Prologue: Man as His Own Maker

Pandora’s Casket
Hannah Arendt and Robert Oppenheimer

Just after the Cuban Missile Crisis, the days in 1962 when the world was on the brink of atomic war, I ran into my teacher Hannah Arendt on the street. The missile crisis had shaken her, like everyone else, but it had also confirmed her deepest conviction. In The Human Condition, she had argued a few years previously that the engineer, or any maker of material things, is not master of his own house; politics, standing above the physical labor, has to provide the guidance. She had come to this conviction by the time the Los Alamos project created the first atomic bombs in 1945. Now, during the missile crisis, Americans too young for the Second World War had also felt real fear. It was freezing cold on the New York street, but Arendt was oblivious. She wanted me to draw the right lesson: people who make things usually don’t understand what they are doing.

Arendt’s fears of self-destructive material invention traces back in Western culture to the Greek myth of Pandora. A goddess of invention, Pandora was “sent to earth by Zeus as punishment for Prometheus’s transgression.” Hesiod described Pandora in Works and Days as the “bitter gift of all the gods” who, when she opened her casket (or in some versions, her jar) of new wonders, “scattered pains and evils among
men.” In the working out of Greek culture, its peoples came increasing-ly to believe that Pandora stood for an element of their own natures; culture founded on man-made things risks continual self-harm.

Something nearly innocent in human beings can produce this risk: men and women are seduced by sheer wonder, excitement, curiosity, and so create the fiction that opening the casket is a neutral act. About the first weapon of mass destruction, Arendt could have cited a diary note made by Robert Oppenheimer, director of the Los Alamos project. Oppenheimer reassured himself by asserting, “When you see something that is technically sweet, you go ahead and do it and you argue about what to do about it only after you have had your technical success. That is the way it was with the atomic bomb.”

The poet John Milton told a similar story about Adam and Eve, as an allegory for the dangers of curiosity, with Eve taking the Oppen-heimer role. In Milton’s primal Christian scene, the thirst for knowledge, rather than for sex, leads human beings to harm themselves. Pandora’s image remains potent in the writings of the modern theologian Reinhold Niebuhr, who observes that it is human nature to believe that anything that seems possible should therefore be tried.

Arendt’s generation could put numbers to the fear of self-destruction, numbers so large as to numb the mind. At least seventy million people perished in wars, concentration camps, and gulags in the first fifty years of the twentieth century. In Arendt’s view, these numbers represent the compound of scientific blindness and bureaucratic power—bureaucrats minded just to get the job done, embodied for her by the Nazi death-camp organizer Adolf Eichmann, to whom she attached the label “the banality of evil.”

Today, peacetime material civilization posts equally numbing figures of self-made self-harm: one million, for instance, represents the number of years Nature took to create the amount of fossil fuel now consumed in a single year. The ecological crisis is Pandoric, man-made; technology may be an unreliable ally in regaining control. The mathematician Martin Rees describes a revolution in microelectronics that creates at least the possibility of a robotic world beyond the powers of ordinary human beings then to rule; Rees envisions such exotica as self-replicating microrobots intended to clean smog that might instead devour the biosphere. A more urgent example is genetic engineering of both crops and animals.

Fear of Pandora creates a rational climate of dread—but dread can be itself paralyzing, indeed malign. Technology itself can seem the enemy rather than simply a risk. Pandora’s environmental casket was too easily closed, for instance, in a speech given by Arendt’s own teacher, Martin Heidegger, near the end of his life, at Bremen in 1949. On this infamous occasion Heidegger “discounted the uniqueness of the Holocaust in terms of the ‘history of man’s misdeeds’ by comparing ‘the manufacture of corpses in the gas chambers and the death camp’ to mechanized agriculture.” In the historian Peter Kempt’s words, “Heidegger thought that both should be regarded as embodiments of the ‘same technological frenzy’ which, if left unchecked, would lead to a world-wide ecological catastrophe.”

If the comparison is obscene, Heidegger speaks to a desire in many of us, that of returning to a way of life or achieving an imaginary future in which we will dwell more simply in nature. As an old man Heidegger wrote in a different context that “the fundamental character of dwelling is this sparing and preserving,” against the claims of the modern machine world. A famous image in these writings of his old age invokes “a hut in the Black Forest” to which the philosopher withdraws, limiting his place in the world to the satisfaction of simple needs. This is perhaps a desire that could be kindled in anyone facing the big numbers of modern destruction.

In the ancient myth, the horrors in Pandora’s casket were not hu-mans’ fault; the gods were angry. Pandora-fear in a more secular age is more disorienting: the inventors of atomic weapons coupled curiosity with culpability; the unintended consequences of curiosity are
hard to explain. Making the bomb filled Oppenheimer with guilt, as it did I. I. Rabi, Leo Szilard, and many others who worked at Los Alamos. In his diary, Oppenheimer recalled the Indian god Krishna's words, "I am become Death, the destroyer of worlds."? Experts in fear of their own expertise: what could be done about this terrible paradox?

When Oppenheimer gave the Reith Lectures for the BBC, subsequently published as Science and the Common Understanding, in 1953—broadcasts intended to explain the place of science in modern society—he argued that treating technology as an enemy will only render humanity more helpless. Yet, consumed by worry over the nuclear bomb and its thermonuclear child, in this political forum he could offer his listeners no practical suggestions about how to cope with it. Though confused, Oppenheimer was a worldly man. He was entrusted at a relatively young age with the bomb project during the Second World War, he combined a first-class brain with the talent to manage a large group of scientists; his skills were both scientific and corporate. But to these insiders, too, he could provide no satisfying picture of how their work should be used. Here are his parting words to them on November 2, 1945: "It is good to turn over to mankind at large the greatest possible power to control the world and to deal with it according to its lights and its values."? The creator's works become the public's problem. As David Cassidy, one of Oppenheimer's biographers, has observed, the Reith Lectures thus proved "a huge disappointment for both the speaker and his listeners."?

If the experts cannot make sense of their work, what of the public? Though I suspect Arendt knew little about physics, she took up Oppenheimer's challenge: let the public indeed deal with it. She had a robust faith that the public could understand the material conditions in which it dwells and that political action could stiffen humankind's will to be master in the house of things, tools, and machines. About the weapons in Pandora's casket, she told me, there should have been pub-

lic discussion about the bomb even while it was being made; whether rightly or wrongly, she believed that the secrecy of the technical process could have been protected even as this discussion occurred. The reasons for this faith appear in her greatest book, The Human Condition, published in 1958, affirms the value of human beings openly, candidly speaking to each other. Arendt writes, "Speech and action... are the modes in which human beings appear to each other, not indeed as physical objects, but qua men. This appearance, as distinguished from mere bodily existence, rests on initiative, but it is an initiative from which no human being can refrain and still be human." And she declares, "A life without speech and without action is literally dead to the world."? In this public realm, through debate, people ought to decide which technologies should be encouraged and which should be repressed. Though this affirmation of talk may well seem idealistic, Arendt was in her own way an eminently realistic philosopher. She knew that public discussion of human limits can never be the politics of happiness.

Nor did she believe in religious or natural truths that could stabilize life. Rather, like John Locke and Thomas Jefferson, Arendt believed that a polity differs from a landmarked building or "world heritage site": laws should be unstable. This liberal tradition imagines that the rules issuing from deliberation are cast in doubt as conditions change and people ponder further; new, provisional rules then come into being. Arendt's contribution to this tradition turns in part on the insight that the political process exactly parallels the human condition of giving birth and then letting go of the children we have made and raised. Arendt speaks of natality in describing the process of birth, formation, and separation in politics. The fundamental fact of life is that nothing lasts—yet in politics we need something to orient us, to lift us above the confusions of the moment. The pages of The Human Condition explore how language might guide us, as it were, to swim against the turbulent waters of time.
As her student almost a half-century ago, I found her philosophy largely inspiring, yet even then it seemed to me not quite adequate to deal with the material things and concrete practices contained in Pandora's casket. The good teacher imparts a satisfying explanation; the great teacher—as Arendt was—unsetsles, bequeaths disquiet, invites argument. Arendt's difficulty in dealing with Pandora seemed to me, dimly then and more clearly now, to lie in the distinction she draws between Animal laborans and Homo faber. (Man does not, clearly, mean just men. Throughout this book, when I have to deal with gendered language, I'll try to make clear when man refers generically to human beings and when it applies only to males.) These are two images of people at work; they are austere images of the human condition, since the philosopher excludes pleasure, play, and culture.

Animal laborans is, as the name implies, the human being akin to a beast of burden, a drudge condemned to routine. Arendt enriched this image by imagining him or her absorbed in a task that shuts out the world, a state well exemplified by Oppenheimer's feeling that the atomic bomb was a "sweet" problem, or Eichmann's obsession with making the gas chambers efficient. In the act of making it work, nothing else matters; Animal laborans takes the work as an end in itself.

By contrast, Homo faber is her image of men and women doing another kind of work, making a life in common. Again Arendt enriched an inherited idea. The Latin tag Homo faber means simply "man as maker." The phrase crops up in Renaissance writings on philosophy and in the arts; Henri Bergson had, two generations before Arendt, applied it to psychology; she applied it to politics, and in a special way. Homo faber is the judge of material labor and practice, not Animal laborans's colleague but his superior. Thus, in her view, we human beings live in two dimensions. In one we make things; in this condition we are amoral, absorbed in a task. We also harbor another, higher way of life in which we stop producing and start discussing and judging together. Whereas Animal laborans is fixated in the question "How?" Homo faber asks "Why?"

This division seems to me false because it slights the practical man or woman at work. The human animal who is Animal laborans is capable of thinking; the discussions the producer holds may be mentally with materials rather than with other people; people working together certainly talk to one another about what they are doing. For Arendt, the mind engages once labor is done. Another, more balanced view is that thinking and feeling are contained within the process of making.

The sharp edge of this perhaps self-evident observation lies in its address to Pandora's box. Leaving the public to "sort out the problem" after the work is done means confronting people with usually irreversible facts on the ground. Engagement must start earlier, requires a fuller, better understanding of the process by which people go about producing things, a more materialistic engagement than that found among thinkers of Arendt's stripe. To cope with Pandora requires a more vigorous cultural materialism.

The word materialism should raise a warning flag; it has become debased, stained in recent political history by Marxism and in everyday life by consumer fantasy and greed. "Materialistic" thinking is also obscure because most of us use things like computers or automobiles that we do not make for ourselves and that we do not understand. About "culture" the literary critic Raymond Williams once counted several hundred modern usages. This wild verbal garden divides roughly into two big beds. In one, culture stands for the arts alone, in the other it stands for the religious, political, and social beliefs that bind a people. "Material culture" too often, at least in the social sciences, slights cloth, circuit boards, or baked fish as objects worthy of regard in themselves, instead treating the shaping of such physical things as mirrors of social norms, economic interests, religious convictions—the thing in itself is discounted.
So we need to turn a fresh page. We can do so simply by asking—though the answers are anything but simple—what the process of making concrete things reveals to us about ourselves. Learning from things requires us to care about the qualities of cloth or the right way to poach fish; fine cloth or food cooked well enables us to imagine larger categories of "good." Friendly to the senses, the cultural materialist wants to map out where pleasure is to be found and how it is organized. Curious about things in themselves, he or she wants to understand how they might generate religious, social, or political values. Animal laborans might serve as Homo faber's guide.

In my own old age I've returned mentally to that street on the Upper West Side. I want to make the case my juvenile self could not then make to Arendt, that people can learn about themselves through the things they make, that material culture matters. As she aged, my teacher became more hopeful that Homo faber's powers of judgment could save humanity from itself. In my winter, I've become more hopeful about the human animal at work. The contents of Pandora's box can indeed be made less fearsome; we can achieve a more humane material life, if only we better understand the making of things.

The Project
The Craftsman: Warriors and Priests; the Foreigner

This is the first of three books on material culture, all related to the dangers in Pandora's casket, though each is intended to stand on its own. This book is about craftsmanship, the skill of making things well. The second volume addresses the crafting of rituals that manage aggression and zeal; the third explores the skills required in making and inhabiting sustainable environments. All three books address the issue of technique—but technique considered as a cultural issue rather than as a mindless procedure; each book is about a technique for conducting a particular way of life. The large project contains a personal para-

dox that I have tried to put to productive use. I am a philosophically minded writer asking questions about such matters as woodworking, military drills, or solar panels.

"Craftsmanship" may suggest a way of life that waned with the advent of industrial society—but this is misleading. Craftsmanship names an enduring, basic human impulse, the desire to do a job well for its own sake. Craftsmanship cuts a far wider swath than skilled manual labor; it serves the computer programmer, the doctor, and the artist; parenting improves when it is practiced as a skilled craft, as does citizenship. In all these domains, craftsmanship focuses on objective standards, on the thing in itself. Social and economic conditions, however, often stand in the way of the craftsman's discipline and commitment: schools may fail to provide the tools to do good work, and workplaces may not truly value the aspiration for quality. And though craftsmanship can reward an individual with a sense of pride in work, this reward is not simple. The craftsman often faces conflicting objective standards of excellence; the desire to do something well for its own sake can be impaired by competitive pressure, by frustration, or by obsession.

The Craftsman explores these dimensions of skill, commitment, and judgment in a particular way. It focuses on the intimate connection between hand and head. Every good craftsman conducts a dialogue between concrete practices and thinking; this dialogue evolves into sustaining habits, and these habits establish a rhythm between problem solving and problem finding. The relation between hand and head appears in domains seemingly as different as bricklaying, cooking, designing a playground, or playing the cello—but all these practices can misfire or fail to ripen. There is nothing inevitable about becoming skilled, just as there is nothing mindlessly mechanical about technique itself.

Western civilization has had a deep-rooted trouble in making connections between head and hand, in recognizing and encouraging the impulse of craftsmanship. These difficulties are explored in the first
part of the book. It begins as a story about workshops—the guilds of medieval goldsmiths, the ateliers of musical instrument makers like Antonio Stradivari, modern laboratories—in which masters and apprentices work together but as equals. The craftsman’s struggle with machines is portrayed in the eighteenth-century invention of robots, in the pages of that bible of the Enlightenment, Diderot’s *Encyclopedia*, and in the nineteenth century’s growing fear of industrial machines. The craftsman’s consciousness of materials appears in the long history of making bricks, a history that stretches from ancient Mesopotamia to our own time, a history that shows the way anonymous workers can leave traces of themselves in inanimate things.

In its second part, the book explores more closely the development of skill. I make two contentious arguments: first, that all skills, even the most abstract, begin as bodily practices; second, that technical understanding develops through the powers of imagination. The first argument focuses on knowledge gained in the hand through touch and movement. The argument about imagination begins by exploring language that attempts to direct and guide bodily skill. This language works best when it shows imaginatively how to do something. The use of imperfect or incomplete tools draws on the imagination in developing the skills to repair and to improvise. The two arguments combine in considering how resistance and ambiguity can be instructive experiences; to work well, every craftsman has to learn from these experiences rather than fight them. A diverse group of case studies illustrates the grounding of skill in physical practice—the hand habits of striking a piano key or using a knife; the written recipes used to guide the neophyte cook; the use of imperfect scientific instruments like the first telescopes or puzzling instruments like the anatomist’s scalpel; the machines and plans that can work with resistances of water, ambiguities on land. Developing skill in all these domains is arduous, but it is not mysterious. We can understand those imaginative processes that enable us to become better at doing things.

In its third part, the book addresses more general issues of motivation and talent. The argument here is that motivation matters more than talent, and for a particular reason. The craftsman’s desire for quality poses a motivational danger: the obsession with getting things perfectly right may deform the work itself. We are more likely to fail as craftsmen, I argue, due to our inability to organize obsession than because of our lack of ability. The Enlightenment believed that everyone possesses the ability to do good work of some kind, that there is an intelligent craftsman in most of us; that faith still makes sense.

Craftsmanship is certainly, from an ethical point of view, ambiguous. Robert Oppenheimer was a committed craftsman; he pushed his technical skills to the limit to make the best bomb he could. Yet the craftsman’s ethos contains countervailing currents, as in the principle of using minimum force in physical effort. The good craftsman, moreover, uses solutions to uncover new territory; problem solving and problem finding are intimately related in his or her mind. For this reason, curiosity can ask, “Why?” and well as, “How?” about any project. The craftsman thus both stands in Pandora’s shadow and can step out of it.

The book concludes by considering how the craftsman’s way of working can give people an anchor in material reality. History has drawn fault lines dividing practice and theory, technique and expression, craftsman and artist, maker and user; modern society suffers from this historical inheritance. But the past life of craft and craftsmen also suggests ways of using tools, organizing bodily movements, thinking about materials that remain alternative, viable proposals about how to conduct life with skill.

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The volumes that follow build on the character of craft set out in this first book. Pandora remains their provocation. Pandora is a goddess of aggressive destruction; the priest and the warrior are her representa-
Religion and war are both organized through rituals, and I investigate ritual as a kind of craft. That is, I'm less interested in the ideologies of nationalism or jihad than in the ritual practices that train and discipline the human body to attack or pray, or the rituals that cause groups of bodies to deploy on the battlefield or within sacred spaces. Again, codes of honor become concrete by choreographing movement and gesture within the physical containers of walls, military camps, and battlefields on one hand, and shrines, burial grounds, monasteries, and retreats on the other. Ritual requires skill; it needs to be done well. The priest-craftsman or warrior-craftsman will share the ethos of other craftsmen when seeking to do the work well for its own sake. The aura surrounding ritual suggests that it is mysterious in origin, veiled in operation. *Warriors and Priests* seeks to see behind this veil, by exploring how the craft of ritual makes faith physical. My aim in this study is to understand how the fatal marriage of religion and aggression might possibly be altered by changing the ritual practices in each. This is a speculative enterprise, to be sure—but it seems more realistic to explore how concrete behavior might change or be regulated than to counsel a change of heart.

The final book in the project returns to more certain terrain, the earth itself. In both natural resources and climate change, we are facing a physical crisis largely of our own human making. The myth of Pandora has become now a secular symbol of self-destruction. To deal with this physical crisis we are obliged to change both the things we make and how we use them. We will need to learn different ways of making buildings and transport and to contrive rituals that accustom us to saving. We will need to become good craftsmen of the environment.

The word sustainable is now used to convey this kind of craftsmanship, and it carries a particular baggage. Sustainable suggests living more at one with nature, as Martin Heidegger imagined in his old age, establishing an equilibrium between ourselves and the resources of the earth—an image of balance and reconciliation. In my view, this is an inadequate, insufficient view of environmental craft; to change both productive procedures and rituals of use requires a more radical self-critique. A stronger jolt to changing how we have used resources would come in imagining ourselves to be like immigrants thrust by chance or fate onto a territory not our own, foreigners in a place we cannot command as our own.

The stranger, remarks the sociologist Georg Simmel, learns the art of adaptation more searchingly, if more painfully, than people who feel entitled to belong, at peace with their surrounding. In Simmel's view, the foreigner also holds up a mirror to the society into which he or she enters, since the foreigner cannot take for granted ways of life that seem to natives just natural. So great are the changes required to alter humankind's dealings with the physical world that only this sense of self-displacement and estrangement can drive the actual practices of change and reduce our consuming desires; the dream of dwelling in equilibrium and at peace with the world risks, in my view, leading us to seek escape in an idealized Nature, rather than confronting the self-destructive territory we have actually made. At least this is my starting point in trying to understand the techniques of environmental craft of a different kind, and why I've titled this third volume *The Foreigner*. That craft is now foreign to us.

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This is in sum the project on material culture I envision. *The Craftsman, Warriors and Priests, and The Foreigner* tell together a story about the declaration made by Shakespeare's Coriolanus: "I am my own maker." Materially, humans are skilled makers of a place for themselves in the world. Pandora hovers over this story in objects, in rituals, and in the earth itself. Pandora can never be laid to rest; the Greek goddess represents inextinguishable human powers of mismanagement, self-
inflicted harm, and confusion. But these powers can perhaps be caged if understood materially.

I write within a long-standing tradition, that of American pragmatism, a tradition explained more fully at the end of this volume. Pragmatism has sought to join philosophy to concrete practices in the arts and sciences, to political economy, and to religion; its distinctive character is to search for the philosophic issues embedded in everyday life. The study of craft and technique is simply a logical next chapter in pragmatism’s unfolding history.

A Note on History

The Shortness of Time

In this project my guide to using the record of history is a thought experiment proposed by the biologist John Maynard Smith. He asks us to imagine a two-hour film that clocks, greatly speeded up, evolution from the first vertebrates to the appearance of ourselves: “tool-making man would appear only in the last minute.” Then he imagines a second two-hour film, charting the history of tool-making man: “the domestication of animals and plants would be shown only during the last half minute, and the period between the invention of the steam engine and the discovery of atomic energy would be only one second.”

The point of the thought experiment is to challenge the famous phrase that opens L. P. Hartley’s novel The Go-Between: “The past is a foreign country.” In the fifteen seconds of recorded civilization, there’s no reason why Homer, Shakespeare, Goethe, or simply a grandmother’s letters should be alien to our understanding. Culture’s time in natural history is short. Yet in these same few seconds human beings have contrived enormously different ways to live.

In studying material culture, I’ve treated the historical record as a catalogue of experiments in making things, performed by experimenters who are not alien to us, whose experiments we can understand.

If in this way culture’s time is short, in another way it is long. Because cloth, pots, tools, and machines are solid objects, we can return to them again and again in time; we can linger as we cannot in the flow of a discussion. Nor does material culture follow the rhythms of biological life. Objects do not inevitably decay from within like a human body. The histories of things follow a different course, in which metamorphosis and adaptation play a stronger role across human generations.

I might have conducted this exploration by writing a strict linear narrative, beginning with the Greeks, ending where we are now. Instead, I’ve preferred to write thematically, going between past and present, to assemble the experimental record. When I’ve judged that the reader needs detailed context, I’ve provided it; when not, not.

Material culture provides in sum a picture of what human beings are capable of making. This seemingly limitless view is bounded by self-inflicted harm whether occurring innocently, by intent, or by accident. Retreat into spiritual values is unlikely to furnish much help in coping with Pandora. Nature might be a better guide, if we understand our own labors as part of its being.
CHAPTER ONE

The Troubled Craftsman

The Craftsman summons an immediate image. Peering through a window into a carpenter’s shop, you see inside an elderly man surrounded by his apprentices and his tools. Order reigns within, parts of chairs are clamped neatly together, the fresh smell of wood shavings fills the room, the carpenter bends over his bench to make a fine incision for marquetry. The shop is menaced by a furniture factory down the road.

The craftsman might also be glimpsed at a nearby laboratory. There, a young lab technician is frowning at a table on which six dead rabbits are splayed on their backs, their bellies slit open. She is frowning because something has gone wrong with the injection she has given them; she is trying to figure out if she did the procedure wrong or if there is something wrong with the procedure.

A third craftsman might be heard in the town’s concert hall. There an orchestra is rehearsing with a visiting conductor; he works obsessively with the orchestra’s string section, going over and over a passage to make the musicians draw their bows at exactly the same speed across the strings. The string players are tired but also exhilarated because their sound is becoming coherent. The orchestra’s manager is worried; if the visiting conductor keeps on, the rehearsal will move into overtime, costing management extra wages. The conductor is oblivious.
The carpenter, lab technician, and conductor are all craftsmen because they are dedicated to good work for its own sake. Theirs is practical activity, but their labor is not simply a means to another end. The carpenter might sell more furniture if he worked faster; the technician might make do by passing the problem back to his boss; the visiting conductor might be more likely to be rehired if he watched the clock. It's certainly possible to get by in life without dedication. The craftsman represents the special human condition of being *engaged*. One aim of this book is to explain how people become engaged practically but not necessarily instrumentally.

Craftsmanship is poorly understood, as I noted in the Prologue, when it is equated only with manual skill of the carpenter's sort. German employs the word *Handwerk*, French the word *artisanal* to evoke the craftsman's labors. English can be more inclusive, as in the term *statecraft*; Anton Chekhov applied the Russian word *mastersvo* equally to his craft as a doctor and as a writer. I want first to treat all such concrete practices as like laboratories in which sentiments and ideas can be investigated. A second aim of this study is to explore what happens when head and heart, technique and science, art and craft are separated. I will show how the head then suffers; both understanding and expression are impaired.

All craftsmanship is founded on skill developed to a high degree. By one commonly used measure, about ten thousand hours of experience are required to produce a master carpenter or musician. Various studies show that as skill progresses, it becomes more problem-attuned, like the lab technician worrying about procedure, whereas people with primitive levels of skill struggle more exclusively on getting things to work. At its higher reaches, technique is no longer a mechanical activity; people can feel fully and think deeply what they are doing once they do it well. It is at the level of mastery, I will show, that ethical problems of craft appear.

The emotional rewards craftsmanship holds out for attaining skill are twofold: people are anchored in tangible reality, and they can take pride in their work. But society has stood in the way of these rewards in the past and continues to do so today. At different moments in Western history practical activity has been demeaned, divorced from supposedly higher pursuits. Technical skill has been removed from imagination, tangible reality doubted by religion, pride in one's work treated as a luxury. If the craftsman is special because he or she is an engaged human being, still the craftsman's aspirations and trials hold up a mirror to these larger issues past and present.

The Modern Hephaestus

*Ancient Weavers and Linux Programmers*

One of the earliest celebrations of the craftsman appears in a Homeric hymn to the master god of craftsmen, Hephaestus: "Sing clear-voiced Muse, of Hephaestus famed for skill. With bright-eyed Athena he taught men glorious crafts throughout the world—men who before used to dwell in caves in the mountains like wild beasts. But now that they have learned crafts through Hephaestus famous for his art they live a peaceful life in their own houses the whole year round." The poem is contrary in spirit to the legend of Pandora, which took form at roughly the same time. Pandora presides over destruction, Hephaestus over the craftsman as a bringer of peace and a maker of civilization.

The hymn to Hephaestus may seem to celebrate no more than a cliché, that of civilization commencing when human beings began to use tools. But this hymn was written thousands of years after the fabrication of such tools as knives, the wheel, and the loom. More than a technician, the civilizing craftsman has used these tools for a collective good, that of ending humanity's wandering existence as hunter-gatherers or rootless warriors. Reflected on the Homeric hymn to
Hephaestus, a modern historian writes that because craftwork "brought people out of the isolation, personified by the cave-dwelling Cyclopes, craft and community were, for the early Greeks, indissociable."2

The word the hymn used for craftsman is *demiourgos*. This is a compound made between public (*demios*) and productive (*ergon*). The archaic craftsman occupied a social slice roughly equivalent to a middle class. The *demiourgoi* included, in addition to skilled manual workers like potters, also doctors and lower magistrates, and professional singers and heralds who served in ancient times as news broadcasters. This slice of ordinary citizens lived in between the relatively few, leisureed aristocrats and the mass of slaves who did most of the work—many of whom had great technical skills but whose talents earned them no political recognition or rights.3 It was in the middle of this archaic society that the hymn honored as civilizers those who combined head and hand.

Archaic Greece, like many other societies that anthropologists until quite recently labeled "traditional," took it for granted that skills would be handed down from generation to generation. This assumption is more remarkable than it might appear. Social norms counted for more than individual endowments in the traditional "skills society." Developing one's talents depended on following the rules established by earlier generations; that most modern of words—personal "genius"—had little meaning in this context. To become skilled required, personally, that one be obedient. Whoever composed the hymn to Hephaestus accepted the nature of this communal bond. As with deeply held values in any culture, it seemed self-evident that people will identify with other craftsmen as fellow citizens. Skill would bind them to their ancestors as to their fellows. In their gradual evolution, traditional skills thus seem exempt from Hannah Arendt's principle of "natality."

If the artisan was celebrated in the age of Homer as a public man or woman, by classical times the craftsman's honor had dimmed. The reader of Aristophanes finds a small sign of this change in the context with which he treats the potters Kittos and Bacchios as stupid buffoons due to the work they do.4 A graver portent of the artisan's darkening fortunes appears in the writings of Aristotle on the nature of craft. In the *Metaphysics*, he declares, "We consider that the architects in every profession are more estimable and know more and are wiser than the artisans, because they know the reasons of the things which are done."5 Aristotle abandons the old word for the craftsman, *demiourgos*, and uses instead *cheironechtron*, which means simply hand-worker.

This shift had a particular, ambiguous meaning for women workers. From earliest times, weaving was a craft reserved for women that gave them respect in the public realm; the hymn singles out crafts like weaving as practices that helped civilize the hunter-gatherer tribes. As archaic society became classical, still the public virtue of women weavers was celebrated. In Athens, women spun a cloth, the *peplos*, that they then paraded through the city streets in an annual ritual. But other domestic crafts like cooking had no such public standing, and no craftwork would earn Athenian women in the classical era the right to vote. The development of classical science contributed to the gendering of skill that produced the word *craftsman* as applying to men. This science contrasted the man's hand dexterity to the inner-organ strength of women as childbearers; it contrasted the stronger arm and leg muscles of men to those of women; it supposed that men's brains were more "muscular" than those of women.7

This gender distinction sowed the seed of a still-living plant: most domestic crafts and craftsmen seem different in character than labor now outside the home. We do not think of parenting, for instance, as a craft in the same sense that we think of plumbing or programming, even though becoming a good parent requires a high degree of learned skill.

The classical philosopher most sympathetic to the archaic ideal of Hephaestus was Plato, who also worried about its demise. He traced
skill back to the root word for "making," poiein. This is the parent word for poetry, and in the hymn, too, poets appear as just another kind of craftsman. All craftsmanship is quality-driven work; Plato formulated this aim as the arete, the standard of excellence, implicit in any act: the aspiration for quality will drive a craftsman to improve, to get better rather than get by. But in his own time Plato observed that although "craftsmen are all poets... they are not called poets, they have other names." Plato worried that these different names and indeed different skills kept people in his day from understanding what they shared. In the five centuries between the hymn to Hephaestus and his own lifetime, something seemed to have slipped. The unity in archaic times between skill and community had weakened. Practical skills still sustained the ongoing life of the city but were not generally honored for doing so.

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To understand the living presence of Hephaestus, I ask the reader to make a large mental jump. People who participate in "open source" computer software, particularly in the Linux operating system, are craftsmen who embody some of the elements first celebrated in the hymn to Hephaestus, but not others. The Linux technicians also represent as a group Plato's worry, though in a modern form; rather than scorned, this body of craftsmen seem an unusual, indeed marginal, sort of community.

The Linux system is a public craft. The underlying software kernel in Linux code is available to anyone, it can be employed and adapted by anyone: people donate time to improve it. Linux contrasts to the code used in Microsoft, its secrets until recently hoarded as the intellectual property of one company. In one current, popular Linux application, Wikipedia, the code kernel makes possible an encyclopedia to which any user can contribute. When established in the 1990s, Linux sought to recover some of the adventure of the early days of computing in the

1970s. During these two decades, the software industry has morphed within its brief life into a few dominant firms, buying up or squeezing out smaller competitors. In the process, the monopolies seemed to churn out ever more mediocre work.

Technically, open-source software follows the standards of the Open Source Initiative, but the brute label "free software" doesn't quite capture how resources are used in Linux. Eric Raymond usefully distinguishes between two types of free software: the "cathedral" model, in which a closed group of programmers develop the code and then make it available to anyone, and the "bazaar" model, in which anyone can participate via the Internet to produce code. Linux draws on craftsmen in an electronic bazaar. The kernel was developed by Linus Torvalds, who in the early 1990s acted on Raymond's belief that "given enough eyeballs, all bugs are shallow"—engineer-speak for saying that if enough people participate in the code-writing bazaar, the problems of writing good code can be solved more easily than in the cathedral, certainly more easily than in proprietary commercial software.

This, then, is a community of craftsmen to whom the ancient appellation demioergoi can be applied. It is focused on achieving quality, on doing good work, which is the craftsman's primordial mark of identity. In the traditional world of the archaic potter or doctor, standards for good work were set by the community, as skills passed down from generation to generation. These heirs to Hephaestus have experienced, however, a communal conflict about the use of their skills.

The programming community is grappling with how to reconcile quality and open access. In the Wikipedia application, for instance, many of the entries are biased, scurrilous, or just plain wrong. A breakaway group now wants to apply editing standards, an impulse that runs smack up against the movement's desire to be an open community. The editor "elitists" don't dispute the technical proficiency of their adversaries; all the professional parties in this conflict feel passionately about maintaining quality. The conflict is equally strong in the generative
realm of Linux programming. Its members are grappling with a structural problem: how can quality of knowledge coexist with free and equal exchange in a community?\textsuperscript{12}

We'd err to imagine that because traditional craft communities pass on skills from generation to generation, the skills they pass down have been rigidly fixed; not at all. Ancient pottery making, for instance, changed radically when the rotating stone disk holding a lump of clay came into use; new ways of drawing up the clay ensued. But the radical change appeared slowly. In Linux the process of skill evolution is speeded up; change occurs daily. Again, we might think that a good craftsman, be she a cook or a programmer, cares only about solving problems, about solutions that end a task, about closure. In this, we would not credit the work actually involved. In the Linux network, when people squash one "bug," they frequently see new possibilities open up for the use of the code. The code is constantly evolving, not a finished and fixed object. There is in Linux a nearly \textit{instant} relation between problem solving and problem finding.

Still, the experimental rhythm of problem solving and problem finding makes the ancient potter and the modern programmer members of the same tribe. We would do better to contrast Linux programmers to a different modern tribe, those bureaucrats unwilling to make a move until all the goals, procedures, and desired results for a policy have been mapped in advance. This is a closed knowledge-system. In the history of handcrafts, closed knowledge-systems have tended toward short lifespans. The anthropologist André Leroi-Gourhan contrasts, for instance, the open, evolving, difficult, but long-lasting craft of metal knife-making in preclassical Greece to the craft of wooden knife-making—a more precise, economical, but static system of fabricating knives that was soon abandoned for the problems of metal.\textsuperscript{13}

Linux is most deeply "Greek" in its impersonality. In Linux online workshops, it's impossible to deduce, for instance, whether "aristotle@mit.edu" is a man or a woman; what matters is what "aristotle@mit.edu" contributes to the discussion. Archaic craftsmen experienced a kindred impersonality; the demosergoi were frequently addressed in public by the names of their profession. All craftsmanship, indeed, has something of this impersonal character. That the quality of work is impersonal can make the practice of craftsmanship seem unforgiving; that you might have a neurotic relation to your father won't excuse the fact that your mortise-and-tenon joint is loose. In one of the British-based Linux chat rooms to which I belong, the normal polite feints and indirects of British culture have disappeared. Gone are such locutions as "I would have thought that..."; in are "This problem is fucked-up." Looked at another way, this blunt impersonality turns people outward.

The Linux community might have served the mid-twentieth-century sociologist C. Wright Mills in his effort to define the character of the craftsman. Mills writes: "The laborer with a sense of craft becomes engaged in the work in and for itself; the satisfactions of working are their own reward; the details of daily labor are connected in the worker's mind to the end product; the worker can control his or her own actions at work; skill develops within the work process; work is connected to the freedom to experiment; finally, family, community, and politics are measured by the standards of inner satisfaction, coherence, and experiment in craft labor."\textsuperscript{14}

If Mills's description seems impossibly idealistic, rather than reject it we might ask instead why craftsmanship of the Linux sort is so unusual. The question is a modern version of Plato's ancient worry: the Linux programmers are certainly grappling with fundamental issues like collaboration, the necessary relation of problem solving to problem finding, and the impersonal nature of standards, yet the community seems special if not marginal. Some cluster of social forces must be pushing these fundamental issues to the sidelines.
Weakened Motivation
Workers Demoralized by Command and by Competition

The modern world has two recipes for arousing the desire to work hard and well. One is the moral imperative to do work for the sake of the community. The other recipe invokes competition: it supposes that competing against others stimulates the desire to perform well, and in place of communal cohesion, it promises individual rewards. Both recipes have proved troubled. Neither has—in naked form—served the craftsman’s aspiration for quality.

The problems with the moral imperative appeared to me personally and sharply on a visit my wife and I made to the communist empire in 1988, on the eve of its collapse. We’d received an invitation from the Russian Academy of Sciences to visit Moscow, a trip to be organized without the “support” of the foreign ministry and its resident spies; we were promised the freedom of the city. We toured Moscow churches previously locked, now overflowing, and the offices of an unauthorized newspaper where people smoked, talked, and at odd moments wrote. Almost as an afterthought, our hosts led us out to the Moscow suburbs, which I had never seen before.

These housing developments were built mostly in the decades after the Second World War. Laid out as enormous chessboards, the suburbs stretch to the horizon across flat land sparsely planted with birch and aspen. The architectural design of the suburban buildings was good, but the state had not been able to command good-quality work. The signs of poorly motivated workers appeared in the details of construction: in almost every building, concrete had been badly poured and sloppily reinforced, well-conceived, prefabricated windows had been set askew into the concrete shells, and little caulk had been applied to the seams joining window frames to concrete. In one new building we found the empty cartons of caulk for sealing the windows, but the contents had been sold, our guides said, on the black market. In a few apartment towers workers had stuffed pieces of newspaper between the window frames and walls, then painted over the seams to give the appearance—lasting only a season or two—that the buildings had been sealed.

Poor craftsmanship was a barometer of other forms of material indifference. The housing we saw was meant for relatively privileged citizens, the Soviet scientific class. These families were allotted individual apartments rather than forced to live in communal space. Yet the negligence of construction was mirrored in the inhabitants’ neglect of their surroundings: window boxes and balconies were bare of plants; walls had crusted over with crayon graffiti or spray-painted obscenities that nobody had bothered to clean up. When I asked about the dilapidated state of these buildings, our tour guides gave us a sweeping explanation. “People”—in general—don’t care; they are demoralized.

This broad condemnation could not apply generally in the empire, since Soviet construction workers had long proved capable of making high-quality scientific and military buildings. Still, the guides seemed bent on proving the emptiness of the collective, moral recipe for craftsmanship. They led my wife and me from block to block with grim satisfaction, pointing out fraudulence and deception, taking almost a connoisseur’s pleasure in contemplating the fake caulk that nature required mere winter to expose. When prodded, one of our guides coined “the ruins of Marxism” to explain the evidence both of demoralized workers and of inhabitants indifferent to their surroundings.

The young Karl Marx thought of himself as a secular Hephaestus whose writings would set the modern craftsman free. In the Grundrisse, he framed craftsmanship in the broadest possible terms as “form-giving activity.” He emphasized that self and social relations develop through making physical things, enabling the “all-round development of the individual.” Before Marx became an analyst of economic injustice, he was a Moses to workers, promising to realize the dignity of labor natural to people as part of a community. This utopian core of Marxism survived even as the older Marx hardened into a bitter, rigid
ideologue. As late as his essay "The Gotha Program," he returned to the view that communism would rekindle the spirit of craftsmanship.\textsuperscript{17}

On the ground, Russia's command economy seems to explain the ruin of Marxism. Economists note the abysmally low productivity of Russian civil society throughout the 1970s and 1980s. The construction industry suffered particular problems of centralized command: its central bureaucracy was bad at estimating the materials needed for a project; the movement of materials across Russia's vast distances was slow and followed irrational paths; factories and construction crews seldom communicated directly. And authorities overreacted to initiative on building sites, fearing that local self-management might germinate general resistance to the state.

For these reasons, the moral imperative, "Do a good job for your country!" rang hollow. The problems on the ground are hardly unique to Russia's construction industry. The sociologist Darren Thiel has found equally demoralized workers at many British building sites. The construction industry in free-market Britain suffers from low productivity; its craft workers are treated badly or indifferently; onsite initiative is discouraged.\textsuperscript{18}

The moral imperative is not, though, inherently empty. In the same decades that Russia was rotting, Japan was prospering under a command economy suffused with its own cultural imperatives to work well for the common good. Japan has been called "a nation of craftsmen," which is a little like calling England a nation of shopkeepers or observing that New Zealanders are good at raising sheep.\textsuperscript{19} Still, in the past half-century the Japanese manifested a practical creativity that brought the country back to life after the Second World War. In the 1950s the Japanese mass-produced cheap, simple goods; by the early 1970s they produced cheap, high-quality automobiles, radios, and stereos, as well as superb steel and aluminum for special applications.

Working precisely to high standards provided the Japanese during these years a sense of mutual and self-respect. In part they needed the collective goal because workers, particularly those in the middle ranks of organizations, spent long hours together laboring, seldom seeing their wives or children, in order to make ends meet. But the moral imperative worked because of how it was organized.

In the postwar years Japanese corporations embraced the nostrums of the business analyst W. Edwards Deming, who advocated, for the sake of "total quality control," that managers get their hands dirty on the shop floor and subordinates speak frankly to their superiors. When Deming spoke of "collective craftsmanship," he meant that the glue binding an institution is created by sharp mutual exchanges as much as by shared commitment. Caricatures of the Japanese frequently depict them as herd-loving conformists, a stereotype that hardly makes sense of how sharply critical Japanese at work in Toyota, Subaru, and Sony plants could be of one another's efforts.

Hierarchy governed the Japanese workplace, but the plain speaking of the Linux community was normal in these plants. Within the Japanese factories it was possible to speak truth to power, in that an adept manager could easily penetrate the codes of courtesy and deference in speech to get across the message that something was wrong or not good enough. In Soviet collectivism, by contrast, the ethical as well as the technical center was too far removed from life on the ground. Marx dealt with "the worker"; Deming and his Japanese followers dealt with the work.

Rather than become Japanese, this comparison asks us to think again about the triumphalism that greeted the collapse of the Soviet empire a generation ago, capitalism winning out as communism collapsed from within. A large part of the triumphalist story turned on contrasting the virtues of competition to the vices of collectivism—individual competition taken to be more likely to produce good work, competition to spur quality. Not only capitalists have subscribed to this view; in the "reform" of public services like health care, the effort has been to promote internal competition and markets to improve the
quality of services. We need to look more deeply at this triumphalist view, because it obscures both the roles competition and cooperation actually play in getting good work done and, more largely, the virtues of craftsmanship.

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The making of the mobile telephone tells an illuminating story about the superiority of cooperation to competition in getting good work done.

The mobile phone is the result of the metamorphosis of two technologies, the radio and the telephone. Before these two technologies fused, telephone signals were broadcast by landline wires, radio signals emitted in the air. In the 1970s mobile phones of a sort existed in the military. These were large, clunky radios with dedicated bands for communication. Domestic versions of the mobile phone operated domestically in taxicabs, their range limited, their sound quality poor. The landline telephone's fixity was its defect, its virtue the clarity and security of transmission.

At the heart of this virtue lay the switching technology of the landline phone, elaborated, tested, and refined with care over several generations of use. It was this switching technology that had to change in order for the radio and telephone to amalgamate. The problem and its solution were clear enough. Much ambiguity lurked, however, in connecting the two.

The economists Richard Lester and Michael Piore have studied the firms that sought to create the switching technology, finding that cooperation and collaboration within certain companies allowed them to make headway on the switching technology problem, whereas internal competition at other corporations diminished engineers' efforts to improve the quality of the switches. Motorola, a success story, developed what it called a "technology shelf," created by a small group of engineers, on which were placed possible technical solutions that other teams might use in the future; rather than trying to solve the problem outright, it developed tools whose immediate value was not clear. Nokia grappled with the problem in another collaborative way, creating an open-ended conversation among its engineers in which salespeople and designers were often included. The boundaries among business units in Nokia were deliberately ambiguous, because more than technical information was needed to get a feeling for the problem; lateral thinking was required. Lester and Piore describe the process of communication this entailed as "fluid, context-dependent, undetermined."20

By contrast, companies like Ericsson proceeded with more seeming clarity and discipline, dividing the problem into its parts. The birth of the new switch was intended to occur through "the exchange of information" among offices "rather than the cultivation of an interpretative community."21 Rigidly organized, Ericsson fell away. It did eventually solve the switching technology problem, but with greater difficulty; different offices protected their turf. In any organization, individuals or teams that compete and are rewarded for doing better than others will hoard information. In technology firms, hoarding information particularly disables good work.

The corporations that succeeded through cooperation shared with the Linux community that experimental mark of technological craftsmanship, the intimate, fluid join between problem solving and problem finding. Within the framework of competition, by contrast, clear standards of achievement and closure are needed to measure performance and to dole out rewards.

Any musician would find the story of the mobile phone eminently clear: good chamber music and orchestral work can only improve, especially in rehearsal, in the same way. Listeners may sometimes imagine that working with a superstar conductor or soloist inspires orchestral players, the virtuoso setting a standard that lifts everyone's game, but this depends on how the star behaves. A soloist withdrawn from collegiality can actually diminish the will of orchestra players.
to perform well. Engineers, like musicians, are intensely competitive creatures; the issue for both is what happens when a compensating cooperation vanishes: the work degrades. The triumphalist story, however, has tended to be blind to this necessary balance.

The evidence of demoralized Russian workers that my wife and I encountered in the Moscow suburbs can be found closer to home. When I returned from this final trip to the empire, I began studying the demoiorgoi of the new American economy: middle-level workers whose skills should have earned them a secure place in the “new economy” in formation since the 1990s. The label refers to labor in the high-technology, finance, and human services sectors, supported by global investors, conducted in institutions that are more flexible, responsive, and focused on the short-term than in the rigid bureaucratic cages of the past. My students and I focused on people who write computer code, do accounting in backoffices, or arrange shipments to local stores in a retail chain—all competent but without sexy job titles or showy incomes.

The world that their fathers and grandfathers knew was in a way protected from the rigors of competition. Skilled middle-class workers found a place, in twentieth-century corporations, in relatively stable bureaucracies that moved employees along a career path from young adulthood to retirement. The forebears of the people we interviewed worked hard for their achievements; they knew fairly well what would happen to them if they didn’t.

It’s no longer news that this middle-class world has cracked. The corporate system that once organized careers is now a maze of fragmented jobs. In principle, many new economy firms subscribe to the doctrines of teamwork and cooperation, but unlike the actual practices of Nokia and Motorola, these principles are often a charade. We found that people made a show of friendliness and cooperation under the watchful eyes of boss-minders rather than, as in good Japanese firms, challenging and disputing their superiors. We found, as have other researchers, that people seldom identified as friends the people with whom they worked in teams. Some of the people we interviewed were energized by this individualized competition, but more were depressed by it—and for a particular reason. The structure of rewards didn’t work well for them.

The new economy has broken two traditional forms of rewarding work. Prosperous companies are intended, traditionally, to reward employees who work hard, at all levels. In these new economy firms, however, the wealth share of middle-level employees has stagnated over the past generation, even as the wealth of those at the top has ballooned. One measure is that in 1974 the chief executive officer of a large American corporation earned about thirty times as much as a median-level employee, whereas in 2004 the CEO earned 350 to 400 times as much. In these thirty years, real-dollar earnings at the median point have risen only 4 percent.

Sheer service to a company was, in an earlier generation, another reward for work, set in bureaucratic stone through automatic seniority increases in pay. In the new economy, such rewards for service have diminished or disappeared; companies now have a short-term focus, preferring younger, fresher workers to older, supposedly more ingrown employees—which means for the worker that, as his or her experience accumulates, it loses institutional value. The technicians whom I first began interviewing in Silicon Valley thought they could see themselves through this problem of experience by developing their skills, creating an inner armory that they could transport from company to company.

But craft does not protect them. In today’s globalized marketplace, middle-level skilled workers risk the prospect of losing employment to a peer in India or China who has the same skills but works for lower pay; job loss is no longer merely a working-class problem. Again, many firms tend not to make long-term investments in an employee’s skills, preferring to make new hires of people who already have the new skills needed rather than to engage in the more expensive process of retraining.
There are wrinkles in this gloomy picture. The sociologist Christopher Jencks has shown that economic "returns to skill" are robust at the upper reaches of the skills ladder but weaker lower down; crack systems designers are handsomely rewarded today, but low-level programmers often do no better and sometimes worse than people with manual service skills like plumbers and plasterers. Again, Alan Blinder argues, although many higher-skilled technical jobs in the West are being sent offshore to places in Asia and the Middle East, there are unexportable jobs that require face-to-face contact. If you live in New York, you can work with an accountant in Bombay, but you cannot usefully deal with a divorce lawyer there.21

Still, the trials of the craftsmen of the new economy are a caution against triumphalism. The growth of the new economy has driven many of these workers in America and Britain inside themselves. Those firms that show little loyalty to their employees elicit little commitment in return—Internet companies that ran into trouble in the early 2000s learned a bitter lesson, their employees jumping ship rather than making efforts to help the imperiled companies survive. Skeptical of institutions, new economy workers have lower rates of voting and political participation than technical workers two generations ago; although many are joiners of voluntary organizations, few are active participants. The political scientist Robert Putnam has explained this diminished "social capital," in his celebrated book Bowling Alone, as the result of television culture and the consumerist ethic; in our study, we found that withdrawal from institutions was tied more directly to people's experiences at work.24

If the work people do in new economy jobs is skilled and high pressure, requiring long hours, still it is dissociated labor: we found few among the technicians who believed that they would be rewarded for doing a good job for its own sake. The modern craftsman may hew inside him—or herself to this ideal, but given the structuring of rewards, that effort will be invisible.

From the social point of view, in sum, demoralization has many sides. It can occur when a collective goal for good work becomes hollow and empty; equally, sheer competition can disable good work and depress workers. Neither corporatism nor capitalism as crude labels get at the institutional issue. The forms of collective communication in Japanese auto plants and the practices of cooperation in firms like Nokia and Motorola have made them profitable. In other realms of the new economy, however, competition has disabled and disheartened workers, and the craftsman's ethos of doing good work for its own sake is unrewarded or invisible.

Fractured Skills
Hand and Head Divided

The modern era is often described as a skills economy, but what exactly is a skill? The generic answer is that skill is a trained practice. In this, skill contrasts to the coup de foudre, the sudden inspiration. The lure of inspiration lies in part in the conviction that raw talent can take the place of training. Musical prodigies are often cited to support this conviction—and wrongly so. An infant musical prodigy like Wolfgang Amadeus Mozart did indeed harbor the capacity to remember large stretches of notes, but from ages five to seven Mozart learned how to train his great innate musical memory when he improvised at the keyboard. He evolved methods for seeming to produce music spontaneously. The music he later wrote down again seems spontaneous because he wrote directly on the page with relatively few corrections, but Mozart's letters show that he went over his scores again and again in his mind before setting them in ink.

We should be suspicious of claims for innate, untrained talent. "I could write a good novel if only I had the time" or "if only I could pull myself together" is usually a narcissist's fantasy. Going over an action
again and again, by contrast, enables self-criticism. Modern education fears repetitive learning as mind-numbing. Afraid of boring children, avid to present ever-different stimulation, the enlightened teacher may avoid routine—but thus deprives children of the experience of studying their own ingrained practice and modulating it from within.

Skill development depends on how repetition is organized. This is why in music, as in sports, the length of a practice session must be carefully judged: the number of times one repeats a piece can be no more than the individual’s attention span at a given stage. As skill expands, the capacity to sustain repetition increases. In music this is the so-called Isaac Stern rule, the great violinist declaring that the better your technique, the longer you can rehearse without becoming bored. There are “Eureka!” moments that turn the lock in a practice that has jammed, but they are embedded in routine.

As a person develops skill, the contents of what he or she repeats change. This seems obvious: in sports, repeating a tennis serve again and again, the player learns to aim the ball different ways; in music, the child Mozart, aged six and seven, was fascinated by the Neapolitan-sixth chord progression, in fundamental position (the movement, say, from a C-major chord to an A-flat major chord). A few years after working with it, he became adept in inverting the shift to other positions. But the matter is also not obvious. When practice is organized as a means to a fixed end, then the problems of the closed system reappear; the person in training will meet a fixed target but won’t progress further. The open relation between problem solving and problem finding, as in Linux work, builds and expands skills, but this can’t be a one-off event. Skill opens up in this way only because the rhythm of solving and opening up occurs again and again.

These precepts about building skill through practice encounter a great obstacle in modern society. By this I refer to a way in which machines can be misused. The “mechanical” equates in ordinary language with repetition of a static sort. Thanks to the revolution in micro-computing, however, modern machinery is not static; through feedback loops machines can learn from their experience. Yet machinery is misused when it deprives people themselves from learning through repetition. The smart machine can separate human mental understanding from repetitive, instructive, hands-on learning. When this occurs, conceptual human powers suffer.

Since the Industrial Revolution of the eighteenth century, the machine has seemed to threaten the work of artisan-craftsmen. The threat appeared physical; industrial machines never tired, they did the same work hour after hour without complaining. The modern machine’s threat to developing skill has a different character.

An example of this misuse occurs in CAD (computer-assisted design), the software program that allows engineers to design physical objects and architects to generate images of buildings on-screen. The technology traces back to the work of Ivan Sutherland, an engineer at the Massachusetts Institute of Technology who in 1963 figured out how a user could interact graphically with a computer. The modern material world could not exist without the marvels of CAD. It enables instant modeling of products from screws to automobiles, specifies precisely their engineering, and commands their actual production. In architectural work, however, this necessary technology also poses dangers of misuse.

In architectural work, the designer establishes on screen a series of points; the algorithms of the program connect the points as a line, in two or three dimensions. Computer-assisted design has become nearly universal in architectural offices because it is swift and precise. Among its virtues is the ability to rotate images so that the designer can see the house or office building from many points of view. Unlike a physical model, the screen model can be quickly lengthened, shrunk, or broken into parts. Sophisticated applications of CAD model the effects on a
structure of the changing play of light, wind, or seasonal temperature change. Traditionally, architects have analyzed solid buildings in two ways, through plan and section. Computer-assisted design permits many other forms of analysis, such as taking a mental journey, on screen, through the building’s airflows.

How could such a useful tool possibly be abused? When CAD first entered architectural teaching, replacing drawing by hand, a young architect at MIT observed that “when you draw a site, when you put in the counter lines and the trees, it becomes ingrained in your mind. You come to know the site in a way that is not possible with the computer. . . . You get to know a terrain by tracing and retracing it, not by letting the computer ‘regenerate’ it for you.” This is not nostalgia: her observation addresses what gets lost mentally when screen work replaces physical drawing. As in other visual practices, architectural sketches are often pictures of possibility; in the process of crystallizing and refining them by hand, the designer proceeds just as a tennis player or musician does, gets deeply involved in it, matures thinking about it. The site, as this architect observes, “becomes ingrained in the mind.”

The architect Renzo Piano explains his own working procedure thus: “You start by sketching, then you do a drawing, then you make a model, and then you go to reality—you go to the site—and then you go back to drawing. You build up a kind of circularity between drawing and making and then back again.” About repetition and practice Piano observes, “This is very typical of the craftsman’s approach. You think and you do at the same time. You draw and you make. Drawing . . . is revisited. You do it, you redo it, and you redo it again.” This attaching, circular metamorphosis can be aborted by CAD. Once points are plotted on-screen, the algorithms do the drawing; misuse occurs if the process is a closed system, a static means-end—the “circularity” of which Piano speaks disappears. The physicist Victor Weisskopf once said to his MIT students who worked exclusively with computerized experiments, “When you show me that result, the computer understands the answer, but I don’t think you understand the answer.”

Computer-assisted design poses particular dangers for thinking about buildings. Because of the machine’s capacities for instant erasure and refueling, the architect Elliot Felix observes, “each action is less consequent than it would be [on] paper . . . each will be less carefully considered.” Returning to physical drawing can overcome this danger; harder to counter is an issue about the materials of which the building is made. Flat computer screens cannot render well the textures of different materials or assist in choosing their colors, though the CAD programs can calculate to a marvel the precise amount of brick or steel a building might require. Drawing in bricks by hand, tedious though the process is, prompts the designer to think about their materiality, to engage with their solidity as against the blank, unmarked space on paper of a window. Computer-assisted design also impedes the designer in thinking about scale, as opposed to sheer size. Scale involves judgments of proportion; the sense of proportion on-screen appears to the designer as the relation of clusters of pixels. The object on-screen can indeed be manipulated so that it is presented, for instance, from the vantage point of someone on the ground, but in this regard CAD is frequently misused: what appears on-screen is impossibly coherent, framed in a unified way that physical sight never is.

Troubles with materiality have a long pedigree in architecture. Few large-scale building projects before the industrial era had detailed working drawings of the precise sort CAD can produce today; Pope Sixtus V remade the Piazza del Popolo in Rome at the end of the sixteenth century by describing in conversation the buildings and public space he envisioned, a verbal instruction that left much room for the mason, glazier, and engineer to work freely and adaptively on the ground. Blueprints—inked designs in which erasure is possible but messy—acquired legal force by the late nineteenth century, making
these images on paper equivalent to a lawyer’s contract. The blueprint signaled, moreover, one decisive disconnection between head and hand in design: the idea of a thing made complete in conception before it is constructed.

A striking example of the problems that can ensue from mentalized design appear in Georgia’s Peachtree Center, perched on the edge of Atlanta. Here is to be found a small forest of concrete office towers, parking garages, shops, and hotels, edged by highways. As of 2004, the complex covered about 5.8 million square feet, which makes this one of the largest “megaprojects” in the region. The Peachtree Center could not have been made by a group of architects working by hand—it is simply too vast and complex. The planning analyst Bent Flyvbjerg explains a further economic reason why CAD is necessary for projects of this scope: small errors have large knock-on effects.31

Some aspects of the design are excellent. The buildings are laid out in a grid plan of streets forming fourteen blocks rather than as a mall; the complex pays allegiance to the street and is meant to be pedestrian friendly. The architecture of the three large hotels is by John Portman, a flamboyant designer who favours such dramatic touches as glass elevators running up and down forty stories of interior atriums. Elsewhere, the three trade marts and office towers are more conventional concrete-and-steel boxes, some faced outside with the Renaissance or Baroque detailing that has become the stamp of postmodern design. The project as a whole reaches for character rather than anonymity. Still, pregnant failures of this computer-driven project are evident on the ground—three failures that menace computer-assisted design more largely as a disembodied design practice.

The first is the disconnect between simulation and reality. In plan, the Peachtree Center populates the streets with well-designed sidewalk cafes. Yet the plan has not actually engaged with the intense Georgia heat: the outdoor seats of the cafes are in fact empty from late morning to late afternoon much of the year. Simulation is an imperfect substitute for accounting the sensation of light, wind, and heat on site. The designers would perhaps have done better to sit unprotected in the midday Georgia sun for an hour before going to work each day; physical discomfort would have made them see better. The large issue here is that simulation can be a poor substitute for tactile experience.

Hands-off design also disables a certain kind of relational understanding. Portman’s hotel, for instance, emphasizes the idea of coherence, with its inner drama of all-glass elevators running up a forty-story atrium; the hotel’s rooms look outward over parking lots. On-screen, the parking-lot issue can be put out of mind by rotating the image so that the sea of cars disappears; on foot, it cannot be disposed of in this way. To be sure, this is not the computer’s inherent fault. Portman’s designers could perfectly well have put in an image of all the cars and then viewed the sea, on-screen, from the hotel rooms, but then they’d have had a fundamental problem with the design. Whereas Linux is set up to discover problems, CAD is often used to hide them. The difference accounts for some of CAD’s commercial popularity: it can be used to repress difficulty.

Finally, CAD’s precisions bring out a problem long inherent in blueprint design, that of overdetermination. The various planners involved in the Peachtree Center rightly pride with pride to its mixed-use buildings, but these mixtures have been calculated down to the square foot; the calculations draw a false inference about how well the finished object will function. Overdetermined design rules out the crinkled fabric of buildings that allow little start-up businesses, and so communities, to grow and vibrate. This texture results from underdetermined structures that permit uses to abort, swerve, and evolve. There is thus missing the informal and so easy, sociable street life of Atlanta’s older neighborhoods. A positive embrace of the incomplete is necessarily absent in the blueprint; forms are resolved in advance of their use. If CAD does not cause this problem, the program sharpens it: the algorithms draw nearly instantly a totalized picture.
The tactile, the relational, and the incomplete are physical experiences that occur in the act of drawing. Drawing stands for a larger range of experiences, such as the way of writing that embraces editing and rewriting, or of playing music to explore again and again the puzzling qualities of a particular chord. The difficult and the incomplete should be positive events in our understanding, they should stimulate us as simulation and facile manipulation of complete objects cannot. The issue—I want to stress—is more complicated than hand versus machine. Modern computer programs can indeed learn from their experience in an expanding fashion, because algorithms are rewritten through data feedback. The problem, as Victor Weisskopf says, is that people may let the machines do this learning, the person serving as a passive witness to and consumer of expanding competence, not participating in it. This is why Renzo Piano, the designer of very complicated objects, returns in a circular fashion to drawing them roughly by hand. Abuses of CAD illustrate how, when the head and the hand are separate, it is the head that suffers.

Computer-assisted design might serve as an emblem of a large challenge faced by modern society: how to think like craftsmen in making good use of technology. “Embodied knowledge” is a currently fashionable phrase in the social sciences, but “thinking like a craftsman” is more than a state of mind; it has a sharp social edge.

Immersed in the Peachtree Center for a weekend of discussions on “Community Values and National Goals,” I was particularly interested in its parking garages. A standardized bumper had been installed at the end of each car stall. It looked sleek, but the lower edge of each bumper was sharp metal, liable to scratch cars or calves. Some bumpers, though, had been turned back, on site, for safety. The irregularity of the turning showed that the job had been done manually, the steel smoothed and rounded wherever it might be unsafe to touch; the craftsman had thought for the architect. The lighting in these aboveground car-houses turned out to be uneven in intensity, danger moons suddenly appearing within the building. Painters had added odd-shaped white strip lines to guide drivers in and out of irregular pools of light, showing signs of improvising rather than following the plan. The craftsmen had done further, deeper thinking about light than the designers.

These steel grinders and painters had evidently not sat in on design sessions at the start, using their experience to indicate problematic spots in the designs plotted on-screen. Bearers of embodied knowledge but mere manual laborers, they were not accorded that privilege. This is the sharp edge in the problem of skill; the head and the hand are not simply separated intellectually but socially.

Conflicting Standards
Correct versus Practical

What do we mean by good-quality work? One answer is how something should be done, the other is getting it to work. This is a difference between correctness and functionality. Ideally, there should be no conflict; in the real world, there is. Often we subscribe to a standard of correctness that is rarely if ever reached. We might alternatively work according to the standard of what is possible, just good enough—but this can also be a recipe for frustration. The desire to do good work is seldom satisfied by just getting by.

Thus, following the absolute measure of quality, the writer will obsess about every comma until the rhythm of a sentence comes out right, and the woodworker will shave a mortise-and-tenon joint until the two pieces are completely rigid, needing no screws. Following the measure of functionality, the writer will deliver on time, no matter that every comma is in place, the point of writing being to be read. The functionally minded carpenter will curb worry about each detail, knowing that small defects can be corrected by hidden screws. Again, the point is to finish so that the piece can be used. To the absolutist in every
craftsman, each imperfection is a failure; to the practitioner, obsession with perfection seems a prescription for failure. A philosophical nicety is necessary to bring out this conflict. Practice and practical share a root in language. It might seem that the more people train and practice in developing a skill, the more practical minded they will become, focusing on the possible and the particular. In fact, the long experience of practice can lead in the opposite direction. Another variant of the “Isaac Stern rule” is: the better your technique, the more impossible your standards. (Depending on his mood, Isaac Stern worked many, many variations of the “Isaac Stern rule” on the virtue of repeated practice.) Linux can operate in a similar fashion. The people most skilled in using it are usually the ones thinking about the program’s ideal and endless possibilities.

The conflict between getting something right and getting it done has today an institutional setting, one I shall illustrate in the provision of medical care. Many elderly readers will, like me, know only too well its outline.

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In the past decade Britain’s National Health Service (NHS) has had new measures for determining how well doctors and nurses do their jobs—how many patients are seen, how quickly patients have access to care, how efficiently they are referred to specialists. These are numeric measures of the right way to provide care, but measures meant to serve patient interests humanely. It would be easier, for instance, if referral to specialists was left to the doctor’s convenience. However, doctors as well as nurses, nurses’ aides, and cleaning staff believe that these “reforms” have diminished the quality of care, using the guideline of what’s practicable on the ground. Their sentiments are hardly unusual. Researchers in western Europe widely report that practitioners believe that their craft skills in dealing with patients are being frustrated by the push for institutional standards.

The National Health Service has a special context quite unlike American-style “managed-care” or other market-driven mechanisms. In the wake of the Second World War, the creation of the NHS was a source of national pride. The NHS recruited the best people, and they were committed; few departed for better-paying jobs in America. Britain has spent a third less of its gross domestic product on health than the United States, yet its infant mortality rate is lower, and its elderly live longer. The British system is “free” health care, paid for through taxes. The British people have indicated that they are happy to pay these taxes, or even contribute more, if only the service can improve.

In time, like all systems, the NHS has worn down. The hospitals physically aged, equipment needing replacement remained in use, waiting times for service lengthened, and not enough nurses were in training. To solve these ills, Britain’s politicians turned a decade ago to a different model of quality, one established by Henry Ford in the American auto industry early in the twentieth century. “Fordism” takes the division of labor to an extreme: each worker does one task, measured as precisely as possible by time-and-motion studies; output is measured in terms of targets that are, again, entirely quantitative. Applied to health care, Fordism monitors the time doctors and nurses spend with each patient; a medical treatment system based on dealing with auto parts, it tends to treat cancerous livers or broken backs rather than patients in the round. A particular wrinkle in British health care is the number of times the health service has been “reformed” along Fordist lines in the past decade: four major reorganizations reverse or depart from previous changes.

Fordism has acquired a bad name in private industry for reasons that Adam Smith first laid out in The Wealth of Nations in the eighteenth century. The division of labor focuses on parts rather than wholes; to the vivacity of merchants, Smith contrasted the dulled wits of factory laborers doing just one small thing, hour after hour, day after day. Smith believed, though, that this system would be more efficient
than work done by hand in the preindustrial way. Henry Ford justified his procedures by arguing that strictly machine-built autos were of better quality than those cars that were in his time assembled in small workshops. The advent of microelectronics in manufacturing has provided further support for this way of making things: microsensors do a much more rigorous, steady job of monitoring problems than human eyes or hands. In sum, by the absolute measure of quality in the thing itself, the machine is a better craftsman than a person.

Medical reform finds its place in this long debate about the nature and value of craftsmanship in a mechanical, quantitative society. In the NHS, the Fordist reformers can claim quality has indeed improved: in particular, cancers and heart diseases are better treated. Moreover, frustrated though they are, British doctors and nurses have not lost the will to do good work; theirs is not the story of the Soviet construction workers. Though fatigued by constant reform and angry at the system of targets, these health care providers have not become indifferent to doing high-quality work. Julian Legrand, an insightful analyst of the NHS, remarks on the fact that although staff are nostalgic for the old days of loose practice, if they were magically transported back two generations, they would be appalled by what they saw.33

Putting nostalgia aside, what is there about medical “craft” that is demeaned by these changes? Studies of nurses provide one answer.34 In the “old” NHS, nurses listened to elderly patients’ stories about their children as well as to complaints about aches and pains; in the hospital wards, nurses often stepped in when a patient crisis erupted, even if they were legally not qualified to do so. Obviously, a sick patient cannot be repaired like an automobile, but behind this stands a deeper point about the practice standard. To do good work means to be curious about, to investigate, and to learn from ambiguity. As with Linux programmers, nursing craft negotiates a liminal zone between problem solving and problem finding; listening to old men’s chatter, the nurse can glean clues about their ailments that might escape a diagnostic checklist.

This liminal zone of investigation is important to doctors in another way. In the Fordist model of medicine, there must be a specific illness to treat; the evaluation of a doctor’s performance will then be made by counting the time required to treat as many livers as possible and the number of livers that get well. Because bodily reality doesn’t fit well inside this classifying model, and because good treatment has to admit experiment, a not insignificant number of doctors create paper fictions to buy themselves time from the bureaucratic monitors. Doctors in the NHS often assign a patient a disease in order to justify the time spent on exploring a puzzling body.

The absolutists working on standards for the system can claim that they’ve raised the quality of care. Nurses and doctors in practice argue against this numeric claim. Rather than fuzzy sentimentalism, they invoke the need for curiosity and experiment and would subscribe, I think, to Immanuel Kant’s image of “the twisted timber of humanity” as applying to both patients and themselves.

This conflict came to a head on June 26, 2006, at the annual meeting of the British Medical Association in Belfast. The association’s president, Dr. James Johnson, observed that the government’s “favored method of raising quality and keeping prices down is to do what they do in supermarkets and offer choice and competition.” To his colleagues he said, “You tell me that the breakneck pace and incoherent planning behind systems reform are seriously destabilising the NHS. The message I am getting from the medical profession is that the NHS is in danger and that doctors have been marginalised.” To the government, Johnson appealed, “Work with the profession. We are not the enemy. We will help you find the solution.”35 When government officials then took the stage, however, an icy, polite silence greeted their speeches.

British doctors and nurses are today suffering from reform fatigue,
an NHS decisively reformed several times in a decade. Any organizational reform takes time to "bed in"; people have to learn how to put the changes into practice—whom now to call, which forms to use, what procedures to follow. If a patient is having a heart attack, you do not want to reach for your "Manual of Best-Practice Performances" to discover the latest rules about what you are supposed to do. The process of bedding in takes longer the bigger and more complex the organization in which one works. The NHS, Britain's biggest employer, consists of more than 1.1 million people. It cannot turn like a sailboat. Both nurses and doctors are still learning the changes proposed a decade ago.

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Embedding stands for a process essential to all skills, the conversion of information and practices into tacit knowledge. If a person had to think about each and every movement of waking up, she or he would take an hour to get out of bed. When we speak of doing something "instinctively," we are often referring to behavior we have so routinized that we don't have to think about it. In learning a skill, we develop a complicated repertoire of such procedures. In the higher stages of skill, there is a constant interplay between tacit knowledge and self-conscious awareness; the tacit knowledge serving as an anchor, the explicit awareness serving as critique and corrective. Craft quality emerges from this higher stage, in judgments made on tacit habits and suppositions. When an institution like the NHS, in churning reform, doesn't allow the tacit anchor to develop, then the motor of judgment stalls. People have no experience to judge, just a set of abstract propositions about good-quality work.

Proponents of absolutist standards of quality, however, have many worries about the interchange between tacit and explicit knowledge—as long ago as in Plato's writings on craftsmanship, the experiential standard is treated with suspicion. Plato views it as too often an excuse for mediocrity. His modern heirs in the NHS wanted to root out embedded knowledge, expose it to the cleansing of rational analysis—and have become frustrated that much of the tacit knowledge nurses and doctors have acquired is precisely knowledge they cannot put into words or render as logical propositions. Michael Polanyi, the modern philosopher most attuned to tacit knowledge, has recognized the justice of this worry. Bedded in too comfortably, people will neglect the higher standard; it is by arousing self-consciousness that the worker is driven to do better.

Here, then, is an emblematic conflict in measures of quality, from which follow two different concepts of institutional craftsmanship. To take a generous view, the reformers of the NHS are crafting a system that works correctly, and their impulse to reform reflects something about all craftsmanship; this is to reject muddling through, to reject the job just good enough, as an excuse for mediocrity. To take an equally generous view of the claims of practice, it encompasses pursuing a problem—be it a disease, a bumerailing, or a piece of the Linux computer kernel—in all its ramifications. This craftsman must be patient, eschewing quick fixes. Good work of this sort tends to focus on relationships; it either deploys relational thinking about objects or, as in the case of the NHS nurses, attends to clues from other people. It emphasizes the lessons of experience through a dialogue between tacit knowledge and explicit critique.

Thus, one reason we may have trouble thinking about the value of craftsmanship is that the very word in fact embodies conflicting values, a conflict that in such institutional settings as medical care is, so far, raw and unresolved.

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An ancient ideal of craftsmanship, celebrated in the hymn to Hephæstus, joined skill and community. Traces of that ancient ideal are still evident today among Linux programmers. They seem an unusual,
marginal group because of three troubled ways in which craftsmanship is now organized.

The first trouble appears in the attempts of institutions to motivate people to work well. Some efforts to motivate good work for the sake of the group have proved hollow, like the degradation of Marxism in Soviet civil society. Other collective motivations, like those in postwar Japanese factories, have succeeded. Western capitalism has sometimes claimed that individual competition rather than collaboration most effectively motivates people to work well, but in the high-tech realm, it is firms that enable cooperation who have achieved high-quality results.

A second trouble lies in developing skill. Skill is a trained practice; modern technology is abused when it deprives its users precisely of that repetitive, concrete, hands-on training. When the head and the hand are separated, the result is mental impairment—an outcome particularly evident when a technology like CAD is used to efface the learning that occurs through drawing by hand.

Third, there is the trouble caused by conflicting measures of quality, one based on correctness, the other on practical experience. These conflict institutionally, as in medical care, when reformers' desire to get things right according to an absolute standard of quality cannot be reconciled with standards of quality based on embedded practice. The philosopher finds in this conflict the diverging claims of tacit and explicit knowledge; the craftsman at work is pulled in contrary directions.

We can understand these three troubles better by looking more deeply into their history. In the next chapter we explore the workshop as a social institution that motivates craftsmen. Following that, we look at the eighteenth-century Enlightenment's first efforts to make sense of machines and skills. Last, we look at tacit and explicit consciousness in the long history of crafting a particular material.

CHAPTER TWO

The Workshop

The workshop is the craftsman's home. Traditionally this was literally so. In the Middle Ages craftsmen slept, ate, and raised their children in the places where they worked.

The workshop, as well as a home for families, was small in scale, each containing at most a few dozen people; the medieval workshop looked nothing like the modern factory containing hundreds or thousands of people. It's easy to see the romantic appeal of the workshop-home to socialists who first confronted the industrial landscape of the nineteenth century. Karl Marx, Charles Fourier, and Claude Saint-Simon all viewed the workshop as a space of humane labor. Here they, too, seemed to find a good home, a place where labor and life mixed face-to-face.

Yet this beguiling image is misleading. The medieval workshop-home did not follow the rules of a modern family guided by love. Organized into a system of guilds, the workshop provided other, more impersonal emotional rewards, most notably, honor in the city. "Home" suggests established stability; this the medieval workshops had to struggle for, since they could not assume they would survive. The workshop as home may also obscure this living scene of labor today. Most scientific laboratories are organized as workshops in the sense that they are small, face-to-face places of work. So, too, can workshop conditions be
carved out of giant enterprises: modern auto plants combine the assembly line with spaces reserved for small, specialist teams; the auto factory has become an archipelago of workshops.

A more satisfying definition of the workshop is: a productive space in which people deal face-to-face with issues of authority. This austere definition focuses not only on who commands and who obeys in work but also on skills as a source of the legitimacy of command or the dignity of obedience. In a workshop, the skills of the master can earn him or her the right to command, and learning from and absorbing those skills can dignify the apprentice or journeyman's obedience. In principle.

To use this definition we need to take account of authority's antonym: autonomy, self-sufficing work conducted without the interference of another. Autonomy has its own seductive power. We might easily imagine that the Soviet construction workers described in the previous chapter would have worked more diligently if they had held more control over their own labor. The British nurses and doctors certainly believed that they could get on better with a difficult job if left alone. They should be masters of their own house. No one working alone could figure out, however, how to glaze windows or to draw blood. In craftsmanship there must be a superior who sets standards and who trains. In the workshop, inequalities of skill and experience become face-to-face issues. The successful workshop will establish legitimate authority in the flesh, not in rights or duties set down on paper. In the failed workshop, subordinates like the Russian construction workers will become demoralized or, like British nurses at the medical convention, grow angry in the physical presence of those whom they must nonetheless obey.

The social history of craftsmanship is in large part a story of the efforts of workshops to face or duck issues of authority and autonomy. Workshops do have other aspects, in their dealings with markets, their quest for funds and profits. The social history of workshops emphasizes how the institutions have organized themselves to embody authority. A significant moment in the history of workshops occurred at the end of the medieval era—a particularly illuminating passage for the problems of authority today.

The Guild House
The Medieval Goldsmith

The medieval craftsman's authority rested on the fact that he was a Christian. Early Christianity had from its origins embraced the dignity of the craftsman. It mattered to theologians and laymen alike that Christ was the son of a carpenter. God's humble origins sending a signal about the universality of his message. Augustine thought Adam and Eve "fortunate to work in a garden.... Is there any more marvelous sight than the sowing of seeds, the planting of cuttings, the transplanting of shrubs?" The religion embraced the work of the craftsman, moreover, because these labors could counteract the human propensity for self-destruction. As in the hymn to Hephaestus, craftwork seemed peaceable and productive rather than violent. For this reason, in the Middle Ages there appeared new craftsmen-saints. In Anglo-Saxon Britain, for instance, Saints Dunstan and Ethelwold were both metalworkers, venerated for their calm industry.

Although it respected craftwork, medieval Christian doctrine also feared the human Pandora, a fear that can be traced back to the faith's origins. Pagan Rome—in its belief that the work of one's hands can reveal much about the soul—represented a monumental folly. Augustine argued in the Sermons that confessio means "accusation of oneself; praise of God." The principle of Christian retreat was founded on the conviction that the further a person can get from obsessing about material things, the closer he or she will come to discovering a timeless inner life not of human making. Doctrinally, the craftsman represents Christ's appearance to humankind but not his being.
The early medieval Christian craftsman found his spiritual home on earth in monasteries such as that of Saint Gall in what is now Switzerland, a walled mountain refuge within which monks gardened, practiced carpentry, and concocted herbal medicines as well as prayed. Saint Gall harbored lay craftsmen whose lives were almost equally subject to monastic discipline. In a nearby nunnery, nuns in strict seclusion nonetheless spent much of each day in the practical activities of weaving and sewing. Saint Gall and kindred monasteries were largely self-sufficient communities, "sustainable" we would say, producing most of what they needed for survival. The workshops of Saint Gall followed the precepts of authority according to the dual canon of the faith: the Holy Spirit can appear to men and women under these conditions; the Spirit is not, however, contained within the walls.

As cities developed in the twelfth and thirteenth centuries, the workshop became a different sort of space, both sacred and profane. A contrast of the parish surrounding the Cathedral of Notre-Dame in Paris in 1300 to the monastery at Saint Gall three hundred years earlier, in 1000, shows some of the differences. The urban episcopal parish contained many private houses—"private" in that a workshop leased or bought premises from the parish and in that monks and religious officials could not enter these houses at will. The Bishop's Landings on the south side of the Seine served the religious community as a door for goods; Saint Landry's Landings on the north side served the intermingled lay community. When Jehan de Chelles began the final phase of building this urban community in the mid-thirteenth century, the State appeared in its inaugural celebrations as the equal partner of the Church. Together and equally these two authorities celebrated "the building trades, feasting the carvers, glassblowers, weavers and carpenters who did the manual labor, and the bankers who financed the work."13

The guilds were corporations that attempted to translate the principle rex qui nunquam moritur—the king never dies—into profane terms.4 Legal documents partly sustained the guilds, but even more the hands-on transmission of knowledge from generation to generation aimed to make them sustainable. This "knowledge capital" was intended as the source of the guild's economic power. The historian Robert Lopez pictures the urban guild as "a federation of autonomous workshops, whose owners [the masters] normally made all decisions and established the requirements for promotion from the lower ranks [journeymen, hired helpers, or apprentices]." The Livre des métiers of 1268 lists about a hundred crafts organized in this way, divided into six groups: foods, jewelry, metals, textiles and clothiers, furs, and building.6

Still, religious authority of a hierarchical sort moved to town. Not only did religious rituals shape the daily routine of urban workers in guilds, but the master of each of Paris's seven major guilds claimed moral stature akin to that of an abbot. In the city, sheer necessity in part prompted this claim. There were no effective police in medieval towns, whose streets were violent both day and night. The equilibrium of the monastery was absent in the city; violence on the streets seeped into and among the workshops. The Latin word auctoritas stands for a personage who inspires fear and awe and so submission: the master of a workshop had to inspire such sentiments to keep order in his house.

Christian morality most shaped the "man" in the urban Christian craftsman. Early Church doctrine generally viewed free time as a temptation, leisure as an invitation to sloth. This fear applied particularly to women. Eve was the temptress, distracting man from his work. The Church Fathers imagined women as specifically prone to sexual license if they had nothing to occupy their hands. This prejudice bred a practice: female temptation could be countered by a particular craft, that of the needle, whether in weaving or embroidery, the woman's hands kept ever busy.

The needle as a remedy for female idleness traces back to the early Church Father Jerome. As is the way of prejudices that mature in time,
this sexual negative became by the early Middle Ages also a source of honor. As the historian Edward Lucie-Smith points out, "queens were not ashamed both to weave and to sew"; Edith, queen of Edward the Confessor, sewed simple clothes, as did Matilda, queen of William the Conqueror.\footnote{7}

Still, the "man" in craftsmanship excluded women from formal membership in guilds, even though women cooked and cleaned in the houses of the city's workshops.

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In the medieval guild, male authority was incarnate in the three-tiered hierarchy of masters, journeymen, and apprentices. Contracts specified the length of an apprenticeship, usually seven years, and the cost, usually borne by the young person's parents. The stages of progress in a guild were marked out first by the apprentice's presentation of the chef d'oeuvre at the end of his seven years, a work that demonstrated the elemental skills the apprentice had imbibed. If successful, now a journeyman, the craftsman would work for another five to ten years until he could demonstrate, in a chef d'oeuvre élevé, that he was worthy to take the master's place.

The apprentice's presentation focused on imitation: learning as copying. The journeyman's presentation had a larger compass. He had to show managerial competence and give evidence of his trustworthiness as a future leader. The difference between brute imitation of procedure and the larger understanding of how to use what one knows is, as we saw in the previous chapter, a mark of all skill development.

The medieval workshop was distinctive in the authority invested in the teachers and judges of this progress. The master's verdicts were final, without appeal. Only rarely would a guild interfere in the judgments of individual masters in a workshop, for in his person the master united authority and autonomy.

Medieval goldsmithing is a good craft to study in this regard, because this craft had a peculiarity that makes it comprehensible rather than foreign to us. The apprentice goldsmith was place-bound while learning how to smelt, purify, and weigh precious metals. These skills required hands-on instruction from his master. Once the apprentice had locally presented his chef d'oeuvre, however, he could move from city to city as a journeyman, responding to opportunities.\footnote{8} The traveling goldsmith journeyman made his presentation élevé to the corporate body of master craftsmen in foreign cities. Through his managerial talents and moral behavior he had to convince these strangers that he could become one of them. The sociologist Alejandro Portes observes about modern economic migrants that they tend to be entrepreneurial in spirit; the passive stay home. This migratory dynamism was built into medieval goldsmithing.

It was for this reason that the goldsmith appealed in his own time to Ibn Khaldun, the first and still one of the greatest of sociologists. He was born in what is now Yemen but traveled extensively in Spanish Andalusia, at the time a mixed society of Jews, Christians, and Muslims, the last of whom ruled tenuously. The Muqaddimah, a vast enterprise, is in part a close observation of craftwork. In Andalusia Ibn Khaldun observed the wares of local Christian guilds, as well as the work of itinerant goldsmiths. The goldsmiths seemed to him like Berbers, made strong by travel and mobility. Sedentary guilds, by contrast, appeared to him inert and "corrupt." The good master, in his words, "presides over a travelling house."\footnote{9}

On the other side of the coin, migrant labor and the flow of international trade in the medieval era provoked some of the same fears we experience today. The great worry of urban guilds was a market flooded with fresh goods the guilds had not made. Guilds of medieval London and Paris in particular mounted defensive actions against the growth of trade in northern Europe. This threat they ward off by imposing punishing tolls and tariffs at the gates of cities and by strictly regulating the operations of fairs within cities. Itinerant guilds such as the
goldsmiths sought contracts that would maintain the same conditions of
labor wherever a goldsmith worked. Like ancient Greek weavers,
these medieval craftsmen sought to hand down craft practices intact
from generation to generation. Hannah Arendt's rhythm of "natality"
and extinction was their enemy, for reasons of keeping the craft prac-
tice internationally coherent.

The *Livre des métiers* mentions in passing masters who become
jouneymen "either on account of poverty or by choice."10 The first
kind of downward mobility we easily comprehend; failed masters be-
come other people's servants. The second is perhaps explained by the
wandering goldsmith—a master in other crafts who renounces his
place in the hierarchy of guilds in one city in order to travel in search of
opportunity.

If adult goldsmiths formed a kind of analogue to modern flexible
workers, moving to where the work is, still guild members forged a
strong sense of community. The guild network provided contacts for
workers on the move. Equally important, the guilds emphasized the
migrant's obligations to newly encountered goldsmiths. Elaborate ritu-
al did the work of binding the guild members to one another. Many
goldsmithing guilds had, moreover, associated fraternities that in-
cluded women, the fraternities supplying help for workers in need,
from organizing social occasions to buying burial plots for the dead. In
an age when written contracts between adults had little force, when
informal trust instead underpinned economic transactions, "the single
most pressing earthly obligation of every medieval artisan was the es-
tablishment of a good personal reputation."
11 This was especially an
urgent matter for itinerant goldsmiths, who were strangers to many of
the places in which they worked. The ritual life of guilds and their
fraternities provided a frame to establish their probity.

"Authority" means something more than occupying a place of honor in
a social web. For the craftsman, authority resides equally in the quality
of his skills. And in the goldsmith's case, the good skills that established
the master goldsmith's authority were inseparable from his ethics. This
ethical imperative appeared in the very technological activity, the assay,
that gave goldsmithing its economic value.

Corrupt, shaved, and false coins assailed the medieval economy.
The goldsmith's role was to tell the truth about disguised substances,
as well as to smelt gold from raw ore. The honor of the guild was meant
to reinforce honesty; goldsmiths discovered to be dishonest were vio-
ently punished by other guild members.12 The repute of the truthful
craftsman mattered politically as well as economically, for he certified
that the wealth of a nobleman or of a city government was genuine. To
strengthen the craftsman's ethical sense, the gold assay by the thir-
teenth century became a religious rite, sanctified by special prayers, in
which the content of gold was sworn by a master craftsman in the name
of God. We may not now believe that faith makes for truth in chemis-
try; our forebears did.

The procedures of the gold assay were not scientific in the modern
sense. Metallurgy was still yoked to the ancient belief in nature's four
basic elements. Only at the end of the Renaissance could metallurgists
effectively deploy the single test of "cupellation," in which a sample is
scorched with hot air, oxidizing impurities like lead.13 Before that, the
medieval goldsmith had to use many tests to arrive at the judgment that
the material he held in his hand was indeed gold.

In the assay, "hands-on" was no mere figure of speech to the gold-
smith. The most important of his tests depended on his sense of touch.
The goldsmith rolled and squeezed the metal, trying to judge from its
consistency its nature. The sense of touch was itself in the Middle Ages
endowed with magical, indeed religious properties, as in the "king's
touch," the king laying hands on a subject to cure scrofula and leprosy.
In craft practice, the slower and more searchingly the goldsmith worked with his hands, the more truthful he appeared both to his peers and to his employers. Instant results employing a single test were suspect.

Ethics also shaped the relationship between goldsmiths and alchemists. Alchemy was not quite in the fourteenth and fifteenth centuries the foolishness we now take it for, because people believed that all solid elements shared the same fundamental "earth." Nor were those who practiced alchemy crooks—even in the late seventeenth century eminent figures like Isaac Newton dabbled in alchemy. "Most of the leading alchemists," the historian Keith Thomas writes, "thought of themselves as pursuing an exacting spiritual discipline, rather than a crude quest for gold." They were in search of the principles of purification by which a substance of "noble value" could be extracted from crude earth, a model in turn for purification of the soul. Thus the goldsmith and the alchemist were often two faces, as it were, of the same coin, engaged in the same quest for purity.

Still, the medieval goldsmith served as the practical critic of alchemical claims, just as he was the counterfeiter's God-sworn enemy. Alchemical treatises abounded in the Middle Ages, some merely fanciful, other deeply serious investigations using the science of the time. In the assay, the goldsmith tested theory literally with his hands. His relation to the alchemical theorists resembles that of the modern British nurse, faced with a stack of paper "reforms," judging them in substance, in practice.

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Goldsmithing is perhaps most revealing in what it tells about the workshop conceived as a craftsman's home—a place that unites family and labor. All medieval guilds were based on the hierarchy of the family, but these were not necessarily blood ties. The master craftsman legally stood in loco parentis to the journeymen and apprentices below him even if they were not his kin. A father entrust his sons to the master craftsman as a surrogate parent most notably by transferring the right to punish misbehavior with physical violence.

Making the workplace into a surrogate family, however, also restrained the authority of the surrogate father. The master was enjoined by a religious oath that no father had ever to swear in words, that of improving the skills of his charges. This contract, notes the historian S. R. Epstein, protected apprentices against "the opportunism of their masters. They were [otherwise] liable to be exploited as cheap labor" without any benefit to themselves. Correspondingly, the apprentice was contracted by religious oath to keep the secrets of his master. These legal and religious bonds brought emotional rewards that the biological bond could not furnish: they guaranteed the good apprentice that he could carry emblems or flags of the guild in civic parades and that he could enjoy a privileged place at banquets. The guild's religious oaths established reciprocal honor between surrogate father and son rather than simple filial obedience.

Today, the dozen years or so of childhood are succeeded by an adolescence that seems to stretch out, agonizingly, another decade. Historians of childhood like Philippe Ariès have argued that in the Middle Ages there was no such stretched-out time of youth: children were treated as young adults from the age of six or seven, fighting alongside older people, frequently marrying before puberty. Though Ariès's account has factual flaws, it explains the relations of authority and autonomy in guild life, for these relations turned on treating the child as an incipient adult.

Historical records show that many guilds privileged the biological sons of masters, but blood sons did not enjoy this privilege securely. Durable family businesses were the exception rather than the rule. By one large estimate, in the 1400s only about half of family businesses passed from generation to generation in the dense European belt of
workshops from Bruges to Venice. By the end of the 1500s, only a tenth of artisan sons took their father's place. More precisely, about half the sons of barrel masters in Bruges took over their fathers' workshops in 1375; by 1500, nearly none did. Paradoxically, the surrogate father's sworn oath to pass on a skill was a surer guarantee than the biological father's power to pass on a business so that the young adult could be master in his own house.

Surrogacy, as people experienced it eight hundred years ago, is not entirely a "foreign country," to recall the phrase of L. P. Hartley. Surrogate parenting is a modern reality in schools, where teachers dominate an ever-increasing portion of the human life cycle. Divorce and remarriage create another kind of surrogate parenting.

The medieval workshop was a home held together more by honor than by love. The master in this house based his authority, concretely, on the transference of skills. This was the surrogate parent's role in child development. He did not "give" love; he was paid to do his particular kind of fathering. As a mirror held up to ourselves, in loco parentis is both an inspiring and an unsettling image of fatherhood: the guild master had a clear role as a father figure, one that expanded a child's horizons beyond the accidents of birth. Moreover, in goldsmithing, the child was inducted into an adult code of honor that widened his horizons beyond that of the individual house, beyond the confines of a particular loved parent. The medieval surrogate father could be affectionate to his charges, but he had no need to love them. Love, in its inner twists and turns, in its sheer generosity, is not the point of craftsmanship. The surrogate father, we might be tempted to say, was a stronger father figure.

In sum, the medieval craftsman was both brother and stranger to the present. His work was migrant, yet he also sought stability through shared skill. Ethical behavior was implicated in his technical work. His craft was hands-on, like a clinical practice. His surrogate parenting reveals still-puissant virtues. Yet his workshop did not endure. Of the many reasons for the decline of the medieval workshop, none is more important than its foundation of authority, the knowledge it could pass on by imitation, ritual, and surrogacy.

The Master Alone
The Craftsman Becomes an Artist

Probably the most common question people ask about craft is how it differs from art. In terms of numbers this is a narrow question; professional artists form a mere speck of the population, whereas craftsmanship extends to all sorts of labors. In terms of practice, there is no art without craft; the idea for a painting is not a painting. The line between craft and art may seem to separate technique and expression, but as the poet James Merrill once told me, "If this line does exist, the poet himself shouldn't draw it; he should focus only on making the poem happen." Though "what is art?" is a serious and endless question, lurking in this particular definitional worry may be something else: we are trying to figure out what autonomy means—autonomy as a drive from within that impels us to work in an expressive way, by ourselves.

This at least is how the historians Margot and Rudolf Wittkower saw the matter in their absorbing history Born under Saturn, which recounts the emergence of the Renaissance artist from the community of medieval craftsmen. "Art" does a lot of heavy lifting in this version of cultural change. First of all, it stands for a new, larger privilege accorded subjectivity in modern society, the craftsman outward turned to his community, the artist inward turned upon himself. The Wittkowers emphasize Pandora's reappearance in the shift; self-destructive subjectivity was evinced by such suicides as the artists Francesco Bassano and Francesco Borromini. In the minds of contemporaries, their genius drove these men to despair.

This version of change is not quite a tight story; the dark consequences of subjectivity were applied in Renaissance thinking more
broadly than to working artists, whether geniuses or not. Robert Burton's *Anatomy of Melancholy* (1621) explored the " saturnine temperament" as a human condition, rooted in the biology of the body, when the brooding, introspective "humour"—a "humour" being closest to what modern medicine would conceive as a glandular secretion—is allowed to flourish. Isolation, Burton explained, stimulated this secretion. His rambling masterpiece returned again and again to the fear that subjectivity turns to melancholy. The "artist" to him is but one instance of the risk of depression entailed by the workings of the human body in solitude.

Art seemed to the Wittkowers to place the artist on a more autonomous footing in society than the craftsman, and this for a particular reason: the artist claimed originality for his work; originality is the trait of single, lone individuals. Few Renaissance artists in fact worked in isolation. The craft workshop continued as the artist's studio, filled with assistants and apprentices, but the masters of these studios did indeed put a new value on the originality of the work done in them; originality was a value that was not celebrated by the rituals of medieval guilds. The contrast still informs our thinking: art seems to draw attention to work that is unique or at least distinctive, whereas craft names a more anonymous, collective, and continued practice. But we should be suspicious of this contrast. Originality is also a social label, and originals form peculiar bonds with other people.

The patrons of Renaissance artists and the market for their art changed as court society grew at the expense of medieval communes. Clients had an increasingly personal relationship to the masters of the studios. Often they did not understand what the artists were attempting to achieve, yet just as often asserted their authority to judge the work's worth. If original in his labors, the artist lacked a collective shield, as the member of a community, against these verdicts. The artist's only defense against intrusion was, "You do not understand me," a not entirely enticing selling point. Again there is a modern resonance: who is fit to judge originality? Maker or consumer?

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The most famous goldsmith of the Renaissance, Benvenuto Cellini, confronted these issues in his *Autobiography*, which he began writing in 1558. His book opens confidently, with a sonnet boasting of two accomplishments. The first is about his life: "I have been involved in astounding exploits and I have lived to tell the tale." Born in Florence in 1500, Cellini was variously imprisoned for sodomy and the father of eight children; an astrologer; poisoned deliberately, once by powdered diamonds and later by a "delicious sauce" prepared by a "vicious priest"; the murderer of a postman; a naturalized French citizen who loathed France; a soldier who spied for the army he fought against; . . . the catalogue of such amazing incidents is endless.

The second advertisement is for his work. He boasts: "In my art / I have surpassed many and arrived at the level of the / only one who was / my better."21 One master—Michelangelo—and no equals; none of his peers is able to rise to his level nor is as original. A famous golden saliccella that Cellini made in 1543 for Francis I of France (now in the Kunsthistorisches Museum, Vienna) served as evidence for this boast. Not even that haughty monarch could casually have taken salt from it. The bowl holding the salt is submerged in a golden clutter. On its crown male and female golden figures represent the Sea and the Earth (salt belonging to both realms), while on the ebony base bas-reliefs of figures represent Night, Day, Twilight, and Dawn plus four Winds (Night and Day pay direct homage to Michelangelo's sculpting of these same figures on the Medici tombs). This glorious object was meant to provoke amazement and it did.

Before inquiring into what might make this a work of art rather than a piece of craft, we should place Cellini among his fellows. Throughout the Middle Ages there were masters as well as journeymen who, as the
Livre des métiers noted, wished to set up on their own as individual entrepreneurs. These craft entrepreneurs wanted simply to pay assistants without being obliged to train them. Their prosperity depended on making a name for their goods as what we today would call a “brand label.”

This last fact sent an ever-more-personal signal of distinction. Medieval guilds did not tend to emphasize individual differences within a town’s workshops; the guild’s collective effort of control names where a cup or coat was made rather than who made it. In the material culture of the Renaissance, naming the maker became increasingly important to the sale of a wide variety of goods, even the most prosaic. Cellini’s saltcellar falls within this general, branding pattern. The very fact that a dish to hold salt had become an elaborate object transcending any mere functional purpose called attention to it and to its maker.

Around 1600, a change in the relation of goldsmiths to other craftsmen slowly appeared, one remarked in Alan of Lille’s Antiquarianus in the early 1180s. Before this time, the forms of working gold into decorative objects had set the pace for painting and glassmaking, the gold frame orienting the objects within it. About this time, the craft historian T. E. Heslop observes, the process slowly began to reverse: “What we would call naturalism, most readily associated with painting and sculpture, came to dominate to such an extent that goldsmiths had to cultivate the arts of drawing and modelling as never before.”

Cellini’s pictures in gold are one result of this process: they are a “new” kind of goldsmithing, in part simply because they incorporate into metalwork another craft practice, that of drawing.

Cellini kept a certain allegiance to the craft workshops from which his art emerged. He was never ashamed of the foundry, its dirt, noise, and sweat. Moreover, he heeded to the traditional craft value placed on truthfulness. In the Autobiography he recounts the struggle to extract gold, real gold and lots of it, from masses of raw ore—whereas even his richest patrons would have been content with the illusion of surface gilding. In carpenter’s terms, Cellini hated veneers. He wanted “honest gold” and held to this same standard of truthfulness in the other materials he worked with, even in cheap metals like brass. It had to be pure, so that things would look like what they are.

We’d thus risk vulgarizing Cellini’s autobiography to see it simply as self-serving. Indeed, though in the economy of the time artisans of all sorts advertised the individual merits of their work, Cellini’s book itself does not fall into the category of publicity. He chose not to publish the autobiography in his lifetime; he wrote it for himself and left it to posterity. Yet, like many other goods, his saltcellar was taken to have public value because it exposed and expressed the inner character of its maker. Francis I certainly thought so, exclaiming, “Here is Cellini himself!”

Distinction of this sort carried material rewards. As the historian John Hale points out, many artists prospered thanks to the distinctiveness of their work: Lucas Cranach the Elder’s house in Wittenberg was a small palace, as was Giorgio Vasari’s in Arezzo. Lorenzo Ghiberti, Sandro Botticelli, and Andrea del Verrocchio all trained as goldsmiths. So far as we can determine, they were wealthier than their peers who remained strictly within the guild orbit of assay and raw material production.

Authority in the generic sense relies on a basic fact of power: the master sets out the terms of work that others do at his direction. The Renaissance artist’s atelier differed little in this from the medieval workshop or the modern scientific laboratory. In an artist’s atelier, the master made the overall design in the painting and then filled in the most expressive parts, such as the heads. But the Renaissance studio existed in the first place because of the master’s distinctive talents; the point was not to produce pictures as such but rather to create his pictures or pictures in his manner. Originality gave a particular importance to face-to-face relations in the studio. Unlike goldsmith assayers, the artist’s assistants had to remain in the physical presence of their
masters; originality is hard to write down in a rulebook you might pack in your luggage.

"Originality" traces its origins back to one Greek word, poesis, which Plato and others used to mean "something where before there was nothing." Originality is a marker of time; it denotes the sudden appearance of something where before there was nothing, and because something suddenly comes into existence, it arouses in us emotions of wonder and awe. In the Renaissance, the appearance of something sudden was connected to the art—the genius, if you will—of an individual.

We'd certainly err by imagining that medieval craftsmen were entirely resistant to innovation, but their craftwork changed slowly and as the result of collective effort. For instance, the immense Salisbury Cathedral began, in 1220–1225, as a set of stone posts and beams that established the Lady Chapel at one end of the future cathedral. The builders had a general idea of the cathedral's eventual size, but no more. However, the proportions of the beams in the Lady Chapel suggested a larger building's engineering DNA and were articulated in the big nave and two transepts built from 1225 to about 1250. From 1250 to 1280, this DNA then generated the cloister, treasury, and chapter house; in the chapter house the original geometries, meant for a square structure, were now adapted to an octagon, in the treasury to a six-sided vault. How did the builders achieve this astonishing construction? There was no one single architect; the masons had no blueprints. Rather, the gestures with which the building began evolved in principles and were collectively managed over three generations. Each event in building practice became absorbed in the fabric of instructing and regulating the next generation.

The result is a striking building, a distinctive building embodying innovations in construction, but it is not original in the sense that Cellini's saltcellar is: an amazing blow, a painting in pure gold. As earlier remarked, the "secret" of originality here is that the two-dimensional practice of drawing has been transferred to the three dimensions of gold, and Cellini pushed this transfer to an extreme that his contemporaries had not imagined possible.

But originality carried a price. Originality could fail to provide autonomy. Cellini's Autobiography is a case study of how originality could breed new kinds of social dependence and, indeed, humiliation. Cellini left the guild realm of assay and metal production only to enter court life with all its intrigues of patronage. With no corporate guarantee for the worth of his work, Cellini had to charm, hector, and plead with kings and princes of the Church. These were unequal trials of strength. Confrontational and self-righteous as Cellini could be to patrons, ultimately his art depended on them. There was in Cellini's life a telling moment when this unequal trial of strength became clear to him. He sent Philip II of Spain the sculpture of a naked Christ in marble, to which the king rather wickedly added a fig leaf made of gold. Cellini protested that the distinctive character of the Christ was spoiled, to which Philip II replied, "It's mine."

We would say now this is a matter of integrity—the integrity of the thing in itself—but it's also a matter of the maker's social standing. Cellini, as he repeatedly stresses in his autobiography, was not to be measured like a courtier, by a formal title or a post at court. But any person who stands out still has then to prove him- or herself to others. The medieval goldsmith furnished proof of his worth through communal rituals, proof about the work's worth through the process of proceeding slowly and carefully. These are irrelevant standards for judging originality. Put yourself in Philip II's elegant shoes: faced with an original and so unfamiliar object, how would you evaluate its worth? Confronted with Cellini's declaration, "I am an artist! Don't touch what I've done!" you, in your kingly majesty, might well think, "How dare he?"

A final, signal fact about Cellini's Autobiography is that his experiences of unrequited dependency and misunderstanding heightened his self-consciousness. Again and again in these pages, humiliation at the hands of a patron drives the writer to bouts of introspection. This
condition was just the opposite of the passive, and so brooding, isolation pictured in the pages of Burton's *Anatomy of Melancholy*. Here the Renaissance artist may well be the emblematic first modern man: active, and so suffering, driven inward, searching for a refuge in his "autonomous creativity." In this view, creativity lies within us, no matter how society treats us.

That belief became powerfully grounded in Renaissance philosophy. It appeared in the writings of the philosopher Pico della Mirandola, who envisaged *Homo faber* to mean "man as his own maker." Pico was one of Hannah Arendt's (unacknowledged) sources; his *Oration on the Dignity of Man* of 1486 was based on the conviction that, as the force of custom and tradition wanes, people have to "make experience" for themselves. Each person's life is a narrative in which the author does not know how the story will turn out. Pico's figure for *Homo faber* was Odysseus, voyaging through the world, not knowing where he would land. A kindred idea of man as his own maker also appears in Shakespeare, when Coriolanus asserts, "I am my own maker," and thus defies the adage of Augustine, who warned, "Hands off the self! Touch it and you make a ruin!"

Art plays a particular role in this life voyage, at least for artists. The work of art become like a buoy at sea, marking out the journey. Unlike a sailor, though, the artist charts his own course by making these buoys for himself. This is how, for instance, Giorgio Vasari proceeds in *The Lives of the Artists* (1568), one of the first books ever written to chart artistic careers. Vasari's "lives" concern artists who develop within, who brought forth works despite all impediments, artists whose creative urge is autonomous. Works of art are the evidence of an inner life sustained even in the face of humiliation and incomprehension—as indeed Cellini sometimes faced. Renaissance artists discovered that originality does not provide a solid social foundation of autonomy.

The scorned or misunderstood artist has a long trajectory in Western high culture, in all the arts. Cellini is the troubled ancestor of Mozart in his dealings with the bishop of Salzburg in the eighteenth century, of Le Corbusier's struggles with a stodgy Harvard University in trying to construct the Carpenter Center for the Visual Arts in the twentieth. Originality brings to the surface the power relations between artist and patron. In this regard, the sociologist Norbert Elias reminds us that in court societies the bond of mutual obligation was distorted. The duke or cardinal paid the tradesmen's bills when it suited him, if at all; Cellini, like many others, died with large uncalled royal debts.

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Cellini's story does, in sum, enable a certain a sociological contrast between craft and art. The two are distinguished, first, by agency: art has one guiding or dominant agent, craft has a collective agent. They are, next, distinguished by time: the sudden versus the slow. Last, they are indeed distinguished by autonomy, but surprisingly so: the fine, original artist may have had less autonomy, be more dependent on uncomprehending or willful power, and so be more vulnerable, than were the body of craftsmen. These differences still matter in their content to people who are not among the small band of professional artists.

Unmotivated workers like the Soviet construction workers, depressed workers like the British doctors and nurses suffer not so much from the work they do as by how it is organized. This is why we should not give up on the workshop as a social space. Workshops present and past have glued people together through work rituals, whether these be a shared cup of tea or the urban parade; through mentoring, whether the formal surrogate parenting of medieval times or informal advising on the worksite; through face-to-face sharing of information.

The historical turn is for these reasons more complicated than a story of decline; a new, disturbing set of work values was added to the sociable workshop. Modern managerial ideology urges even the lowliest worker to work "creatively" and evince originality. In the past the
satisfaction of this command proved a recipe for distress. The Renais-
sance artist still needed a workshop, and his assistants in it undoubt-
edly learned from the example of their master. The master’s own mas-
tery changed in content; claims for his distinctiveness and originality
now posed a motivational problem for him. He would need the will to
fight in order to validate these claims. His honor took on an adversarial
character. The workshop would serve him as a refuge from society.

“His Secrets Died with Him”
In Stradivari’s Workshop

In the Autobiography, Cellini says that the “secrets of his art would
die” with him.26 His daring and innovation certainly could not be
passed down through pageants, feasts, and prayers of earlier times; the
value of the work lodged in its originality. So here was a concrete limit
placed on the long-term viable life of the workshop. In modern par-
lance, knowledge transfer became difficult; the master’s originality
inhibited the transfer. This difficulty remains, in scientific laborato-
ries as much as in artists’ studios. Although in a lab the neophyte can be
readily inducted in procedures, it’s harder for a scientist to pass on the
capacity to look suspiciously for new problems in the course of solving
old ones or to explain the intuition formed from experience that a
problem is likely to wind up a dead-end.

The difficulty of knowledge transfer poses a question about why it
should be so difficult, why it becomes a personal secret. This isn’t the
case in music conservatories, for instance; both through individual and
master classes, and in workshop discussions, expression is constantly
analyzed and refined. In the famous Class 19 conducted by Mstislav
Rostropovich at the Moscow Conservatory in the 1950s and 1960s, the
great cellist used all manner of weapons—novels, jokes, and vodka, as
well as strict musical analysis—to bludgeon his pupils into becoming
themselves more individually expressive.27 Yet in the fabrication of mu-
sical instruments, the secrets of masters like Antonio Stradivari or
Guarnieri del Gesù have indeed died with them. Mountains of cash and
endless experiments have failed to prize out the secrets of these mas-
ters. Something in the character of these workshops must have inhib-
ited knowledge transfer.

When Antonio Stradivari began making violins, he formed part of a
tradition whose standards on carving the belly, back, and peg boxes of
stringed instruments had been set by Andrea Amati a century earlier.
Subsequent luthiers (the word represents makers of varied stringed
instruments) paid fealty to these Cremona masters and their Austrian
neighbor Jacob Stainer. Many trained in the workshops of their disci-
plines; others learned by repairing old instruments that came into their
hands. Carving books existed from the origins of lutherie in the Renais-
sance, but the texts were expensive to produce and few in number;
technical training involved hands-on contact with the instruments and
on spoken explanation passed generation to generation. The young
luthier would have held in his hands, copied, or repaired an Amati
original or prototype. This was the method of knowledge transfer that
Stradivari inherited.

Inside, the workshop of Stradivari also looked back in that, like
that of other luthiers, the physical house was both a place of work and a
home, filled with Stradivari’s family and many young male apprentices
and journeymen lodgers. Labor dominated all waking hours. The work-
shop operated from dawn to dusk, with the work team literally rooted
to the benches, since the unmarried apprentices slept underneath
them on bags of straw. As in the past, Stradivari’s male children learn-
ing the business were subjected to the same formal rules as lodger
apprentices.

Youngsters at work usually did such preparatory labor as soaking
wood in water, rough molding, and rough cutting. Journeymen higher
up did finer belly cutting and neck assembly, and the master himself took charge of the ultimate installation of the parts and of varnishing, the protective coating of the wood being the ultimate guarantor of its sound. The master, however, was everywhere present in the production. We know, thanks to the researches of Tony Faber, that Stradivari occupied himself with the smallest details in the production of his violins. Though he rarely traveled, in the house he was in constant motion, not confined to an office—an imperious, even hectoring character who sometimes threw spectacular tantrums, oozing instructions and exhortations.28

Yet the medieval goldsmith would not have felt at home here. Like Cellini’s, the Stradivari workshop revolved around the extraordinary talents of an individual. But Cellini might also have trouble understanding it: the master now presented himself to the open market, rather than to one or a few patrons. The number of luthiers and the volume of instruments had by Stradivari’s time also radically expanded. Supply began to exceed demand. Even Stradivari, famous as he early on became, had to worry about markets because he dealt with many private clients and this market patronage proved fickle, especially at the end of his long life. In the general economic decline of the 1720s his workshop had to trim costs, and much of its output went into stock.29

Cracks in the workshop hierarchy widened owing to the uncertainties of the open market; ambitious apprentices, seeing that even so famous a master had an uncertain fate, began to buy out or beg off the last years of their contracts. What was unusual in the time of the Livre des métiers had now become normal: the open market shrunk the time frame of the master’s dominion.

The market also deepened those inequalities whose seed was planted in the Renaissance branding of craft goods. As early as 1680, Stradivari’s success put pressure on other families like the Guarneri, whose business was founded by Andrea Guarneri. The grandson Bartolomeo Giuseppe, known as “del Gesù,” worked in the shadow of Stradivari. “In contrast to Antonio Stradivari’s vast international clientele,” Guarneri’s biographer tells us, his “customers were by and large . . . humble Cremonese players who [performed in] palaces and churches in and around Cremona.”30 As great a maker as Stradivari, del Gesù could sustain his workshop for only fifteen years; he had even more trouble holding onto the best apprentices.

When Antonio Stradivari died, he passed on the business to his two sons, Omobono and Francesco, who never married and who spent their adult lives in their father’s house as his servant-heirs. They were able to trade on his name for several years, but the business eventually foundered. He had not taught, he could not teach either of them how to be a genius. (The work of theirs I’ve held and played is excellent, but no more than that.)

This is the brief outline of a workshop death. For nearly three centuries luthiers have struggled to revive this corpse in order to recover the secrets of Stradivari and Guarneri del Gesù that died with them. Even while the Stradivari sons were alive, this investigation of originality began. Guarneri del Gesù’s imitators set to work about eighty years after his death, abetted by the false story that he made his greatest violins while in prison. Today analysis of the masters’ work proceeds on three fronts: exact physical copies of the instruments’ form; chemical analyses of the varnish; and work that reasons backward from the sound (the idea here being that one could copy the sound in instruments that do not look like a Strad or a Guarneri). Even so, as the violinist Arnold Steinhardt of the Guarneri String Quartet has remarked, the professional musician can almost instantly distinguish between the original and any copy.31

Missing in these analyses is a reconstruction of the workshops of the master—one element that has irretrievably gone missing. This is the absorption into tacit knowledge, unspoken and uncodified in words, that occurred there and became a matter of habit, the thousand little everyday moves that add up in sum to a practice.
The most significant fact we know about Stradivari’s workshop was that he was all over it, popping up unexpectedly everywhere, gathering in and processing those thousands of bits of information that could not signify in the same way to assistants who were doing just one part. The same thing has been true in scientific labs run by idiosyncratic geniuses; the master’s head becomes stuffed with information only he or she can see the point of. This is why the secrets of the physicist Enrico Fermi as a great experimenter can’t be fathomed by poring over the minutiae of his lab procedures.

To put this observation abstractly: in a workshop where the master’s individuality and distinctiveness dominates, tacit knowledge is also likely to dominate. Once the master dies, all the clues, moves, and insights he or she has gathered into the totality of the work cannot be reconstructed; there’s no way to ask him or her to make the tacit explicit.

In theory the well-run workshop should balance tacit and explicit knowledge. Masters should be pestered to explain themselves, to dredge out the assemblage of clues and moves they have absorbed in silence within—if only they could, and if only they would. Much of their very authority derives from seeing what others don’t see, knowing what they don’t know; their authority is made manifest in their silence. Would we then sacrifice Stradivari’s cellos and violins for the sake of a more democratic workshop?

In the seventeenth century the person most alive to the problem of knowledge transfer was the poet John Donne. He couched the problem of singularity in terms of scientific discovery, imagining the innovator as a phoenix rising from the ashes of received truth and tradition, in these famous lines:

Prince, Subject, Father, Son, are things forgot,
For every man alone thinks he hath got
To be a Phoenix, and that then can be
None of that kind, of which he is, but he.⁴¹

Today the difficulty of recovering the secrets of genius illuminates the contrast we made in the first chapter between the two craft standards of quality: the absolute standard versus quality of practice. The masters set an absolute standard, one that often proves impossible to reproduce. But the democratic question just posed should be taken seriously. Why try to recover someone else’s originality? The modern luthier wants to get on with the business of making violins; the luthier wants to make the best violins possible according to his or her bright-enough lights rather than be immobilized, imprisoned by fruitless imitation. This is the claim of practice against correctness. And yet. The Stradivarius Davidoff cello defines what a cello can be, what is possible; it sets a standard that, once you’ve heard it, you can never forget, particularly if you happen to be making a cello.

“His secrets died with him” casts a particular shadow in science. The sociologist Robert K. Merton sought to explain knowledge transfer in science by invoking the famous image of “standing on the shoulders of giants.”⁴³ By that he meant two things: first, that the work of great scientists sets the terms of reference, the orbits, within which lesser standard scientists revolve; and second, that knowledge is additive and accumulative; it builds up in time as people stand on the giants’ shoulders, like those human pillars in the circus.

In craftwork, Merton’s idea would apply to the makers of Salisbury Cathedral, whose labors worked within the orbit of their forebears—whether giants or not. The idea would make sense of the rituals of the medieval goldsmiths; these celebrated the standards set by the monastic founders of the guild as fathers. Though his model illuminates medieval masons and goldsmiths, it is harder to apply to the more modern realm of Stradivari’s workshop. The desire to stand on the luthier’s shoulders has certainly existed ever since his death; finding a footing has proved frustrating; thinking about a giant can prove paralyzing. In practice we do something that is distinctive whenever we solve thorny practical issues, no matter how small. And yet a scientist
can no more forget Einstein's ambition than an instrument maker a Stradivarius's sound.

* * *

The history of the workshop shows, in sum, a recipe for binding people tightly together. The essential ingredients of this recipe were religion and ritual. A more secular age replaced these ingredients with originality—a condition separate in its practical terms from autonomy, originality implying in the workshop a new form of authority, an authority frequently short-lived and silent.

One mark of the modern world is that we have become as worried about paying obeisance to authority in this personalized form as to authority of an older, more religious sort. To quote just one instance of this worry: Cellini's near-contemporary Étienne de La Boéte was one of the first to question submission to higher authority through either admiration or imitation. In his view, people are more capable of freedom. In the Discourse of Voluntary Servitude, he wrote: "So many men, so many villages, so many cities, so many nations sometimes suffer under a single tyrant who has not other power than the power they give; who could do them absolutely no injury unless they preferred to put up with him rather than contradict him... It is therefore the inhabitants themselves who permit, or rather, bring about their own servitude." Servitude through admiration or tradition must be cast off. If correct, then the workshop cannot be a comfortable home for the craftsman, for its very essence lies in the personalized, face-to-face authority of knowledge. And yet it is a necessary home. Since there can be no skilled work without standards, it is infinitely preferable that these standards be embodied in a human being than in a lifeless, static code of practice. The craftsman's workshop is one site in which the modern, perhaps unresolvable conflict between autonomy and authority plays out.

CHAPTER THREE

Machines

The greatest dilemma faced by the modern artisan-craftsman is the machine. Is it a friendly tool or an enemy replacing work of the human hand? In the economic history of skilled manual labor, machinery that began as a friend has often ended up as an enemy. Weavers, bakers, and steel-workers have all embraced tools that eventually turned against them. Today the advent of microelectronics means that intelligent machines can invade realms of white-collar labor like medical diagnosis or financial services once reserved for human judgment.

The seduction of CAD lies in its speed, the fact it never tires, and indeed in the reality that its capacities to compute are superior to those of anyone working out a drawing by hand. Yet people can pay a personal price for mechanization; misuse of CAD programming diminished the mental understanding of its users. This seems a sad story, but perhaps it can be told in a different way. Might we, in our very comparative imperfection, learn something positive about being human?

Workers as much as writers struggled with this philosophical question at the dawn of the Industrial Age in the eighteenth century. Their observations and arguments were based on an experience of material culture that had long predates machine production.

As early as the fifteenth century, Europe had been suffused by what