. The first smartphone was the Simon Personal Communicator, developed by Frank Canova at IBM's lab in Boca Raton, Florida.⁹ No single geography—not even Silicon Valley—dominates invention. And yet all these breakthrough products have one thing in common. When it came to turning ideas into blockbuster products, the Valley was the place where the magic happened.

What explains that magic? The title of a 1995 *Time* essay echoed Bono's answer: "We Owe It All to the Hippies."¹⁰ But the Valley's distinguishing genius is that the patina of the counterculture combines with a frank lust for riches. The pot-smoking, sandal-wearing inventors of Bono's acquaintance have never been ashamed to earn vast fortunes, and the Valley is the place where career ladders have been scorned not just by bohemians, who disdain them as bourgeois, but even more by overachievers, who regard them as a pitifully slow way to get ahead. Steve Jobs was among the many who embodied both sides of this contradictory culture. He was too modestly egalitarian to demand a boss's reserved slot in the company parking lot but too arrogantly entitled not to steal the space designated for disabled drivers.¹¹ He was a communalist collaborator, sharing his intellectual property

freely with ostensible rivals; he was also a capitalist competitor, paranoid and controlling. It was this combination of laid-back creativity and driving commercial ambition that truly defined Silicon Valley, making it the place where flights of imaginative fancy begat businesses that shaped societies and cultures.

Quite where this contradictory culture sprang from is naturally difficult to pinpoint. Some put it down to the frantic pioneer materialism of San Francisco's nineteenth-century gold rush, which enriched individualistic hustlers from outside the old hierarchies and spawned a burst of entrepreneurship, including the creation of the first Levi Strauss jeans. Other theories emphasize California's education and prosperity, which fostered progressive open-mindedness and workaholic focus all at once. But the tonic of liberation capital provides another explanation, one that merits more attention than it has received until now. By freeing talent to convert ideas into products, and by marrying unconventional experiments with hard commercial targets, this distinctive form of finance fostered the business culture that made the Valley so fertile. In an earlier era, J. P. Morgan's brand of finance fashioned American business into muscular oligopolies; in the 1980s, Michael Milken's junk bonds fueled a burst of corporate takeovers and slash-and-burn cost cuts. In similar fashion, venture capital has stamped its mark on an industrial culture, making Silicon Valley the most durably productive crucible of applied science anywhere, ever. Thanks to venture capital, the Traitorous Eight were able to abandon William Shockley, launch Fairchild Semiconductor, and set this miracle in motion. By 2014, an astonishing 70 percent of the publicly traded tech companies in the Valley could trace their lineage to Fairchild.¹²



In the year before they turned to liberation capital, the young researchers at Shockley Semiconductor Laboratory were discovering that their boss was at once a scientific genius and a maniacal despot. When Shockley had recruited them, they had felt honored to be chosen: getting a call from the great scientist was "like picking up the phone and talking to God."¹³ Handsome,

bespectacled, with a professorial receding hairline, Shockley was not only the father of semiconductors but also a fine showman: he would begin lectures by promising to get into a hot subject; then he would open up a book and smoke would burst from the pages.¹⁴ But as soon as the young recruits entered the presence of this deity, his flaws became apparent. Shockley staged public firings, posted employee salaries on a company bulletin board, and laughed at one scientist for agreeing to work for too little.¹⁵ He hired the smartest researchers he could find, but was quick to belittle them, sometimes taunting an employee, "Are you sure you have a PhD?" When a few members of his team ventured that they would like to publish academic papers, Shockley responded with contempt and egotism. He jotted down some notes on one of his own theories and told them, "Here, flesh this out and publish it."¹⁶

"I don't think 'tyrant' begins to encapsulate Shockley," one of the young researchers said later.¹⁷

In May 1957, fifteen months after Shockley had launched his operation, his financial backer paid him a visit. The previous year, when Shockley had wanted money, venture capital had barely existed.¹⁸ So Shockley had turned to Arnold Beckman, founder of the eponymous Southern California company Beckman Instruments. Beckman had set Shockley up as a division of his company, hoping to see rapid and profitable progress. Now he arrived to demand more commercial output and less managerial dysfunction.

Shockley responded with defiance. "If you don't like what we're doing up here I can take this group and get support any place else," he railed.¹⁹ Then he stormed out of the room.

Watching their boss yell at Beckman, Shockley's young researchers realized that they faced a choice. This was the 1950s, the era of big corporations, big labor, and big white-collar hierarchies; the title of a 1956 bestseller proclaimed a new kind of American, the meek "organization man." Even research and development were increasingly stultified: one chapter of *The Organization Man* was titled "The Bureaucratization of the Scientist."²⁰ Shockley's engineers could either submit to the zeitgeist and languish unproductively under a suffocating manager or seize the opening created by

his outburst. Huddling over lunch after the confrontation, they resolved to take their grievances to Beckman and demand that he clamp down on Shockley. "Look, goddammit!" one rebel declared. "We either have to do something about this or stop talking about it!"²¹

Gordon Moore, who would later become head of research and development at Fairchild, was chosen as the group's spokesman. Balding, with bushy brows lurking behind fashion-forward 1950s glasses, Moore was at once unpretentiously quiet and unyieldingly confident. Borrowing a phone at a colleague's home after the rebels' lunch conference, he dialed Beckman.²²

"That's not a serious threat," Moore told Beckman, referring to Shockley's outburst. "Shockley couldn't take the group with him if he wants to at this stage of the game."

"Things aren't going well up there, are they?" Beckman asked nervously.

"No, they really are not."²³

Beckman agreed to meet Moore and his colleagues, and after a few rounds of discussion he promised to take their side against the boss. Despite his scientific talent, Shockley was stifling progress; sometimes it takes a good defenestration for capitalism to advance. Shockley would be phased out of his management responsibilities, Beckman assured the rebels. His role at the company would be restricted to an advisory function.

Within a few days, however, Beckman lost his nerve. He was running his own company, and he could make decisions as he wanted; unlike a modern venture capitalist, he had no investors holding him accountable for his return on capital.²⁴ He was therefore free to duck unpleasant decisions, and a call from a senior East Coast scientist, protesting that Shockley would be ruined by a demotion, might have been enough to change his mind. Shockley might be a tyrant, but he was after all a Nobel Prize-winning tyrant, Beckman now reasoned. He informed the young rebels that they would have to make their peace with the boss.

Having experienced the difficulty in changing a company from the inside, the mutineers considered their options. They were all supremely qualified and could easily get hired elsewhere, but they knew they were most likely to accomplish something if they stuck together as a team. At the same

time, if keeping the team together meant suffering under Shockley, it was not a pleasant prospect. In a recent episode, the tyrant had demanded that his staff submit to a lie detector test.²⁵

One evening as they pondered their predicament, the rebels hit on a possible solution. Eugene Kleiner, the only member of the band over thirty, had a connection via his father to a New York investment firm. Kleiner would write to his father's broker and request assistance. A team of Shockley engineers stood ready to quit the company, Kleiner would explain in his letter. Perhaps a well-connected finance house could identify an employer willing to hire the entire squad?



At this stage in the story, none of the rebels had thought of starting a new enterprise. The idea had simply not occurred to them: venture-capital funds willing to back a crew of young and unknown scientists were virtually unheard of; what's more, they were contrary to the spirit of postwar finance. The 1929 crash and the ensuing Depression had destroyed investors' risk appetite for a generation; the big money-management houses had names like Fidelity and Prudential and were more interested in preserving capital than in taking chances. To the extent that financiers wanted to buy any corporate equity, they preferred safe, established companies—preferably ones sitting on enough working capital that a shareholder could count on making money *even if they went bust*. The legendary investor Benjamin Graham, assisted by a young hire named Warren Buffett, ferreted out companies that traded at least one-third below the value of their cash, inventory, and receivables so that they could be liquidated at a profit: in one coup, Buffett bought a block of Union Street Railway of New Bedford, Massachusetts, which was selling for \$45 but had \$120 per share of cash in the bank.²⁶ So long as there were bargains to be found with such huge margins of safety, risky technology ventures appeared almost disreputable. In 1952, *Fortune* observed that "it might shock the unsuspecting holder of, say, a John Hancock life-insurance policy to learn that his money was helping to finance . . . scientific gadgetry."²⁷

Of course, there were exceptions to this caution, but they were scat-

tered and obscure. In 1949 a romantic ex-Marxist named Alfred Winslow Jones had created the first “hedged fund,” but until the 1960s, when a crowd of sideburned gunslingers began to emulate his methods, he operated under the radar. Three years before Jones, a pair of rich East Coast families—the Whitneys and the Rockefellers—had begun to dabble amateurishly in risky fledgling businesses, but their motives were patriotic and philanthropic rather than straightforwardly commercial. On the West Coast, a group of San Francisco brokers invited entrepreneurs to pitch startups over informal lunches, but at the time of the Shockley defections they were only just getting started. The most serious early experiment—the one with a real claim to be seen as the forerunner to modern venture capital—was American Research and Development. But ARD focused on the Boston area, and the Shockley rebels had not heard of it. Like the Whitneys and the Rockefellers, it was imbued with public-service motives. And, as we shall see presently, it did not serve as the model for later venture investors.

John Hay Whitney exemplified these early experiments in adventurous finance.²⁸ He was possessed, as a 1951 *New Yorker* profile put it, of a “vibrating social conscience,” the result of his experiences during World War II.²⁹ Taken prisoner by the Germans, he had informed his captors that he was fighting for freedom; when his enemies retorted that the United States was no freer than Hitler’s Germany, Whitney saw some of the captured American soldiers nodding in agreement. Appalled, he returned home after the war, withdrew his name from the Social Register, and created a foundation to address social problems. As part of his efforts, he launched a \$5 million fund to safeguard the spirit of free enterprise by providing investment capital for entrepreneurs.³⁰ But after five years in operation, J. H. Whitney & Company had backed just eighteen ventures; his successes included an early maker of the building material perlite and Vacuum Foods, the producer of Minute Maid orange juice. In his first five years, moreover, Whitney outperformed the much safer S&P 500 by a relatively modest margin.³¹ Indeed, on the risk-adjusted basis that financiers use to measure themselves, the fund could not justify its existence.³²

Whitney’s ego, not to mention that vibrating conscience, bridled at commentators who bracketed him with ordinary bankers. *The New York*

Times referred to his fund as a "New York investment banking firm," and one day the irritated patriarch challenged his colleagues to come up with a better term.

"I think we should get the connotation of risk into the description of our firm," one person responded.

"I think the most interesting aspect of our business is the adventure," said another.

"How about private venture capital investment firm?" a third offered, abbreviating the term "adventure capital," which was already used in some circles.³³

"That's it!" Whitney concurred. The *Times* editors were duly informed of the philanthropist's desired usage, and by 1947 the paper was making occasional reference to venture capital.³⁴ But despite Whitney's efforts, his linguistic innovation failed to catch on widely. As late as 1962, pioneering tech investors who introduced themselves as venture capitalists were met with blank stares.³⁵

In April 1946, the Rockefeller family launched a parallel effort to Whitney's, aiming to solve the generally acknowledged lack of finance for new firms. "What we want to do is the opposite of the old system of holding back capital until a field or an idea is proved completely safe," declared Laurance Rockefeller, the prime mover, adding, "We are putting money into many underdeveloped areas."³⁶ His fund proceeded to back a cotton mill in Africa, a South Pacific fishing company, a Pennsylvania helicopter company, and a motion picture project on Long Island. "Capital no longer is used just for profit," Rockefeller exulted. "It goes where it can do the most good."³⁷ Perhaps as a result, his profits were not good. In 1961, *Barron's* reported that Rockefeller Brothers had returned \$40 million on the \$9 million invested during fifteen years in business.³⁸ The S&P 500 had shot up by 600 percent over this period.³⁹

The early West Coast amateurs were at least able to claim some spectacular returns. Reid Dennis, one of the half a dozen financiers who attended the investment lunches in San Francisco, won an early bet on Ampex, a pioneering maker of tape recorders. Ampex had captured the attention of the singer Bing Crosby, who preferred to play golf on Sunday afternoons

rather than perform his radio show live. "I don't know anything about tape recording," Dennis later recalled thinking, "but I think that technology is going to be useful for a lot more things than just recording Bing Crosby's voice."⁴⁰ And so in 1952, fresh out of business school, Dennis wagered all his savings—a total of \$15,000—on the company, telling his wife that "if she was good enough to get me, she ought to be able to get somebody else to support her if anything happened."⁴¹ Ampex succeeded wildly, going public in 1958, and Dennis earned about \$1 million—a return, as venture capitalists learned to say later, of 67x.⁴² "I realized it was a pretty good way to make a living," Dennis mused fondly, "so I began looking around at other high-tech companies down here."⁴³

The Ampex win earned Dennis a reputation among San Francisco brokers, which in turn led to the creation of the informal lunch club that styled itself "the Group." Starting in 1957, five or six regulars convened at Sam's or Jack's in the financial district, restaurants "where the sole was dependable and the sourdough fresh."⁴⁴ Sam's was a particular favorite because it had little plywood booths that permitted an illusion of privacy, even if the plywood was just an eighth of an inch thick.⁴⁵ The entrepreneur would tell his story, the men would munch their sourdough, and then the supplicant would be instructed to stand outside on the sidewalk while he awaited a verdict. If all had gone well, there would be a handshake and a promise of perhaps \$80,000 or \$100,000, with the likelihood of more capital from the Group's camp followers and hangers-on.⁴⁶ "We essentially grew up in the business, and then they changed the name of it to venture capital," Dennis remembered.⁴⁷ But even though the San Francisco lunch club boasted some successes, it financed only around two dozen deals in the late 1950s and early 1960s. Its full significance would emerge later, when it was formalized as the Western Association of Venture Capitalists.⁴⁸

Of all the early experiments, it was, unsurprisingly, Boston's that led during the immediate postwar years. Given MIT's position at the heart of the military-industrial complex, it was natural to bet that the region's economic development could be accelerated by financing technologies from its labs. To lead such an effort, an elite band of New Englanders—among them the head of MIT and the president of the Boston Federal Reserve Bank—turned

to Georges Doriot, a dapper French immigrant with a military mustache and a military bearing who taught at Harvard Business School. With the blessing of the Boston patriarchs, Doriot assumed the helm at American Research and Development in 1946.

Doriot was the ultimate embodiment of the military-industrial complex. During World War II, he had overseen technology procurement for the Pentagon's Quartermaster Corps, a position he had used to champion innovations—cold-weather shoes, water-repellent fabrics, and the light-weight plastic armor Doron, which was named after him. He was thus perfectly suited to the task of investing in high-tech firms emerging from the Pentagon-backed laboratories around Boston.⁴⁹ He badgered his investment team to visit the labs regularly, sometimes placing a subway token on a desk and admonishing the young man sitting too peacefully behind it, "MIT is only a token away."⁵⁰ An early Doriot win was High Voltage Engineering Corporation, an MIT spinout that made generators and nuclear particle accelerators, challenging incumbents such as General Electric.⁵¹

In 1957—the year the Group started its lunch meetings, and the year of the mutiny against Shockley—Doriot made the bet that transformed ARD's fortunes. He financed Digital Equipment Corporation, a company founded by two MIT professors who had helped to develop the TX-0 computer at the military-backed Lincoln Laboratory. The TX-0's achievement was to show how transistors could outperform vacuum tubes in equipment built for the military; Digital Equipment's premise was that transistors could also revolutionize computers made for civilians. To a modern venture capitalist, this pitch would have been instantly attractive: the founders came from a cutting-edge research lab, and they proposed to commercialize a technology that was already proven. But in the financial climate of the 1950s, even the most compelling scientists had a hard time raising money, and Doriot exploited this circumstance to the maximum, making Digital's founders an offer that by later standards would have counted as an insult. ARD would provide a \$70,000 investment and a \$30,000 loan in return for 70 percent of the company: it was a "take it or leave it" offer. Lacking any alternative, the MIT professors accepted; nor did they protest when Doriot managed to push his stake up to 77 percent.⁵² Having seized so much of the equity,

Doriot was in a position to profit massively when the professors succeeded. By the time ARD closed in 1972, it had reaped some \$380 million from its bet on Digital—or \$2.3 billion in today's money.⁵³ It was a bonanza that accounted for perhaps 80 percent of all the gains that ARD generated over a quarter of a century.⁵⁴ It was an early demonstration of the power law.

Doriot is sometimes regarded as the father of venture capital—a case made by his biographer, Spencer Ante.⁵⁵ Like John Hay Whitney, Doriot was at pains to distinguish himself from ordinary financiers, but being a business school professor, he was more penetrating and persuasive in defining venture capital's mission. In lectures delivered in his thick French accent, he proclaimed that the greatest rewards were to be had from the most ambitious and least obvious projects; that investors would have to wait patiently for returns to mature over the long term; and that the best prospects involved advanced technology, not orange juice or fishing in Asia.⁵⁶ Anticipating later venture capitalists, he understood that his role was to provide not simply money but also managerial counsel, assistance with hiring, and tips on everything from marketing to finance. He staged technology fairs to advertise his portfolio companies' products and advised Digital Equipment to present sample circuit boards on sheets of purple velvet, in the manner of a jeweler showing off a brooch. Plugging his protégés into ARD's network was all part of Doriot's service. "Your company was on display," one founder said of ARD's well-attended annual meetings, at which entrepreneurs mingled with investors. "The networking that was created and the introductions that were possible, all of that was very important. Anything that helps you keep your confidence, when you have no reason to have confidence, is valuable."⁵⁷

The way Doriot talked about his partnership with company founders was eerily modern. The founders were young, willful, and courageous; the venture capitalist's role was to contribute wisdom and experience. The founders were brilliant, erratic, and sometimes emotionally fragile; "the venture investor must always be on call to advise, to persuade, to dissuade, to encourage, but always to help build."⁵⁸ Like later venture capitalists, Doriot was emphatic that the company founders were the stars of the entrepreneurial drama. "Seek out creative men with the vision of things to be done,"

he counseled; show “loyalty to the idea and to its initiator, the creative man.”⁵⁹ Needless to say, Doriot’s adoring deference to “creative men with the vision” did not prevent him from pocketing 77 percent of a creator’s output. In this, too, Doriot anticipated the hypocrisy that would occasionally mark the venture industry in years to come.

Yet in other ways Doriot was less a founding father than a failed prophet: a pioneer who stumbled onto the wrong territory and led his followers astray. ARD was the first venture outfit to raise capital from institutional investors, but rather than setting up ARD as a partnership, in the manner of future venture capitalists, Doriot structured it as a public company, a decision that ensnared him in a cat’s cradle of regulation.⁶⁰ ARD was restricted in its ability to grant stock options to employees, in its freedom to invest fresh capital into portfolio companies, and in the way that it calculated the value of investments.⁶¹ In 1964, the Securities and Exchange Commission raided ARD’s offices, showing up at the John Hancock building in Boston without warning. “They fully expected that we were here with nothing else to do but receive them and spend the next two days with them,” Doriot huffed.⁶² Following the raid, the SEC claimed that Digital Equipment’s valuation—at one hundred times its acquisition cost—needed restating. “Is the valuation too high? Is it too low? Just what is wrong with it?” Doriot protested furiously.⁶³ “I rather resent, after twenty years of experience, to have two men come here, spend two days, and tell us that we do not know what we are doing.” Doriot kept files of his letters to the regulators. One folder was labeled “Not sent—on advice of counsel.”

Aside from his poor choice of legal structure, Doriot damaged the appeal of his example by disdaining financial incentives. He never shed the public-service brand that came with ARD’s original regional-development mission. “Capital gains are a reward, not a goal,” he proclaimed loftily.⁶⁴ He refused to pay his young lieutenants generously, telling them that they were in business not to make money but to serve their country.⁶⁵ Likewise, he promised never to abandon underperforming portfolio companies, even if they hogged capital that could be more productively deployed elsewhere; it was as though pulling the plug on one of his protégés would be morally akin to abandoning a wounded comrade on the battlefield. Because Doriot

refused to tie money to success and vice versa, his staff and his investors grew fed up with him: they were fine with psychic income, but they also wanted the financial sort. Charles P. Waite, an ARD employee who worked hard to take one portfolio firm public, remembered, "I had made a very substantial contribution to that company. The CEO's net worth went from 0 to \$10 million and I got a \$2,000 raise."⁶⁶ For their part, Wall Street investors viewed ARD as a freakish philanthropic enterprise and consistently valued its shares at a discount to the value of its portfolio companies.⁶⁷

ARD's inability to impress Wall Street, and its consequent failure to spawn an industry of imitators, entailed a painful irony. Whatever his faults, Doriot assembled stakes in thrilling growth enterprises over his twenty-five years in business; thanks to Digital Equipment and the power law, he multiplied his original investors' stake some thirty times over, trouncing the S&P 500.⁶⁸ And yet throughout ARD's existence, its own stock mimicked one of those pitifully undervalued, stodgily mature companies beloved by Benjamin Graham and Warren Buffett. Because Wall Street disdained it, ARD would be worth more to its owners if liquidated or merged into another company. And so, in 1972, it was.



Such was the inhospitable financial landscape in June 1957, when Shockley's young researchers plotted their revolt. ARD had not yet financed Digital Equipment; the San Francisco lunch group was just getting started; a pair of philanthropic plutocrats financed odd projects in exotic overseas locations or on the East Coast. It was hardly surprising that the Shockley rebels could not imagine raising money to start their own enterprise. Instead, Eugene Kleiner's letter to his father's broker laid out a different aspiration: the team of disaffected Shockley scientists hoped to be hired by "a company which can supply good management."⁶⁹ Kleiner's wife, Rose, typed up the letter, dated June 14, 1957. Then she mailed it to the New York firm of Hayden, Stone.

The broker who had served Kleiner's father was preparing to retire from Hayden, so he passed the letter on to a young MBA named Arthur Rock.⁷⁰ Slight, taciturn, his eyes often clouded behind large glasses, Rock

was not an obvious founding father, especially not of a new kind of swash-buckling finance. Unlike the Whitneys and the Rockefellers, he had grown up poor in Rochester, New York, the child of Yiddish-speaking immigrants, and had worked as a soda jerk in his father's small grocery store. Unlike Doriot, he had no experience with military technology, and not much even with the military; during a miserable stint as an army conscript, he had bridled at reporting to superiors whom he considered "not too bright." Perhaps because of his tough childhood—he suffered from polio, performed miserably in athletics, and was brutally victimized by anti-Semitic classmates—Rock was reserved to the point of being prickly.⁷¹ Deal-making financiers are supposed to be suave. But Rock suffered fools impatiently, and the fools always knew.

And yet, as luck would have it, Rock was the perfect person to receive Kleiner's letter. Two years previously he had assembled a funding package for General Transistor, the first independent manufacturer of germanium semiconductors, which were to be used in hearing aids. Having steeped himself in this emerging industry, Rock appreciated Shockley's divine status among scientists: the god could hire anyone, so it followed that Kleiner and his comrades must be top of their field. At the same time, the fact that Kleiner's crew was on the point of mutiny added an extra dimension: the scientists evidently had character as well as credentials.⁷² The combination of an elite team and a potentially breakout technology added up to an obvious commercial opportunity. It was a prospect analogous to Digital Equipment, which Doriot would finance later that summer.

On June 20, 1957, Rock placed a long-distance call to Kleiner, assuring him of his interest. The next day he wrote Kleiner a letter, urging him to keep his team together until they could meet face-to-face.⁷³ The following week Rock flew to San Francisco, accompanied by a glad-handing Hayden partner named Alfred "Bud" Coyle.

Rock and Coyle met Kleiner and his comrades at a San Francisco restaurant for dinner. The visitors from Wall Street understood that the rebels wanted to operate as a team, without Shockley's suffocating oversight. They further understood that the engineers wanted to remain in the Santa Clara valley, where they all had bought homes. But they had come to pro-

pose a novel way of meeting those objectives—one that the rebels had failed to imagine.

“The way you do this is you start your own company,” Rock said simply.⁷⁴ By striking out on their own, the scientists would be able to work independently in the location of their choosing. But more than that, they would be company founders. They would own the fruits of their creative wizardry. A self-made loner from outside the establishment, Rock felt strongly on this last point. A certain kind of justice would be served.⁷⁵

Rock’s proposal took some digesting. “We were blown away,” a researcher named Jay Last remembered later. “Arthur pointed out to us that we could start our own company. It was completely foreign to us.”⁷⁶

Gordon Moore, the engineer who led the failed appeal to Arnold Beckman, recalled a similar reaction. Years later, when he had achieved fame as the co-founder of two iconic Valley companies, Moore was still at pains to describe himself as an “accidental entrepreneur.” “I’m not the sort who can just say, ‘I’m going to start a company,’” he reflected. “The accidental entrepreneur like me has to fall into the opportunity or be pushed into it.”⁷⁷ At that restaurant in San Francisco in late June 1957, Rock was pushing him firmly.

Rock himself remembered something different. Thinking back on that same dinner, he recalled that his mention of company ownership had changed the researchers’ bearing. “They seemed to perk up a bit,” he said later.⁷⁸ Unburdened by Doriot’s sense of patriotic mission, untroubled by a plutocrat’s vibrating conscience, Rock celebrated silently. The way he saw things, the fact that the scientists responded to financial incentives was all to the good.⁷⁹

The discussion moved to practicalities. The researchers said they needed \$750,000 to get their business started. Rock and Coyle countered that they should have at least \$1 million. The Wall Streeters were projecting more confidence than was really justified: finding north of \$1 million to launch an untested collective would not be straightforward.⁸⁰ But the financiers’ bravado served to win over doubters. With the promise of a seven-figure funding package, whatever resistance the researchers had been feeling began to melt away.

Next came the question of who should lead the rebels. In his letter to Hayden, Kleiner had stated openly that the band of traitors, then numbering seven, included “no person who has ambitions as a manager at the top level.” That had been fine while the plan was to be managed by another company. But if the new goal was to stay independent, the scientists would need to identify a leader who could unite their group. Persuading investors to finance a loose collective with no plausible chief executive would be out of the question.

Among the young men at Shockley’s laboratory, Robert Noyce stood out as the obvious leader. A charmer, a prankster, physically graceful, he was the engineer who had compared Shockley’s recruitment phone call to a divine audience. But Noyce had been agonizing about whether to join the mutiny and had stayed out of the meetings so far. The son and grandson of Congregational ministers from small-town Iowa, he worried about the ethics of betraying Shockley. According to one mutineer, Noyce was asking himself, “What would God think?”⁸¹

Rock and Coyle persuaded the seven to get to work on Noyce. The financiers had laid out a vision of liberation. The researchers would have to reciprocate by recruiting a chief.

The plotters designated a member of their band named Sheldon Roberts to phone Noyce. The call stretched late into the night, with Noyce swinging erratically between eagerness and caution. Finally, with the carrot of the \$1 million-plus funding package dangling in front of him, Noyce agreed to join the others for a meeting with Coyle and Rock.⁸²

The next day Sheldon Roberts picked up Noyce in his family’s station wagon. They toured their colleagues’ houses, stopping in Los Altos, Palo Alto, and Mountain View, picking up a new conspirator at each stop. Then they made their way to the Clift hotel in downtown San Francisco and proceeded to the grand, art deco Redwood Room where Rock and Coyle were waiting.

When the meeting got under way, Rock understood that the deal’s weakness had been fixed. This newcomer, Robert Noyce, was a natural born leader. His eyes blazed fiercely.⁸³ His colleagues were content to let him speak for them.⁸⁴

There were no more reasons not to go forward. Bud Coyle pulled out ten crisp dollar bills and proposed that every man present should sign each one. The bills would be “their contracts with each other,” Coyle said.⁸⁵ It was a premonition of the trust-based contracts—seemingly informal, yet founded, literally, on money—that were to mark the Valley in the years to come.



Unlike Doriot’s American Research and Development, the brokers from Hayden, Stone lacked a ready pot of money to fund startups. Instead, they backed companies by assembling coalitions of willing investors on an ad hoc basis, with the Hayden partners’ capital accounting for a small share of the total. Now, to raise the \$1 million-plus that he had promised the eight traitors, Rock jotted down the names of around thirty-five potential backers. ARD and Rockefeller Brothers were on the list.⁸⁶ So were technology companies that might have an interest in a semiconductor investment.

Rock quickly discovered how radical his vision was. The investment groups such as ARD and Rockefeller came up with excuses. The rebels had no management experience; the idea of writing such a large check made them queasy. Meanwhile, the technology companies Rock contacted cited a different objection: they would consider putting up the capital to create a new subsidiary, much as Beckman had done for Shockley, but they were not inclined to back eight scientists without the right to control them.⁸⁷ Besides, backing the Shockley defectors and allowing them to own stakes in their new enterprise would set a disruptive precedent: What if the backer’s own employees demanded company stock, too?⁸⁸ Where Rock saw justice in young scientists owning the fruits of their own enterprise, others saw trouble. The whole point of the organization man was that he was instinctively obedient. Why buy workers’ loyalty with stock options when the culture of the 1950s provided it for free?

After approaching thirty-five potential investors, Rock had failed to raise a single cent. Then Bud Coyle suggested Sherman Fairchild, a playboy with an inherited fortune who was a self-described “putterer” and science enthusiast.⁸⁹ Like the Whitneys and the Rockefellers, Fairchild had enough money to yawn at the prospect of more of it. Unlike the Whitneys and the

Rockefellers, he might be tickled by the notion of a new semiconductor venture.

In late August 1957, Bob Noyce and Eugene Kleiner flew to New York. They made their way to Sherman Fairchild's Manhattan town house, which was fitted out with glass walls and whizzy blinds that opened and shut electronically.⁹⁰ After some initial pleasantries, Noyce uncorked the flair that Rock had seen in him. Fixing Fairchild with those blazing eyes, he explained that the future would be built on silicon-and-wire devices, meaning on simple sand and metal, materials that cost almost nothing. Huge profits would flow to the company that fashioned transistors from these basic elements, and Fairchild could be the visionary who backed the winner.⁹¹ It was a version of the "call to greatness" speech that charismatic entrepreneurs would deliver repeatedly in the Valley. Fairchild was sold.

Now all that remained was to close the terms of the deal. Rock had promised the defectors the chance to own their own company, and he did his best to deliver. Each of the eight founders was invited to put up \$500 in return for 100 shares in the startup. The men scraped together the money, but not without difficulty; \$500 was two or three weeks' salary, and Noyce had to call his parents to ask if his grandmother could lend him the funds.⁹² For its part, Hayden, Stone bought 225 shares at the same price as the founders, and 300 more shares were set aside in a kitty to help recruit senior managers; despite Noyce's charisma, Fairchild saw him as merely the interim chief. Each founder was therefore left with just under 10 percent of the company, with the prospect that this share would fall to 7.5 percent when new management materialized. Meanwhile, Fairchild's company, Fairchild Camera and Instrument, was stumping up just about all of the initial capital—some \$1.4 million, dwarfing the \$5,125 put up by the scientists and Hayden. But because Fairchild's money came in the form of a loan rather than equity, the founders' ownership was not being diluted.⁹³

On the face of it, the eight scientific founders had landed a great deal. But, anticipating the opacity of later venture financings, some of these numbers were not what they seemed. After all, Sherman Fairchild's negotiators had a powerful hand to play: thirty-five other investors had rejected Rock outright. If Georges Doriot of ARD could seize 77 percent of Digital Equip-