

Shop Class as Soulcraft

An Inquiry into the Value of Work

Matthew B. Crawford

The Penguin Press
New York
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THE PENGUIN PRESS

Published by the Penguin Group

Penguin Group (USA) Inc., 375 Hudson Street, New York, New York 10014, U.S.A. •
Penguin Group (Canada), 90 Eglinton Avenue East, Suite 700, Toronto, Ontario
Canada M4P 2Y3 (a division of Pearson Canada Inc.) Penguin Books Ltd, 80 Strand,
London WC2R 0RL, England Penguin Ireland, 25 St Stephen's Green, Dublin 2, Ireland
(a division of Penguin Books Ltd) Penguin Books Australia Ltd, 250 Camberwell Road,
Camberwell, Victoria 3124, Australia (a division of Pearson Australia Group Pty Ltd)
Penguin Books India Pvt Ltd, 11 Community Centre, Panchsheel Park,
New Delhi-110 017, India Penguin Group (NZ), 67 Apollo Drive, Rosedale,
North Shore 0632, New Zealand (a division of Pearson New Zealand Ltd)
Penguin Books (South Africa) (Pty) Ltd, 24 Sturdee Avenue,
Rosebank, Johannesburg 2196, South Africa
Penguin Books Ltd, Registered Offices:
80 Strand, London WC2R 0RL, England

First published in 2009 by The Penguin Press,
a member of Penguin Group (USA) Inc.

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Line drawings by Thomas van Auken

Library of Congress Cataloging-in-Publication Data
Crawford, Matthew B.

Shop class as soulcraft : an inquiry into the value of work / by Matthew B. Crawford.
p. cm.

Includes bibliographical references.

eISBN : 978-1-101-05729-2

1. Work. I. Title.

HD4824.C72 2009

331—dc22

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For my girls,
the whole happy troupe
B, G & J

And in loving memory of my father,
Frank S. Crawford, Jr.

Introduction

Anyone looking for a good used machine tool should talk to Noel Dempsey, a dealer in Richmond, Virginia. Noel's bustling warehouse is full of metal lathes, milling machines, and table saws, and it turns out that much of it once resided in schools. EBay is awash in such equipment, also from school. Most of this stuff has been kicking around the secondhand market for about fifteen years; it was in the 1990s that shop class started to become a thing of the past, as educators prepared students to become "knowledge workers."

The disappearance of tools from our common education is the first step toward a wider ignorance of the world of artifacts we inhabit. And, in fact, an engineering culture has developed in recent years in which the object is to "hide the works," rendering many of the devices we depend on every day unintelligible to direct inspection. Lift the hood on some cars now (especially German ones), and the engine appears a bit like the shimmering, featureless obelisk that so enthralled the proto-humans in the opening scene of the movie *2001: A Space Odyssey*. Essentially, there is another hood under the hood. This creeping concealedness takes various forms. The fasteners holding small appliances together now often require esoteric screwdrivers not commonly available, apparently to prevent the curious or the angry from interrogating the innards. By way of contrast, older readers will recall that until recent decades, Sears catalogues included blown-up parts diagrams and conceptual schematics for all appliances and many other mechanical goods. It was simply taken for granted that such information would be demanded by the consumer.

A decline in tool use would seem to betoken a shift in our relationship to our own stuff: more passive and more dependent. And indeed, there are fewer occasions for the kind of spiritedness that is called forth when we take things in hand for ourselves, whether to fix them or to make them. What ordinary people once made, they buy; and what they once fixed for themselves, they replace entirely or hire an expert to repair, whose expert fix often involves replacing an entire system because some minute component has failed.

In this book I would like to speak up for an ideal that is timeless but finds little accommodation today: manual competence, and the stance it entails toward the built, material world. Neither as workers nor as consumers are we much called upon to exercise such competence, most of us anyway, and merely to recommend its cultivation is to risk the scorn of those who take themselves to be the most hardheaded: the hardheaded economist will point out the "opportunity costs" of spending one's time making what can be bought, and the hardheaded educator will say that it is irresponsible to educate the young for the trades, which are somehow identified as jobs of the past. But we might pause to consider just how hardheaded these presumptions are, and whether they don't, on the contrary, issue from a peculiar sort of idealism, one that insistently steers young people toward the most ghostly kinds of work.

Around 1985, articles began to appear in education journals with such titles as "The Soaring Technology Revolution" and "Preparing Kids for High-Tech and the Global Future." Of course, there is nothing new about American futurism. What is new is the wedding of futurism to what might be called "virtualism": a vision of the future in which we somehow take leave of material reality and glide about in a pure information economy. New and yet not so new—for fifty years now we've been assured that we are headed for a "postindustrial society." While manufacturing jobs have certainly le

our shores to a disturbing degree, the manual trades have not. If you need a deck built, or your car fixed, the Chinese are of no help. Because they are in China. And in fact there are chronic labor shortages in both construction and auto repair. Yet the trades and manufacturing have long been lumped together in the mind of the pundit class as “blue collar,” and their requiem is intoned. More recently, this consensus has begun to show signs of cracking; in 2006 the *Wall Street Journal* wondered whether “skilled [manual] labor is becoming one of the few sure paths to a good living.”

This book is concerned less with economics than it is with the *experience* of making things and fixing things. I also want to consider what is at stake when such experiences recede from our common life. How does this affect the prospects for full human flourishing? Does the use of tools answer to some permanent requirement of our nature? Arguing for a renewed cultivation of manual competence puts me at odds with certain nostrums surrounding work and consumption, so this book is in part a cultural polemic. I mean to clarify the origins of, and thereby interrogate, those assumptions that lull us into accepting as inevitable, or even desirable, our increasing manual disengagement.

I will be making frequent reference to my own work experience, most recently as a motorcycle mechanic. Seeing a motorcycle about to leave my shop under its own power, several days after arriving in the back of a pickup truck, I suddenly don't feel tired, even though I've been standing on concrete floor all day. Through the portal of his helmet, I think I can make out the edges of a grin on the face of a guy who hasn't ridden his bike in a while. I give him a wave. With one of his hands on the throttle and the other on the clutch, I know he can't wave back. But I can hear his salute in the exuberant “bwaaAAAAP! blum-blum” of a crisp throttle, gratuitously revved. That sound pleases me as I know it does him. It's a ventriloquist conversation in one mechanical voice, and the gist of it is “Yeah!”

The wad of cash in my pants feels different than the checks I cashed in my previous job. Following a doctorate in political philosophy at the University of Chicago, I took a job as executive director of a Washington “think tank.” I was always tired, and honestly could not see the rationale for my being paid at all—what tangible goods or useful services was I providing to anyone? This sense of uselessness was dispiriting. The pay was good, but it truly felt like *compensation*, and after five months I quit to open the bike shop. It may be that I am just not well suited to office work. But in this respect I doubt there is anything unusual about me. I offer my own story here not because I think it is extraordinary, but rather because I suspect it is fairly common. I want to do justice to intuitions that many people have, but which enjoy little public credit. This book grows out of an attempt to understand the greater sense of agency and competence I have always felt doing manual work, compared to other jobs that were officially recognized as “knowledge work.” Perhaps most surprisingly, I often find manual work more engaging *intellectually*. This book is an attempt to understand why this should be so.

My examples are drawn mostly from the mechanical repair and building trades because that is what I am familiar with (I used to work as an electrician), but I believe the arguments I offer can illuminate other kinds of work as well. It so happens that most of the characters who appear in this book are men, but I am sure that women, no less than men, will recognize the appeal of tangible work that is straightforwardly useful.

Allow me to say a word about what this book is *not*. I want to avoid the kind of mysticism that gets attached to “craftsmanship” while doing justice to the very real satisfactions it offers. I won't be talking about Japanese sword makers or any such thing, and generally prefer to use the term “trade” over “craft” to emphasize the prosaic nature of my subject (though I won't observe this distinction rigorously). Compared to any real craftsman, my own skills are execrable, so I have no basis for

talking about the higher spirituality that is alleged to arise from a perfectly fit mortise or whatever. *A* a rough working formula, we might say that craftsmanship, as an ideal, provides the standards, but that in a mass-market economy such as ours, it is the tradesman who exemplifies an economically viable way of life, one that is broadly available and provides many of the same satisfactions we associate with craftsmanship. Also, we tend to think of the craftsman as working in his own snug workshop, while the tradesman has to go out and crawl under people's houses, or up a pole, and make someone else's stuff work. So I want to avoid the precious images of manual work that intellectuals sometimes traffic in. I also have little interest in wistful notions of a "simpler" life that is somehow more authentic, or more democratically valorous for being "working class." I do, in fact, want to rehabilitate the honor of the trades, as being choice-worthy work, but to do so from within my own experience, which I find is not illuminated by any of these fraught cultural ideals. Hardly any of the people I have worked with as an electrician or a mechanic have fit the stock image of "blue collar." Quite a few have been eccentrics—refugees from some more confining life. Some drift in and out of the work, as I have, as their circumstances dictate.

This book advances a nestled set of arguments on behalf of work that is meaningful because it is genuinely useful. It also explores what we might call the ethics of maintenance and repair, and in doing so I hope it will speak to those who may be unlikely to go into the trades professionally but strive for some measure of self-reliance—the kind that requires focused engagement with our material things. We now like our things not to disturb us. Why do some of the current Mercedes models have no dipstick, for example? What are the attractions of being disburdened of involvement with our own stuff? This basic question about consumer culture points to some basic questions about work, because in becoming less obtrusive, our devices also become more complicated. How has the relentless complication of cars and motorcycles, for example, altered the jobs of those who service them? We often hear of the need for an "upskilling" of the workforce, to keep up with technological change. I find the more pertinent issue to be: What sort of personality does one need to have, as a twenty-first-century mechanic, to tolerate the layers of electronic bullshit that get piled on top of machines?

What follows is an attempt to map the overlapping territories intimated by the phrases "meaningful work" and "self-reliance." Both ideals are tied to a *struggle for individual agency*, which I find to be at the very center of modern life. When we view our lives through the lens of this struggle, it brings certain experiences into sharper focus. Both as workers and as consumers, we feel we move in channels that have been projected from afar by vast impersonal forces. We worry that we are becoming stupider, and begin to wonder if getting an adequate *grasp* on the world, intellectually, depends on getting a handle on it in some literal and active sense.

Some people respond by learning to grow their own vegetables. There are even reports of people raising chickens on the rooftops of apartment buildings in New York City. These new agrarians say they get a deep satisfaction from recovering a more direct relationship to the food they eat. Others take up knitting, and find pride in wearing clothes they have made themselves. The home economics of our grandmothers is suddenly cutting-edge chic—why should this be?

With hard economic times looming, we want to become frugal. Frugality requires some measure of self-reliance—the ability to take care of your own stuff. But the new interest in self-reliance seems to have arisen before the specter of hard times. Frugality may be only a thin economic rationalization for a movement that really answers to a deeper need: We want to feel that our world is intelligible, so we can be responsible for it. This seems to require that the provenance of our things be brought closer to home. Many people are trying to recover a field of vision that is basically human in scale, and extricate themselves from dependence on the obscure forces of a global economy.

I would like to consider whether this poignant longing for responsibility that many people experience in their home lives may be (in part) a response to changes in the world of work, where the experience of individual agency has become elusive. Those who work in an office often feel that, despite the proliferation of contrived metrics they must meet, their job lacks objective standards of the sort provided by, for example, a carpenter's level, and that as a result there is something arbitrary in the dispensing of credit and blame. The rise of "teamwork" has made it difficult to trace individual responsibility, and opened the way for new and uncanny modes of manipulation of workers by managers, who now appear in the guise of therapists or life coaches. Managers themselves inhabit a bewildering psychic landscape, and are made anxious by the vague imperatives they must answer to. The college student interviews for a job as a knowledge worker, and finds that the corporate recruiter never asks him about his grades and doesn't care what he majored in. He senses that what is demanded of him is not knowledge but rather that he project a certain kind of personality, an affable complaisance. Is all his hard work in school somehow just for show—his ticket to a Potemkin meritocracy? There seems to be a mismatch between form and content, and a growing sense that the official story we've been telling ourselves about work is somehow false.

The time is ripe to dwell on this unease rather than dismiss it. The scope of the economic crisis is still uncertain as I write this, but it appears to be deepening. We are experiencing a genuine crisis of confidence in our most prestigious institutions and professions. This presents an opportunity to reconsider some basic assumptions. The question of what a good job looks like—of what sort of work is both secure and worthy of being honored—is more open now than it has been for a long time. Wall Street in particular has lost its luster as a destination for smart and ambitious young people. Out of the current confusion of ideals and confounding of career hopes, a calm recognition may yet emerge that productive labor is the foundation of all prosperity. The meta-work of trafficking in the surplus skimmed from other people's work suddenly appears as what it is, and it becomes possible once again to think the thought, "Let me make myself useful."

Back to basics, then. The cover is cracked. It is time to rip it off, look directly at the inner workings and begin to fix things for ourselves.

A Brief Case for the Useful Arts

In schools, we create artificial learning environments for our children that they know to be contrived and undeserving of their full attention and engagement. Without the opportunity to learn through the hands, the world remains abstract, and distant, and the passions for learning will not be engaged.

—A CERTAIN SHOP TEACHER WHOSE NAME I HAVE LOST

Tom Hull teaches welding, machine shop, auto shop, sheet metal work, and computer-aided drafting at Marshfield High School in Coos Bay, Oregon. He is also president of the Technology Educators of Oregon. Asked about the current state of his profession, he says a lot of schools shut down their shop class programs in the 1990s, when there was a big push for computer literacy. To pay for the new computers, electives were cut. Shop was especially attractive as a target: it is expensive and potentially dangerous. Further, as Hull says, “you can’t shove fifty students at a time into a shop class like you can a PE class.” In California, three-quarters of high school shop programs have disappeared since the early 1980s, according to the California Industrial and Technology Education Association.¹ There are efforts in North Carolina, Florida, and California to revive shop, but finding people competent to teach it has become difficult. “We have a generation of students that can answer questions on standardized tests, know factoids, but they can’t do anything,” according to Jim Aschwenden, executive director of the California Agricultural Teachers’ Association.²

Meanwhile, people in the trades are constantly howling about their inability to find workers. The slack has been taken up to some extent by community colleges that offer shop class. Tom Thompson, of Oregon’s Department of Education, says there is anecdotal evidence to suggest that one of the fastest-growing segments of the student body at community colleges is people who already have a four-year degree and return to get a marketable trade skill. There are also for-profit schools such as Universal Technical Institute and Wyoming Technical Institute that draw students from around the country. Both graduate about 95 percent of their students, and about 98 percent of those who graduate get jobs in their first year after finishing.

Hull sends out a quarterly newsletter to the graduates of his shop programs. It is like a nineteenth-century almanac, a combination of useful information and intellectual inquiry, as well as examples of human uplift. The newsletter includes shop tips (for example, clever ways to clamp an irregularly shaped object in preparation for welding), book reviews, digressions on aesthetics, and success stories in which he profiles the careers of his former students. A recent issue featured Kyle Cox, a welder and fabricator for Tarheel Aluminum. Hull caught up with his former student as he fabricated an all-

aluminum pile-driving barge on the docks in Charleston. Cox says the job changes every day, and that's what he loves about it. He also likes being "useful to the world."

One of Hull's recent columns reflected on the Fibonacci sequence, an infinite series of numbers where the ratio between adjacent pairs approaches a certain value known as the golden ratio, found throughout nature. Hull writes, "the sequence portrays a human characteristic as well, as the ratio is not immediately achieved, but gets closer and closer, and not by some steady slope to perfection but by *self-correcting oscillations*" about the ideal value. This seems to capture the kind of iterated self-criticism, in light of some ideal that is never quite attained, whereby the craftsman advances in his art. You give it your best, learn from your mistakes, and the next time get a little closer to the image you started with in your head. Hull clearly has a humanist's view of what is now called "Career and Technical Education," and plays a major role in the lives of his students. He says his work as a shop teacher is "the best job I can imagine."

Many educators find their work fulfilling. Is there something about the useful arts in particular that can elicit such devotion? For one gets the sense that Hull takes himself to be pointing his students not just to a livelihood but to some more comprehensive view of what a good life looks like.

The Psychic Satisfactions of Manual Work

I started working as an electrician's helper shortly before I turned fourteen. I wasn't attending school at that time and worked full-time until I was fifteen, then kept the trade up during the summers while in high school and college, with steadily increasing responsibility.³ When I couldn't get a job with my college degree in physics, I was glad to have something to fall back on, and went into business for myself, in Santa Barbara.

I never ceased to take pleasure in the moment, at the end of a job, when I would flip the switch. "And there was light." It was an experience of agency and competence. The effects of my work were visible for all to see, so my competence was real for others as well; it had a social currency. I was sometimes quieted at the sight of a gang of conduit entering a large panel in an industrial setting, bent into nestled, flowing curves, with varying offsets, that somehow all terminated in the same plane. There was a skill so far beyond my abilities that I felt I was in the presence of some genius, and the man who bent that conduit surely imagined this moment of recognition as he worked. As a residential and light commercial electrician, most of my work got covered up inside walls. Still, I felt pride in meeting the aesthetic demands of a workmanlike installation. Maybe another electrician would see it someday. Even if not, I felt responsible to my better self. Or rather, to the thing itself—craftsmanship has been said to consist simply in the desire to do something well, for its own sake. If the primary satisfaction is intrinsic and private in this way, there is nonetheless a sort of self-disclosing that takes place. As the philosopher Alexandre Kojève writes,

*The man who works recognizes his own product in the World that has actually been transformed by his work: he recognizes himself in it, he sees in it his own human reality, in it he discovers and reveals to others the objective reality of his humanity, of the originally abstract and purely subjective idea he has of himself.*⁴

The satisfactions of manifesting oneself concretely in the world through manual competence have been known to make a man quiet and easy. They seem to relieve him of the felt need to offer

chattering *interpretations* of himself to vindicate his worth. He can simply point: the building stands, the car now runs, the lights are on. Boasting is what a boy does, because he has no real effect in the world. But the tradesman must reckon with the infallible judgment of reality, where one's failures or shortcomings cannot be interpreted away. His well-founded pride is far from the gratuitous "self-esteem" that educators would impart to students, as though by magic.

Many people would be reluctant to bestow the term "craftsmanship" on the work of an electrician, and reserve the word for those who make finely wrought objects. This seems a fair reservation, and I see no need to quarrel with it.⁵ My own experience in making craft objects is limited to that of a hobbyist but is perhaps worth relating. People who make their own furniture will tell you that it is hard to justify economically, and yet they persist. Shared memories attach to the material souvenirs of our lives, and producing them is a kind of communion, with others and with the future. I once built a mahogany coffee table on which I spared no expense of effort. At that time I had no immediate prospect of becoming a father, yet I imagined a child who would form indelible impressions of this table and know that it was his father's work. I imagined the table fading into the background of a future life, the defects in its execution as well as inevitable stains and scars becoming a surface textured enough that memory and sentiment might cling to it, in unnoticed accretions. More fundamentally, as Hannah Arendt writes, the durable objects of use produced by men "give rise to the familiarity of the world, its customs and habits of intercourse between men and things as well as between men and men." "The reality and reliability of the human world rest primarily on the fact that we are surrounded by things more permanent than the activity by which they were produced, and potentially even more permanent than the lives of their authors."⁶

All material things turn to dust, ultimately, so perhaps "permanence" isn't quite the right idea to invoke here. The moral significance of work that grapples with material things may lie in the simple fact that such things lie outside the self. A washing machine, for example, surely exists to serve our needs, but in contending with one that is broken, you have to ask what *it* needs. At such a moment, technology is no longer a means by which our mastery of the world is extended, but an affront to our usual self-absorption. Constantly seeking self-affirmation, the narcissist views everything as an extension of his will, and therefore has only a tenuous grasp on the world of objects as something independent. He is prone to magical thinking and delusions of omnipotence.⁷ A repairman, on the other hand, puts himself in the service of others, and fixes the things they depend on. His relationship to objects enacts a more solid sort of command, based on real understanding. For this very reason, his work also chastens the easy fantasy of mastery that permeates modern culture. The repairman has to begin each job by getting outside his own head and noticing things; he has to look carefully and listen to the ailing machine.

The repairman is called in when the smooth operation of our world has been disrupted, and at such moments our dependence on things normally taken for granted (for example, a toilet that flushes) is brought to vivid awareness. For this very reason, the repairman's presence may make the narcissist uncomfortable. The problem isn't so much that he is dirty, or uncouth. Rather, he seems to pose a challenge to our self-understanding that is somehow fundamental. We're not as free and independent as we thought. Street-level work that disrupts the infrastructure (the sewer system below or the electrical grid above) brings our *shared* dependence into view. People may inhabit very different worlds even in the same city, according to their wealth or poverty. Yet we all live in the same physical reality, ultimately, and owe a common debt to the world.

Because craftsmanship refers to objective standards that do not issue from the self and its desires, poses a challenge to the ethic of consumerism, as the sociologist Richard Sennett argued in *The Culture of the New Capitalism*. The craftsman is proud of what he has made, and cherishes it, while the consumer discards things that are perfectly serviceable in his restless pursuit of the new.⁸ The craftsman is then more possessive, more tied to what is present, the dead incarnation of past labor; the consumer is more free, more imaginative, and so more valorous according to those who would sell us things. Being able to think materially about material goods, hence critically, gives one some independence from the manipulations of marketing, which as Sennett points out typically divert attention from *what a thing is* to a backstory intimated through associations, the point of which is to exaggerate minor differences between brands. Knowing the production narrative, or at least being able to plausibly imagine it, renders the social narrative of the advertisement less potent. The craftsman has an impoverished fantasy life compared to the ideal consumer; he is more utilitarian and less given to soaring hopes. But he is also more independent.

This would seem to be significant for any political typology. Political theorists from Aristotle to Thomas Jefferson have questioned the republican virtue of the artisan, finding him too narrow in his concerns to be moved by the public good. Yet this assessment was made before the full flowering of mass communication and mass conformity, which pose a different set of problems for the republican character: enervation of judgment and erosion of the independent spirit. If the modern personality is being reorganized on a predicate of passive consumption, this is bound to affect our political culture.

Since the standards of craftsmanship issue from the logic of things rather than the art of persuasion practiced submission to them perhaps gives the craftsman some psychic ground to stand on against fantastic hopes aroused by demagogues, whether commercial or political. Plato makes a distinction between technical skill and rhetoric on the grounds that rhetoric “has no account to give of the real nature of things, and so cannot tell the cause of any of them.”⁹ The craftsman’s habitual deference is not toward the New, but toward the objective standards of his craft. However narrow in its application this is a rare appearance in contemporary life—a disinterested, articulable, and publicly affirmable idea of the good. Such a strong ontology is somewhat at odds with the cutting-edge institutions of the new capitalism, and with the educational regime that aims to supply those institutions with suitable workers—pliable generalists unfettered by any single set of skills.

Today, in our schools, the manual trades are given little honor. The egalitarian worry that has always attended tracking students into “college prep” and “vocational ed” is overlaid with another: the fear that acquiring a specific skill set means that one’s life is *determined*. In college, by contrast, many students don’t learn anything of particular application; college is the ticket to an *open* future. Craftsmanship entails learning to do one thing really well, while the ideal of the new economy is to be able to learn new things, celebrating potential rather than achievement. Somehow, every worker in the cutting-edge workplace is now supposed to act like an “intrapreneur,” that is, to be actively involved in the continuous redefinition of his own job. Shop class presents an image of stasis that runs directly counter to what Sennett identifies as “a key element in the new economy’s idealized self: the capacity to surrender, to give up possession of an established reality.” This stance toward “established reality,” which can only be called psychedelic, is best not indulged around a table saw. It is dissatisfied with what Arendt calls the “reality and reliability” of the world. It is a strange sort of ideal, attractive only to a peculiar sort of self—insecurity about the basic character of the world is no fun for most people.

As Sennett argues, most people take pride in being good at something specific, which happens through the accumulation of experience. Yet the flitting disposition is pressed upon workers from above by the current generation of management revolutionaries, for whom the ethic of craftsmanship

is actually something to be rooted out from the workforce. Craftsmanship means dwelling on a task for a long time and going deeply into it, because you want to get it right. In management speak, this is called being “ingrown.” The preferred role model is the management consultant, who swoops in and out and whose very pride lies in his lack of particular expertise. Like the ideal consumer, the management consultant presents an image of soaring freedom, in light of which the manual trades appear cramped and paltry: the plumber with his butt crack, peering under the sink.

With such images in their heads, parents don’t want their children to become plumbers. Yet that filthy plumber under the sink might be charging somebody eighty dollars an hour. This fact *ought*, at least, to induce an experience of cognitive dissonance in the parent who regards his child as smart and wants him to become a knowledge worker. If he accepts the basic premise of a knowledge economy that someone being paid a lot of money must *know* something, he may begin to wonder what is really going on under that sink, and entertain a suspicion against the widely accepted dichotomy of knowledge work *versus* manual work. In fact, that dichotomy rests on some fundamental misconceptions. I’d like to offer an alternative account, one that will give due credit to the cognitive richness of manual work. In pursuing these questions, we arrive at insights that help to explain why work that is straightforwardly useful can also be intellectually absorbing.

The Cognitive Demands of Manual Work

In *The Mind at Work*, Mike Rose provides “cognitive biographies” of several trades, and depicts the learning process in a wood shop class. He writes that “our testaments to physical work are so often focused on the values such work exhibits rather than on the thought it requires. It is a subtle but pervasive omission. . . . It is as though in our cultural iconography we are given the muscled arm, sleeve rolled tight against biceps, but no thought bright behind the eye, no image that links hand and brain.”¹⁰

Skilled manual labor entails a systematic encounter with the material world, precisely the kind of encounter that gives rise to natural science. From its earliest practice, craft knowledge has entailed knowledge of the “ways” of one’s materials—that is, knowledge of their nature, acquired through disciplined perception. At the beginning of the Western tradition, *sophia* (wisdom) meant “skill” for Homer: the technical skill of a carpenter, for example. Through pragmatic engagement, the carpenter learns the different species of wood, their fitness for such needs as load bearing and water holding, their dimensional stability with changes in the weather, and their varying resistance to rot and insects. The carpenter also gains a knowledge of universals, such as the right angle, the plumb, and the level, which are indispensable for sound construction. It is in the crafts that nature first becomes a thematic object of study, and that study is grounded by a regard for human utility.

In the tradition that developed in the West, “wisdom” lost the concrete sense it originally had in Homer. In religious texts, on the one hand, “wisdom” tended toward the mystical. In science, on the other hand, “wisdom” remained connected to knowledge of nature, but with the advent of idealization such as the frictionless surface and the perfect vacuum, science, too, adopted a paradoxically otherworldly ideal of *how* we come to know nature: through mental constructions that are more intellectually tractable than material reality, hence amenable to mathematical representation. Descartes, generally credited with inaugurating the scientific revolution, begins from radical doubt

about the very existence of an external world, and builds up the principles of scientific inquiry from the foundation of a radically self-contained subject.

Yet this solipsistic ideal doesn't gibe perfectly with the history of science. For in fact, in areas of well-developed craft practices, technological developments typically preceded and gave rise to advances in scientific understanding, not vice versa. The steam engine is a good example. It was developed by mechanics who observed the relations between volume, pressure, and temperature. This was at a time when theoretical scientists were tied to the caloric theory of heat, which later turned out to be a conceptual dead end. The success of the steam engine contributed to the development of what we now call classical thermodynamics. This history provides a nice illustration of a point made by Aristotle:

*Lack of experience diminishes our power of taking a comprehensive view of the admitted facts. Hence those who dwell in intimate association with nature and its phenomena are more able to lay down principles such as to admit of a wide and coherent development; while those whom devotion to abstract discussions has rendered unobservant of facts are too ready to dogmatize on the basis of a few observations.*¹¹

Many inventions capture a reflective moment in which some worker has made explicit the assumptions that are implicit in his skill. In a beautiful article, the cognitive scientists Mike Eisenberg and Ann Nishioka Eisenberg give real pedagogical force to this idea, and draw out its theoretical implications. They offer a computer program to facilitate making origami, or rather Archimedean solids, by unfolding these solids into two dimensions. But they then have their students actually make the solids, out of paper cut according to the computer's instructions. "Computational tools for crafting are entities poised somewhere between the abstract, untouchable world of software objects and the homey constraints of human dexterity; they are therefore creative exercises in making conscious those aspects of craft work . . . that are often more easily represented 'in the hand' than in language."¹² It is worth pausing to consider their efforts, as they have implications well beyond mathematics instruction.

In our early work with HyperGami, we often ran into situations in which the program provided us with a folding net that was mathematically correct—i.e., a technically correct unfolding of the desired solid—but otherwise disastrous. . . . Here, we are trying to create an approximation to a cone—a pyramid on a regular octagonal base. HyperGami provides us with a folding net that will, indeed, produce a pyramid; but typically, no paper crafter would come up with a net of this sort, since it is fiendishly hard to join together those eight tall triangles into a single vertex. In fact, this is an illustrative example of a more general idea—the difficulty of formalizing, in purely mathematical terms, what it means to produce a "realistic" (and not merely technically correct) solution to an algorithmic problem derived from human practice.

I take their point to be that a realistic solution must include ad hoc constraints known only through practice, that is, through embodied manipulations. Those constraints cannot be arrived at deductively starting from mathematical entities. These experiments with origami help us to understand why certain aspects of mechanical work cannot be reduced to rule following.

When I first starting working in the bike shop, after quitting the think tank, I would come home from work and my wife would sniff at me. She'd say "carbs" or "brakes" as she learned to identify the various solvents used in cleaning different parts of a motorcycle. Leaving a sensible trace, my workday was at least imaginable to her. But while the filth and odors were apparent, the amount of

head scratching I'd done since breakfast was not. Mike Rose writes that in the practice of surgery, "dichotomies such as concrete versus abstract and technique versus reflection break down in practice. The surgeon's judgment is simultaneously technical and deliberative, and that mix is the source of its power."¹³ This could be said of any manual skill that is diagnostic, including motorcycle repair. You come up with an imagined train of causes for manifest symptoms and judge their likelihood before tearing anything down. This imagining relies on a stock mental library, not of natural kinds or structures, like that of the surgeon, but rather the functional kinds of an internal combustion engine, their various interpretations by different manufacturers, and their proclivities for failure. You also develop a library of sounds and smells and feels. For example, the backfire of a too-lean fuel mixture is subtly different from an ignition backfire. If the motorcycle is thirty years old, from an obscure maker that went out of business twenty years ago, its proclivities are known mostly through lore. It would probably be impossible to do such work in isolation, without access to a collective historical memory; you have to be embedded in a community of mechanicantiquarians. These relationships are maintained by telephone, in a network of reciprocal favors that spans the country. My most reliable source, Fred Cousins in Chicago, has such an encyclopedic knowledge of obscure European motorcycles that all I can offer him in exchange is regular deliveries of obscure European beer.

There is always a risk of introducing new complications when working on decrepit machines (kind of like gerontology, I suppose), and this enters the diagnostic logic. Measured in likelihood of screwups, the cost is not identical for all avenues of inquiry when deciding which hypothesis to pursue—for example, when trying to figure out why a bike won't start. The fasteners holding the engine covers on 1970s-era Hondas are Phillips head, and they are *always* rounded out and corroded. Do you *really* want to check the condition of the starter clutch, if each of ten screws will need to be drilled out and extracted, risking damage to the engine case? Such impediments can cloud your thinking. Put more neutrally, the attractiveness of any hypothesis is determined in part by physical circumstances that have no logical connection to the diagnostic problem at hand, but a strong pragmatic bearing on it (kind of like origami). The factory service manuals tell you to be systematic in eliminating variables but they never take into account the risks of working on old machines. So you have to develop your own decision tree for the particular circumstances. The problem is that at each node of this new tree, your own unquantifiable risk aversion introduces ambiguity. There comes a point where you have to step back and get a larger gestalt. Have a cigarette and walk around the lift. Any mechanic will tell you that it is invaluable to have other mechanics around to test your reasoning against, especially if they have a different intellectual disposition.

My shop mate in the early years, Thomas Van Auken, was also an accomplished visual artist (he is the illustrator of this book) and I was repeatedly struck by his ability to literally *see* things that escaped me. I had the conceit of being an empiricist, but seeing things is not always a simple matter. Even on the relatively primitive vintage bikes that were our specialty, some diagnostic situations contain so many variables, and symptoms can be so under-determining of causes, that explicit analytical reasoning comes up short. What is required then is the kind of judgment that arises only from experience; hunches rather than rules. I quickly realized there was more thinking going on in the bike shop than in my previous job at the think tank.

Socially, being the proprietor of a bike shop in a small city gives me a feeling I never had before. I feel I have a place in society. Whereas "think tank" is an answer that, at best, buys you a few seconds when someone asks what you do and you try to figure out what it is that you in fact do, with "motorcycle mechanic" I get immediate recognition. I barter services with machinists and metal fabricators, which has a very different feel than transactions with money, and further increases my

sense of belonging to a community. There are three restaurants in Richmond with cooks whose bikes have restored, where unless I deceive myself I am treated as a sage benefactor. I feel pride before my wife when we go out to dinner and are given preferential treatment, or simply a hearty greeting. There are group rides, and there used to be bike night every Tuesday at a certain bar. Sometimes one or two people would be wearing my shop's T-shirt, which felt good.

Given the intrinsic richness of manual work—cognitively, socially, and in its broader psychic appeal—the question becomes why it has suffered such a devaluation as a component of education. The economic rationale so often offered, namely, that manual work is somehow going to disappear, is questionable if not preposterous, so it is in the murky realm of culture that we must look to understand these things. Here a bit of history can help; a glance at the origins of shop class early in the twentieth century reveals cultural currents that continue to swirl around us.

Art, Crafts, and the Assembly Line

Early in the twentieth century, when Teddy Roosevelt preached the strenuous life and elites worried about their state of “over-civilized” spiritual decay, the project of getting back in touch with “real life” took various forms. One was romantic fantasy about the premodern craftsman. This was understandable given changes in the world of work at the turn of the century, a time when the bureaucratization of economic life was rapidly increasing the number of paper shufflers. As T. J. Jackson Lears explains in his history of the Progressive era, *No Place of Grace*, the tangible elements of craft were appealing as an antidote to vague feelings of unreality, diminished autonomy, and a fragmented sense of self that were especially acute among the professional classes.

The Arts and Crafts movement thus fit easily with the new therapeutic ethic of self-regeneration. Depleted from his workweek in the corporate world, the office worker repaired to his basement workshop to putter about and tinker, refreshing himself for the following week. As Lears writes, “toward the end of the nineteenth century, many beneficiaries of modern culture began to feel they were its secret victims.”¹⁴ Various forms of antimodernism gained wide currency in the middle and upper classes, including the ethic of craftsmanship. Some Arts and Crafts enthusiasts conceived their task to be evangelizing good taste as embodied in the works of craft, as against machine-age vulgarity. Cultivating an appreciation for objets d'art was thus a form of protest against modernity, with a view to providing a livelihood to dissident craftsmen. But it dovetailed with, and gave a higher urgency to, the nascent culture of luxury consumption. As Lears tells the story, the great irony is that anti-modernist sentiments of aesthetic revolt against the machine paved the way for certain unattractive features of late-modern culture: therapeutic self-absorption and the hankering after “authenticity,” precisely those psychic hooks now relied upon by advertisers. Such spiritualized, symbolic modes of craft practice and craft consumption represented a kind of compensation for, and therefore an accommodation to, new modes of routinized, bureaucratic work.

But not everyone worked in an office. Indeed, there was class conflict brewing, with unassimilated immigrants accumulating in America's eastern cities and serious labor violence in Chicago and elsewhere. To the upper classes of those same cities, enamored of the craft ideal, the possibility presented itself that the laboring classes might remain satisfied with their material lot if they found joy in their labor. Shop class could serve to put the proper spin on manual work. Any work, it was

posited, could be “artful” if done in the proper spirit. Somehow a movement that had started with reverence for the craftsman now offered an apologetic for factory work. As Lears writes, “By shifting their attention from the conditions of labor to the laborer’s frame of mind, craft ideologues could acclaim the value of any work, however monotonous.”¹⁵

The Smith-Hughes Act of 1917 gave federal funding for manual training in two forms: as part of general education and as a separate vocational program. The invention of modern shop class thus serviced both cultural reflexes of the Arts and Crafts movement at once. The children of the managerial class could take shop as enrichment to the college-prep curriculum, making a bird feeder to hang outside Mom’s kitchen window, while the children of laborers would be socialized into the work ethic appropriate to their station through what was now called “industrial arts” education. The need for such socialization was not simply a matter of assimilating immigrants from southern and eastern Europe who lacked a Protestant work ethic. It was recognized as a necessity for the broader working-class population, precisely because the institutions that had previously served this socializing function, apprenticeship and guild traditions, had been destroyed by new modes of labor. In his 1915 report to the United States Commission on Industrial Relations, Robert Hoxie worried thus:

*It is evident . . . that the native efficiency of the working class must suffer from the neglect of apprenticeship, if no other means of industrial education is forthcoming. Scientific managers, themselves, have complained bitterly of the poor and lawless material from which they must recruit their workers, compared with the efficient and self-respecting craftsmen who applied for employment twenty years ago.*¹⁶

Needless to say, “scientific managers” were concerned more with the “efficient” part of this formula than with the “self-respecting” part, yet the two are not independent. The quandary was how to make workers efficient and attentive, when their actual labor had been degraded by automation. The motivation previously supplied by the intrinsic satisfactions of manual work was to be replaced with ideology; industrial arts education now concerned itself with moral formation. Lears writes that “American craft publicists, by treating craftsmanship . . . as an agent of socialization, abandoned [the effort to revive pleasurable labor. Manual training meant specialized assembly line preparation for the lower classes and educational or recreational experiences for the bourgeoisie.”¹⁷

Of the Smith-Hughes Act’s two rationales for shop class, vocational and general ed, only the latter emphasized the learning of aesthetic, mathematical, and physical principles through the manipulation of material things. It is not surprising, then, that the act came four years after Henry Ford’s innovation of the assembly line. The nascent two-track educational scheme mirrored the assembly line’s severing of the cognitive aspects of manual work from its physical execution. Such a partition of thinking from doing has bequeathed us the dichotomy of white collar versus blue collar, corresponding to mental versus manual.

These seem to be the categories that inform the educational landscape even now, and this entails two big errors. First, it assumes that all blue-collar work is as mindless as assembly line work, and second, that white-collar work is still recognizably mental in character. Yet there is evidence to suggest that the new frontier of capitalism lies in doing to office work what was previously done to factory work: draining it of its cognitive elements. Paradoxically, educators who would steer students toward cognitively rich work might do this best by rehabilitating the manual trades, based on a firmer grasp of what such work is really like.

This would take courage. Any high school principal who doesn’t claim as his goal “one hundred percent college attendance” is likely to be accused of harboring “low expectations” and run out of

town by indignant parents. This indignation is hard to stand against, since it carries all the moral weight of egalitarianism. Yet it is also snobbish, since it evidently regards the trades as something “low.” The best sort of democratic education is neither snobbish nor egalitarian. Rather, it accords a place of honor in our common life to whatever is best. At this weird moment of growing passivity and dependence, let us publicly recognize a yeoman aristocracy: those who gain real knowledge of real things, the sort we all depend on every day.

But is it feasible to make a decent living in the trades? Or are we headed for a “postindustrial” society in which there will be little need for the work of the hand? Are we perhaps already there? What are the economics of “the knowledge economy”? My purpose in this book is to elaborate the potential for human flourishing in the manual trades—their rich cognitive challenges and psychic nourishment—rather than stake out policy positions or make factual claims about the economy. But it may be well to consider some economic views that can nourish our skepticism about the postindustrial vision, and open the way for our larger inquiry.

The Future of Work: Back to the Past?

Writing in *Foreign Affairs*, the Princeton economist Alan Blinder considers the question of job security and falling wages for U.S. workers in light of global competition:

*Many people blithely assume that the critical labor-market distinction is, and will remain, between highly educated (or highly skilled) people and less-educated (or less-skilled) people—doctors versus call-center operators, for example. The supposed remedy for the rich countries accordingly, is more education and a general “upskilling” of the work force. But this view may be mistaken. . . . The critical divide in the future may instead be between those types of work that are easily deliverable through a wire (or via wireless connections) with little or no diminution in quality and those that are not. And this unconventional divide does not correspond well to traditional distinctions between jobs that require high levels of education and jobs that do not.*¹⁸

Blinder suggests the crucial distinction in the labor market will be between what he calls “personal services” and “impersonal services.” The former either require face-to-face contact or are inherently tied to a specific site. Physicians who treat patients don’t need to worry that their jobs will be sent offshore, but radiologists who examine images have already seen this happen, just as accountants and computer programmers have. He goes on to point out that “you can’t hammer a nail over the Internet.”

Blinder’s analysis suggests a future of rising wages for construction, for maintenance and repair work on physical plants, and for maintenance and repair of durable machines (such as cars) that aren’t so cheap that they become disposable at the first sign of trouble, as for example a toaster oven is. In a follow-up piece in the *Washington Post*, he writes that “millions of white-collar workers who thought their jobs were immune to foreign competition suddenly find that the game has changed—and not to their liking.”¹⁹

He finds 30 million to 40 million U.S. jobs to be potentially offshorable, ranging from “scientists, mathematicians and editors on the high end” to “telephone operators, clerks and typists on the low end.” Blinder predicts a massive economic disruption that is only just beginning, affecting people who

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