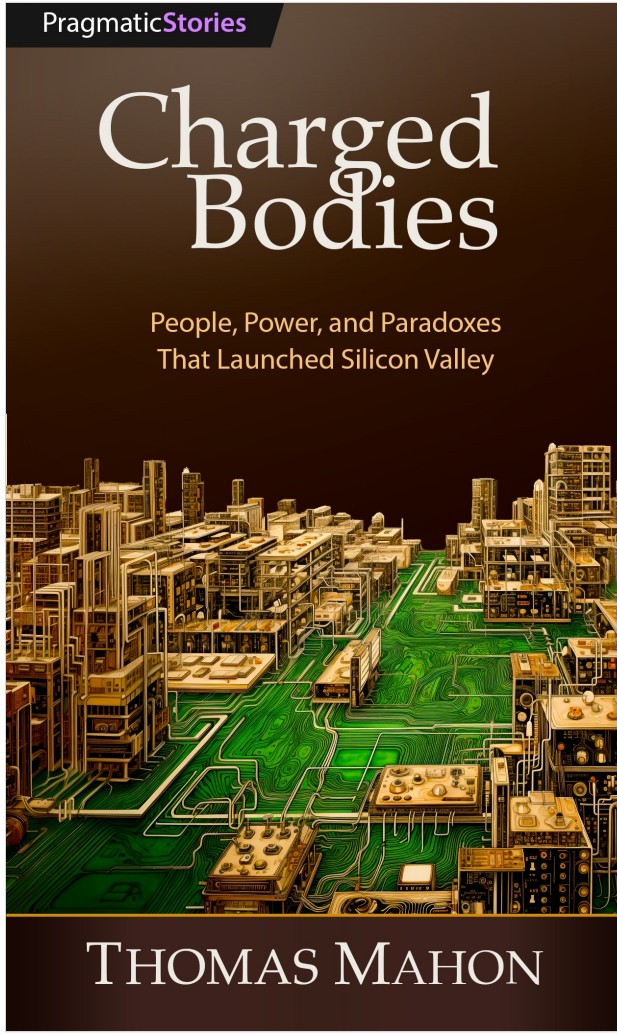

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There is no history, only biography.

➤ *Ralph Waldo Emerson*

CHAPTER 1

Overview

It's dangerous to pull off to the side on the winding roads in the Santa Cruz Mountains at night. You run the risk of being sideswiped by another motorist who comes barreling around a curve. But for the view, it's worth the risk.

I find a place to pull over, end my ascent and get out of the car. A steep, forested mountainside lies to the south and the west. Behind it and above it is a black and starlit sky. This could be the most deserted place in Arizona, Utah, or Wyoming. It's only when I walk across the road and face to the north and east that the brilliant and sprawling valley two thousand feet below abruptly comes into view: the San Francisco Bay Area.

A stunning sweep of orange light runs from Leland Stanford's old farm in Palo Alto on my far left, about fifteen miles or so south by southeast into San Jose on my right. Behind the arc of light is blackness again: the Bay and the expansive tracts of salt evaporators. Rising beyond that is a scattering of lights on the lower slopes of the Diablo Range in the East Bay.

Even at this late hour, I sense a gigantic engine idling. It seems I can hear the dynamo bristling in place, waiting to come fully to life again when the sun comes over the Diablos in a few hours.

A place should have a name before it has a nickname.

Officially, this is called the Santa Clara Valley. It stretches between the Santa Cruz Mountains and the San Francisco Bay, from Palo Alto, through Mountain View, Sunnyvale and Santa Clara, down to San Jose. Then continues on, beyond what I can see, about as far south again toward the farming community of Gilroy.

The northern half of the valley has another, more contemporary identity. These two hundred or so square miles of orange street lights down below me are better known as Silicon Valley.

That half-county down there saw the development of the integrated circuit, the microprocessor, the personal computer and the video game, not to mention such esoterica as distributed data processing, the Winchester disk drive and the plug-compatible mainframe.

Silicon Valley is symbolic of more than the latest developments in electronic and computational wizardry. It marks as well an economic and cultural frontier where successful entrepreneurship and venture capitalism, innovative work rules and open management styles provide the background for what is perhaps the most profound and far-reaching inquiry ever into the nature of intelligence. Combined with research here in bioengineering and "artificially intelligent" software, this inquiry may extend dramatically our sense of who we are and what we can do, and affect our very evolution.

If the changes promised by Silicon Valley were only of a technical or commercial nature, this place could be compared to Birmingham or Manchester, Pittsburgh or Detroit. But a visitor who spends some time here—exploring the labs and executive suites, the bars and garages—would come away with the sense that a time, a place and a group of people have come together as in Periclean Athens, Renaissance Florence or postwar Paris to affect world culture.

For good or ill? That judgment can't yet be made. And by the time it can be made, the products and technologies

generated in, and represented by, Silicon Valley will be all-pervasive. This technology controls the beating of arrhythmic hearts; brings air travelers safely though crowded skies; stands to revolutionize the concept of classroom, workplace and entertainment; cooks meals while the diners are at work; credits and debits bank accounts without any exchange of greenbacks or silver; and makes long-range weather forecasts that affect food prices, foreign trade, and geopolitical strategy.

The same silicon-based semiconductors that make all that possible, however, also guide nuclear missiles and allow bombs to become "smart."

These individual applications are merging and becoming all-encompassing, until electronic devices stand to occupy the center of our culture, affecting art, aesthetics, philosophy and perhaps theology, as much as our medicine, transportation, and defense. And that development—that heritage of Silicon Valley—may prove to be every bit as profound as the creation of tools or the invention of writing.

Parallel with the possible misuse of the technology, as a matter of concern, is the ever-widening gap between the advancement of that technology and the limited comprehension of it by people it affects.

It's as if our world were coming to run simultaneously on two clocks, or live by two calendars. The technocrats are on one time; everyone else is on another. Dialog becomes increasingly difficult. As difficult as it would have been for a Victorian to explain his age's advances in psychology, engineering, and the social sciences to one from the Middle Ages. Not only would it be hard to explain the specifics, but the very concept of such progress would have been difficult to convey to one from the static medieval world.

Silicon Valley represents a midpoint in the progression between King Arthur's plaintive plea for magic—"Merlin, make me a hawk so I can fly away!"—and the calm request of the starship's Captain Kirk—"Beam me up, Scotty." Who are these technocrats and what is this place? What is its role

in the evident transformation of our world, and how did it come to assume that position? Surely the full responsibility for the electronic and computer revolution can't all be attributed to these few square miles.

Indeed, neither the first electronic components nor the first computer systems came from here. And today, major semiconductor foundries are located in Texas and Arizona, while established manufacturers of mainframes and minicomputers are headquartered in New York, Pennsylvania, Minnesota, Massachusetts, and Japan. The trade press that covers the electronics and computer industries is, for the most part, centered in New York and Boston.

What then is Silicon Valley's claim to fame? It's the place where the man who co-invented the semiconductor chose to start his own company; it's half a county which, having virtually no industrial base of its own as recently as World War II, saw nearly seventy other semiconductor businesses spin into existence from that first company between 1955 and 1980; it shares the honor of developing an advanced type of semiconductor that integrates many electronic circuits onto a single piece of silicon; then it saw the development of the microprocessor that, in effect, integrates a number of integrated circuits onto a fleck of pure sand.

Like that protozoan that belongs in both the plant and animal kingdoms, the microprocessor belongs in the domains of both electronic components and computer systems. And because that "computer on a chip" came from Silicon Valley, the microcomputer industry—the mass manufacturing and merchandising of personal computers—grew up around here, too.

Those computers are powerless without programs to direct them. So a microcomputer software industry developed here as well, creating programs for business, for learning, and for fun and games.

Work is also being done to create software that is "artificially intelligent," allowing computers to be self-correcting:

able not only to compute, but to compute about their computing; possibly able to create their own programs.

Software exists on a medium-either "floppy" or rigid disks, or silicon chips. A number of companies were started here to make both the memory media and the hardware to access the stored information.

Then, too, the microprocessor has found other applications besides driving computers, in such fields as telecommunications, computer-aided design, industrial control, and robotics. Companies in these industries are here, as well. And all of these companies—whether hardware or software vendors—have their support services: for machining, calibrating, tooling, documenting, publicizing, accounting, litigating, registering.

The microprocessor allows genetic engineers to handle the massive amounts of information they deal with. Many of the key patents in this new field are held by institutions in this area. So Silicon Valley promises to become *Siliclone* Valley, too. In fact, even now, thought is being given to merging recombinant DNA research with advances in semiconductor design to create "biochips," or molecular electronics devices. Combine that with robotics and artificial-intelligence software, and we may someday see "living computers." Should that ever happen, how will we define ourselves thereafter?

Clearly, the impact of Silicon Valley, and what it represents, goes far beyond new technology development and new enterprise formation, to hint at some major rethinking of our self-perception.

What's often missed in all the microprocessor-based, user-friendly, ergonomically designed, polysyllabic jabberwocky of high technology, however, is the lubricating effect blood, sweat, and tears have on the free flow of electrons.

The human drives in this community are as diverse as the disciplines of the new technologies themselves. People here are driven by greed and ambition, by hunger and desperation, by a quest for style and elegance and celebrity

status. Not unlike anywhere else. But here, unlike elsewhere, the end result of all this enterprise is the height of impersonality and anonymity: "black boxes" with poetic sobriquets like the 2100 Z/A. The tension between the impersonality of the end products and the passion to create them in this single-focus community is fascinating.

As diverse as they all are, however, the new technologies ultimately trace their roots back to semiconductors, those tiny devices made of pure sand from which this valley takes its name, and on which its reputation originally rested. This place is, literally, a kingdom built on sand. As our world is, increasingly, a society pervaded by and built upon those tiny chips of inorganic silicon that appear to mimic the thought processes of our minds.

How does a semiconductor come to pervade our lives? Consider that a spring is a memory device. Stretched or compressed, it returns to its original shape. But it takes a lot of space to accomplish that, and it has some inherent inefficiencies. Consider replacing that spring—in an automobile's suspension, for example—with a sophisticated memory chip. In one more area, then, our dependence shifts from something we can see and understand to a device whose operation most people take on faith. And until such time as there is at least some general understanding of the basics of electronics by laypeople, the mechanical and the comprehensible will continue to be replaced by the seemingly magical. Ironically, the ultra-logical world of electronics may lead us to a new age of superstition.

The community of Silicon Valley is the first in the world in which virtually the whole society—the economy, the idle chatter, the world outlook—revolves around the new electronic technologies. There are lawyers here, but they help new technology companies get started; the local politicians go to Washington to urge incentives for entrepreneurs; bakers offer not chocolate chip, but silicon chip cookies, boxed like floppy disks; much of the medical research here is microprocessor-based; philosophers speculate on the

locus where the studies of high-energy physics and theology intersect; such literature as comes from here is destined for the pages of industrial and trade, not literary, magazines; composers create with computers; and the great academic institutions here have, by and large, made their reputations in their engineering and business schools. This is the place where "high tech" is making its first appearance as one of the liberal arts.

In some respects, Silicon Valley is a state of mind. Other places, trying to recreate the phenomenon, hope to attract technical industries with claims of being "Silicon Desert" (Arizona), or "Silicon Forest" (Oregon), or "Silicon Glen" (Scotland). But something unique and unprecedented has happened here, the impact of which goes far beyond this valley. The world of the late twentieth and early twenty-first centuries will certainly owe its ultimate shape to the technologies that first flowered here.

What's to become of this valley, and of us all everywhere, as a result of the work and the attitudes generated there? Does this place have any connection to the larger America beyond these bordering mountains—the America of the Grand Canyon and the Blue Ridge Mountains, the Rust Belt and the South Bronx? Or did it just spring spontaneously into being sometime between 1955 and 1975, the offspring of some gigantic computer-aided design mechanism, independent of any past?

No, that is definitely not the case. For as I look below me, one of the brightest of those night-lit streets is the spine of this valley's development, its link to a long-vanished past. El Camino Real was first trod by eighteenth-century Spanish Franciscans in the service of God and king, as they founded the missions around which grew such communities as San Jose, Santa Clara, San Carlos, San Mateo, San Bruno, San Francisco.

How ever did Mission Santa Clara metamorphose into today's industrial suburbs? That story begins even before the padres, with pacific natives living in Edenlike innocence;

and continues after the military, cultural, and religious domination of the Spanish, to an idyllic, Arcadian Californio society based on horsemanship and hospitality; to the later Yankee discovery near here of man's ultimate fantasy, a mountain of gold; to the dream-racked sleep of a bereaved railroad baron; to the frustrated boosterism of local promoters; to tenacious young men at the turn of the century transfixed by the seemingly miraculous phenomenon of wireless communications; to an engineering professor who took the base notion of applied technology and graced it with all the academic legitimacy in the world. From this valley, and those Berkeley hills across the Bay, came two seminal technologies, radar and atom smashing, that helped win World War II for the Allies. All of this before anyone ever heard of such a thing as a transistor.

Between the roots of this place and the products of its labs and assembly lines there has developed here a community in some ways like, and in some significant ways unlike, any other community. Ever. This book is a portrait of that community as a community; a self-portrait, actually, drawn by those who shape and share this place. What's my interest in all this? I came here, from much farther east, some years back to manage a public relations agency that represents companies in this valley. I'm a layman; I didn't have a technical background. But what struck me was that my work was giving me an opportunity to witness the center of a revolution—cultural as much as technical—from the inside.

I am an outside agent called in to live for a while at the center of a company and help shape its identity as a technical, business, and social entity. But because I'm an outside agent who moves on, and because of the pace at which things happen here, there is little time to retreat from the day-to-day, to pull back and get a larger view such as this nighttime mountainside provides. That's what compels me to undertake this project now. To pull back from the details of my daily work, writing about the intricacies of LAN and

CAD/CAM and VLSI and CMOS, and instead find out, from the denizens and habitués of this most remarkable place, what it's all about, in more detail than I see from the freeway and in less detail than I care to gather from spec sheets and tech manuals.

This is not a book about chips. Rather, it's about a community of people who care passionately about technologies and a society built upon chips.