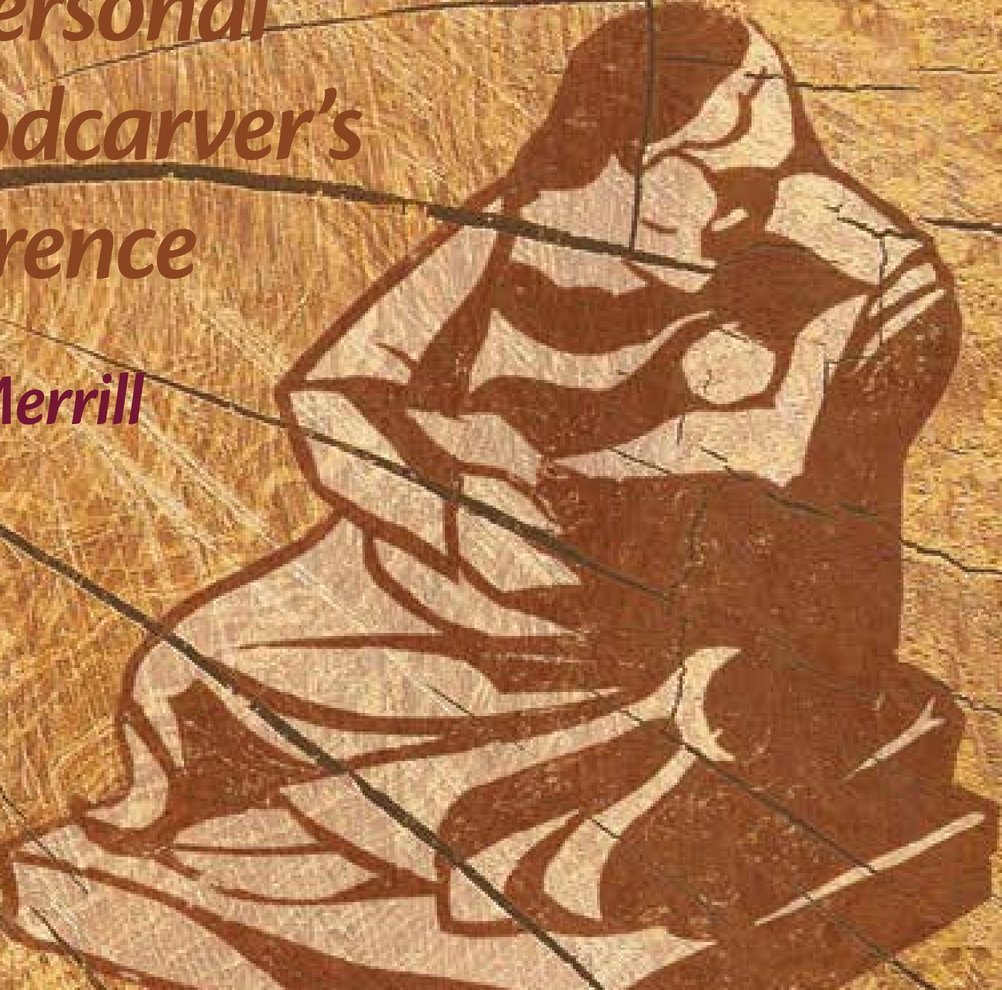
Heartwood

A personal woodcarver's reference

Ted Merrill



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by Ted Merrill

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This book is dedicated
to woodcarvers everywhere,
and to all who admire wood
and who love stories.

It is also dedicated,
posthumously and lovingly,
to the memory of Ted Merrill.

ACKNOWLEDGMENTS

Normally, readers would expect acknowledgments to be a personal expression of gratitude from the author. Sadly, though, Ted Merrill's life ended before he could put the finishing touches on this book. That task has fallen to me, his eldest son and the editor and designer of this book.

Considering that, I would like primarily to acknowledge Ted himself and his countless positive contributions to people's lives, even beyond the lifetime of help and personal nourishment he provided as a physician and surgeon. Overwhelmingly, those who knew him felt his personable humility and, beneath it, his peaceful character, his formidable intellect, and his broad understanding of the nature and essence of life.

I would also like to acknowledge the help and companionship Ted enjoyed later in life thanks to his wife Janis and, even later, her daughter Janel. Without them, he would have lived far more uncomfortably and would not have been anywhere near completion of his final two books by the time of his death.

Lastly, I'd like to acknowledge the generosity of Eric Meier, creator of the online wood compendium at wood-database.com. Images and information from that website vastly improved the central portion of this book, and Mr. Meier graciously donated their use.

— David Merrill, 2015

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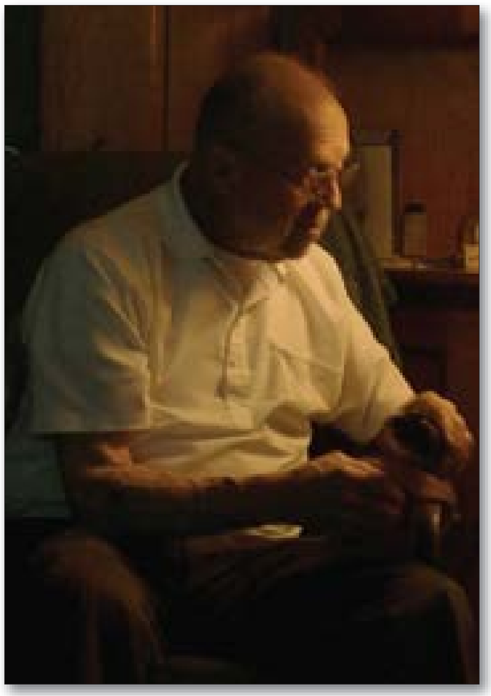
Introduction

A book about wood risks being just another book; plenty of books (made of wood fiber) have been written by people who were charmed, challenged, commercially involved, or in some other way affected by wood.

This book is not an exhaustive treatise about anything, nor a systematic catalog of woods. It contains little information that is really new, but recounts my experiences, discoveries, and feelings about wood, things I have found interesting or exciting, with some related comments as biologist, artist, and — to coin a word — xylosopher.

Any errors in the book are from my own ignorance. I only half apologize for them, because half-knowledge is that broad band that lies between certainty and the unknown, and I am still learning as I can.



The author, engrossed in his handiwork.

The names of people and places have not been changed. I hope they will forgive this intrusion; they have been important and integral parts of my continuing encounter with wood and have taught me much of what I know.

Wood has infiltrated into my being so that my acquaintances now treat me as a wood person, and my sources of wood are thus assured. A friend invites me over to salvage part of a cedar tree that has fallen. Another saves part of a plum tree he has cut down. Getting into my car after work, I find a piece of an apricot tree from an unknown source. Someone gets his stepmother to leave off two chunks of osage orange at my office.

My collection grows, and my acquisitiveness far exceeds my rate of using the wood. In a fanciful moment I see myself moving into my declining years, gradually disappearing under a pile of the world's assorted woods; with them I decay slowly back into the earth, leaving nothing to mark the spot but some green shoots and a handful of rusting chisel blades.

Part One:
Getting Into It

Shifting scenes, shifting sands

I was born into pine.

One of my earliest memories is the scent of a pine board and the fine translucent shavings that curled smoothly away from my father's plane. I learned to use a hammer by driving innumerable shingle nails into a pine block; celebrated my sixth birthday ecstatically trying my new vise, coping saw, and block plane on a thin pine board; spent hours beyond counting gathering dead pine branches for camp fires, then circling and shifting to elude their fragrant but pungent, eye-stinging smoke.

Having been shown by a family friend, at age seven, how to carve two chain links from a single piece of pine two-by-four, I actually achieved this by age ten — having at last learned to *cut through* the fibers down there in that narrow, tricky space between the links before trying to pry them out — and whittling became one of my pastimes. Any little piece of wood that came to hand was a likely victim, as long as it was pine. I split pine and fir blocks for the winter's heating, and became moderately proficient in time as a woodworker in pine and fir. (I still use a pine tool chest, painted an ugly gray, that I built in high school 60 years ago.)

Aspen and cottonwood near water, sagebrush in dry country, and occasional fruit trees in orchards were the exceptional woods of my youth, familiar as trees for birds' nests, climbing, shade, hiding places, and textures of the world, but not often held in the hand. My father showed me how to make an arrow from a cedar shingle (which indeed was wood), hook it onto a string tied to the end of a stick, and fling it gloriously out of sight into the sky. When not admiring frogs, hatching tadpoles in jars, or amazing myself with pond scum under the microscope, I might make whistles from the willows beside Soldier Creek, but hardly classed them as wood. To a boy growing up in southern Idaho, wood meant pine and fir.

Fir has its uses, but for whittling it is not as versatile, nor as congenial, as pine — too much difference between the soft spring wood and the harder, compact summer wood; and fir is more brittle and inclined to split and splinter (a fact burned into my memory through splinters removed by my mother's sewing needle, the wound then seared by tincture of iodine).

An 8-link chain, carved by the author from one piece of wood.

Hardwoods were exotic and rare, encountered only as furniture or other finished objects. A hickory axe handle, an oak leg from a broken chair, and spools and tinkertoys of some mysterious white wood were tantalizing samples from a fantasy world of somewhere, from storybook places like New England or other foreign lands. Beech and oak and ebony, ash and mock orange and teak, yew and ivory and whalebone and bamboo all were the stuff of mystery and imagination, like pirate ships and buried treasure.

In medical school there was little time to play with wood. However, I did come upon a leg broken from a pool table, probably tulip wood, and cut off a piece from which to carve a little gnome-like man as a gift. (It's a daunting challenge, in a large metropolitan medical center and university, to find an ordinary hand saw. Don't bother to look on the upper floors; you have to go down, and down some more.)

In the third year we each had an oral exam and career interview with one of the teachers. I was assigned the bacteriology professor, chose Rocky Mountain spotted fever as the subject for the quiz (perhaps because my first experience of a funeral, seeing a dead body, had been for Blackie, my Sunday School teacher, who died after a tick bite) and bravely told him that I planned to go back out west into general practice.

"Oh, no!" he protested. "A Columbia man's too good for general practice! You should go into research, or maybe teaching."

I wished later that I had told him, "Ah, not so; only a Columbia man is good enough for general practice!"

General practice suited me well, but after eighteen years, living in a remote village in eastern Oregon, I found myself asking, "Is there anything left of me outside of that M.D. stereotype?"

What to do? Maybe, after all, I should try teaching, a sort of sabbatical, take a break for a while from dealing with other people's pains and anxieties, injuries and illnesses, dying and being born. I began to make inquiries.

At one university they said they could find me a part-time position teaching nutrition. At another, there might be a job available in two years as assistant in the biology department. Not really very encouraging.

I had heard of a small, private, "experimental" college in Vermont, and flew to San Francisco to meet Tim Pitkin, the founder and president of the 25-year-old college, who was there on a speaking engagement.

After we had returned to our respective homes, Tim wrote to me: "What four subjects could you offer to teach, two each semester, that could justify my hiring you?"

I heaped together most of my major interests, cut them like a pie into quarters, and went to Goddard College with my proposal. My first reaction to the place was to laugh. My second, after talking to people for a day and a half, beginning to understand better Tim's educational philosophy, was to want to teach there.

This old family farm estate in Plainfield, renovated and converted into a college, was not a baby-sitting institution. It had become the hippie capital of New England. It was common for a student just out of high school to enroll for negative reasons (to evade the draft and a trip to Viet Nam, or for a pretense at education without responsibility); to waste his time and his parents' money. But it was also common for a student a little more mature, in school with serious intent, to make good use of an excellent learning challenge and opportunity.

The college was divided into two campuses separated by a ten-minute stroll through the trees. Northwoood was six low dormitories around two ponds. Greatwood had the farm buildings: the Silo, converted to administrative offices; the Haybarn, now an auditorium, stage, and dressing room; Martin Manor, with conference and classrooms; a former extra residence with Physics in the basement and Chemistry on the first floor; and the herbarium-turned-library which I was to dismantle and remodel into a biology lab because a wealthy alumnus had donated a fine new library — incongruous in this setting, but fine nevertheless.

The difference between Northwood and Greatwood was that on Greatwood when the students played volleyball they kept score.

My subjects were Anatomy and Physiology — which I taught each semester — and some eccentric smaller courses like Homeostasis, Principles of Ecology, and Some Aspects of Life, Death, and Dying.

For students of the sixties and seventies whose attitudes were largely anti-authority and anti-science, Anatomy and Physiology was too forbidding a title, so I played at their own game and called it Human Form and Function as a Basis for Identity. It worked; the students came, and they and I had a good time.


The Vermont house at Brook Road and Creamery Street

Thus at last, in my late forties, I lived in Vermont amid a wealth of hardwood forests. Here the people and the wood seem in some way to be a part of each other. The history and traditions, industries, culture, house and furniture construction, hand tools, the gestalt and style of New England are largely the result of interactions of man, wood, and weather. And my life took a new fork in the road.

I made a fair start at becoming acquainted with some of the local trees and their fabric.

I felt shock at stacking maple and birch and beech and — heaven help us! — cherry and apple cordwood for the fire; to burn such treasure seemed sacrilege, even though I knew that burning hardwood is safer and more economical than burning pine or fir. Wood carving and sculpture occupied more of my spare time, and I became a compulsive wood collector and admirer, filling my yard and house and shed with blocks and logs and boards and billets and sticks of all kinds, in various stages of seasoning. I would rob the firewood pile of all the better pieces, until I had nothing left to burn and had to haul it all back out of the shed.

After two years I knew that it was time to get back into medicine or I might get hopelessly behind. Satisfied that I had largely achieved my purpose of rehabilitation and self-rediscovery, I left teaching and took a part time job in the emergency room in Central Vermont Hospital. Now I had even more time for playing with wood. On a lovely rough pine board, 18 by 60 inches, I carved a sign for the front of our house: "WOOD, SILVER, AND STRING." My wife did weaving, our daughter did silver jewelry, and I entered into commercial wood carving.

By that I mean that I sawed, chiselled, rasped, whittled, and sanded much of the time, and occasionally finished a piece that I considered "for sale." My wages — omitting any costs of materials, tools, utilities, or keeping the house warm, and counting only my time spent in the shop — figured out to about four cents per hour. The other two craftsmen in the family fared the same. But it really was a nice sign above the door.

After six years in Vermont we decided to move back to Oregon — because for my wife the Vermont winters were heavy and long, and because, after all, it was home. My greatest dilemma was what to do about the wood. For all these years I had been collecting pieces of wood; weighing them periodically to keep track of their moisture loss; sealing their ends with paraffin or jockeying them in and out of plastic bags to slow their drying; watching for cracking or fungus growth; and keeping biographical notes on more than a hundred pieces in my "Wood Log" notebook. The pieces ranged in size from twigs the size of my thumb to a log almost too big for George Boardman's wrecker to bring to my yard. There were three glorious pieces of beech whose combined weight was 500 pounds; two irregular chunks of black walnut over 100 pounds each; a 170 pound black cherry log. There were blocks and slabs and home-sawed little boards of beech and hop-hornbeam, butternut and black walnut, cherry and basswood, three kinds of birch and three kinds of maple. There were apple and sumac, elm and poplar, lilac and box elder, white ash and black locust. Some were special because they were big, others because they were thoroughly seasoned; some because they were of unusual and intriguing shapes, others because I hadn't carved that kind before. Any that were still without cracks were special, as were all pieces of butternut, beech, or black walnut. And each piece, when numbered and weighed and entered in the book and handled a few times, acquired a ridiculous sentimental value. Several were in the early stages of carving, roughed out with the chain saw and awaiting further seasoning or for me to get around to working on them. Almost all of these were woods that I had never seen growing before.

Once we left Vermont this treasure would be irreplaceable. But at thirty cents a pound — the going rate for a commercial mover of household goods for 3,000 miles — it was out of the question. What to do?

The final solution was the largest available rental truck, into which, grunting and muttering, we loaded the heavy things: two tons of wood; eight hundred pounds of yarn on spindles (my wife had bought the remaining stock from an expired water-driven textile mill for her weaving); half a ton of books, a refrigerator and freezer, a workbench and 250 pounds of tools; and what miscellaneous items had not gotten into the movers' van with the household goods and furniture.

It's not that no wood grows in Oregon; it is the nation's largest producer of softwood timber. Having completed the move and stored my collection — enough to keep me carving for years — I found that, mostly in the western part of the state, there actually is a lot of hardwood, including alder, oak, madrone, vine maple and other maples, nut and fruit woods, black locust, myrtle, mountan mahogany, and probably more that I haven't seen, in addition to the stately fir, pine, and larch. But there is no significant supply of beech, sugar maple, yellow birch, butternut, or hop-hornbeam, so my effort was not in vain. If I want to make a spoon, a pair of earrings, or a four-foot sculpture, I need but go to my closet or my barn for the right piece of wood.

This grand collection has its dark side: besides the logistical problems of living with and around and among it, it carries a hidden accusation of disloyalty. Here again in Oregon, where my wood opportunities are as yet unexploited and even unexplored, whenever I select a piece of Vermont wood for a carving or sculpture or to make a toy or trinket for a gift, I feel a secret twinge of guilt toward Oregon. The Vermont wood will never be used up, and thus will forever accuse me — one of those notches cut in a man's soul that give form to his living and dying.

Substance

The task and the challenge for a teacher — any teacher — is to expose to the student the marvels and mysteries of the natural world, and to motivate the student to assign meaning to what he sees. (Nancy Katch, after weeks of discussion and debate, said with fire in her voice, "I'll let you say that the body is a machine, if you won't say that it's only a machine!")

Four hundred years ago people who wondered and studied how the world works were likely to be called philosophers rather than scientists. Such a man was Jan Baptist van Helmont, in Belgium. He wondered what a tree is made of. What does a tree need to grow?

He put a carefully weighed amount of soil in a tub, planted a small tree, and added nothing but water. Five years later he again weighed the tree and the soil. The tree had gained 164 pounds, but the soil had lost only a few ounces.

Van Helmont thus proved to his satisfaction that a tree forms itself completely out of water. He believed, in fact, that water was the "master substance" from which everything else is made.

Since van Helmont's time, numerous other scientist-philosophers have wondered and experimented and argued and taught each other a great deal more about water and air and trees — about the nature of substance.

The substance that things are made of, all those things around us that we can see and touch and use, varies endlessly in its qualities but consists of only a few simple kinds of basic bits or parts, such as electrons and protons, neatly strung together with electric glue. Wind and water, apples and pennies, palaces and pollywogs are all made of the same basic units in different arrangements. Their connections are relative and elastic, so these little bits are able to engage in the constant invisible motion inherent in atomic and molecular assemblies, choreographed by the innate requirements of their natures. Their dance gives us heat, and produces the molecular enthusiasms necessary for chemical reactions of all kinds.

If you accept the modular theory of the universe, all that stuff about atoms and molecules and how uniform and precisely interchangeable are all the individual ones in each category; and if you have played with Tinker Toys or Lincoln Logs or Erector Sets enough to feel the rules of that kind of modular game, then the world takes on a very special and exciting perspective. You can then believe that a molecule of water in your tears is precisely the same as one from Antarctica or the River Jordan — probably, in fact, has actually been there. You can believe that by processes of interaction, substances can change into other substances and back again, and in exactly equivalent and predictable amounts; and a wholeness, a totally interconnected and integrated world becomes apparent. This sort of quantitative and qualitative fidelity in the physical world defines the nature and the limits of life stuff and life processes.

The world is a constant, kaleidoscopic confrontation of substances with each other. A rainstorm, a steam engine, a football game, or just a deep breath are dramatic displays of the activity and interactivity of substances. Equally remarkable though more subtle are the imperceptible additions to the diameter of a giant fir tree a few millimeters each year, or its decay over the decades after it dies. On a longer and larger scale the movements of the stars and planets reflect the action of substances on each other; and at the other end of the spectrum is the subatomic dance of mystical particles — whether to call them "substance" or not may be left to physicist-philosophers to decide.

Some substances are familiar and can be held in the hand. Others can only be smelled, or sensed in the touch of an autumn breeze. Still others are strange to us because they exist in relatively small amounts, or are found in out-of-the-way places.

Living may be thought of as a continuing set of transactions with the substance of the world, and our responses to such transactions vary endlessly.

Take water. What does water do to you? How do you respond to gulps of cold water on a hot day? To a glistening drop hanging on a spider web in morning's first sun? To foam-topped waves leaning over your boat? The gathering trickle at the foot of a snowbank being freed by the sun after a hard winter? The water coursing through your veins with its cargo of other stuff? Or to rain? It's all the same stuff, but substance is as substance does, and as it evokes the expressions of our being.

The Cosmic Erector Set contains over 100 different kinds of atoms, but all living things are made mostly of just four of these basic pieces of the set — carbon, oxygen, hydrogen, and nitrogen — with tiny but crucial amounts of several others.

Here we must step into another mode of thinking, for I have never seen an atom. I embrace the tools of imagination adopted over the years by those who followed van Helmont, and which were passed on to me by my father and chemistry teacher. Because the specific elements have been discovered, studied, and given names, I use the initial of each to represent one atom of that element, and assemble them like Tinker Toys:

A molecule of water is H_2O; a molecule of carbon dioxide is CO_2. Or more specifically, water is H-O-H and carbon dioxide is O=C=O. The hyphen and equals symbols between the atoms represent their electrical attraction to each other: hyphen indicates a single bond (lesser attraction) and equals indicates a double bond (greater attraction). To know wood, to understand van Helmont's tree, you must know the carbon-hydrogen-oxygen dance that unites the plant and animal worlds. It is also the pivot around which Earth's entire circle of life revolves.

Chlorophyll, the green stuff within the tiny cells of plant leaves, is a master Tinker Toy player. Using its enzyme trickery and energy from sunlight, it essentially combines six H_2O with six CO_2 to produce glucose, $C_6H_{12}O_6$, which is the plant's food. If you count the atoms in six H_2O and six CO_2 molecules (6 C, 12 H, 18 O) and subtract the atoms in glucose (6 C, 12 H, 6 O), you'll see that 12 oxygen atoms remain, which naturally pair off into six molecules of oxygen (O_2).

In other words, photosynthesis consumes CO_2 and releases O_2 in equal amounts, and thus provides most of the oxygen in Earth's atmosphere.

The plant does not stop there. It strings together many glucose units into chains of assorted lengths and shapes to produce starches, which human digestive enzymes are able to disassemble again into glucose — the primary fuel for our own cells. If, however, the glucose units are connected in a slightly different way, instead of starch they become cellulose, the stiff structural stuff in the cell walls of plants. Our human enzymes can't unlock those connections (we can't digest wood), but some fungi and bacteria can. In fact, a cow can't digest the cellulose in grass either, so she employs specialized bacteria in her unique set of stomachs to do it for her.

A tree, after all the water is removed, is about 70 percent cellulose.

Looking at the above, we can see where van Helmont missed part of the picture. His tree made itself by combining water, which he supplied, with carbon dioxide from the air, which he couldn't see, and in the process it had oxygen left over — roughly fifty pounds of it.

Ironically, this same gentleman later was the discoverer of carbon dioxide — "gas sylvestre" — but not until long after he was gone did anyone understand the true relationships among water, carbon dioxide, and trees.

Now, adding oxygen back to the cellulose of his tree — whether through oxidation by fire or through decay via the enzymes of fungi and bacteria — will convert it back to water and carbon dioxide. (I remember disassembling the Tinker Toy structures and putting the pieces back in the can.)

One of the heavy political debates of our time, of course, relates to precisely these processes — the burning of fossil fuels and wood, which turns carbon into carbon dioxide in the air, which can change the climate; and preserving and planting trees, which remove the carbon dioxide from the air and sequester it in wood as carbon.

If only Jan Baptist van Helmont could be here now!

Structure and growth of a tree

All living things are made of cells. A plant cell, like an animal cell, is a little glob of magic jelly confined by an exceedingly thin membrane. The membrane is a living part of the cell; that is, it is deeply involved in the chemical dynamics of whatever you wish to define as "life".

The cell membrane is very delicate and elastic, and a group of animal cells stacked together make a soft, squishy mass such as muscle or liver. A plant cell, however, produces just outside of each cell membrane a tough, stiff cell wall made of cellulose, which gives the whole piece firmness and rigidity. In a dry plant, such as hay or seasoned wood, the cells have died, the magic jelly has become dehydrated leaving a mere wisp of protein and other life chemicals inside each cell, and most of what remains is the cellulose of the cell walls glued together by lignin — the skeletal remains of the formerly living plant. The size, shape, and consistency of a piece of straw or a wooden chest or last season's rose lying crisply on the shelf is mainly a matter of the amount and arrangement of the cellulose in the cell walls.

Wood is built from elongated cells or tubes of various types laid parallel, lengthwise of the tree or branch. In some cases the tube or vessel for transporting fluid is open for long distances. (To demonstrate this, a forester at the University of Vermont took me into a laboratory, selected a dry piece of red oak board several inches long from his collection, stuck one end in a dish of water, and blew an amazing blast of bubbles through the length of the block.) In other cases the vessel is blocked here and there by membranes (tyloses), and water and dissolved nutrients move along by diffusion (you can't blow air — or liquid — through white oak, so it makes much better cider barrels than red oak.)

A seedling tree in its first year is a short little stem, with a central core of pith about the size of pencil lead. On the outside is a covering of bark, the innermost surface of which is a one-cell-thick layer, the cambium; this is where all the growth takes place. The cells of the cambium are continuously reproducing, and as the new cells form, some end up on the side of the cambium closest to the light and air, and become part of the bark, while most of them form on the other side of the cambium sheet and become the wood, between the cambium and the pith. Arranged in rows and cemented together, they produce the fiber-like structure, constantly adding wood just beneath the bark.

In its second year the tree grows upward a few inches. The top part is just a flimsy twig with the same structure as the original seedling, but the lower part that is now two years old has added a second year's cylinder of thickness to the first. The most rapid growth takes place in the spring, when the cells formed are larger, less compact, with relatively more water content and less cellulose. Later in summer, in hotter and drier weather, the growing cambium produces smaller and more densely packed cells, making a thinner, usually darker and harder layer. In winter there is little or no growth.

Adding layer after layer, like a candle dipped repeatedly into melted wax, the tree grows as a very elongated cone. In a thirty-year-old tree, a section through the butt will contain thirty annual rings, but a section halfway up the tree will show only about half as many. The oldest branches will have the most rings, but never as many as the trunk.

The thickness of the annual rings varies tremendously with the species of tree and especially with the growing conditions — total moisture per year, distribution of available moisture through the year, temperature, light or shading by other trees, nutrients, soil conditions, and no doubt other factors. I have seen a piece of fir board with sixty-six rings to the inch; and English walnut, sequoia, and balm of Gilead each with some rings as much an inch apart.

Endgrain of the tropical African hardwood avodire, which has no discernible growth rings.

Tropical woods differ from the familiar ones that grow in my part of the world, in that you rarely can find any sign of annual growth rings. The temperature and moisture available remain so constant throughout the year that the tree's growth is even and continuous, hence it doesn't form seasonal variations in hardness and color as do trees in the temperate zones, though sometimes differences in rainfall may produce growth variations that show as faint rings.

In addition to the longitudinal arrangement of cells, as fibers and vessels, there are cells lined up radially in the tree, forming strands or bundles called medullary rays, like irregularly scattered spokes of a wheel, which carry fluid and nutrients to and from the deeper parts of the trunk.

As the tree keeps adding its alternate layers of spring and summer wood, these new cells join in the business of synthesizing, collecting, transporting, and paying back various nutritional substances, water, and oxygen; in short, they are alive. After a few years, however, the older cells (deeper inside the tree) gradually die; their chemical commerce ceases, and they tend to become the repository for various resins, by-products of the cells' actions. Since they are still surrounded by a living layer of sapwood, a fraction of an inch to several inches thick, these senescent cells do not dry out, and are protected (usually) from fungi and bacteria; therefore they remain dead and inert but intact, usually darker in color and somewhat denser and harder. That is the heartwood of the tree.

African ebony logs

The heartwood is often the preferred part of the tree for making furniture or other articles because of its color and durability. In some woods the difference is dramatic; in African ebony the heartwood is jet black to brownish black, while the sapwood is white or creamy in color. In other woods, such as most spruces and firs, basswood and poplars, the heartwood does not darken noticeably and can hardly be distinguished from the sapwood. In some species, such as black locust and black cherry, the sapwood is often only a few growth rings thick, while in the sugar maple it makes up most of the wood except in very large old trees.

Because of its cellular nature and arrangement, wood has "grain"; that is, most of the cells are aligned parallel with the long way of the tree or branch. Furthermore, the cells will separate from adjacent cells more easily than they will break or tear crossways. Therefore, striking a block of wood with an axe on the end of the grain or crosswise on the side of the grain gives two very different results; in the one case the cells tend to separate lengthwise — the wood splits, and the separation may extend a long way beyond the blade — while in the other case the cells are crushed together and torn, but do not part nearly as easily to make way for the tool's passing.

The size, arrangement, relative numbers, density, strength, and cohesiveness of the various cells in the wood all combine to give the wood many of its physical characteristics. In addition, resins or pigments deposited in or between the cells often give the wood special qualities of color, odor, taste, feel, texture, and resistance or susceptibility to decay and to tools. Color varies from holly, the whitest of woods, to ebony, the blackest, and in the lovely hues department we find creams, yellows, oranges, reds, browns and purples — all of the spectrum, in fact, except the blue-green section; here (so far as I know) we must rely on various fungus invaders in the wood to fake up these colors for us. They sometimes do this with distressing exuberance, thus completing the color scheme while trying to unravel the structure.

Part Two: A Sampling of Woods

Maples

sugar maple, *Acer saccharum*

soft or red maple, *Acer rubrum*

bigleaf maple, *Acer macrophyllum*

"Sugar maple is also known as hard maple, rock maple, sugar tree, and black maple; silver maple as white maple, river maple, water maple, and swamp maple; boxelder as ash-leaved maple, three-leaved maple, and cut-leaved maple; and bigleaf maple as Oregon maple."

— *from Wood Handbook No. 72, U.S.D.A. 1955, p. 18.*

There are many maples, but ***the*** maple, the queen of them all, is the sugar maple. It provides maple syrup and sugar; the majority of the spectacular fall foliage of upper New England; a significant element in the cultural identity of Vermont; excellent firewood; and a very special wood for carving. In late winter (an occasional optimist may call it early spring), usually around the middle of March, it freezes at night but thaws in the daytime, and the sap begins to flow in the maple trees. Vermonters go into the “sugar bush” (grove of maple trees) with calipers to measure whether a tree is large enough for one, two, or even three sap buckets. A hole is bored in the tree trunk; a metal spout about three inches long and a half inch thick is driven into the hole; and a bucket is hung on a hook on the end of the hollow spout. Once or twice a day the sap is emptied from the buckets into a tank on a sled and hauled to the sugar shack, where a wood fire keeps the sap constantly boiling in the evaporating tanks. About forty gallons of sap boils down to one gallon of syrup. On a warm day after a frosty night there is a rapid drip from the spout, which slows down and stops toward sundown. This continues for about six weeks, when the weather warms up and the upward flow of sap diminishes.

We had five maple trees around our front yard.

A tap driven into the trunk of a sugar maple

“How do you know when it’s time to tap your maple trees?” I asked. Well, around Plainfield, you tap your trees when Walter Smith taps his.

I borrowed three spouts and buckets from Belmont Pitkin, who has a big sugarbush, and hung them in our largest trees. Here was vivid justification for the term “sapwood.” It was amazing to see the amount of flow; a two-gallon bucket would sometimes fill in a day if the temperatures were just right. I tried in vain to estimate from this fact how much fluid actually moves up through the sapwood of the entire tree per hour; but if I had been able to come up with a figure, it would have been unbelievable.

We eagerly put our first gallons of sap in a canning kettle and started it boiling on the back of the stove, adding more as the kettle could hold it. We couldn't keep up with the trees, and buckets and jugs of sap accumulated on the back porch. On the third day of boiling I happened to glance up at the ceiling, and recoiled in horror. The wall paper on that whole side of the room was standing out in great blisters, and had turned a soggy brownish color here and there, reflecting the ancient character of the paste beneath. We hastily moved the whole operation onto a gasoline camp stove out in the garage. It lost some of its Vermont authenticity by this change in fuel, but it was very clear that this was not a casual kitchen project, and that forty gallons of distilled water absorbed into walls and ceiling was too dear a price to pay for a gallon of syrup.

We finally got our gallon of syrup, but we didn't have the knack of filtration, temperature control, rate of heating, precipitating out the impurities, and how fast to add the fresh sap. Our product fell far short of Pitkins' quality syrup; but the experience was both enlightening and fun, and after about a week the kitchen wallpaper miraculously shrank back almost to its original appearance.

There's hardly any better firewood than seasoned maple, but I kept wanting to reserve all the better pieces (bigger pieces) from the woodpile for carving. The sapwood — usually two to five inches thick — is light creamy color to almost white; the heartwood varies from tan to grey-brown, occasionally quite dark. The wood is hard, with small inconspicuous vessels so that it is compact and to the unaided eye appears non-porous. The grain tends to be straight and to split cleanly, but is tough and not inclined to splinter. The annual rings are not prominent, either to the eye or in resistance to cutting, giving a smooth uniform character to the wood. As an added attraction, the medullary rays are fine and shiny and lie in numerous small bundles which, on a radially cut piece that has been polished, produce shimmering glints of softly reflected light — the real hallmark of maple.

Curly and birdseye maple are not separate species or strains, but variations in the grain of individual trees. The curly or wavy figure in the grain, accented by the shine of the medullary rays, make curly or birdseye maple especially attractive and much sought after for furniture, musical instruments, and gunstocks.

A fishing lure of sugar maple with reflective bundles of medullary rays

Gilman Keasey says he thinks it is a genetic difference. He once bought the stumps in an old walnut orchard that had been cut down. These were English walnut that had been grafted, as is customary, onto black walnut rootstock. He found that about forty percent of these stumps had curly grain, and surmised that all had been seedlings from the same parent tree. He also says the outer part of the tree is the curly part, maybe only the outer two inches in depth, or sometimes several inches, but not all the way to the center.

You can't tell which is a curly tree by looking at the outside; you have to cut into it under the bark to tell. My only piece of curly maple I found one night in a random woodpile, and had split most of it into kindling before I realized what it was. The most credible statement I've seen about it is that some kind of fungus or other infection affects the cambium, so that removing the bark reveals little spines projecting from its inner surface, and corresponding pits in the surface of the sapwood. This effect, carried forward over the years, could readily distort the grain into a curly pattern (in quartersawn or radial surface) or bird's eye pattern (in flatsawn or tangential surface). This could explain Gilman Keasey's observation that only the outer part of the tree shows these patterns, and could also explain a high percentage of curly walnut stumps among adjacent trees due to the same fortuitous infection.

Red maple, or soft maple, has much the same structure as sugar maple but is not quite as hard, durable, predictable, white, uniform, nor ivory-like to the touch and to the blade. Its rays are slightly larger and have a rosy tint, a trace of which is in the lenthwise fibers as well. It is a trifle more splintery, but tends like sugar maple to have straight compact grain and can produce a very attractive finished appearance. If one hadn't been spoiled by knowing sugar maple, red maple would be a very fine wood.

Finished and sealed board of red curly maple

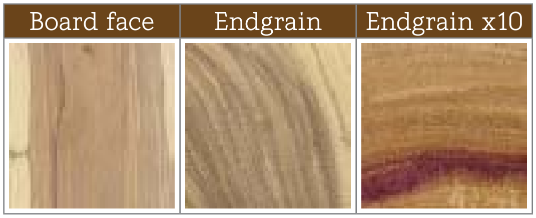
Bigleaf maple, I believe, is more like red maple in texture and hardness but lacks the pinkish tint. Having lived in Oregon and been surrounded by it, I still have had little experience with it.

Striped maple, or moosewood, is a small tree growing in the northern part of the range of the sugar maple. It has pale, slightly roughened stripes on the bark, lengthwise of the trunk or branches, and its leaves are up to ten inches across. Its wood is uniform, about as hard as red maple and less exciting in appearance. The small piece that I have appears to be all sapwood.

If you don't mind a blister on your finger, whittle something nice from sugar maple. It yields grudgingly to the knife, but the result is well worth it.

Lilac

lilac, *Syringa vulgaris*



Across from our house in Plainfield, where Creamery Street meets Brook Road, three lilac trees stood in the yard of Newt and Maudie Davis. They also had three maple trees, one of which Newt could remember his grandfather planting sixty years ago.

During an ice storm one night a lilac branch about two inches thick came down, broken off by wind and the weight of frozen rain and snow. Seeing Newt out next morning dragging it away, I went over to visit and to ask him for a piece of the wood, and he was glad to be rid of it.

I was astonished to discover the color in lilac heartwood — a truly purple-colored purple. It was the color, from my childhood memory, of the juice of home-canned blackberries mixed with cream thick from the skimming pans. A quarter inch of pale tan sapwood surrounded layers of the purple, which shaded here and there into streaks and bands of varied browns and tans. Not until later when I found other pieces from other sources could I really believe that this was the typical color of lilac wood.

I learned of a lady in Montpelier who was taking out some dying lilacs but couldn't bear to throw away the wood. I went to see her, took the pieces she had saved, and dug out the stump for her. Practically every trunk or fallen branch of lilac I've seen, if it was over an inch of thickness, has appeared to have at least the beginning of decay starting at the central pith; this five-inch trunk was a mere shell one to two inches thick. As I chopped at the roots a mouse jumped out of the dark cavity and fled down over the bank, while the family cat lay and peered vacantly toward the horizon.

Here the purple color was even more erratic; it was limited more or less distinctly to certain annual rings in the remaining heartwood, but with some shifting from one ring to another as one followed it around the tree. It seemed that there were only three or four purple years in the last thirty-six, in some places about ten years separated. All before that (another twenty, perhaps) had gone with the core of the tree, comsumed by the subvisible purple-eaters.

An angle cut along a small lilac trunk

I wondered whether a white lilac tree would have the same purple color — until the blossoms came out again in the spring and I realized that my branch was from Newt's white lilac tree.

That spring Newt died. After a month away with relatives Maudie came back, alone in the old house — wouldn't hear of moving out, they said. For a while she took regular walks up Brook Road, and tried to keep up her yard and flowers, but gradually she lost the briskness of her step and the shine in her eyes. In the fall she began wandering about the neighborhood looking for Newt. Then we heard she was in the hospital, then in the nursing home. Within a year she was up with Newt in the cemetery.

Already by then I thought I could see a little loss of brilliance in the purple wood. Now, three years later, the purple in a finished piece is still there but much faded and shaded toward a reddish brown; but a piece of the original branch, cut open and polished, still is the same bright purple as the day after the storm.

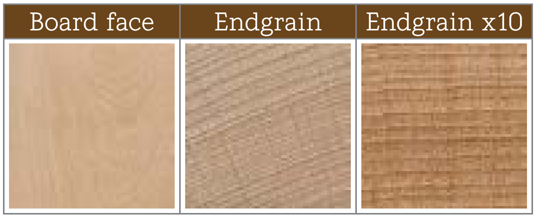
The wood is dense, about the same hardness as soft maple, tough and not splintery. It feels quite a lot like dogwood. If that improbable purple could be kept from fading, I'd be grateful.

After moving back from Vermont to Oregon I acquired only two pieces of lilac, and they contained no real purple, but rather a tan to dark brown with a faint lavender tint — pretty against the creamy sapwood but not what I was hoping for. Is it a different variety? Different soil composition? The drastically different climate? Or a chance variation? Which is "typical" color? I don't know; so expect, but don't count on, brilliant purple in your lilac wood.

When I'm carving lilac I still see Maudie Davis, standing tall in the early morning sun under her lilac tree and gazing into the distance past Great Brook.

Beech

American beech, *Fagus grandifolia*



For a good, solid feeling, you can't beat a block of beech. It's tough; it always makes me sweat when I take a billet of beech and a handsaw to rough out a spoon. Often at Christmas I make a spoon or two, and they're usually beech or yellow birch. The wood is compact and quite heavy, pale reddish brown with slightly darker rays evenly spaced so that a tangential or oblique cut surface has a characteristic pattern like rows of little hyphens. The texture and color are very uniform, the annual rings not prominent.

Closeup of a beech board showing the evenly spaced dark rays

The wooden parts of many tools (old style planes, mallets, scribers, levels), scientific instruments (slide rules, balances, cases) and some musical instruments have traditionally been made of beech because of its reliable resistance to warping or cracking under changes in humidity and its durability under constant use.

Beech is one of the few woods that can be burned in a stove and will keep a fire going even when it is completely green. I once thoughtlessly covered my dry woodpile with new green wood, and had to burn beech the day after I cut it. You really have to keep crowding it into the stove, and you waste a lot heat boiling off that pint of water for each pound of dry wood equivalent. And it isn't good for your chimney. But it kept us warm for a couple of days until I could get the woodpile straightened out.

I started saving pieces of beech the first time I saw some in with the firewood, always trying to get a piece to season thoroughly without checking.

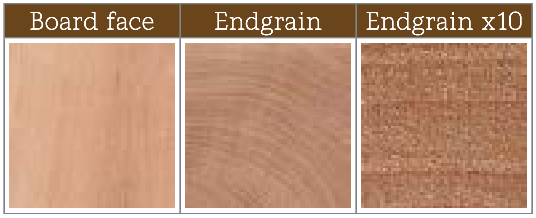
I asked Conrad Motyka, a forester, where I could find some big pieces of beech for carving. He said he knew of some being taken down, was in fact working on it this week and would leave a couple of pieces behind his office where I could pick them up.

The next day I came home and found that he had delivered three four-foot lengths right into my woodshed, ten miles from his office, as he "happened to be nearby anyway." He's a big bear of a man, but I still marvelled when my wife told me that he just picked each one from his truck and carried it inside; it was all I could do to tip them up on end.

I poured melted paraffin on the ends, weighed them (close to two hundred pounds apiece), and patted and soothed them in my shed. I gave one away, and the other two sit in my garage, three years off the stump and still losing weight, and terribly checked despite my efforts and high hopes. Even so, they're a couple of real hunks of wood — and at worst they contain more great spoons than I'll ever find time to liberate from the log.

Dogwood

dogwood, *Cornus sp.*



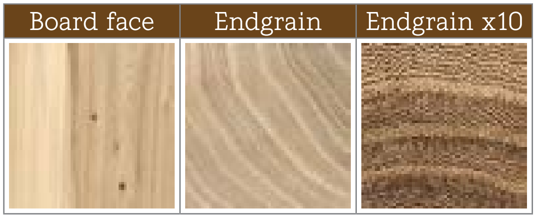
Over thirty years ago my bride and I had our honeymoon on Duck Island, off Long Island, New York. Just outside our window a glorious dogwood bloomed. Since then, dogwood has held a certain romantic charm for me, but its wood has been rarely encountered. One summer, visiting my brother in British Columbia, I got a piece of a small dogwood tree.

Dogwood turns out to be excellent for small carvings. It is both tough and moderately hard, but not brittle. The grain is fine and compact, the color faintly pink. Having only a small piece, and in line with the sentimental connotation of dogwood in my past, I have made several pairs of linked heart-shapes, three-fourths of an inch or less in diameter. They seem strong for their size, and when tossed and rattled in the hand the links make a ringing, clinking sound suggestive of ivory or hard plastic.

I look forward to getting some more dogwood.

Elm

white or American elm,
Ulmus americana



Looking out over a forest in Vermont one may see elms as the tallest trees, pushing up above the ever-present sugar maples and the beech, butternut, and ash. But often these towering lookouts show as bare bony fingers protruding above the green surroundings, dead trees fallen prey to *Ceratocystis ulmi.* This tiny but eager fungus was first described in 1921 in the Netherlands, hence was named Dutch elm disease, but is thought to have come from Asia to Europe during World War I. In 1930 it appeared in New York, then spread throughout the eastern United States and Canada, then steadily westward, hitch-hiking on the helpful elm bark beetle. It is now present throughout the U.S. The American elm is especially susceptible, and millions of them have died. In 1975 you could still see live elms in Vermont, but many of them showed parts of the tree dead and other parts wilting and slowly giving in to the relentless invader. My impression then was that maybe four out of five of the elms in a random sample of the countryside were dead or dying.

A similar fate earlier befell the native chestnut trees of North America, at the microscopic hand of another fungus, *Endothia parasitica.* When the Dutch elm disease was first invading this continent, most American chestnut trees had already succumbed to this infection. Jim Stirling of the Vermont State Forestry

Service said that there were a few old chestnut stumps around Vermont, and that saplings grew up from the roots, got a few feet high, then sickened and died as had the parent. He knew of one chestnut tree eight inches in diameter which was being watched by the foresters secretly and with hopeful anxiety somewhere in Vermont.

At Oregon State University in Corvallis in 1978, some signs of the disease appeared in a few of the elms that bordered streets of the campus and elsewhere in town. There was anguished debate as to what to do. It was believed that the disease commonly spread from one tree to an adjacent one through their spontaneous "root grafting," so in a few places alternate trees were cut down. Also some anti-fungals were injected into the sapwood of some trees. I am told that quite a lot of elm trees are still alive and apparently well in Corvallis.

An elm tree has a distinctive shape — like a vase, some say, but a spreading jet of water seems to fit better my image of an elm. To find the turn off the back road toward Chickerings' house, the landmark to watch for was an elm, not yet dead; our son Richard said, "Turn at the spurting fountain tree."

Because there are so many dead and dying trees, there's always plenty of elm wood available, but it isn't in great demand. "Why do you insist on carving elm?" they ask.

Elm has a bad reputation: people say it's good for nothing. You can't really burn it. Evalyn, up the hill from us, complained that she couldn't get the oven hot enough to bake when she burned elm. But some people have told me they burn it in big "chunkwood" stoves. It doesn't burn hot, but will hold a fire all night. What Evalyn was burning wasn't dry, anyway, because Leon had cut down the big dead elm by his house six months before, and chunks that size take at least a year or more to season well.

Elm is almost impossible to split; the fibers interlace and intertwine in little bundles, so when you've laboriously driven a pair of wedges through a block there are still those little cables of tough springy wood, big as a toothpick or big as a pencil, holding the two surfaces together. (When it's frozen, though, it's more brittle and therefore splits better.)

For the same reason, you can't smooth it in the usual ways. With other woods, if a plane lifts and tears up bits of the grain you know that you need only reverse your direction and it will shave smoothly. Not so with elm; when you plane a piece parallel with the grain, even if your blade is good and sharp, either way you cut is likely to catch errant bundles of fibers and leave a torn, splintery surface. A surface that has been sawed or shaved along the grain is raspy to the touch — reminds me of handling a dogfish shark in biology class. And furthermore it dulls the tools faster than other woods.

It cracks. Any wood will check as a large piece dries, the amount of cracking depending largely on the rate of drying. But elm is especially unstable, writhing and squirming and warping with increase or decrease in humidity, and tends to tear itself apart with numerous small cracks often spaced less than an inch apart on an exposed end. Yet this self-immolation — like many a suicide gesture — is a mere threat; the tangled fibers of the grain prevent any real separation, so that the loss of strength of the piece is much less than the amount of cracking would suggest.

Behind a little mill outside of East Montpelier I saw a pile of elm lumber. It wasn't exactly a "stack" of lumber in the usual sense, because the boards were so dramatically warped, curled, and twisted that there was no possibility of putting them neatly one on top of another. One board had twisted nearly ninety degrees from one end to the other. And a friend of mine told me of an old chair he saw that was made of elm. It was a beautiful chair, but at any one time only three legs touched the floor — and it was a different three with each change of weather.

A table made of American elm

Leon Potter says, "Elm lumber is real bad for soakin' water. You leave a elm plank get wet, you won't be able to pick it up."

A British woodworker speaks of some woods as "mild working timber." His complimentary term is distinctly not applicable to elm; working it is a confrontation, not a soothing operation for a sleepy Sunday afternoon. You must be constantly alert for a reversal of the grain direction that will cause the chisel or knife or plane to dig in. Coming sideways on a crack may further splinter its margin or take an invisibly loosened chip off an edge.

Elm is stubborn wood. Yet when met by stubbornness carefully and respectfully applied, with plenty of sandpaper, it will yield a polished surface that is worth it all. The prominent annual rings are widely spaced, giving a bold pattern; the rows of vessels along the layers of spring wood have a unique zig-zag arrangement which gives an openness to the grain and pleasing coarseness to the figure; the sparkle of the medullary rays on a radial section can be invoked almost as nicely as in maple; and the satiny sheen of the grain curling around a knot is ample reward for the struggle.

A harsh working timber it may be, but elm is definitely all right in its place.

What's in a name?

box elder or ash-leaved maple, *Acer negundo*

black locust, *Robinia pseudoacacia*

staghorn sumac, *Rhus typhina*

Webster Lund, from up Brook Road, stopped by one day as I was visiting in the yard with Leon Potter, my neighbor, who merits the dignity of the title "an old Vermonter." Webster's beat-up old Pontiac had kids' heads sticking out of every window, and the open trunk was filled precariously with firewood-length chunks of a log that was startlingly crimson in the center, with creamy white sapwood.

"What is it?" I asked.

"That's mountain ash," he replied. "It's a cross between a ash and a maple. It's the same as the ones that grow along the river banks around here. This'n stood over by Haines's barn, across from Bartlett's store, and he got me to take it down for him. You could ask him for some of it; there's plenty there."

I knew the ones he meant; the Winooski River and others in the area were rimmed in places with good-sized trees that tended often to lean out over the water in a sweeping, protective gesture.

Webster drove away. Leon — short, chunky, a gravedigger by trade — shook his head. "That's no mountain ash," he muttered. "That's willow. Hell, I've been workin' in the woods around here all my life, and I know that's willow."

Boards of box elder, sometimes called "flameboards"

The next day I went over and talked to Mr. Haines.

"What is it?" I asked.

"That's soft maple." he said. "Grows along river banks. It's not much good for firewood, but it'll burn some. Sure, take whatever pieces you want."

I loaded up two big chunks with the most red in them, and was about to drive away when Mr. Haines came back out. "If you're interested in wood," he said, "I'll show you something else." He led me behind the barn to two small six-foot logs leaning against the fence.

"About ten-twelve years ago," he said, "we sent in our order for garden seeds in the spring, and they sent back this little extra bonus of seeds for a tree. I stuck 'em out here, and this one grew like everything. It got so it was shading the garden too much, so I finally cut the thing down this spring. It's been seeding all over the place, and I've been pulling up the new ones like weeds. Don't know what it is. You can have this piece if you want; it's just in the way."

I took one piece home, along with one of the little "weed" seedlings.

The questions of identity were finally settled by the tree books: the red-hearted mountain-ash-willow-soft-maple is box-elder, or ash-leaf maple, *Acer negundo*. Its red heartwood is disappointingly splintery and prone to tear and to separate along the growth rings; the more solid sapwood is moderately soft, "mild working," reasonably compact and resistant to splintering or tearing ahead of the blade. Except for the red color, it's just another ordinary sort of wood.

The weed seedling proved the mystery tree from the garden to be black locust, *Robinia pseudoacacia*. Twelve years had given seven inches of diameter with light tawny-brown heartwood, prominent rings, and almost lemon-yellow sapwood. A dried piece was moderately hard and quite tough.

Siding of black locust

I put a small piece of box-elder and a similar one of locust, both green, together in a plastic bag. In three days the locust was covered with round spots of mold — red, white, and black — but the box-elder had none at all. The difference was so startling that I repeated the procedure; the result was the same. Though locust is reported to be highly resistant to decay and excellent for fence posts, the sapwood apparently contains substances especially appealing to some fungi even more than the fairly high carbohydrate of the box-elder, which — being related to the sugar maple — does contain some sugar.

I went back a few weeks later to get the other piece of locust. Mr. Haines showed me his garden, which by now put mine to shame. Then he said, "Wait a minute," and went in the house to bring out a small table lamp.

"Most people don't know about this kind of wood. You ever seen it?" I confessed ignorance.

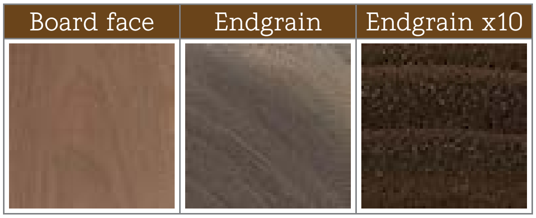
"I turned this on the lathe out of shoe-make! It finished up real pretty. You don't see it too often worked up like this, but it grows all around here."

Mr. Haines' "shoe-make" was staghorn sumac, *Rhus typhina*. It grows on hillsides, along roadsides, and in that part of Vermont, especially along railroad tracks. Later, when I was picking chokecherries near North Montpelier, I cut a piece of dead sumac about three inches in diameter, and found it even more colorful than Mr. Haines' lamp. It is quite soft, with prominent porous orange-brown rings of summer wood and paler tan to orange-grey spring wood. The rays are fine but distinct on a radial surface, and there is an irridescence to the wood that I haven't seen anywhere else. I have since been told that the rings fluoresce under ultraviolet "black light," but haven't checked this out.

Mr. Haines contributed a lot to my education.

Black walnut

black walnut, *Juglans nigra*



There's something special about some woods; it's subtle, hard to define, a combination of color and texture, the way it responds to the blade — cutting smoothly with a minimum of tearing or splitting on ahead of the cut — and the kind of finished appearance that can be achieved. Black walnut is one such special wood. There are very few black walnut trees around Plainfield, Vermont; a number of people who should know have told me there weren't any. However, Doug Guy led me one spring to a grand treasure.


Unfinished black walnut board

Just inside the entrance of the little East Calais cemetery back in the hills were three big black walnut trees. One of them had cracked at the first crotch, enough to let decay begin. A huge limb, twenty-two inches thick — practically half the tree — became weakened and broke off in a windstorm. The cemetery caretaker dragged it outside the fence to get it out of the way, and the smaller branches were cut off for firewood. The remaining nine-foot log was too short and irregular for anyone to take it for milling into lumber, so it was left lying on the grass, along with some limbs and short pieces.

For five years the wood lay there on the earth, almost concealed by grass in summer, a smooth bulge in the snow in winter, warming and cooling, freezing and thawing. The water in the wood slowly evaporated, moving constantly but imperceptibly out from the center, slowly seeking equilibrium with its surroundings — hot dry summer days, soggy weeks of intermittent rain, moist earth below and breezes above. It never got dry, never got saturated, never stopped changing in one direction or the other.

A rotting log of black walnut

The Little Folk accepted the log and made it their own. The fungi, bacteria, and wood-dependent insects whose labors had already brought the log down from the sky redoubled their activities, having now a different set of surfaces exposed and new conditions of darkness and moisture under the log. The wood and bark, no longer living, became easier prey; many newcomers were able to penetrate the bark and lay eggs which gave rise to several species of grub-like larvae, shiny blue-white or yellow or orange in the dark sticky layer between bark and wood. Big black carpenter ants, three fourths of an inch long, took up residence in the rotted core of the butt of the log; hour after hour, for the eight months of each year when they weren't frozen solid, they chewed and bored and their progeny chewed and bored endlessly interconnecting mazes of tunnels, mostly in the wood already softened by fungi but peripherally in the sound, hard wood as well, extending the domain of their colony to a space of perhaps six to eight gallons within the log.

The dark chocolate-colored heartwood, stolid and stubborn, yielded but slowly to the invasion; the dead cells, inert and passive these past fifty years, pitted their mummified cell walls of cellulose and lignin and their protective chemical residues against the organic onslaught and stood fast, unafraid in the dark but perhaps disturbed by the vibration of the ants' munching an eighth of an inch away. Even the lighter colored sapwood, its cells dying gradually since no longer connected to roots and leaves, resisted; on the underside of the log, which never completely dried out, it gave up an inch of thickness; on the upper side, bathed in air and sun and rain, barely a quarter of an inch. A small branch, reaching a few feet up out of the grass and inaccessible to the timid denizens of damp and darkness, lost hardly anything but its bark, while a firewood-length piece four inches in diameter, inadvertently left behind in the grass, was entirely reduced to a spongy, dust-filled mass of decay.

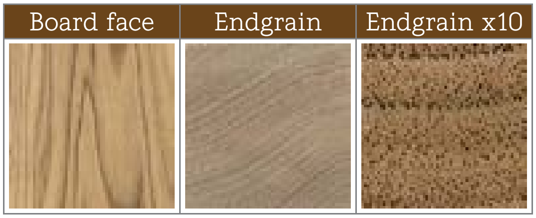
Pieces liberated from a fallen log of black walnut

With an odd mixture of elation, reverence, and mourning, I cleared away the grass and picked up my chain saw. It was difficult to decide how to go about it. I was sure that I would never again possess a piece of black walnut this size; I couldn't tell from the outside how much sound wood remained; I couldn't plan, on the spur of the moment, all the potential sculptures and carvings which the piece might yield; and I had no way to handle that size and weight as a single piece. How and where to cut? I sliced a thin layer from each previously cut surface, tested the accessible surfaces with a chisel, and finally determined where to make the least number of cuts leaving the biggest pieces that I thought I could maneuver into the truck.

I ended up with two chunks, almost entirely sound, one weighing 120 pounds and the other 170 pounds; another piece which was about one third occupied by ants, over 200 pounds; another two-foot-long section of the butt, rotten in the center with a two- to five-inch shell of sound wood; and several small pieces. The first large sculpture provided more than a bushel of scraps fallen from the saw — enough to last me for years of carving small figures, earrings, pendants, or other minutiae. The other large pieces, sitting in the shed, lost ten to fifteen pounds of weight, or roughly one and a half gallons each, in the first two months. If there were still a couple of those big black ants concealed in a partly decayed knot, I couldn't seriously begrudge them their lodging.

Butternut

butternut, *Juglans cinerea*



At the foot of Martin Johnson's lane, by the highway to Marshfield, stood a butternut tree. Driving home one day I saw that it had blown down in the previous night's storm. When I called Martin's house his wife referred me to the town roadmaster, as the tree was on town right-of-way. Burt Wild, the roadmaster, wasn't in but his secretary assured me they'd be glad to have the tree taken away. Chortling over my good fortune, I took my chain saw and set out.

I found that the butt of the tree was rotted almost entirely away, leaving only a thin layer of living sapwood surrounding the crumbling mass within. The trunk therefore had not broken but actually compressed and folded like a drinking straw folds, and was bent sharply over, head-high from the ground. Above this level, however, the tree was almost all sound wood, so I cut off the limbs and sawed the trunk into manageable pieces — three six-foot lengths, the largest eight inches in


A center-cut slab of butternut

diameter, plus a couple of pieces from a large branch. This was my largest find of butternut, by far.

By the time I was well started cutting it began to rain, and within ten minutes there were sheets of water drenching me and the earth; I was slipping in the mud, water was spraying from the saw, and I could hardly see the road. I finished cutting and loading up what I wanted, and threw the branches back off the driveway. By then I was so wet and cold and miserable that I decided not to cut down the six-foot stump with the bent-over top, but squished into the car and headed shivering for home.

A box carved by the author out of butternut

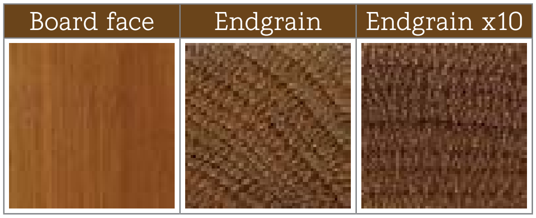
Later I trimmed the pieces, cut away all visible rotten wood, put aside the small pieces to dry for whatever need might arise, and sealed the ends of the larger pieces with hot wax for slow patient curing for the more distant future. Now, three years later, they have reached stable weight with almost no checking,

Butternut has much the same texture as black walnut, to which it is related (and which the living tree closely resembles), but it is softer and of a much lighter shade. It gives a warm, modest color and figure when finished, and is a great pleasure to carve. It is intermediate in tendency to check with drying. Large butternut trees are often hollow; this gives a two-fold benefit to squirrels, who winter in the hollow with a stash of butternuts. They seem to find the stony-hard shells and skimpy kernels of the nuts more rewarding to struggle with than do most humans.

For months after that rainy afternoon, whenever I drove from Plainfield to Marshfield I saw that decaying stump, standing like a giant finger bent over at the last joint, pointing out with an accusing gesture my failure to finish the job. But I never got around to go back and lay it to rest. I hope Martin Johnson or Burt Wild has done it by now.

Hop-hornbeam

eastern hop-hornbeam,
Ostrya virginiana



At Rob Tarule's place one day we cut beech and hop-hornbeam for firewood. I was reminded of the catalog from my favorite woodcraft supply company; their fine quality wooden planes have " ... beech body and hornbeam shoe."

I never heard of hop-hornbeam until I lived in Vermont. Some Vermonters, surprisingly, haven't either by that name, but instead call it leverwood. Sometimes it is called ironwood — not to be confused with other "ironwoods" of which there are several: "... any of numerous trees and shrubs (as various ebonies, hornbeams, or acacias) with exceptionally tough or hard wood...." It should also not be confused with hornbeam, of the genus Carpinus, also called blue beech, which grows in the same range. (I've never seen any.)

Hop-hornbeam is abundant in some areas of Vermont forest. The trees are not very large — from shrub size up to eight inches in diameter — with shaggy or scaly bark and vertical ridges which make a cross-section look scalloped (like some junipers in Oregon).

Rev. Murdoch Hale, who has some on his place near Barre, says that although the wood is very hard and strong, it rots fast once it's on the ground in a damp place.

Harold Townsend, one of the main repositories of history and lore around Plainfield, tells of a shipbuilder from Massachusetts who used to come to Vermont, go to a farmhouse, and ask for permission to look through the farmer's woodlot. When he found a leverwood tree that was large enough with the right accidental curve in it, he would buy the tree, fell it and hew it to shape, and haul it back to the shipyard to use as the stem of the ship — the central timber in front, to which the planking of the hull is fastened.

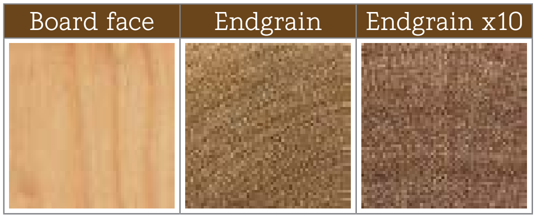
The papery bark of eastern hop-hornbeam

Later I learned that the counterpart of the stem, in the rear of the ship, is the horn timber, or horn beam; presumably this is the origin of the tree's name. So perhaps either Harold Townshend or I was confused as to which end of the ship his story fitted.

The wood is hard, compact, and tough rather than brittle. It varies in color from creamy sapwood to tan or rosy heartwood. It makes a nice handle for a small garden pick that I'm remaking into a carving adze, and a polished surface has a pleasingly warm glow.

Birch

yellow birch, *Betula alleghaniensis*



A very long time ago — probably in fourth grade — our teacher read to us a poem called "The Swinging Birches." According to this poem (obviously a fairy tale, since I had never seen a grove of birches) you can climb a tree of appropriate size, clasping the smooth white bark with hands and legs and working around the little twig-like branches, shinnying up just to where the tree is frighteningly small. Then, if you cling to the slender creature with your hands but lean out and let go with your knees, the tree will gently bend into a graceful arc and let you down until your feet touch the ground. If your size and attitude are properly matched to those of the tree, this dance is accomplished without harm to either party, so it can be repeated even with the same tree.

Many years later, walking through Bear Valley in Oregon, where meadows met an area mostly populated by fir and a few Ponderosa pines, I came upon a grove of small trees of assorted sizes with smooth white bark. They were not birch, but aspen. Nevertheless, with a sudden flashback to that poem, I laid down my pack and clambered perhaps fifteen feet up a tree a little thicker than my arm. With some apprehension I swung out in the prescribed manner, and descended soft as thistledown to the grass below, exactly as the poet had predicted!

When released, the tree sprang aloft again but remained tilted slightly to one side — not broken, I assure you — and I was forced to speculate that a birch may be better suited than aspen for this kind of activity. The trial was successful enough, however, that last summer I introduced my nine-year-old granddaughter to The Swinging Aspens.

A grove of young birch trees

I still have not seen an idyllic grove of young birches. However, the town road department was planning to widen and improve the road a few miles out of East Montpelier, Vermont, and had hired someone to cut down the trees in about a twenty-foot swath beside the road. Citizens were invited to help themselves to the firewood before the deadline for starting construction. My van seemed inadequate for this project, so Ed Smith rather reluctantly loaned me his pickup.

He was reluctant partly because the clutch was inoperative, so that one had to shift gears in mid-flight by carefully matching the engine speed to that of the vehicle and then shifting softly but decisively while the gears weren't looking, to avoid grinding them away. I assured him that I understood the anatomical principles of the parts involved, and would apply the utmost care in cooperating with the machine; he finally agreed with a mixture of grace and apprehension.

About half of the downed trees were yellow birch, with a couple of white birch and a few hop-hornbeam and beech. I sawed up and loaded in a fair pile of eight-foot pieces and headed for home. A couple of times I had to coast to a stop and start over because I would have the engine speeding up as the truck slowed down, or vice versa; but I finally got the wood and the truck home intact, to Ed's considerable relief.

As usual, I robbed my firewood pile of the larger and more sound-looking pieces, which I squirreled away in a small shed by the barn. This time the pieces that seemed like keepers were mostly yellow birch. Through the years yellow birch, along with beech, has become one of my preferred woods for making spoons. The grain is uniform, without prominent annual rings. It is not splintery when worked with saw and chisel and gouge. It works up a lot like beech but the rays are not as prominent as in beech, so the figure in the finished surface is more homogeneous.

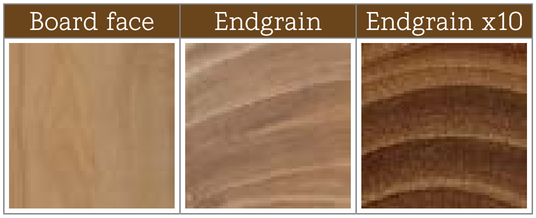

Spoon carved from yellow birch

We have a spoon of yellow birch which has seen constant use in the kitchen for fifteen years, and has withstood hot and cold stirring in everything from pancake batter to tomato sauce, from boiling candy to blackberry jam; it is a bit discolored and has a narrow crack at the tip, but is still more than serviceable.

I suspect that yellow birch is superior to aspen for sky-swooping, just as it is for spoons.

Apple

apple, *Malus sp.*



Apples are familiar enough, but apple wood is not so often seen. It seems to be the same wood in Oregon as in Vermont. So far as I know, you can't tell Jonathan apple wood from golden delicious or any other kind, though there are differences, as with any wood, between one individual tree and another. I have a piece from a tree grown in the mild, moist climate of western Oregon — six and a half inches in diameter, ten years old, and all sapwood. Another tree, from the dry area east of the Cascades, is only one inch larger but three times as old, and all but the outer half inch is the typical brown, non-living heartwood. Applewood is hard, rather brittle, heavy (but floats in water), and leaves a bright glossy surface when cut with a sharp blade. It appears dense and non-porous. The sapwood is usually a narrow layer of an inch or less, and sometimes thinned out to nothing on one side of the tree.

A few of the serious hippie types at Goddard College were truly seeking a productive and responsible new way of being in the society. John Davidge was one of these, and gave me my first apple tree. A young, red-bearded, mildly scruffy idealist, he had bought an old run-down place outside of Plainfield to renovate. The apple trees were badly in need of pruning and care, and one was largely dead. At John's invitation I cut it down, along with a large branch from another tree. After discarding the rotten parts I carried home several usable pieces, one weighing nearly forty pounds. Later, a commercial apple grower gave me parts of a dying and discarded tree from Windy Wood Farm.

Since one seldom has occasion to cut down a healthy apple tree, I have never had a piece of wood from the trunk of a healthy tree, though I have seen a branch ten inches in diameter pruned from a huge tree that hangs out over Harrison Boulevard in Corvallis, Oregon, and traded the lady a ball-in-cage whittled out of white ash for a piece of it.

Apple blanks ripe for carving

Henry Moore is said to have insisted on making his sculptures only from trees that were living and healthy when cut. There is much to be said for this view if you want as consistent, uniform, and predictably sound a piece as possible, with no intrusion or softening by fungus. However, it is often possible to get excellent pieces of wood from old dead trees; in fact, a tree which has died and has seasoned while still standing is likely to have dried with less checking and thus sometimes will produce the best pieces of wood.

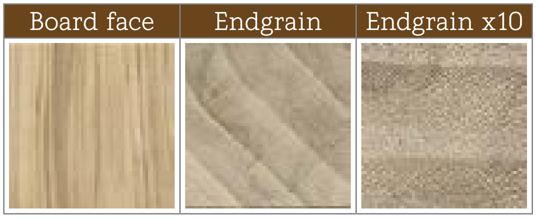
The most intriguing piece of applewood I've ever seen was from an old dead tree I cut down in Eastern Oregon. It had been broken, pruned, trimmed, negected, and deprived of water. When it finally succumbed the trunk was fourteen inches through, and the inside was hollowed out by decay.

After half a day with a chain saw, chisel and mallet, I had a hollow cylinder four feet long and over a foot across, the wall roughly one inch thick after all the decay was removed, with an opening about four inches wide along the full length of one side. I thought how wonderful a piece this would be if smoothed and polished and fenestrated like a sinuously formed meshwork of vines, with a light inside.

Unfortunately, when I moved again I was forced to abandon this and other lovingly accumulated pieces, but that fine finished product still resides in my imagination.

Balm of Gilead

balm of Gilead, *Populus gileadensis*



Webster Lund, seeing me in the yard chipping on a piece of elm, stopped by and asked, “Would ya like to have a good big log? I’ve got one ya could really make somethin’ out of!”

I went to his place to look at it. He said it was balm of Gilead, which he cut down last year for a lady in Barre because it was hanging out dangerously over her three-story apartment house.

“It took me a month to take it down,” said Webster, “cuttin’ off pieces and lettin’ ‘em down with ropes. One of the branches you could walk out sixty feet from the trunk. That was quite a tree!” Webster has a reputation for being the man to call when you have a really tough problem with taking down a tree.

The log was lying down over the bank between the road and the brook. Some brush and other trash had been dumped beside it and burned; the log was charred on one side and both ends, but refused to burn up. It was nine feet long and forty-four inches through at the big end. I cut a fifteen-pound chunk from one end with the chain saw and took it home to try it out. After drying a small piece for a few days and carving a fish from it, I decided to take the log, and hired George Boardman to bring it down the two miles lashed up to the back of his tow truck, the front wheels barely keeping contact with the road.

My chain saw, with a sixteen-inch bar, can't cut through a log thicker than thirty-two inches, so I had to cut in from each side and the top (taking care to keep all the cuts lined up in precisely the same plane) and then finish with an old push-and-pull bucksaw — and struck a nail five inches from the center of the log.

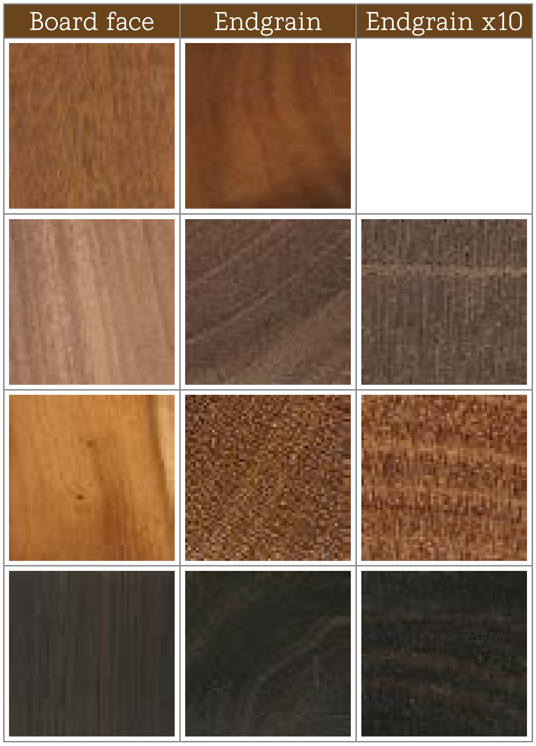
To my surprise, a count of the rings showed the log to be only fifty years old, which means an average annual ring width of nearly a half inch; there was at least one place where a single year's spring wood layer was was more than an inch thick!

Top of a balm of gilead stump

In Oregon's Willamette Valley (moist, mild climate with long growing season) that wouldn't seem so surprising; there I've seen both Sequoia gigantea and English walnut with one-inch growth rings. By contrast, I have a piece of clear quarter-sawn fir lumber, probably from higher elevation in arid Eastern Oregon, with sixty-six rings to the inch.

I read that balm of Gilead is a "sterile variant of a balsam poplar." The wood is soft but quite compact and uniform, with unobtrusive difference in color or texture between spring and summer wood. It has much less tendency to check with drying than any other wood I know. However, the log had an old, partly healed crack along one side which obviously had been there for many years — a disappointment of only moderate severity, since I have been able to cut it into sound pieces bigger than I can move by hand, and bigger solid pieces of wood than I have ever had before. I made a nice big salad bowl from one of the scraps, and most of it is still waiting.

Mahoganies and ebonies



mountain mahogany, *Cercocarpus ledifolius*

African mahoganies, *Khaya spp.*

South American mahoganies, *Swietenia spp.*

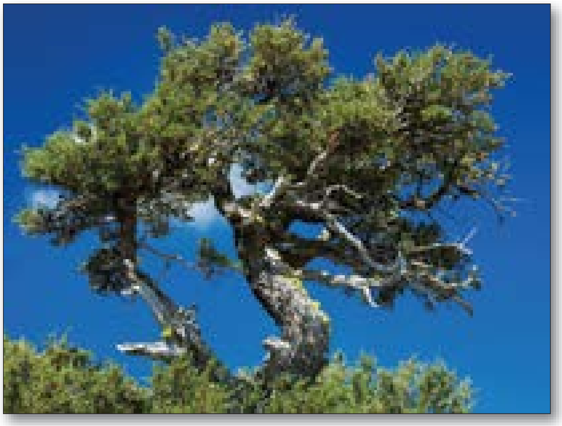
ebonies, *Diospyros sp.*

Hardness of woods varies from balsa, which you can rather easily take a bite out of, to various kinds called ironwood, to ebony or mountain mahogany, either of which is quite willing to break an imprudently applied axe blade and which require frequent sharpening of tools.

The award for the hardest wood that I have carved has to be divided between African ebony and mountain mahogany. Ebony would probably win an official contest, but there's enough variation from one piece to another to make their ranges of hardness overlap.

In Barre, Vermont, under a bench in a semi-defunct machine shop, I saw a piece of ironwood about five by five by eighteen inches. It was nearly black, with hints of yellow here and there, and weighed a lot. Bearings for some machines used to be made from this wood. I had a heavy discussion of the piece with the owner but couldn't afford the $70 he wanted for it, so I can't really compare this ironwood with ebony or mountain mahogany.

There are several species of ebony in the various tropics of the world, but I have experienced ebony only in some bits from Cameroun in West Africa, inherited from my father-in-law who was a second-generation Presbyterian missionary. The heartwood is jet black, homogeneous, heavy, and very hard; the skimpy outside layer of sapwood is starkly contrasting white or cream color.


Mountain mahogany on the hoof

Mountain mahogany is a shrub of the semi-arid mountains of eastern Oregon and Washington. Occasionally it grows to a tree twenty feet high and six inches through the trunk.

I found such a tree below Starr Ridge in Grant County, Oregon, dead and just standing there aloof from the rest. With a two-foot frame saw and an axe, I set to.

A half hour later, gasping and drenched with sweat, I watched the tree's very modest plunge to earth. The saw seemed not to have suffered much, but there was a half inch broken off one corner of the axe blade. With some additional struggle I removed the branches and cut off a six-foot length of log; I could barely drag and lift it into the van.

The name "mahogany" is applied to many hardwoods. The "true" or classical mahoganies are in the family Meliaceae, mainly two groups: genus Swietania in the tropics of the western hemisphere (S. mahogani, Honduras or Dominican mahogany; and varieties of S. macrophylla in South America); and Khaya ivorensis and other species in Africa (African mahogany).

Finished boards of six kinds of mahogany

So-called Philippine mahogany includes a group of Philippine trees (Philippine cedar, narra, lumbayo, red lauan, white lauan, tanguile, almon, bagtikan, and others) botanically unrelated to the Meliaciae family. They are generally softer, lighter in weight, coarser and more splintery than the "true" mahoganies, but this varies greatly. The name "mahogany" is sometimes given also to other tropical woods that may resemble the real thing.

The only tropical mahogany I've used was some that I found washed up on an Oregon beach. It's surprising how much mahogany shows up in the driftwood on Oregon and California beaches, and I can't tell one kind from another; it's confusing to a novice mahoganophile. I believe mountain mahogany is the only temperate-zone, dry-country tree to have been honored with the name.

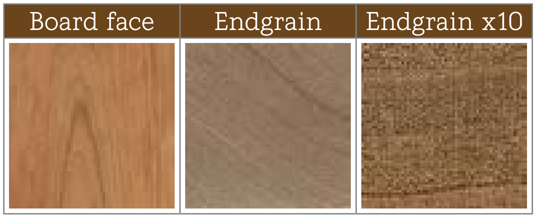
Mountain mahogany is both hard and heavy. With the bark removed, even a well-seasoned piece will sink in water. The sapwood is light tan and the heartwood light brown with a hint of orange. A branch two inches through is already mostly heartwood, with maybe a quarter inch of sapwood. Growth is slow. The rings are indistinct, irregular in spacing but close together; I can't tell whether all of the rings I can make out are annual rings, or whether some are "false" rings caused by variations in moisture or temperature in a single year. If they each represented a year, a two-inch-thick piece that I have would be nearly thirty years old. The rings are so obscure that it almost resembles a tropical wood in this respect.

Like most very hard woods, mountain mahogany cuts smoothly, and a sharp blade leaves a bright glossy cut surface — but the blade doesn't stay sharp very long. Shaved across the end grain it is very brittle and comes off almost in a powder, like ebony; but along the grain it makes fine tight curls, while ebony again makes crumbs or small flakes instead of shavings because of its brittleness.

If you want to do mahogany you can select from quite a large number of different kinds, or even fake it. But don't try a piece of mountain mahogany, or ebony, unless you really mean it.

Black cherry

black cherry, *Prunus serotina*



Until I lived in Vermont, a cherry tree was an orchard dweller up to eight inches in diameter and twenty feet high, with first branching not above head high. Now I have seen a wild black cherry tree eighty feet high and twenty inches through the trunk, the first branches twelve feet from the ground. The amount of glorious red-brown heartwood in such a prince of the forest is awesome.

I don't know Lew Christie's background, but he reminded me of pictures of a French-Canadian lumberjack — tall, dark, lean, and strong, his brown eyes seeming always to be burning into the future. He was clearing a place on his land (devoid of any actual road) outside of East Montpelier, and cut three big cherry trees. He tried to get the logs out to where he could haul them to the mill and sell them, but finally in impatience and frustration he started cutting them up for firewood. I expressed my shock and distress at this, and one day he left a piece off in my yard — nearly five feet long and fourteen inches thick, weighing 180 pounds. With its ends sealed with wax, it's standing in my garage now, and after three years is down to about two thirds of its original weight and still slowly losing, with only slight checking.

The sapwood of black cherry is very light in color and, in a large old tree, only an inch or two thick. The heartwood is the familiar color found in expensive furniture, but varies a great deal from one tree to another, and from one part of the tree to another. The streaks and swirls of light and dark in a cherry board often suggest a seascape or landscape; the rays give a variety of glowing patterns when polished. It is solid and carves well, not splintering badly.

Rough-cut, highly figured black cherry board

Left in a moist place, cherry rots fairly quickly, and I have seen several logs with rotten centers. It checks only moderately, and doesn't seem to warp badly. Larry Weng says that to use it for a table top, unless it's quartersawn you have to glue up strips not over two inches wide, with grain facing in alternate directions, to prevent twisting and warping; but Al Balistreri built us a kitchen countertop from boards six to eight inches wide and it didn't warp during the year that we lived with it, even though there was a steam radiator directly under it.

Cedar

western red cedar, *Thuja plicata*

eastern red cedar,
Juniperus virginiana

Alaska cedar or yellow cedar,
Chamaecyparis nootkatensis

Port Orford cedar,
Chamaecyparis lawsoniana

The smell of my grandmother's bedroom and my mother's cedar chest intermingle in the far back childtime of my memories. Things old and special — tatting, and garments sewn of silk with invisible stitches — were kept in the cedar chest along with two dolls and some leather-bound books, and other things. Whenever there was occasion to lift the lid of that imposing box I tried to hover near to savor the mysterious and awesome scent. I was later surprised and charmed to find a similar odor when I put a pencil in the pencil sharpener.

The name of cedar and, with some variation, the fragrance of its resins are shared by several families and many species of trees around the world. The heartwoods are shades of white, yellow, red, purplish, and brown. The softness, straight grain, clean splitting, and resistance to weather and biodegradation, along with the fragrance and color, have helped cedar to play crucial roles in human cultures.

Perhaps nowhere is this more vividly seen than along the Pacific Coast from Alaska to northern California, where indigenous peoples are famous for totem poles, canoes and boats, longhouses, sweat lodges and implements made from cedar, with uses both utilitarian and spiritual. From Alaska south to Washington this is generally Alaska or yellow cedar, which has yellow heartwood almost indistinguishable from the sapwood. From Washington on down to northern California the cedar of choice is more likely to be western red cedar, which has reddish brown heartwood and pale tan or yellow sapwood and which can be split into long and amazingly uniform planks or boards. It is sometimes called shinglewood, or canoe cedar. Both the ranges and the uses of these two species overlap considerably.

Eastern red cedar boards

I believe that most cedar chests and closet linings — for the special aromatic and insect-repellent quality of the wood — are made from eastern red cedar, as are the familiar cedar-smelling pencils. Shingles that I have known are usually western red cedar, but other cedars and redwood are also used for this purpose, either split or sawn.

We humans seem to have a perverse tendency, when a resource becomes scarce, to place a higher value on it and therefore to pursue it more avidly, thus ensuring that it will become even more scarce — sometimes even extinct. The stands of huge old cedars in the moist forests of the Pacific coastal ranges have been severely depleted, and cedar lumber is now costly. As a result, stealing individual cedar trees has become a well developed art in some areas of Oregon — usually in the forest out of sight, but I knew of a homeowner in Corvallis, Oregon, who had two large cedars growing in front of his house on a busy city street. He went on vacation, and returned to find two obscenely raw and naked stumps in his parking strip, and a grand new view of the sky. I have been told that occasional trucks and crews with "Tree Service" signs and uniforms have made a specialty of this practice.

I have a forty-year-old house with twelve-inch-wide cedar siding — clear, knot-free boards, some as long as twenty feet. Two pieces were cracked and recently needed to be replaced. A two-day search turned up a lumber wholesale dealer who had some on hand, but he said that such boards are nearly a thing of the past; when his present supply is gone he won't be ordering any more. I bought enough to do my repair, and a couple of extra pieces. At today's official minimum wage, one hour's work will buy just under two lineal feet of one of those boards.

Hearing a chain saw in the distance, I walked through the alley and down the street in Corvallis until I found a man cutting down a Port Orford cedar growing in his yard. He said it had died last summer from some type of root disease. They grow well and fast in the Willamette Valley, he said, but the disease is prevalent here.

"In reality," he advised, "don't waste your time fooling around with Port Orford cedars here."

I gave him fifty cents and took home my first sample of this member of the cedar family. The tree was about seventeen years old and nine inches in diameter at the butt (about a quarter of an inch layer of growth per year). The wood was light in both color and weight, and dried with only moderate checking. It smelled fine!


Western red cedar deck

Gilman Keasey has used Port Orford cedar to make arrows for archery. He says that in northern California, in the southern part of its natural range, there is often a lot of variation in wood texture between two trees growing in the same area. He usually used trees he found down and left by loggers, and would cut a chunk out of the side of each tree to see whether it would be suitable for his purpose before going to the trouble of sawing it up and hauling it home.

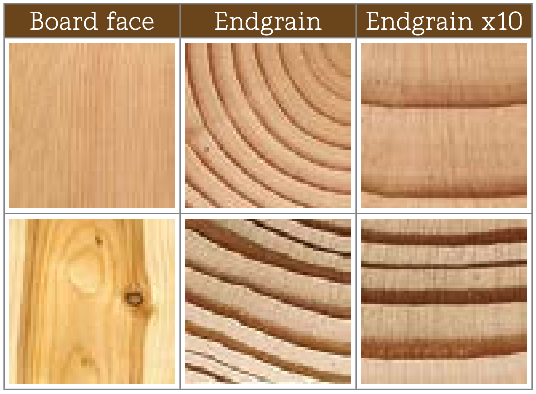
I could see what he meant; the piece I brought home was fibrous, splintery, and except for the fragrance, hardly worth the fifty cents.

I've never made a canoe, and I can't with confidence tell one cedar from another, but I know that carving small items from cedar is a bit tricky because it is brittle and tends to split or splinter easily along the grain. With care and a good sharp blade, however, it is a fine wood in a class all by itself.

Fir and tamarack

Douglas fir, *Pseudotsuga menziesii*

western larch (tamarack), *Larix occidentalis*



I was making a table, a hasty, non-fancy utility table for my wife's weaving studio, just a frame and legs on which to lay a door for the tabletop. I built the frame from fir two-by-fours, and went to buy one-by-four pieces for bracing the legs. Some No. 2 pine should be suitable, I thought (meaning some knots allowed, but not loose ones; some pitch streaks or defective edges, but no cracks nor severe grain distortion).

At the lumber yard I was dismayed to find their No. 2 pine stored outside in the rain, wet and in some places moldy; it looked miserable. After looking around and negotiating with the man, I finally gave in and bought ten feet of clear fir one-by-four — finish lumber, nicely surfaced (and very expensive), with no knots or flaws.

Back home again, I cut off a piece for a brace — and then I looked at the wood more closely. I was astonished at the spacing of the annual rings; counting on the end grain (the board was quarter-sawn), I found sixty-six rings to the inch!

Checking the cut surface of the end grain with a 20x magnifying lens showed me that in some years the tree had produced only five or six cells in thickness of spring wood and three or four cells of summer wood, or only a ten-cell-thick layer of wood added in a whole year.


A fir board with dense annual rings

I had to stop working at it and re-evaluate this situation. This grand old fir had died for me (in part) and had devoted 250 years just to growing this four inches in radius! Even assuming that the tree was a mere three feet in diameter (a modest assumption for old-growth fir in Oregon, even yet), and assuming that, as is likely, it grew much faster in its early decades — still, imagine the majesty of such a tree, its steadfast and unhurried chemistry over the years, compressing two hundred and fifty summers of sun and sighing wind, and two hundred and fifty springtimes of sharp frosty nights, and two and a half hundred Christmases, into a mere four inches of accrued radius, while eight generations of my ancestors made their way slowly and fitfully from the Atlantic to the Pacific. Such wood is awesome material!

My respect and reverence for the tree were too much. I put the pieces of the wood away, later to be glued into a block for a sculpture, and went back and picked out some fair pieces of No. 2 pine (grown almost in the equivalent of my lifetime, sixteen rings to the inch) for the lowly purpose of bracing the table legs.

Last winter in Eastern Oregon we burned almost six cords of wood, purchased from four different wood cutters. Most of it was tamarack, with some red fir and even a bit of lodgepole pine. Around here people say the only kinds of wood good for burning are tamarack and red fir. Since the Forest Service only permits dead trees to be taken for firewood, and since tamarack is the only "evergreen" around here that loses its needles in winter and thus could be mistaken for a dead tree, wood-cutting permits aren't dispensed until after winter has passed and the needles begin to reappear, so you'd better have enough wood on hand to last out the chilly part of the spring.

Names for trees vary with location. Putting together local custom with various book references, my impression is that fir trees around here big enough for commercial milling into good lumber are Douglas fir, and that younger and smaller and faster growing trees of the same species have a reddish heartwood and are called red fir. Furthermore, what is usually called tamarack here is actually western larch; the books say that tamarack is a related species that grows in the eastern U.S. But as long as we are both talking about the same tree, I can live with it.

Eugene Crump always brings me good wood, and this year, to be safe, I bought six cords. The first five were tamarack — my favorite because it is straight grained and from big trees with very few knots, so it's easy to split and to stack neatly. The last cord was mostly red fir. I know it will burn well, but the tree was twisted, the grain stringy and somehat interlocked, full of big knots, and when Eugene was putting it through his hydraulic splitter he over-estimated the size of my stove, so I had many a good sweat, with the aid of chain saw in addition to axe and splitting maul, getting that last cord wrestled into usable sized but often weirdly shaped pieces, and the stack looks pretty rickety and shaggy next to all that neat, clean, compact tamarack. As the old saying goes, wood warms you twice, once when you split it and once when you burn it. And a nice big, largely seasoned woodpile in place by the end of July gives one a good, warm, smugly comfortable feeling.

Woods from Vietnam

During two months as a volunteer USAID doctor in Vietnam in 1966, with very little of the language in my repertoire, I tried to inquire about wood. In the town of Tan An, south of Saigon, I bought a piece of hardwood about two by two by twenty-four inches in a "lumber store" — a five-foot-wide open shelf facing the street — for 200 piasters (about $2.00).

"Cai gi?" (what is this?), I asked.

"Go," replied the proprietor.

Aha! I gloated to myself. I had added a third species of wood to my vocabulary, along with cam lai and mit which I had already heard of. But when I looked later in my dictionary I found that go means wood; and further inquiry confirmed that what I had purchased was cam lai.

Cam lai blocks

Based on my limited knowledge and experience, cam lai turned out to be the prince of woods in Vietnam. It is hard and heavy, almost like ebony, but is a dark reddish brown; its sawdust is just the color of a new terra cotta brick. I didn't see it growing. In Long An province, at the north edge of the Mekong delta — elevation about five feet above sea level — I saw hardly any trees growing outside of towns except banana trees. Hardwood is imported from the mountains to the north and west, I was told.

During a visit to those mountains in the Central Highlands I flew over jungles and rubber plantations, and rode through areas that looked a bit like some parts of eastern Oregon, but I didn't recognize any of the trees. On the military post in Kontum, the roof in the bar of the officers' club was held up by a round pillar of cam lai about nine inches in diameter, aged and polished to a deep reddish brown with a streak of cream-colored sapwood along about half the length of one side. I paused in passing a couple of times to caress it; that was one beautiful piece of wood!

Down in the town of Kontum I found a carpenter who had some cam lai. I asked him to cut off a fourth of a meter (ten inches) from a board about two inches thick and five inches wide — about all I felt I'd have room for in my luggage. His price was a ridiculous 200 piasters — same as my purchase in Tan An. But I had revealed my eagerness to get it, and with the help of a young entrepreneur on a motorcycle who was interpreting for me (and no doubt splitting the fee) he was able to make the price stick. I paid him, rode briefly with the young man on his machine, and happily walked off with my prize.

Cam lai posts

Walking a couple of blocks up the road, I saw two men sawing a strip off the edge of a 2- by 10-inch plank. The plank was propped about eight feet off the ground, with one man standing on top and the other on the ground below as they took turns pulling on a frame saw. I learned from them that the wood was mit, from the jackfruit tree such as I had seen growing along the street nearby. They sold me a 2- by 2-inch piece about fifteen inches long for twenty piasters. I then showed them my piece of cam lai. They confirmed what it was, and asked how much I had paid for it. When I told them, we all had a good laugh together — at me for being a sucker, and at them for not taking advantage of that fact.

Mit is said to be used widely for carving Buddha and other figures for the temples. It is white, moderately soft, with an open grain like oak (though more uniformly spaced). I don't quite see what would be the attraction of mit for temple carvings — but maybe it doesn't check much, or maybe there are symbolic aspects of it that are obscure to a stranger.

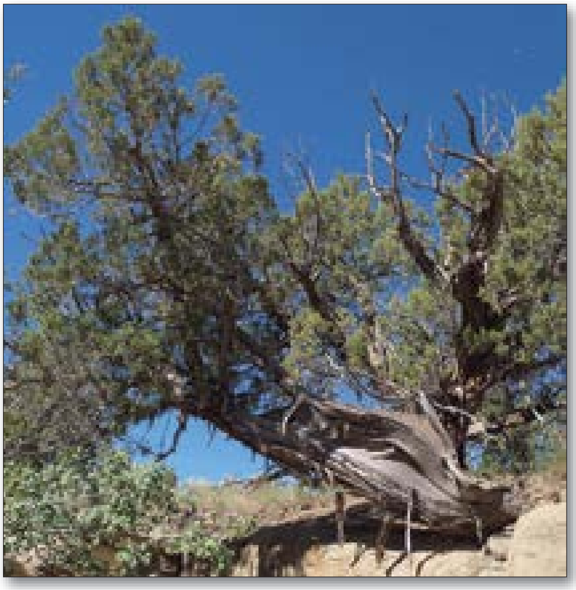
A large mit tree

Besides these two species I brought home a piece of thao lao, a rather tough and stringy wood that I found broken off one of the ornamental trees along the street in Tan An. It's not very exciting, but the little piece of sapwood I have isn't a fair sample. I have carved one small figure from the mit (not quite a Buddha). The two blocks of cam lai have produced a number of small items: ear rings, a pendant, and a couple of small figures. I gave one of these to my seventeen-year-old interpreter, Miss Nga, who said, "Oh, Sir, thank you! She will be my … [consulting her dictionary] … my taliswoman!" I gave a stingy sample to one of my woodcarving friends, and there's still most of it left. At this rate it will last quite a while; but it's anxiously guarded, for I never expect to go back and get another piece.

Sagebrush

sagebrush, *Artemisia tridentata*

Many years ago Howard Davis ran the store, post office and gas station at Sunbeam, a very small and remote community where Yankee Fork enters the Salmon River in Idaho. During the long isolation of winter he spent much of his time doing inlay with exotic woods. He showed us some beautiful little boxes, and a chess board which contained, as I remember, over thirty species of wood.



Mature, characteristically gnarled and twisted sagebrush

A wood biologist came by one time who prided himself on being able to identify any kind of wood by examining thin cross sections with a lens. Almost the only piece in Howard's collection that the fellow couldn't identify was — to Howard's delight — sagebrush.

I first knew sagebrush from early childhood, walking along with Dad while he hunted pheasants in the open expanses just outside the cultivated fields of corn, sugar beets, or potatoes in southern Idaho.

Sagebrush is seldom thought of as a material for woodworking, and for good reason. It grows as a gnarled, twisted shrub. Most pieces, if taken in two hands and untwisted, will shatter, separating along the growth rings like so many layers of brittle cardboard. Most sagebrush isn't more than a couple of inches thick at a maximum. Occasionally, though, a piece can be found that is solid and can be sawed or otherwise worked without splitting or falling apart, and I have seen places where the brush is taller than a man's head and up to five inches thick at the base.

It grows slowly — ten or twelve rings to the inch in the piece I have before me — which is not surprising considering that it lives in country that is hot and dry most of the year. It seems to do most of its growing on one side and eroding away on the other, so the "central" pith is commonly exposed or lying near the surface in a spiral up the trunk or branch. This would appear to be because the bark, with its cambium layer which makes the new wood, is missing along that side — whether for extrinsic or intrinsic reasons, I don't know, but that's the way it is.

Sagebrush as found in eastern Oregon

The annual rings of summerwood are dark and very thin, almost pithy themselves. The rays are about as wide vertically as in beech and give a beech-like "hyphenated" look to an oblique or tangential cut surface. The overall color is generally a rather warm grey-brown.

Don't trust the summerwood layers to stay together under any kind of stress, but a finished piece does have an interesting appearance.

Part of our reason for moving back from Vermont to Oregon is that Vermont has no sagebrush and no lava rock, and that just goes against nature.

Part Three: Being with Wood

Odors

In green, freshly cut pieces the odors of different woods are as distinctive as their faces. But how can one describe an odor? I can only say "It is like ..." or "It faintly resembles ..." something with which you are familiar; or I can indicate something of how I feel about the odor. And odors can be subtly deceptive. There's a certain fragrance which, at a distance and perceived faintly, could be either the delightful blossom of honeysuckle, or pseudomonas aeruginosa, the putrid greenish gray bacteria of infected burns and rotting broccoli fields.

Some woods are easy. Cherry smells like almond or peach pits, elm like a distant pig sty. Lilac has a rather purple smell, but hardly at all like its blossoms. Yellow birch is a bit like elm, yet rather sweet and pleasant; soft maple is even more like elm, milder but rather disagreeable. Grey birch seems to vary from piece to piece in the same tree (my sample has been cut down and lying outside for a year) but is rather sharp and sweet, with just a suggestion of an over-ripe, nearly rotten orange. Black walnut is distinctive (a dark, solid smell); its very close cousin, butternut, is quite different but I can find no words for it. Sugar maple has an elusive odor, perhaps best observed when it is hot from the friction of a saw or drill. Leverwood smells very faintly — "It only smells fresh and woody," my wife said — perhaps a bit like willow twigs.

The "softwoods" (evergreens or conifers) are in a class by themselves in the odor department because of the pungent resins they contain. Except for spruce and tamarack, they have very distinctive odors. Most of the cedars have similar, though not identical, odors, known to everyone in cedar chests and freshly-sharpened pencils. Most pines (white, yellow, red, sugar, lodgepole) smell like ... well, like pine, whether green or seasoned. Douglas fir has a rather strong smell, doubtless now most familiar in common fir plywood. The sticky sap or pitch of pine or fir has a pungent odor which only partly resembles that of the woods.

With some woods the odor comes through better as a taste, as in my childhood memory of an empty sewing thread spool used in lieu of a soap-bubble pipe. My wife points out, and I concur, that Tinker-Toys tasted like spools but Lincoln Logs did not. A recent taste test on shavings from my wood collection convinces me that most spools and Tinker-Toys were not maple or basswood as I had thought, but white birch. I would guess that toothpicks, and the tongue depressors in your doctor's office, are probably white birch as well.

The odor or taste is less strong in a seasoned piece, and often is qualitatively different as well, but still lingers. A piece of fir from a hundred year old house, shaved or split open, still smells and tastes like fir.

Seasoning wood

All life happens in water. Even in a dry and parched looking horned toad in the Mojave Desert, the living cells are full of and bathed in water. A tree is no exception.

In a living tree, depending on the species and the season, forty to seventy percent of the weight is water. When the tree is cut down or when the sapwood, and thus the tree, has died, the processes that created the tree cease and water begins to leave the wood.

Consider the water in two categories: free water, inside cell cavities and vessels and in spaces between the cells; and absorbed water, present within the microfibrils of the cellulose itself, in the very fabric of the cell walls. The amount of free water varies widely from species to species. When the free water is all gone from the cells and spaces in the wood and has been replaced by air, but the cell walls are still wet layers of cellulose, the wood is said to be at "fiber saturation point." At this stage, for all species the absorbed water is about thirty percent of the weight of the wood, and the piece has not changed size.

From this point on, removing more water begins to cause the walls of each cell to contract and shrivel with drying, and the wood starts to shrink. If all the moisture is removed, the maximum shrinkage will be roughly six to eight percent of the original width of the piece. However, it isn't easy to remove all of the water; it requires prolonged heating in an oven. Under ordinary drying in air, the water continues to leave slowly until its concentration at the surface of the wood matches that of the surrounding air, when usually about six to ten percent of the wood's weight is water. Thereafter the wood will take up or give off water according to the humidity of the air.

The gradual movement of water out from the center is slow and deliberate, especially after the fiber saturation point is reached. Like molecular movement in general, it is influenced by temperature. Drying takes place faster in the heat of summer — even though the relative humidity may be lower in winter — and fastest in a dry kiln heated by steam. When frozen, the log loses almost no water.

As moisture leaves the surfaces, the outside of the piece dries below the fiber saturation point and begins to shrink before the inside does. The outer layer, trying to become smaller, finds itself wrapped around the still soggy and non-compressible middle, and this tension tends to break the outer layers apart. Because of the capillary structure of the wood, with long hollow cells and vessels bringing water readily to their cut ends, water is lost from the ends of the grain up to five or ten times as fast as from the sides, so "checks" or "shakes" (spontaneous longitudinal cracks) appear first and worst at the ends. The faster the evaporation, the greater the difference in moisture content between inside and outside, hence more checking.

A badly checked stump

Because faster drying causes more checking, preventive strategies mostly involve slowing evaporation from the surface so the water inside has time to move outward from the middle and distribute itself more evenly. The commercial method is to speed diffusion out from the interior by increasing temperature, as in a dry kiln.

I have tried various ways to control the rate of evaporation. Dale Rookstool gave me a piece from the butt of a freshly cut mulberry tree, about fourteen inches across and three feet long. It weighed 117 pounds. I put it in a plastic bag, tied tightly shut; but obviously this wouldn't let it dry at all. With only a vague guess as to what to do, I poked several small holes in the bag, and set it in a corner of my shed. Every few months I weighed it.

After two years it finally stopped losing weight. At seventy pounds, it had lost forty percent of its green weight. It had no visible checks, and no fungus growth apparent. Unfortunately, I moved away and left it behind, so to this day mulberry is a mystery wood for me.

With that one I was just lucky. The plastic bag approach can be useful, but it has its problems. Slowing the evaporation enough to keep the wood surface damp encourages the growth of fungi; these flourish on the surface, and also invade, discolor, and then decay the wood to varying depths. The mycelia of the fungus often follow the grain of the wood, and can even travel for several feet along a narrow strip within a log. This hazard varies with temperature, with the particular fungi invisibly present in the vicinity, and especially with the species of wood.

Another method of slowing water loss is to seal the ends with wax. I have used plain white paraffin such as is used by some ambitious folk to seal their jars of jams and jellies. By trial and error I learned some of the rules for successful paraffinizing.

The problem is to get the paraffin to adhere firmly and to stay securely in place for as long as it takes the wood to reach its final, nearly constant weight. If the surface is wet, melted wax won't adhere. It works best to wait a few days after the piece is cut, just until no wetness can be seen or felt on the cut end of the wood; but don't wait beyond this point, or checking may sneak up on you.

The second rule is to have the paraffin hot enough. I have found an old aluminum coffee pot on an electric hot plate to be handy for melting the wax. Just barely melted is not hot enough, because it will start to cool and congeal as soon as it touches the wood, and therefore will promptly flake and chip away from the surface. But if too hot it will burst into flame. Just barely smoking hot is about right; if the pot is starting to boil, it is very close to igniting.

Be sure there's plenty of paraffin in the pot to cover the end of the wood completely with one continuous pour, or it will form non-adherent places and cracks in the wax, largely defeating its purpose. Standing a sealed log on end may tend to loosen the wax and undo the whole effort; but it often works if done carefully, and a collection of sealed logs takes up less room if they are standing up.

Occasional weighing is the best way to know when the seasoning is complete, because the piece eventually stops losing weight. The origin of the term "seasoning" is obvious, and it really is a more organically descriptive word than "curing," because complete drying of any firewood-length piece the thickness of your leg is sure to take more than one fall, winter, or spring.

As mentioned earlier, part of the problem in seasoning is the differential shrinkage between outside and inside because of the lag in water movement. If only it were that simple. The other part of the problem is that in every species, when all is at equilibrium and evenly dry, shrinkage has occurred along the circumference, along the annual rings, more than along the radius of the tree. This ratio varies with the species, in oven-dry wood, from a very slight difference (as, presumably, in my mulberry piece) to more than a 2-to-1 difference, so that no matter how nicely you retard the drying, you are eventually doomed to defeat in the curing of a full-round section of a tree; the inside will always have to burst the outside.

This explains why a flatsawn board will warp more than a quartersawn board, a round bowl turned on a lathe will become an oval, and any piece of wood containing the center pith of the tree will have to crack.

It also explains my holiday fiasco.

One Christmas I decided to make each of my five daughters and daughters-in-law a hand mirror. Each was a different wood and different shape, five or six inches across and less than a half inch thick, with the wooden back extending down into a handle. A piece of mirror was cut to shape and inlaid into the wood, cemented in place with dabs of epoxy cement.

I was happy with the results, and so were the recipients. The butternut, black cherry, black walnut, black locust, and beech all polished up nicely, the forms were sensuous, and their emergence from under the Christmas tree made all the effort seem worthwhile.

One of the ill-fated mirrors. Beside it is one of many carvings by the author of things linked to things inside of things sliding freely on things.

All was well until sometime in February, when my oldest daughter — with some embarrassment — showed me her mirror, from which the glass had popped out of its recess. I suddenly realized my error, and phoned each of the other girls in turn. Two of the mirrors had cracked. After two more months, every one had either come unglued or the glass had broken. I had allowed no provision for the inevitable constant flexing of the wood in compliance with the changes in moisture in the air, and the glass was rigid and unforgiving.

The wood itself had not been damaged, and I was able to salvage the project by chiseling out the glass where necessary and gluing mirrors back in place, this time on thin pads of leather that could absorb the wood's movement without letting go.

In dealing with this perverse quirk of nature, several evasive actions are possible. One is to do the best you can in slowing the seasoning, then accept the eventual self-mutilation of the piece and work around it.

Another is to submit to the inevitable and cut out of the log a piece that does not include the very center of the tree. I had a billet of black cherry about 4 by 5 by 20 inches, cut from one side of a log 14 inches across. It cured beautifully to constant weight by the paraffin seal method, and I used about half of its length, hollowed out to make a button box with upholstered top. The remainder of the block (I did not seal its most recently cut end) has been lying around in a variety of rooms and climates for twenty years. The other day I came upon it behind some old boards in an open garage at the peak of summer heat. There was a crack visible more than half way across either end and running the full length of the piece.

The black cherry button box in question

I hurried to the phone to call my youngest daughter. “Do you have that cherry wood button box that was your mother’s?”

“I certainly have. It’s right there on the dresser.”

“Does it have a crack in either end?”

“I’ll look.” (Brief pause.) “No, no cracks.”

“How about the under side of the lid?” (The top is covered in blue gabardine with dogwood blossoms embroidered on it.)

“No, no cracks.” I heaved a sigh of relief.

I have to assume that the leftover solid piece, although carefully brought originally to moisture equilibrium, couldn’t keep up with the constant changes in humidity it experienced over the years and at some point it was losing moisture too fast, while the box ends that represent that same cross-section from the tree are so thin (less than a half inch) that moisture can come and go uniformly enough to prevent internal stresses.

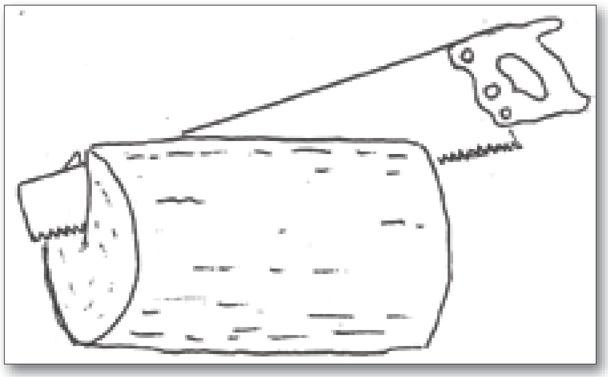


Figure 1

Theoretically it should be possible to outsmart the differential shrinkage in the log by sawing a slot the entire length of the piece along one side from surface to core, as illustrated in ***Figure 1.*** This should allow the shrinkage to occur throughout the piece and convert the saw kerf to a uniform wedge-shaped groove, and thus avoid any other checking (provided, of course, that the drying was slowed enough by sealing the ends).

I have never tested this theory completely, but almost. I had a piece of sugar maple from the firewood pile, still not long from the living tree, about seven inches in diameter, which I had necked down with an adze to make a pedestal for a walnut sculpture. I knew that it would check, but decided to try to concentrate the destruction in one place. With a hand saw I made a cut in the wide base from the periphery right to the central pith (***Figure 2***).

I put it in a plastic bag with a few small holes and set it aside. After several months, when it had reached constant weight, there were almost no visible cracks except the saw kerf, which had widened from a sixteenth of an inch to five eighths of an inch! I had changed my plan for the other sculpture, so instead carved the maple piece into a nesting bird, using nature's kerf as part of the design.

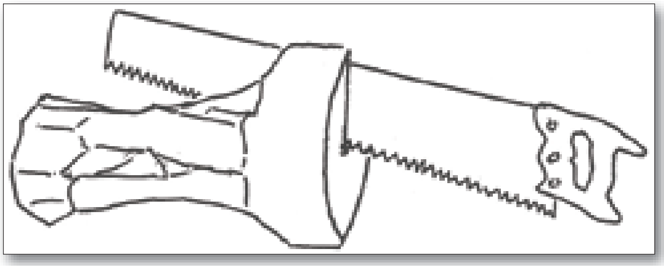


Figure 2 *A cut from periphery to center can minimize checking*

There is one other approach in which I once invested hope and optimism, and a bit of money and effort. I read about polyethylene glycol in large-molecule form — molecular weight of around 1,000, or "PEG-1000." This material, in a concentrated water solution, supposedly would gradually replace the water in the wood so that when it was allowed to dry there would be little or no shrinkage, and might make it possible to cure a large piece, even a section of a full-round log, without the treacherous self-destruction. I procured a large plastic garbage barrel, a sufficient supply of PEG-1000, and some skimpy instructions. I prepared the solution and submerged in it a number of chunks of various woods of various sizes, green, weighted down with rocks. As advised, I changed the solution after three months (to compensate for dilution by water exuding from the wood), and after another three months I sealed the ends of some of the pieces and laid them all out to dry in a room that was extremely humid because of all the green wood stored in it. As months went by and the pieces dried to constant weight, I could detect very little difference in the checking between the pieces with PEG-1000 treatment and those without; a two-inch-thick slice from the end of a 14-inch cherry log cracked hideously despite the treatment.

There still may be some merit to this procedure if carried out properly. When I visited Israel in 1992, two prior years of drought had lowered the water level in the Sea of Galilee by several feet, and the residents in Kibbutz Ginossar found, buried in the exposed mud, a boat believed to be a fishing boat from the era of Bible stories of Peter the fisherman. We were shown a video of the process of rescuing the boat. After some two millennia of submersion the ancient wooden craft was extremely fragile, but they succeeded in excavating it from the muck almost intact, stabilized it by blowing styrofoam around it, and transported it to a water-filled tank in a building constructed specially for the purpose. The styrofoam was peeled away, and PEG solution was added, 30 liters per day. They calculated that after seven years and forty tons of PEG the boat would be strengthened so that it could be dried, studied, and displayed; but we were only allowed to peer in through windows at the cover on top of the tank.

The concept, then, remains alive and well. Perhaps my material, my technique, or my expectations were faulty. It wouldn't be the first time, and wood never allows one to become complacent.

Nails in the flesh

In front of the fire station in Plainfield they were taking down another big elm tree, dead two years and a potential hazard to nearby buildings. I ran over and asked for a six-foot length from the butt.

"Gladly," the man said. I told him where in the yard to leave it, and hurried on my errand. When I returned that evening, there — right in the middle of my driveway — were two eight-foot lengths, weighing probably a thousand pounds apiece. Somewhat dazed, I recalled one of life's basic rules: be careful what you ask for.

I parked my car elsewhere, and at my first opportunity, a few days later, I attacked the larger of the logs. Intending to try a slice off the end, to see whether it would season without too much cracking and could be used for a tabletop, I laid my chainsaw to the wood and started the cut. I was about to stop and switch to the other side (my saw, with a sixteen inch-bar, can't cut through a twenty-eight-inch log with one cut) when the chain bounced, touched, and bounced sickeningly a second time before I could lift the saw and ease the throttle. A look at the chain confirmed that I had hit something other than wood, and that I faced half an hour of filing to shorten and sharpen the chippers on the saw chain.

Knocking out pieces of my half-slice with an axe and then with a chisel, I dug out a large nail, moderately rusty and blackened, with a shiny spot where my saw had struck. The nail was embedded eight inches from the surface of the tree. An eighth of an inch to the left and I would have missed it entirely.

Since a tree grows by adding layers to the circumference of what is already there, a nail driven six feet from the ground into a tree with six inch radius will still be six feet from the ground fifty years later. It will also still be six inches from the center of the tree, and fifty growth rings — perhaps two to six inches of wood — will have covered it over.

I suddenly recalled that every winter I had seen, nailed to this very tree, a sign ordering “No overnight parking on street, November to April” so snow plows could do their work. Each spring the sign was removed — but the nails probably were not.

My count of growth rings put the tree’s age at 106 years. A lot can happen to a tree in a century of standing on the main street of the village, beside a yard in front of the Grange Hall and church-turned-gymnasium-turned-fire-station. I shuddered to think how many other things had been nailed to this tree: mail boxes, cleat ladders, clotheslines, notices of parades and church doings, grange supper announcements, election “warnings”, tree houses, horse hitching rings.

Going back and peering at those logs with the X-ray vision of my imagination, I saw the wood studded to the core with nails of all kinds and sizes, along with a few large staples and pieces of wire, each lying hopefully in wait to be liberated by the touch of my saw.

The logs lay in my yard for weeks untouched after that first ill-fated cut, until finally I had them hauled away.

Rob's house

There are still some craftsmen around. A movement exists, at least in parts of New England and Oregon, to revive some of the old skills with hand tools. One day, with my 18-year-old daughter and 20-year-old son, I spent several hours helping Rob Tarule and his crew of neighbors, friends, and a couple of "real" carpenters from Woods Hole, finishing the last stages of preparation for a Vermont house-raising in the hills above Marshfield.

Rob had selected and cut trees from his farm and hauled them to the Chaloux Lumber Company outside of Barre to be sawed into timbers for the sills, posts, plates, joists, and rafters; two he had hewed by hand into six by nine inch timbers. These had been brought to his home, a half mile from the site of the new building where a foundation and decking had already been built.

For many weeks Rob, Ed Smith, and sometimes a few other friends had been working on the timbers. The plan was to construct the house, as nearly as practicable, in the manner of early New England builders. This meant mortise-and-tenon joints at all the major unions, secured by wooden pegs, and it meant everything done by muscle power. This principle was breached in Rob's case to the extent of using a chain saw for the original logging, and for some trimming operations during the construction. (And by use of the sawmill, but this of course was not cheating; many of the early American builders had water-powered sawmills.) Otherwise the entire operation was done with hand tools: cutting mortises and tenons in the spruce and fir and hemlock timbers; shaping the ends of the rafters; planing or "dressing" the surfaces of the timbers to be left exposed; cutting "lets" or notches in the sills for the ends of the joists to rest in; whittling the scores of ash pegs, or trunnels, an inch and a quarter in diameter (Joan Smith did most of these, with a drawknife and a shaving horse); boring the holes for the pegs; and in one place splicing two timbers together end to end. This last was achieved, where a single fifty-foot run was required along one wall, by means of a "tabled scarf" joint, locking the timbers together by wedges driven in from either side. Lovingly executed by one of the experienced carpenters in Rob's crew, the joint looks like that shown in ***Figure 1.***

Rob honored me by letting me use one of his razor-sharp chisels to do the final paring of a mortise in one of the timbers. He said the traditional rule in post-and-beam construction is to cut all mortise and tenon joints to one-eighth-inch precision, but he was trying for one-thirty-second. This tolerance would be far exceeded by the random twisting and shrinking of even a well-seasoned timber in any given week of weather changes. But you have to set your goals and draw the line someplace; better to err on the side of meticulous pickiness. Rob would feel better this way.

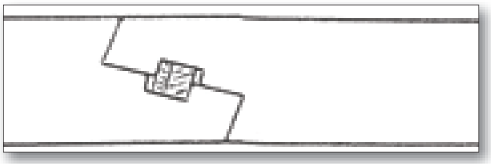


Figure 1

I spent two hours at the honing bench with the Woods Hole visitors, learning some tricks about sharpening plane irons and then servicing the planes for the seven or eight people who were dressing timbers. On this soft, partly-seasoned wood a plane would go for about a half hour before detectably needing resharpening. "This one wants a little more rocker and a touch-up," the plane-wielder would say, meaning a slight increase in the almost imperceptible curve of the cutting edge so that the center would take a shaving without the corners leaving linear tracks.

Sharpening tools has been a different experience for me ever since that day.

There was a certain timeless, solid comfort on entering that house. I last saw it when the skeleton and roof were in place and two rooms finished enough to move into, and to serve me a cup of tea.

Chokecherry syrup

Chokecherry grows as a tall shrub, generally with close-set clumps of stems. The largest "trunk" I've seen was less than two inches thick, and the largest I've ever cut was not over an inch and appeared to be all sapwood. David Judson has recently told me of some sort of steam-heating process by which chokecherry stems can be made so plastic that they can be pressed together into a solid sheet of wood; but my experience suggests that there isn't enough chokecherry wood in the world to make this a very attractive commercial venture. I've never heard of cultivating chokecherries, nor seen any for sale. I am inclined to call the wood trivial; but not so the fruit.

Chokecherries are a wild fruit, a country fruit, something to be learned about from grandmothers. Somewhere in childhood I tasted chokecherry jelly, a memory now blurred by the years.

Chokecherry endgrain, finished and unfinished.

At a harvest auction we bought a jar of chokecherry jelly, but it turned out to be syrup instead. It was good on hotcakes, but we don't often do hotcakes. I tried some on vanilla ice cream — and I was hooked. That was a true taste sensation! I began planning for the next chokecherry season: I would make jars and jars of chokecherry syrup, enough to last the whole year, strictly for ice cream. I started noticing the places where chokecherries grow, along roadsides and creek banks, and to keep track of their seasonal changes.

There is a small, silent subculture of people who sneak out at the crucial time, fill their buckets, and slip home again with an engagingly innocent look, never revealing their purpose. They must feel foolish collecting such small, unappetizing fruit, ninety percent seed and five percent skin, whose bitter-tart mouth-puckering character makes the fruit so uniquely worthy of its name.

On discovering a dense growth of bushes along a little Vermont back road, I secretly set my goal. After the buds opened into creamy white plumes hanging all over the ten to fifteen foot high shrubs, I furtively drove by every few days to check on the fruit's development.

The state of ripeness is critical to success in using the cherries; if picked too soon they are sour and lacking in flavor, with hardly any juice, while if left a couple of days too long they will be whisked away by birds, or will start to dry and shrivel to nothing — or mold, if the weather is wet.

Just when my cherries reached their peak of perfection I had a day free — and rain came in a steady downpour. I waited through the morning for it to slacken, but in vain. In mid-afternoon I gave up waiting and ventured forth with my buckets and a short step ladder, clad in warm clothes and an old rubber poncho with a hood, and entered the thicket.

Despite the rain I was soon sweating. The poncho was of a military color, but surely no one would ever try to defend his country wearing one of these; it made movement awkward, and reaching upward caused the hood to descend over my eyes and deflected a gush of water down my neck. My glasses were fogged by sweat from within and raindrops from without; I had to peer out sideways to locate the fruit, and then pick it by feel.

After a time the gushes of water were barely noticeable; the steady tapping of rain on the poncho, the dank wetness that had penetrated to the farthest reaches of my underclothing, and the slap of branches across my face blended into a soothing trickle of misery and a pleasant reverie. Visions of pint after pint of chokecherry syrup lined up on the shelves of my mind; no jelly this time, but my own private treasury of Chokecherry Syrup For Ice Cream. My collection of cherries grew slowly, and once I spilled a quart or so out into the underbrush, but eventually one bucket was filled and I started another.

The day had been warm enough when I set out, but now dusk was approaching and suddenly the heat and sweat of an hour before turned to a chilly dampness. My neck was stiff from gazing upward, my knees trembled from leaning into the ladder, and I began to shiver. The second bucket was far from full, but finally discomfort prevailed; I picked up my ladder and buckets and made my way back through the bushes and over the fence to the car.

I had two and a half gallons of cherries, and still had ahead of me the main assault on the fruit. I had assured my wife that since this project was my idea, I was not going to require her to get involved at all. This was presented as a generous gesture; it was, in fact, the exact opposite, to assure myself control of all the fine points at which I didn't trust anyone else: cooking the berries barely enough to release the juice (as the cookbook had instructed for some other fruit); squeezing out every last ounce of the precious fluid; boiling it with the sugar just long enough to maximize the flavor but not enough to cause it to jell; and adding only what water was absolutely necessary so the juice would not be diluted at all.

When I reached the house and slogged in with my buckets, Betsy made “tch-tch” noises and heated water for tea.

An hour later, warmed by dry clothes and the hot drink and strengthened by a bowl of stew, I set out an array of large containers, washed the cherries, and poured them into a big canning kettle. The water that clung to the berries, I decided, would be enough to start it cooking, whereupon enough juice would flow out to continue the process. With the heaping kettle of fruit on the stove, I watched. I waited. Nothing seemed to be happening. I turned the heat up a bit. Still nothing happened. I tried to stir the cherries, but the kettle was too full. I dipped half of the fruit into another kettle and resumed stirring.

This time I saw a wisp of steam rising — and to my dismay the spoon brought up a couple of blackened cherries, burned and crisp. I was making charcoal!

Hastily I removed the kettle from the stove and poured the cherries into yet another kettle, leaving a single layer of charred little balls adhering to the bottom of the pot. The process began again; this time I reluctantly added about a cup and a half of water and stirred constantly.

After what seemed like a very long time the pot was steaming again, and some of the cherries were softened and losing their skins. A few minutes later their color was changing and I decided the cooking had proceeded far enough. I dumped the cooked cherries out into another large container, and repeated the cooking process with the remaining fruit.

At last I was ready for the main act — squeezing out the juice. The jelly bag, made from muslin, was hung from two lengths of broom handle thrust through hems at the top and laid between two chairs, with a kettle on the floor underneath.

I ladled a couple of quarts of the cooked fruit into the bag, and watched hopefully for juice to gush forth into the kettle. None did. I twisted the neck of the bag and squeezed. A small purple stain appeared on the cloth.

Holding the bag twisted against the sticks to keep the fruit tightly compressed, I seized the middle and squeezed with both hands, strangulation style; two tablespoonfuls of juice came oozing out through the cloth, and a bit dripped into the pan. Nearing desperation, now I massaged and squeezed, massaged and squeezed, snatching my hands away between squeezes because the mass was still steaming hot.

Massage turned out to be the key. I kept kneading the bag up and down, back and forth, the seeds acting like gizzard stones grinding the pulp. The juice continued, not to to gush but to drip and trickle. When at last the effort produced scant returns I emptied and rinsed the bag and refilled it with cooked fruit — four times.

An hour and a half had elapsed, and the kettle was half full of juice. I bathed my numb and paralyzed forearms, flexed the fingers a few times, and moved on.

The cookbook had said under “Jams and Jellies” (there was no “Syrups” department) that fruits differ in their pectin content. Some require added pectin to jell, while others need only be boiled with sugar. The book was silent on chokecherries. I measured the juice and added the sugar, put the pot on to boil, and began cleaning up the mess. (The kitchen was by now a shambles. Betsy occasionally surveyed the fruity scene but generously refrained from comment.) I noted the time, determined not to cook the mixture long enough to give it any incentive to jell.

As I came in from emptying the bucket of pulp and seeds Betsy was giving the simmering juice a stir with the big wooden spoon. I gave her a pat in passing — and then I froze. I saw her arm extended, her wrist tilt, and she poured the contents — the entire contents — of a paper packet into the kettle.

“What are you doing?” I cried.

She looked startled. “I was just adding this pectin for you. You do want it to thicken up some, don’t you?”

“Thicken up?” I yelled. “Thicken up! You’ve just turned my whole batch of syrup into jelly!”

In twenty-seven years together, though we had had some disagreements, I had never struck her. I didn’t strike her then, but the depth of my rage amazed me. I didn’t know what to do. We were both silent as I gently took the spoon from her hand and probed the boiling mixture, searching for some ghastly lump of pectin that I could fish out and banish.

At last she said, on the verge of tears, “I don’t think that was enough pectin to make it all jell — at least not very hard.” Then, “You could add some water to it,” she added helpfully. I didn’t dignify this disgusting suggestion with a reply. After long moments of contemplation I took the kettle off the stove, stirred it again, and let some of the liquid run off the edge of the spoon.

"Jelly test (the book had said): . . . drops will run together and leave the spoon in a large flake or sheet . . . " I couldn't be sure, but the test appeared to be negative; maybe there was still hope. But instead of the smug satisfaction that had consoled my aching neck, stiff knees, and macerated hands, now my mind and gut held a cold emptiness. I poured the liquid into scalded jars (five and a half pints, it came to), screwed down the lids, and finished the cleanup. Both of us felt bad, and there was nothing more to discuss. We went to bed and slept a fitful sleep.

The next morning both the fruit mixture and I had cooled off, and I had achieved a sort of resigned tranquility. Strolling casually into the kitchen I gently tilted the jars one by one. The fluid within poured from side to side with a a slightly viscous — yes, a distinctly syrupy quality. I drew a long breath which filled both my lungs and my soul with equal satisfaction, and went to give Betsy a hug.

The syrup lasted almost a year. It was delicious, and I enjoyed every dish of ice cream. Yet it contained some subtle residue that I could not quite define — not detectable to the tongue but more vaguely to the spirit. Chokecherry syrup never seemed quite the same again. If anyone ever offers me a dish of vanilla ice cream with chokecherry syrup I'll jump at the chance; but as for making it ever again myself, I think I'll just live with the memories.

The spirit of old trees and stumps

"The tree is sun, frozen in place by the crystalline exigencies of the world."
— *Richard Grossinger, Solar Journal*

A dead tree, a big log rotting on the ground, or just an old stump has a special spirit or gestalt of its own. It is a bridge between life and death, past and future, between the high ethereal sun-and-vapor world and the palpable flesh-and-stone part of the biosphere. Gone is the crisp, highly organized and energized phase of being — cells turgid with magic syrup, tubular columns in serried layers, warp and weft adjusted to the pull of the winds, the constant bumper-to-bumper molecular traffic up and down the crowded freeways of xylem and phloem, and leaves glinting sharply in the sun. Gone is the dynamic symmetry, the brilliant recycling of world-stuff pouring through a mere pattern, the dance of the particles choreographed by DNA of ages past. It lies here now a mute, passive repository for carbon which the chloroplasts in its leaves once extracted from the air. The hulk now lies inert, its cellulose lattice still intact at the heart but melting at the edges into simpler juices, feeding unseen micro-communities. Bacteria labor in the moist darkness; fungi protrude from the crumbling surface and extend their tendrils deep within the wood.

Years flash slowly by and the process waxes and wanes, the predators feasting on a warm summer day after rain but staying their tools as winter jams their enzymatic cogs. Bit by bit, the substance of the tree is liberated, entropy personified. Its elemental components disperse: minerals back to the soil or into the skeleton of a passing nuthatch, carbon and hydrogen and oxygen back into the globe-circling winds; energy once used in the tree's creation now honestly repaid in exactly equivalent caloric currency of oxidative heat released (though the sun won't accept the refund). The biologic cremation is finally complete. All that remains on the forest floor is a ridge of good earth and ferns and flowers marking the grave, and birthplace of a sapling to repeat the cycle.

In the village of Plainfield is a sidewalk along the main street which at one point had been carefully curved out around the base of a big elm. I never saw the tree, but have always felt grateful to the builders of the sidewalk; they stuck to their designated line, parallel with the street, except in this one place. Here a higher consideration prevailed and, respecting the priority and seniority of the elm, they curved their path neatly around it. Before it was my turn to live there the tree had been cut down to a circular platform ten inches high. Walking along and guided by your mood, you could go over the stump (a hop up, two steps across, and a jump down) or around on the sidewalk.

To maintain one's proper perspective in life, one must view an old tree as a frame of reference for size, time, and process.

This year the sidewalks have been repaired and the old elm stump was summarily removed by a wondrous stump-chewing machine. The sidewalk is now straight, with a livid patch of new asphalt the only memorial to the old elm. Though the Klinefelters have better access to their driveway, I grieve a little.

Encounter

"It's no good to complain because stones are hard and water is wet."
— *Abraham Maslow*

A sculptor works through constant transaction, negotiation, and compromise with his material. Beyond the creative impulse and the tactical planning, sculpture becomes a meeting of two different substances — steel and wood — and two different forces — the shearing of the saw or chisel working as an extension of the muscles, and the cohesion-elasticity-reluctance of the fabric of the wood.

Wood has been uniquely available and congenial to humans and their purposes throughout their past. Trees were around long before people, and some of the qualities of wood made it especially suited to the uses of this tool-making animal. It's harder than dough and softer than iron. It's firm enough to use for levers, diggers, stabbers, clubs, wedges, rollers, containers. It's not as extensible as rubber, but soft or fragile enough to be broken, cut, abraded, drilled, split, or otherwise shaped with the aid of harder substances. It floats in water, hence is fine for rafts or boats. It comes naturally in sizes and shapes suitable for making frames of houses of all sorts. It's elastic enough to serve for fishing rods, bows, and springs, but rigid enough for rafters and bridges. Being combustible, it has been the major facilitator of the use of fire in harnessing non-muscular energy.

Wood is durable. The oldest known living organism is a bristle-cone pine which has reached an age of over 4,000 years. This means that the cells that formed in the young sapling about the time the Phoenicians were introducing the idea of an alphabet to the Greeks have been entombed as non-living heartwood within the living expanding shell of sapwood to the present day. A white pine log (not petrified) found embedded in a peat deposit in Michigan was carbon dated at about 6,400 years old; similarly preserved wood has been found in sand and gravel deposits in Indiana, 18,000 years old; in a peat deposit in France, 19,000 years; and in Illinois, at a seventy-foot depth, 21,000 years. Wooden objects in the cool dry tomb of Tutenkhamen have remained for over 3000 years as good as new, yet a piece of wood lying in the back yard in the Willamette Valley of Oregon may rot away in a single season. And wood retired in other places can absorb minerals into its tissues and become petrified, turning to stone.

Wood is seductive in its promise but stern in its demands. Only by understanding and accepting the limitations set by the block of wood, meeting it on its own terms, can the sculptor enter the encounter with any hope of success.

By the demands made by the wood, I mean the facts and reality of its character. It twists and changes shape as its moisture content changes. Its strength differs greatly in different directions in the same piece. It has a strong tendency to split and tear itself apart, cracking as it dries, and to continue on its way toward the self-immolation of decay unless certain conditions are met.

Wood is suitable for making some kinds of forms but not others. The weight vs. compression and tensile strength, or molecular cohesion, set certain limitations, and especially the difference in strength in different directions, along the grain vs. across the grain, dictates the possibilities and limitations in form. A table leg with the grain running parallel with the floor would be a failed venture.

The sculptor must constantly attend to these demands. He must control the content and flow of moisture in various ways; he must either accept a certain amount of cracking (perhaps incorporating the cracks into the design) or select only a part of the original tree that will embody a minimum of the isometric struggle going on within the wood. He must be constantly aware of the direction of the grain in the depths hidden from his view, or his cut will go amiss. He must negotiate and compromise with the piece of wood, and quite literally obtain permission from the wood for each cut, or the encounter will become a confrontation and both participants will be losers.

My dealings with wood afford me a special kind of pleasure, on two levels. First, the wood symbolizes the chemistry of life and the dynamics of the earth's skin. Substances from the earth and sky have joined temporarily in a network of cellulose and lignin. Details of the pattern reflect the coding of the specific DNA chain that makes it a tight, hard piece of maple or a tough but porous openwork of oak, and also reflects the earth's movement around the sun on its tilted axis, the seasonal changes imprinted in the annual rings. The rise and fall, birth and death and recycling of trees in a forest is a prototype of what the biosphere is all about, for me to participate in and to emulate.

Second, there is a sensuous pleasure in carving, smoothing, negotiating with the wood and eliciting from it some sort of distinct statement of form and texture. For the sculptor, wood offers to his touch and tools an exciting range of possibilities. A finely honed blade moving over a piece of wood transmits into the very belly of the carver a recitation of qualities: the difference in hardness between pine and beech; the smooth flow of the blade gliding down the grain or the gritty resistance moving across the grain; the alternating jumps in pressure and sound as the blade passes the annual rings in a piece of oak or ash or fir. The varying sounds and changing appearance of the surface under the saw, rasp, chisel, plane and sandpaper express the varied agreements between the carver and the medium. The final fruit of the interaction between the carver and the carved is always a statement of the character of each.

I take off my hat to wood.

On seeing and knowing

I was once astonished to learn that in viewing art our eyes actually and literally move about through the scene, not randomly, but specifically following the lines of the picture. Successful composition in a painting is an arrangement of lines which is compelling, leading the eye movements through and around and repeatedly back to a main point of interest, and not out and off the edge. The eye moves, taking the viewer on a vicarious journey through the scene, so that the experience is felt “as if” actually making the trip. Why do our eyes do this, and what does the trip mean to us?

Lines and forms take their meaning from memories, from physical encounters, compromises, and integration embedded in our experiences of the past. Consider a sphere. My past experience with marbles and billiard balls has made me know that a ball feels the same all over, is the most uniform and symmetrical of all objects, and will roll on a flat surface. Further experience with bubbles, balloons, wounded basketballs and squashed plums makes plain that a sphere is a ball-full contained within the skin of a ball; that sphere-ness implies a uniformly restraining containing action, against a uniformly omnidirectional force of fluid striving to burst out. Eventually even a picture of a sphere evokes an almost-aware remembering of these experiences of hand and eye, and the image is at once interpreted within this set of memory-contexts.

Consider a cube. Cubes (or other rectangular solids) have taught us to see them as rigid structures, the flat planes resisting distortion through their own invulnerability. Unlike a sphere, a cube need not be tightly inflated to survive;

seeing it punctured, we do not expect it to collapse. A flat plane re-presents to us the planes of our childhood, of walls and floors and tables, of boards and boxes, of doors we could not breach. Plane says rigidity, especially if reinforced by another plane intersecting it. Hence the firmly immutable form of a rectangular solid; and the more nearly cubical it is, the more convincingly rigid, unbending, indomitable it seems.

And so with other forms:

Parabola: a moving body and a force acting at an angle to its path.

Ellipse: two forces, centripetal and centrifugal, acting in a reciprocal feedback relationship on a moving body; or more viscerally, a squeezed or stretched circle.

Cylinder: movement of a circle through space; implied forces in the movement (your hand along a broom handle).

Tube: shape of fullness of a long hollow-skin cylinder; like a sphere, it implies a space-fluid inside; not like a stick, despite some similarity.

Tapering shape of a limb …

… of a tree — implies division or expenditure over time/distance, from trunk to branch to twig

… of a person — implies the qualitative changes from muscle to tendon, soft to tough, contractile to tensile, strong to dexterous, much to little; from one kind of vulnerability to another.

Recognition of a shape is a memory in the muscles, a memory from feet, fingers, tongue. To confront a form is to relive a thousand meetings. Is it a circle? You have felt your fingers slide around the edge of a bowl, your mouth caress a lifesaver candy, your feet trace the curving walk beside the park; you have sidestepped the sweep of a gate, and have swung on a rope or on the radius of your mother's arm. The centrifugal balance in the arc of the road's turning calls up the memories, as does your lip on the edge of your coffee cup. A circle is a circle, a fact/phenomonon printed indelibly in your memory circuit to the end of your time.

The memory is muscular. You do not passively feel an object; the muscles move the finger along a surface, and skin and muscles jointly feed back the data, call out the bearings — now we have gone two inches south, now a right turn, this edge is a straight line (check it later by sighting) with a dip just here (invisible in this light); oops! here an intersection, the finger carried back the other way, one good turn deserves another. Or walk down one street, turn two blocks along another, up a flight of stairs. These are shapes, stored in the memory of the legs but integrated with other memories, other strong 90-degree trips and returnings and rigid rectangular knowing; the sidewalk never sags and walls don't ooze away.

Our perception is based on learned integration of sensory experiences in the physical world — experiences with the various properties of substances and forces. Richness of past experience defines the potential for future perception. He who has never walked up and down a hill nor driven a wedge between two objects will not fully appreciate and experience a picture of a sloping line or surface. Try to describe the color "green" to a person blind since birth with no experience of color.

As perception is limited by past experience, so is conception — creativity or invention — limited by one's perceptual memory. Even our fantasy grows out of and is limited by this repertoire of knowing how things are; fantasy can only rearrange the bits of knowing into new combinations.

Gravity provides the ubiquitous framework, the corollary verities of up-downness and sideways-level-flatness:

Horizontal represents the ultimate acknowledgement of and concession to gravity. Common sense shows us that the world is flat.

Vertical is the world's denial, objection, resistance to gravity.

Roundness and rectangularity are the geometry of our tools and techniques — wheels and boxes — and consequently of our perception. Rooted in simple mathematical and physical characteristics of the world, our technology of tools-to-make-tools-to-make-tools has spawned a progressive roundness and regularity in the things we invent, hence in the way we think, and has channeled our creativeness. We learn to expect rooms to have 90-degree corners so rectangular furnishings will fit in "efficiently," and so we can use "standard" shapes and sizes of boards and panels.

Hardness-softness. Step on a stone but not on dough. The ground will hold you up but pudding won't.

Elasticity, flexibility, cohesiveness. A rubber band is not like a wire, a string is not a blade of grass.

Liquid. A special case of softness.

Wetness. Includes liquidity, but more: coolness of evaporation, special surface effects, reflections, changes in friction; soaking into solids; wet fibers cling together.

Mass, weight, bigness. Judged first in relation to the size of me or my parts.

Spaces. Closed-in-ness, closed-out-ness. Psychophysical experiencing has informed us viscerally that an orifice or cavity permits/invites filling, putting something in, going in; and that an elongated projection implies/invites/enables inserting, jabbing, axial thrusting, reaching. The interpretation of such forms as "vaginal" or "phallic" is only one of a more general set of ways of understanding, viewing, feeling, knowing.

Once we have encountered and learned these properties of the world, then perception (integration and interpretation of incoming sensory data) takes place in terms of these remembered experiences. A coin is perceived as circular even when viewed partly on edge; trees signify verticality, so a group of slanting trees makes either gravity or the ground seem tilted. All manner of "optical illusions" (actually, perceptual illusions) are based on interpretation of visual patterns in accord with past encounters.

Viewing a shape or encountering an object is an active process, an interaction between the viewer and the viewed. One's mode of experiencing an object is drawn from all past history, the world-view and world-expectation that one has built bit by bit out of all previous encounters. The difference between a rope and a snake, an apple and a stone are immediately perceived and understood, translated into terms of one's experience. The difference between one kind of snake and another will be immediately translated only by a person whose previous encounters have built the perceptual/conceptual repertoire needed for this specific distinction.

No thing is truly static and inert. Every object or shape stands on a time line, containing and expressing a state linking the past with the future. Every form absolutely bespeaks its history; our reading of its history, however, is relative and rooted in our own history — our meeting and understanding of similar forms, shapes, processes in the past.

In viewing a shape we create our own time line. We see/think progressively, thus creating the dynamism of the shape, re-creating the shape, re-creating the motion, the event-event-event along the line of the shape, following and reliving vicariously the movement along the line/surface/space experienced in some bygone time.

I see a square, and feel the rightness, justice, 90-degreeness, box-cage-prison-safeness, the unflinching rigidity of a rectangle.

I see a hillside, and feel the forces, the pressures, the gentle eternal urgings of the sand, "let us come down" gravity says but someone is in the way, only those on top can move tangentially with the rain water flooding down toward the valley, a few feet today, an inch next year, but never impatient, slowly at last reaching the plane/tapering/flat of the gentle bottom of the hill where I (momentarily so bravely) begin my ascent.

The hill is shaped like a breast or a shoulder — or vice versa.

My eye/soul/body feels the shape of a hill and it is burned into my being, my muscles know it and the movement climbing sliding become part of my seeing a curve, an S, an armpit or the skull of an ant forever.

The artist's palette

Colors can be precisely defined as wavelengths of light, in angstrom units; but practically, a color isn't a color until it is seen by the eye and interpreted by the brain. A painter uses the "primary" colors of red, blue, and yellow, and by mixing these can make any hue desired, adding white, black, or "counteracting" colors if needed to lighten or darken it.

A painter has the complete range of color from which to choose, and usually a patternless surface on which to lay it. The case is quite different with the wood cutter: his palette lies already concealed within the wood. Like painting with a striped paint, he starts with a pre-colored piece and exposes, layer by layer, the colors and lines and patterns which leap into view with each stroke of the blade.

Cylindrical annual rings are revealed in the contours of the carved surface.

The intersections of planes in space are lines. Though in a strict sense conical, for practical considerations a tree is built as a laminated cylinder, hence as a series of cylindrical planes, the annual rings. The intersections of these intrinsic planes with those of your superimposed cuts are like contour maps. They may be straight and parallel, as in a sawn board; concentric, as in a cross section; parabolic, as in an oblique conic section; or written in endless variations of script in complex cuts across and around the grain.

Color in wood is a function of time, in two scales. The annual weather cycle in temperate zones produces the familiar growth rings, with the spring wood generally softer and lighter in color, the summer wood composed of smaller cells growing more slowly and more densely packed, hence harder and darker in color.

The second time scale affecting color is the life span of the tree. The wood formed during the most recent years is still living, and the cells are functioning physiologically, transporting water and nutrients up, down, and sideways. The central part of the tree that is older than twenty or thirty years (more or less, depending on species and circumstances) has died, the cells "embalmed" in the center of the tree, intact but no longer functioning. Resins and other substances are deposited there, so that the non-living core or heartwood of the tree is darker colored; these chemical changes in the heartwood make it usually more resistant than the sapwood to insects and to some kinds of rot after the tree is cut down. In the living tree, however, the heartwood is more susceptible to decay, hence the familiar example of a hollow tree. The difference between sapwood and heartwood may be slight and gradual, as in birch and pine; or it may be very noticeable, as in cherry, or extremely bold and striking as in the creamy white and coal-black of African ebony. Many environmental factors influence both the chemical composition of the heartwood and the rate and pattern of dying within the tree, so that color variations and figures, especially at knots and branches and at the junction of heartwood and sapwood, are endless.

Though historical epochs are not labeled in the tree in words and numbers, each mark and color change within a tree can be thought of in terms of dates

— closer rings in the drought of 1804; a wound from a fire sixty years ago; a branch broken off on the day of my birth, and subsequently healed over; iron coloring from a maple sugaring spout driven in a half-century ago; the invasion of fungus year before last, still slowly spreading its stain through the cellulose lattice.

Transient though it is, a living tree clings to today in color and carries the record forward into tomorrow, until it falls prey to fire or saw or the enzyme secretions of microbes in one year or a thousand.

An artist has the choice at the outset, either to work graphically with the colors and patterns within the wood, or to ignore these attributes of the material and attend only to form and surface texture in the final piece. This choice must take into account both the design of the piece and the character of the wood. For example, a carving with delicate detail, or a small piece with subtle form and an implied message of smoothness and simplicity, will be degraded by heavy lines, dramatic contrasts of color, or complex figures intrinsic in the grain patterns. In such a piece of wood, the shape of the small piece may be overwhelmed by the pattern in the wood, while a large piece in the same wood could hold its own nicely.

The colors and figure visible on the surface of a piece of wood may suggest certain things that could be done with it. A couple of years ago a friend gave me a bundle of short cherry boards. Many of them have grain patterns and colors that cry out "Sea and sky!" A cherry-colored sunset invites a sailboat of walnut and perhaps sails and a cloud or a couple of birds in white (pine or maple), maybe a sun or moon, perhaps a dark sliver of island or promontory to verify the location of the horizon. Once you start this kind of scenery building, the possibilities are endless.

Whereas a painter's colors are laid on a flat surface, the sculptor has the added possibilities — and problems — of a third dimension. Here again the character (size, shape, color, texture, grain) of the wood defines what is possible and what is not, and may suggest ways of designing around those features.

One morning as I fed the fire with chips and waste from my back yard chainsaw sculpture, a piece of poplar seemed to stick to my hand and I drew it back from the flames and looked at it. Why did it cry out to be rescued?

First: It was a flat piece, about 7x10", in effect a small board of irregular thickness averaging a half inch with roughly straight edges at random angles. Thus it presented a flat surface, on which a two-dimensional statement could be made, as in drawing.

Second: Having a certain thickness — and thinness — it suggested also penetration, cutting a design into, or better yet, through the wood, thus carrying one's seeing and experiencing beyond two dimensions while not fully encompassing the third.

Finally: The rough gray surface, reporting the chainsaw's bite followed by months of sun and rain, was in sharp contrast to the polished-bright flesh of the tree which I knew to lie just below that dull disguise. Here then were the materials ready-made for a two-tone, two-texture approach which will lend additional liveliness to a three-dimension relief or cut-out carving.

Thus is my firewood pile constantly robbed; I laid the piece under the table in my shop.

Knots, crotches, burls, bends, defects and old wounds in the wood may similarly suggest or neatly lend themselves to a wide variety of shapes. The sculpture may consist merely in finding the form and presenting it unaltered, or may involve changing it drastically, or perhaps combining two or more pieces.

Similarly, what is found within the wood in color or pattern may lead one to a particular design. Knots with their different color (and formidable hardness) may suggest features (head, eye, belly, hand) or may be considered as defects to work around, or to discard.

Cracks, actual or potential, are a constant factor to be dealt with. It is occasionally possible to incorporate a crack into one's plan, but generally it is at best a nuisance to be accepted and ignored or filled and hidden, and at worst it means destruction of the piece. I once made a carving of two intertwined figures from a block of myrtle wood, and had to give the male figure two right arms until I had progressed far enough into the block to see where the crack went and thus which arm could stay. A crack always extends farther than it can be seen. In a seasoned piece of wood it may appear to advance and retreat with the slight expansion and contraction caused by changes in the atmosphere.

Sometimes I am paralyzed by the infinite possibilities in my woodpile.

The calculus of an egg

I have just been carving an egg — the shape of one side of an eggshell split lengthwise, a foot wide and a foot and a half long. To make the form properly, one must know the egg. What is the statement made by an egg? As with all forms, an egg bespeaks the forces and interactions that created it. All bird eggs, though differing greatly in size and considerably in shape, have nevertheless the same general form that distinguishes them sharply from spheres and even from elliptical solids. An egg, when viewed, is unmistakably an egg — a reflection of the great similarity in the anatomy and physiology of all female birds.

An egg begins as a single specialized cell within the ovary of (let us say) a chicken — one of many thousands of such special cells, or oocytes. Around the oocyte are the follicle cells, creating the wall of a little bubble under the surface of the ovary. The egg cell, surrounded by the follicle, grows and grows, to visible size and eventually indeed to the size of an egg yolk. (If you've ever prepared a laying hen for the stewpot you've seen the cluster of ova, dozens of them from pinhead size up to full yolk size, that represents the ovary.)

Each day or so, under stimulus from the pituitary gland, the ripest follicle ruptures and the ovum slips out, to be "swallowed" by the flimsy funnel-shaped end of the oviduct. This tube is a thin, floppy membrane composed of muscle and a bit of connective tissue; it is surrounded on all sides by the chicken, which is a warm, moving, clucking, largely hydraulic mass of viscera and muscle hung on a rack of unobtrusive bones.

In the process of living, the chicken creates a uniform (because hydraulic) pressure around the tube, which now contains a spherical yolk — spherical because hydraulically filled and elastically bounded. The yolk is propelled slowly down the tube by wave-like muscular contractions, squeezing more at the trailing than at the leading end of the yolk. I say "end" because now the compressive forces on the yolk are not evenly distributed, else it would go nowhere; they consist of the uniform "background" compression of the chicken's abdomen, plus the cylindrically oriented muscle action of the oviduct. (Distorting effects of gravity are neutralized by the overall fluid suspension of chicken-ness.)

The midportion of the oviduct secretes albumin, a wonderfully slippery fluid which is poured forth around the yolk as it creeps past. This whole glob now comprises the entire egg, minus the shell and shell membrane. (If fertilization is to be, it has been by now; the sperm must loiter in the oviduct and intercept the yolk some eighteen hours before final emergence of the egg to the light of day.) In the lower portion of the oviduct the tough and nearly inelastic shell membrane is gradually added, and the egg's form is set. Addition of the shell is anticlimactic — but I must agree with the hen's cackling celebration of a creation more subtle and grand than we credit her with.

Thus is the egg wearing its history for all to see. But how am I to emulate and plagiarize the shape of an egg? I cannot replay the processes by which it came to being. By what artifice, then, can I make an imitation?

First, I know that the egg is longer than it is wide, or somewhat ellipse-like (the axial, cylinder part of the oviduct's influence).

Second, I know that the egg is circular in one plane or profile, perpendicular to the long axis (the circumferential muscular symmetry of the oviduct's influence).

Third, I know that the egg is not truly elliptical, but is widest at a point (plane) closer to one end than the other (the polar, differential aspect of the oviduct's axial dynamics).

Fourth, I know (or infer and believe) that within these three limitations, the egg is as nearly spherical as possible (the symmetrical, omnidirectional, self-equalizing efforts of elastic membranes to confine their liquid contents to minimum surface area).

Stated differently,

$$\text{In an elliptical solid,} \qquad \frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$$

But not quite. This is the mathematical expression for a false, "idealized" egg, an ellipsoidal solid the same at both ends — an egg without a soul. The real eggness must speak also to the asymmetry, the squeezed-from-behind character of this would-be ellipsoid; it must move the x and z axes a bit toward one end.

Mathematics being merely the expression of that which is, there must be such a formula. I have not the calculus, and the mathematicians of my acquaintance have all declined my invitation to place themselves in fantasy within the oviduct of a hen; they have not felt vicariously that dark, moist vector ride which could form their viscid equations into the real thing. So we rely, perforce, on the hand and eye.

Having mentally catalogued these eggly features, I must begin a process which is the reverse of that used by the chicken. She builds the egg starting at the core and working outward, with contractile forces modulating the continual addition of substance, whereas I must continuously remove material, progressively forcing the boundary inward by some self-equalizing means until the true contour of eggness is reached. I lay out the length, the breadth, and the line of greatest girth on my sternly rectangular block of wood, then begin hewing off the parts that are obviously outside of the egg (oh, spare the hen this harsh beginning!). Eyeing the emerging form, I think and see in two dimensions and turn it this way and that to compare the succession of profiles that appear. The continuity between the lines of the blunt end and the pointed end of the egg forces the curve into place, and the tangents to the curves at either end are parallel, pushing the form into its neatly oval hemi-connection with its axis.

This two-dimensional approach, looking at profiles as graphs, is all very well for a while; but the more nearly the shape is approached, the less sure becomes the chisel. Even those dimensions already established do not precisely define the egg; which of the various profiles, as I turn it in my hands, is most nearly the right one? Which of all possible eggs will it be? The profiles as the egg rotates — all side views — must become identical.

Here the hen had the advantage of me. Having use of the fundamental principle that pressure throughout a liquid equalizes itself, she need not resort to unitary and fallible chisel strokes; the smoothly continuous and self-integrating pressures and tensions surely form the egg in darkness while she picks morsels from the ground, or sleeps.

What self-regulating leveller can I find as counterpart for the hen's technique? My eye is no longer equal to the exacting task. An abrasive surface, however, flat but with some elastic padding, will serve; the feedback of high spots exerting more pressure on the pads than the low spots assures that the high spots are cut down proportionately faster. But to distribute the grinding action evenly, the motion must be circular. Plotting the coordinates, measuring, is of no help now. Look with the eye, but look especially with the hand. Think egg; let the form flow in through the muscles, and then out again through the muscles which so often have known spheres and eggs. The abrasion flows over the surface fluidly, until hand-eye-brain-wood knows when at last the true egg is born.

I am the obverse of a chicken's inside.

Blades and cutting

The term "cutting" is a euphemism for a much cruder, less surgical-sounding activity. A bulldozer scraping a road, a shovel cutting sod, an axe chopping firewood, a pocket knife whittling a stick, and a razor shearing my whiskers are all blades operating in similar manner. Viewed from a distance, these are simple acts of cutting; but if you look closely enough, they become entirely different phenomena.

In each case, the degree of apparent roughness or raggedness of the cut surface depends on your distance from it. Looking across a valley at a dirt road that runs along the opposite hillside, you can see the straight, sloping line of the road and the smooth, even surface on the embankment above it. But if you are standing on that road, the surfaces appear a little less smooth, the lines slightly less straight; and if you kneel and put your face a few inches from the ground, you probably won't find a smooth surface or straight line anywhere.

You can easily imagine that the action of a bulldozer's blade, rather than severing cleanly, is more like ripping, tearing, gouging, grinding, scraping, and splitting. But zoom in on the cutting edge of the shovel, the axe, the pocket knife, and the razor, and you'll find that all are behaving in a similar fashion: rending and pulling or wedging the material apart with a rounded and irregularly jagged edge. All leave a surface that appears smooth only from a distance, though you may need a microscope to see the raggedness of the knife- and razor-cut surfaces.

Some of the differences reflect characteristics of the material being cut. The rocks and soil are brittle, crystalline, or granular; the wood is fibrous in a linear and parallel way; the whiskers are fibrous in a non-parallel, amorphous way.

The scale at which we look at things is crucial to our interpretation. It had been calculated in my youth, and now is confirmed by direct observation, that the earth seen from far enough away appears as smooth as a polished billiard ball. The difference between the highest and lowest points on the earth's surface is only 1/1800 of the diameter of the whole ball; yet, when close at hand, the Himalayas are bumps of awesome magnitude.

Blades differ in the scale at which the cutting is done. A shovel "cuts" into the sod, but if you look closely at the result you may see grass blades that have been simply draped over the edge of the shovel and pushed down into the dirt; stones shoved aside or possibly cracked; a crudely torn earthworm; a layer of densely packed clay along the "cut" surface; and a random jumble of clods and crumbs.

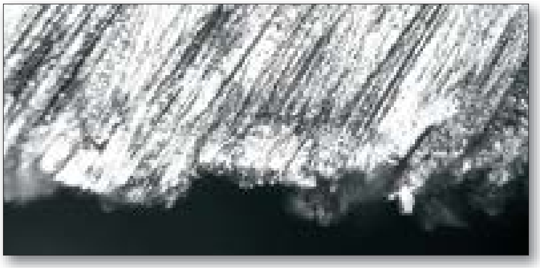


Figure 1 *A sharp blade at extreme magnification*

The objective in sharpening a blade is to reduce the scale at which the ripping and tearing and roughness is observable, and in doing so also to reduce the force required to push the blade. You don't sharpen your shovel the same as you do your plane iron. A fairly sharp knife blade will scarcely cut a hair. A razor blade can cut a flea neatly in two, but the microscope will make it look as if you had used a shovel. Given enough magnification, there is no such thing as a sharp blade or a smooth cut; even the edge of a very sharp blade looks like the one shown in ***Figure 1***.

With this concept in mind, let us examine the meeting of chisel and wood. We may wish to carve the equivalent of the polished wooden billiard ball — a surface which, viewed and felt with the unaided eye and finger, will look and feel smooth, with no detectable defects, gouges, nicks, splinters, steps, or cracks. Yet if seen large, the very texture of the wood itself is not homogeneous, but full of gaps, holes, dents, and fissures even before we have at it with the blade, and after the deed is done the surface is a shambles.

A blade has thickness which decreases toward the edge. It is primarily a wedge moving through the material, moving straight ahead with its edge and thrusting laterally with its diverging surfaces against the parts that the edge has passed by. It is a combination of tearing through and across the fibers, and splitting the fibers apart ahead of the blade. Usually we are cutting a thin piece away from a much larger and stronger one. The wedging effect means that something must give, and the two parts of the wood separate in accordance with their respective abilities. The thinner piece either will be weak enough to break up as it separates, curling away from the blade as a chip or shaving (***Figure* 2**), or will be stiff and strong enough to transmit the stress far along ahead of the blade and will cause the fibers to separate as a splinter or slab (***Figure* 3**, *next page*). If you are cutting kindling for the fire or making boards or cedar shakes with a froe (a nearly extinct art), you hope for the splitting effect, while in most other uses of the blade you hope for the chip or shaving.

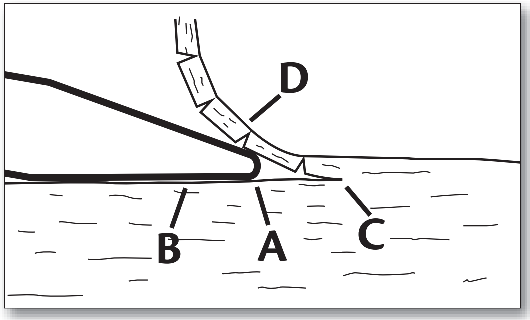


***Figure* 2** *Pressure points of a shallow knife cut*

In ***Figure* 2**, what appears as a simple cut is actually wood cells or fibers being broken and wedged apart. At **A** the wood cells or fibers are being crushed and torn. At **B** they are being squeezed and compacted against the unyielding solid wood below. At **C** the lateral force of the blade, opposed below by a solid mass but above only by a thin shaving, is prying the sides of the fibers apart ahead of the blade, splitting the wood parallel with the grain and forcing a succession of wedge-shaped cracks across the grain, making a shaving **D** that curls away from the blade.

If the blade is sharper, the encounter is similar but its scale is changed. Crushing of fibers just beyond the blade is less — that is, the crushed and torn layer left behind the cut doesn't extend so far into the surface, and it looks and feels smoother. The object of sharpening any blade is to keep the scale of the damage small enough for the purpose at hand.

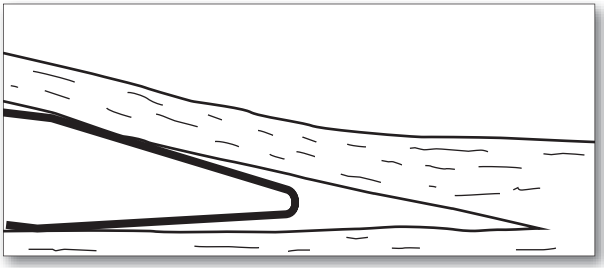


Figure 3 *Splitting effect of a deep knife cut*

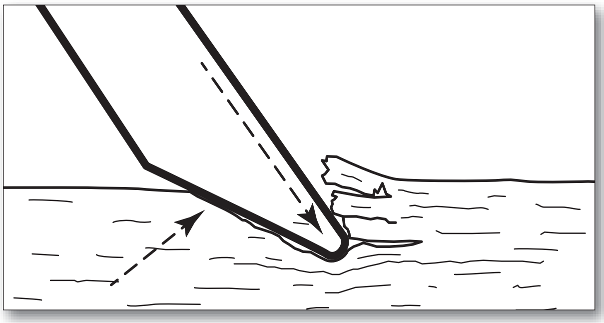


Figure 4 *Driving force is along one face of the wedge. Pressure against the other face makes the blade veer away from the driving force.*

Along the flow of the grain is the direction of easiest separation, so the cut tends to veer toward and follow the grain unless otherwise deflected or prevented. The main determinants of the direction of the cut are the forces against the sides of the blade. These in turn are determined by the shape of the blade, the direction of the forces applied, and the character of the substance being cut. As a blade passes through wood there is always some resistance to either side of the wedge. If one side is near a surface and restrained only by a thin shaving or chip, then the resistance against the opposite side of the blade will force it toward the surface. This action can be adjusted by raising or lowering the angle of thrust of the blade, as in ***Figure 3***.

In the cases shown in ***Figures 2 and 3***, the force pushing the blade is applied "straight ahead" with respect to the wedge. If instead of a double bevel the blade has a single bevel (as with a chisel), the driving force now is straight along one face of the wedge (***Figure 4***).

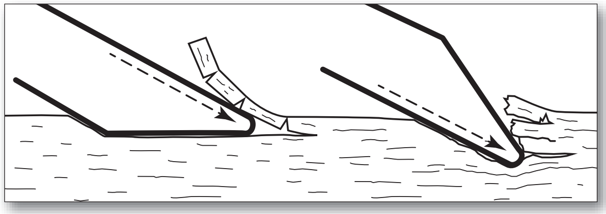


Figure 5

Consequently, the lateral force against the wood (or, conversely, the resistance of the wood against the blade) is greater on one side. This tends to make the blade veer away from the axis of the driving force. As shown in ***Figure 5***, if a single-bevel chisel is driven along the grain near a surface, it tends to go deep or shallow according to which face is uppermost (with the handle at the same angle in either case).

With most free-held blades (knife, chisel, gouge) the heel of the bevel provides the main means for controlling the depth of the cut, because it serves as a fulcrum against which the lateral resistance of the wood can be adjusted by raising or lowering the angle of thrust. As illustrated in ***Figure 6***, if the bevel is ground flat, the fulcrum is at a specific point some distance from the cutting edge. If it is rounded, the fulcrum in effect is closer to the edge, and at an indeterminate distance which varies with the compressibility of the wood, the amount of force applied, and the angle of the driving force. The fulcrum acts like a rocker.

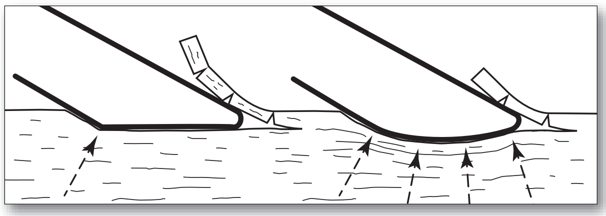


Figure 6

The rounded bevel is more difficult to control and has a tendency to "jump out" of the wood during a cut.

The effect of the heel of the bevel as fulcrum is especially important in using a curved-edge gouge to carve a depression. One of the pleasures of making a spoon is cutting out the hollow. Make passes of the gouge from the edge inward toward the center of the bowl, from a succession of starting points completely around the rim; you can then lift out the rosette of shavings thus formed, like petals of a flower (***Figure 7***).

Figure 7 *The rosette of shavings in the hollow of a spoon*

Repeating this procedure, remove blossom after blossom until the depth of the bowl is right. The heel of the bevel guides the forward thrust and the depth of each shaving as it rides down and across the sides of the hollow.

In some tools, such as a plane, an additional control element is added: a depth stop is provided, attached rigidly to the blade and riding on the wood surface, which sets a precise limit to the depth of cut and overcomes the tendency of the bevel to drive itself deeper into the wood.

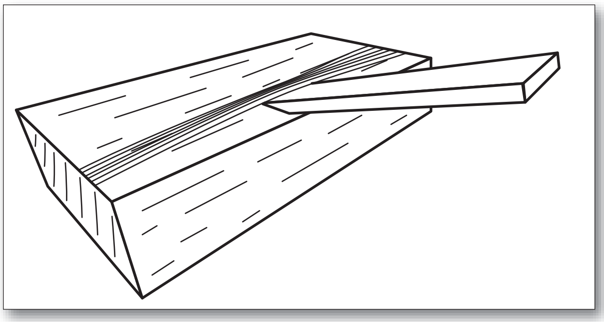


Figure 8 *Fibers lift in bundles when a chisel is driven across the surface*

Thus far we have been looking at cuts *along* the grain. If you drive a chisel *across* the surface of a board, bundles of fibers from the main piece will split off in both directions from the blade in an uncontrollable manner, as in ***Figure 8***. To make a controlled cut across the grain, you must first cut through the fibers where the cut is to end. The most common method is to make a “stop cut” on each side of the area to be removed (***Figure 9***) by pressing or driving the blade vertically, severing the fibers. You can then turn the blade and split away and remove the portion between. The stop cuts can be deepened by repeated vertical and angled cuts before removing the material between them. Even for removing the thinnest shaving across the surface, unless the material gives permission otherwise, a stop cut may be necessary.

Certain kinds of planes (e.g. rabbet or plow planes) take care of the stop cut by one or more cutting spurs that run just ahead of the edge of the blade, scoring and severing the fibers along the line of the cut so they can be lifted out by the main blade without tearing or splitting away at the edge. This same principle applies in various kinds of crosscut saws.

Figure 9 *Defining the area with stop cuts helps prevent overshoot when you cut across the grain*

With a curved gouge the corners of the blade should always be kept above the surface, to ensure that the fibers are cut across before the deeper central part of the blade lifts out the chip.

Blades come in infinite variety of size and shape. They are distinguished one from another mainly by how they are driven, and by the scale of their crudeness.

Sharpening

Let us ignore the sharpening of a bulldozer blade or a garden shovel and move directly to chisel, plane iron, and pocket knife — those blades intended for the fine cutting of wood. I keep relearning over and over, the hard way, that between a sharp blade and a really finely sharpened blade lies a striking difference indeed.

To sharpen a blade is a distinctly personal, almost an intimate act. One might think it cold and hard, just steel on stone. But there's a richness to it, a challenge, a tingle of anticipation and a clean sensory exchange between the hand, the ear, and the other materials. Not so much, perhaps, with a chisel or plane iron: just clamp it in the jig, select the angle, and let the roller ride back and forth on the bench top as the metal caresses the abrasive surface. But even here the transformation, frustratingly slow and tantalizingly hopeful, the eager inspection from time to time and the patient resignation to the need for a little more grinding to remove that single tiny nick — these are what binds the carver to his tools and leads him at last to the wood.

The pocket knife, that most basic and important of all tools, is different. The attitude of blade to stone is free-hand, eyeballed but nevertheless intently and carefully controlled. A moment's lapse of attention, the blade tilted up too far, and another five minutes of honing is needed to correct the error.

At a microscopic level, sharpening a blade involves a series of jagged points on an abrasive surface gouging out overlapping lines of metal chips or shavings or particles from the sides of the blade. Inspect the blade carefully before you begin sharpening; the irregularities determine how much metal you must grind away to get the result you are after. A magnifying glass, a four- to six-power lens, is very helpful, though I have finally settled on a jeweler's loupe. You will also need a good bright light, preferably from a bare bulb.

On a plane iron or chisel that has been abused and looks like ***Figure 1***, you'll have to grind all the way back to the dotted line to produce a good surface out to the tip.

Figure 1

Whether to do the roughing-out part of the grinding on a power grinder or abrasive belt, or laboriously the old-fashioned way by muscle and stone, is a matter of personal choice, philosophy, and what you have available. One excuse for my avoidance of a grinder is that it's tricky to avoid heating the metal too much. If you are happily and rapidly removing metal amid a shower of sparks, and the steel at the very tip of the blade turns a lovely irridescent blue garnished with yellow, you have ruined the temper of that part and must now grind the colored part away in order to get back to hard steel again. (My other excuses are harder to define. My son once said to me, "Dad, why do you always do everything the hard way?" I guess it just seems to work out better that way.)

The back surface of a chisel or plane iron must remain flat, and should be left alone unless perhaps to remove a heavy burr after grinding, and then should only be laid down flat on a fine stone to polish the surface.

The narrower the angle between the faces of a blade, the sharper (by definition) is the blade, but the more vulnerable it is to damage, i.e. to bending, wearing, or chipping at the extreme edge. The angle in a barber's razor is about

15° to 18° and I wouldn't want to try it on maple. The best angle for most cutting of wood is somewhere between 20° and 30°.

A common compromise between sharpness and durability in a chisel is to grind the bevel to 25°, but then grind a secondary bevel at the tip, perhaps an eighth of an inch or less, to 30° (***Figure 2***). This makes resharpening easier because there is less metal to remove each time.

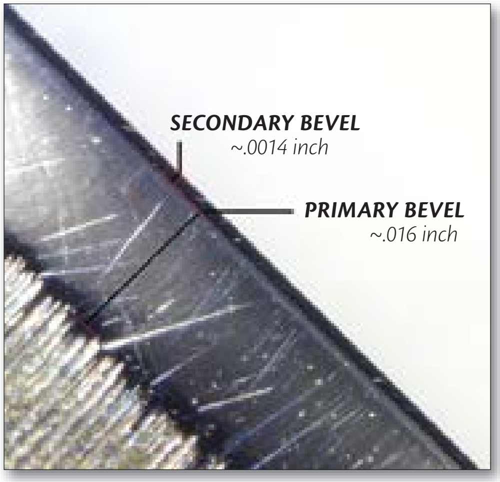


Figure 2 *A double-beveled chisel blade*

With a double-bevel blade such as a knife, of course, unlike the chisel or plane iron, the angle of blade to stone must be half of the desired cutting angle, and should be kept the same on both sides of the blade.

Most kinds of stones for sharpening, if used dry, will soon clog up with metal particles jammed between the abrasive points or in the "pores" of the stone so that the stone becomes glazed with metal and will no longer cut. Applying either oil or water to the stone during the honing will avert this problem. Some older carpenters of my acquaintance have sets of different stones in a mount that rotates them through a bath of oil; the oil floats the particles of metal away as they are formed, so the cutting ability of the stone is not impaired. This arrangement is convenient, but for a very fine stone such as a hard Arkansas, a lighter oil like kerosene or WD-40 works better; a heavier oil tends to float the blade so it scarcely touches the fine abrasive. For sharpening the pocket knife when camping or fishing, it's handy to carry a small carborundum stone of medium grit and either dip it in water or spit on it (furtively, if in fastidious company) before applying the blade or the fish hook. It doesn't work well to alternate between oil and water on the same stone.

Many different abrasive surfaces, coarse to fine, are available: India combination with one coarse and one finer side; carborundum stones; Arkansas stones of various degrees of fineness (soft white, which is very fine, and hard black which is even finer); diamond stones and ceramic stones (which I have never tried); and wet-and-dry silicon carbide paper of differing grits up to 600 or even finer, laid on a perfectly flat hard surface such as glass. For pocket knife, chisels, and plane irons I have settled on an India combination stone, the coarse and then the fine side, followed by a soft white Arkansas stone, used with oil which is wiped off frequently to remove the floating metal particles. For ultimate sharpness this probably doesn't quite cut it, and one final finer grit (hard Arkansas or ceramic) will no doubt give a keener finish; but for my purposes this has proven quite adequate.

This pocket knife — which I have carried constantly for over thirty-five years — is a small, simple knife with three blades and simulated bone faces on the handle. The circular metal "Tree" brand logo has long since fallen out of the handle. The blades are narrower and shorter than when it was new, but I like them better this way. The surfaces of the steel are — like my skin — mildly pitted and darkened from years of exposure and experience, but the joints are still sturdy, and the honed surfaces stay bright and new. The knife has been around the world once; has dressed out two deer, skinned two coyotes (because my chicken flock was being decimated) and a road-killed raccoon; cleaned innumerable fish; trimmed hundreds of corns and calluses (always with conspicuous wiping with alcohol and a careful explanation that it works better than a standard disposable scalpel blade); opened abscesses in both man and beast; scraped paint and rust and stripped insulation from wires; and devoted countless hours — on train and bus, in faculty meetings and the orthodontist's waiting room, in my shop and at discussions with family and friends around the after-dinner table — to whittling and carving. A concave denim "whittling apron" fitted over my knees catches the shavings.

Each of the three blades has its own assignment, and each is sharpened accordingly:

The short, squat blade with the rather blunt curve at the end is for crude, harsh work. It gets little sharpening, mostly on the coarse side of the India stone, just enough to restore an edge for scraping paint from glass, stripping electrical insulation or for cleaning under my nails, but not seriously sharp.

Figure 3 *The glint along the edge, seen from the side of or directly above the edge, signals the need for sharpening.*

The long blade is for general cutting — wood, string, leather, rope, meat, cardboard. Here again the magnifying glass. Looking directly down on the edge of the blade under strong direct light, if you see a bright glint of light along the edge (***Figure 3***), it means the edge is rounded or jagged and that the faces of the wedge-like blade don't intersect at a line of near-zero width as they theoretically should. Some metal must be removed to correct this.

Just now my knife is embarrassingly dull. Cutting with the long blade doesn't feel effortless as it should; it lacks that silky smoothness sliding through the cedar in sharpening a pencil, and yesterday I had to use a sawing motion to cut through a nylon cord. The reflected-light test confirms the deficiency.

I lay the India stone in its shallow recess in a maple block with the coarse side up, and apply a few drops of light household oil.

Because of the handle, the blade has to be laid across the stone. Because of the knuckles, the stone has to be near the edge of the table or other supporting surface. One can debate whether to move the blade always forward along the stone, as if to slice a shaving off the surface, or to draw it away from the edge as in buttering toast, or to slide it parallel with the edge as if drawing a line with the blade. In aid of both speed and keeping a nearly constant angle, I combine all three modes (***Figure 4***).

How much pressure to apply? I can't estimate it in ounces; perhaps about enough pressure to cut a waffle with a fork.

To keep the degree of grinding nearly the same on both sides of the blade, and to free up my mind for things other than counting every stroke, I have borrowed a rhythm from the music world and internalized a phrase of 4:4 time (or the basic count of my old drill sargeant): 1 2 3 4 2 2 3 4 3 2 3 4 4 and turn the blade. Thus I make 13 strokes on each side of the blade, alternating repeatedly while I talk, listen, or daydream, and while the memory in the muscles subconsciously maintains a nearly constant angle on either side. If the angle varies appreciably, the feel and sound changes and jerks my attention back to the task before me.

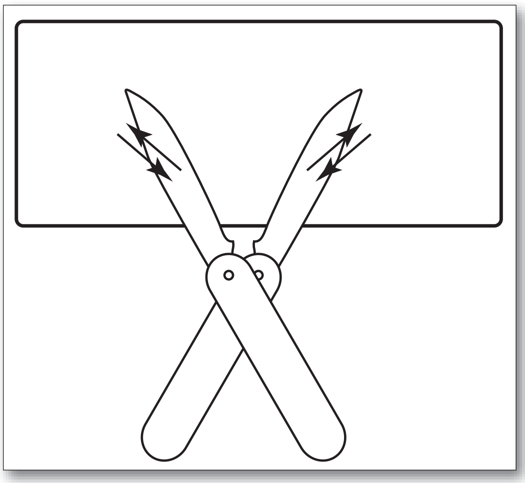


Figure 4 *You can choose what kind of movement and how to execute it. The author takes 13 strokes per side, combining 3 movements in the directions shown.*

The cutting edge of the knife is obviously not a straight line. You must curve the thought that leads the hand that leads the blade across the stone, so that the honing effect continues, *at the same angle*, out to the very tip of the blade.

Now we must discuss the burr, or wire edge — the final key to satisfaction or frustration. As the steel is progressively ground away and the planes of the two faces of the blade come closer and closer to sharp, the metal along the very edge becomes so thin that it tends to bend upward and ride over the stone instead of being ground away. When the blade is turned to the other side, this little flap bends the opposite way (***Figure 5***).

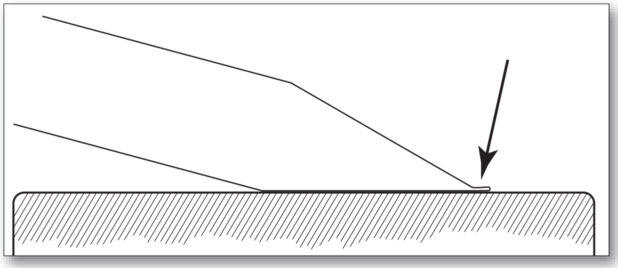


Figure 5 *A burr or wire edge develops along the edge as the blade faces come closer to sharp.*

Here the magnifier again is useful. Looking now from the reverse direction, on the side of the blade opposite that which last touched the stone, you can see the fine glint reflected from the wire edge.

Those parts of the blade which have not yet been able to form a burr are not yet sharp, and need some more work.

When a burr has formed along the entire length of the blade, further honing on this stone will not yield any further improvement, but will only add to the width of the burr. It is time to move to a finer stone, the soft Arkansas stone. Honing on the finer abrasive will also add to the burr, but will make it thinner at its base (***Figure 6***).

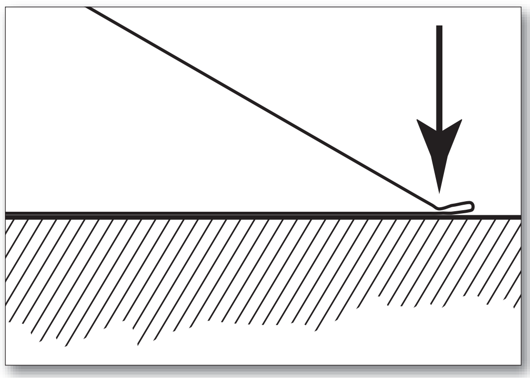


Figure 6 *The base of the wire edge becomes thinner when the blade is sharpened on a finer stone.*

Finally, after the finest stone, the “flapper” of wire edge is removed by stropping, which bends it back and forth on a piece of oiled leather until it breaks off. (If the job is finished on a fairly coarse stone the wire edge is thick enough to require some pressure on the leather, and one may be able to see extremely fine threads of metal on the leather.) At this point re-inspection with the lens for residual burr on the blade is useful, but feeling with the thumb carefully from one side and then the other will give nearly the same information.

Not everyone will agree with the above. Some say that the wire edge will not form if the blade is always pushed forward over the stone. Others advise finishing by moving the blade parallel with the edge "to grind off the burr." I disagree. I believe that formation of the wire edge is indeed increased by coarser abrasive surface, and by drawing the blade backward along the stone, and by increased pressure on the blade; but I am convinced that sharpening by an abrasive surface always produces some degree of wire edge. It can, indeed, be ground off, but only by finishing with a stroke or two at an increased angle, in effect making a very tiny "secondary bevel" which actually reduces the effective sharpness.

I asked Joe West, my barber, how he sharpens his razor.

"You know," he said, "that under a microscope the blade's like a saw. Every evening after work I give it ten or twelve licks on a fine carborundum, then on a ceramic stone — pushing the blade forward over the stone so it won't form a burr, and without pressure, just letting the weight of the blade on the stone. Then I give it the canvas side of the strop, then the leather side."

"What does the stropping do?" I asked. "Do you have some kind of abrasive on the strop?"

"No, it just kinda smooths it off."

I refrained from suggesting to him my belief that the strop was in fact removing a microscopic wire edge.

I watched my neighbor, Rex Redden, a tree care specialist and also an entertainer with his "Broken Top Lumber Jack Show," sharpen his six-pound Tuitahi axe before competing in the horizontal chop event at the Albany Timber Carnival. He moved the fine side of his India stone back and forth parallel with the six-and-a-half inch curved edge of the blade, and was happy when he was able to shave a small patch on his forearm with the axe; he says that for his tree work and for throwing axes in his show he doesn't sharpen them that fine. B.J. Youd, 62-year-old former world champion chopper from Tasmania, while waiting before the event, occasionally pulled a small stone from his pocket and wiped it very lightly along either side of the cutting edge of his axe. Perhaps this was just to calm himself before the starter's signal, or maybe he was adding a very tiny secondary bevel, as referred to above with chisels. In either case, I was charmed by this dramatic and classy little touch.

I have come now to the smallest blade on my knife, the one used for fine work — removing splinters, trimming calluses and hangnails, nipping out clippings from the newspaper, or carving chain links and other little wooden doodads. It is jealously guarded from ever contacting metal. Here is where my sharpening passion finally focuses, but also where the least work is needed. Today the reflected-light test is negative, and the blade gets only a touch-up on the soft Arkansas stone and the oily leather. Sharpening a pencil is again a satisfying act, the little blade will shave my arm, and the world has been put right once more.

Hot wood

When I was a child my father built a camping trailer. With visions of the pioneers' Conestoga wagons dancing in his head, he obtained four strips of pine board about a half inch thick, four inches wide, and long enough. I recall Mom repeatedly heating the tea kettle so Dad could pour hot water on his wagon bows and gradually bend them enough to fasten the ends to the sides of the trailer. Perhaps he became impatient, or Mom couldn't keep up with the demand; but the third piece cracked in mid-curve. Henceforth my enjoyment of camping was lightly punctuated by looking up from the blankets at the canvas canopy and seeing this one place cobbled up with a wooden splint screwed to the bow. For many years I believed that it was the water that softened the wood enough for bending, and that the heat merely hastened the soaking.

Larry Weng was a young, slender, intense man with brown eyes and dark unruly hair and no visible means of support except his significant other and her mother. I stopped by his place on some errand and found him stretching a piece of rawhide over the top of a conga drum.

"That's a mighty pretty drum. Where did you get it?" I asked, intrusively.

"I made it," he said. "There's another one over there."

I knew he did some woodworking, but this seemed outside the envelope. The drum was about two feet high, some seven inches across at top and bottom and maybe nine inches at the widest place, which was above the middle, giving it the shape of a graceful urn. Its body consisted of twelve identically shaped staves of alternating dark and light wood, tapering gradually at either end and with edges beveled to make a perfect fit. One drum was maple and black walnut, the other white ash and black cherry.

Larry was a bit secretive at first about his method, having some optimistic thoughts of making drums for sale; but he was proud enough of the product to show me how he did it.

By trial and error with cardboard patterns and a bit of geometry he had worked out the shape of a piece to be cut out of flat stock with a bandsaw. The twelve pieces were then placed in a brass hoop which held the lower ends snugly in a circle, edge to edge, so the top ends splayed out in a bouquet of sticks.

He had fitted a small oil barrel with a short copper tube soldered into a hole in one side. A length of rubber tubing connected this copper nipple with the vent on top of a pressure cooker that sat on an electric hot plate.

Around the diverging tops of the staves he placed a band clamp — a length of heavy webbing with a screw tightener. He lowered this assembly into the metal barrel, and with the lid in place he fed in the steam. After the apparatus had been heated up about fifteen or twenty minutes he removed the cover, lifted out the drum-to-be, and tightened the band clamp; the wood pieces bent inward uniformly, about half as far as needed.

Repeating this process once, or maybe twice, brought the tops of the staves snugly together. Addition of a second brass band completed the job.

It was hard at first for me to believe that these pieces of solid hardwood, five eighths of an inch thick, could be bent so easily; but I have since learned that bending wood by means of heat is a widely used process in making furniture, walking canes, and other objects. Heat softens the lignin and cellulose and can make the wood quite plastic.

Gilman Keasey called me one day and said he had something to show me. I had first met Gilman when I was driving just outside of Corvallis, Oregon, and saw a man — the upper half of him — bobbing up and down in a hole beside a big stump. Curiosity pulled me over, and I found him down in a pit, lovingly digging out a black walnut stump — one of three that the land owner had granted him. He could visualize innumerable gunstocks with wonderfully varied patterns of grain concealed within the stumps. After that day we often discussed wood.

What he had now on his dining table was a wooden box. The box was nothing very special, but inside were what appeared to be oversized checkers — seven of them, about an inch and three quarters across and less than a half inch thick. We guessed cherry wood, but there wasn't much to go on except the uniformly dark, reddish brown color, so it was strictly a shallow guess. On each face of each disk was a design in relief, very finely detailed like a coin.

"What do you think these are?" Gilman asked. He had bought them, box and all, at a yard sale. No information about them was available, no hint as to their history. The box gave no clues, and we doubted that it was the original container of the pieces.

"Part of some game?" I ventured.

Several had identical patterns — a vine with leaves on one side, and a proverb, in English, printed on the other. One had a picture of a regal-looking chicken with finely detailed feathers. One, the most intriguing of all, had a military scene — a city in the background, a sailing ship in the harbor, and a finely dotted line of trajectory from the ship to a cannon ball appearing to explode in mid-air.

Just as perplexing a question as when and why they were made was how they were made. The designs were all in positive relief. There was no trace of any tool marks, and it seemed inconceivable that such fine detail could have been carved so smoothly and so identically in multiple pieces. But what were the alternatives? We tried to envision a means of stamping the images so deeply into the end grain of wood, but it didn't seem likely.

At home I puzzled over the matter, and decided to try stamping a pattern into wood. First I cut out a cube of black cherry roughly an inch on a side, and finished the endgrain with fine sandpaper. I smoothed the head of a twenty-penny nail with a file. Using metal-engraving tools inherited from my stepfather the jeweler, I carved a small pattern into the surface of the nail head — an apple with two leaves attached to the stem. I sawed off the nail so I had an apple stamp with a shank about an inch and a half long.

I tried, with a hammer and what seemed like plenty of force, to drive the stamp into the side and into the end of my cherry block; the effect was almost imperceptible.

To try the only other possible approach that Gilman and I could come up with — and hearkening back to Larry Weng and his conga drums — I inserted the stamp and the piece of cherry into a metal vise so that the stamp was pressed against the block. The turn of the vise handle came to an abrupt and decisive stop as the stamp met the wood.

I then applied the flame of a small propane torch to the shank of the nail, trying to keep the fire away from the face of the wood, and kept pressure against the vise handle. After two or three minutes of heating the stamp in this way I was near to giving up when suddenly the vise handle moved, and as I continued the heating and the pressure the stamp gradually sank straight into the cherry endgrain, to a depth of almost an eighth of an inch. I stopped in fear of burning the wood, and when the stamp was pulled out there was a perfect apple, complete with stem and leaves, there in positive relief in the twenty-penny depression!

And what had happened to the structure of the wood? With a chisel I split the block from the back end, right through the apple picture, and applied my magnifying lens; the fibers were buckled, crushed and collapsed in upon themselves just below the indentation, then solidified again upon cooling.

I hastened back to Gilman's house and showed him my almost certain proof that his mystery checkers were produced by stamping with a metal die, through courtesy of heat applied by some means more efficient than mine.

Burning wood

"Ash brown or ash green,
Fit to warm the bedroom of a queen."
— *Source unknown*

On a bright cold day in late Vermont winter I sit before the stove thinking what a lot the fire tells me about wood and things.

I kindled the fire with newspaper (itself a product of wood dismantled and reassembled), laid on several small sticks split from a piece of sugar maple, and a few handfuls of miscellaneous chips and shavings from my shop wastebox. On top I placed a couple of larger pieces of split maple, a length of yellow birch branch, and a slightly larger piece of maple. Now I sit watching the result, and waiting for the warmth.

Raymond Foulds is a forester at the University of Vermont. In yesterday's Burlington Free Press he said that a cord of good hardwood has about the same heat value as a ton of anthracite coal. (In my boyhood, each evening after school I filled the coal bucket in the barn and set it by the stove before splitting the kindling.) He also listed the best wood fuels: shagbark hickory, black locust, hop-hornbeam and white oak. Almost as good, he says, are white ash, beech, yellow birch, sugar maple, and red oak. Fair woods are white birch, black cherry, American elm, red maple and pitch pine. Poor woods (about half the heat value of coal) are aspen (poplar), basswood, butternut, hemlock, white pine, red spruce, and black willow.

A prudent and experienced Vermonter always has an adequate supply of dry firewood for the winter. That means that last summer, and continuing this winter, he has been cutting the wood for next winter, and that the wood being burned this winter has been cut, split, and drying for a year or more.

But because this is our first year of using the woodstove seriously, and because in behavior I resemble more the grasshopper than the ant, our wood supply is inadequate and mostly "green" (wet), having been cut this fall and winter and thus still containing much of the moisture of the living tree. Our limited supply of dry wood left from last year is used sparingly for starting the fire and for the occasional boost in the burning of green wood.

Today the proportion of green wood on the fire is greater than I intended; the enthusiastic flames from the newspaper bring forth sizzling noises from the wood, and only with more dry shavings and a bit of blowing is the fire induced to accelerate and swallow the larger pieces.

At one end of the grate a swirl of white smoke arises, the effluent of partially heated chips of cherry and shavings of birch and butternut. At the other end the blaze dances merrily around the maple log, where a row of bubbles are sputtering out from the space between the bark and the wood. The sizzling, frying sounds grow louder, mixed with the intensified fluttering whisper of hot gases within the chimney. As I watch, I think back a century and a half to the British scientist Michael Faraday, and his little book of Christmas lectures, The Chemical History of a Candle. It explains by elegantly simple experiments the nature and causes of the different parts of the flame — the blue or colorless part where vapor is burning but giving off little light; the yellow part where solid particles are burning and glowing brightly; the fuel which is being gradually mobilized by the heat; and much more.

There are, of course, hazards and drawbacks to burning green wood. First, a lot of the heat produced by burning is wasted on evaporating the water in the wood. This also means the smoke (volatile oils and resins as well as solid particles) are cooler and more inclined to condense on the walls of the flue, only to ignite later as a chimney fire.

I've been cutting firewood with Rob Tarule on his place for a couple of days; he offered to give me half of what we cut in exchange for my help. One day we cut only beech and leverwood (hop-hornbeam). I've learned that both, but especially beech, will burn pretty well even green. Just to try it, we kept the fire going in the stove one entire day using nothing but beech that had been live standing trees the day before, and had no trouble at all. Maybe our shortage of dry wood won't be quite so serious after all.

Yesterday, because the snow had melted off, Rob wanted to clean up around his house, so we cut up some trees that were already down near his driveway. These were all soft maple and gray birch; there were some "popple" and fir too, but they're not great fuel and we didn't take them.

I keep being impressed, as I watch the flames, that I'm seeing and feeling solar energy. The cellulose, which makes up half to three fourths of the wood's dry weight, has been made by the tree out of water and carbon dioxide from the air, using the sun's energy captured by the chlorophyll system in the leaves, and releasing oxygen in the process. In burning, the reverse takes place. The wood releases not only exactly the same amount of water and carbon dioxide, but also exactly the same amount of energy that was used in creating the cellulose. And the process of burning consumes exactly the same amount of oxygen that was released during the synthesis of the cellulose. If, instead of going into my stove, the tree were to lie down and rot away, the cellulose would still be reduced ultimately to water and carbon dioxide — a sort of biological cremation — with again the same amounts of oxygen consumed and energy released, not in flames but in slow, imperceptible loss from the decaying mass and the running to and fro of the little wood-eating creatures who aid in the process.

I see other things in the fire. The flames point upward instead of down, not because the released energy wants to get back to the sun whence it came, but because heating air causes it to expand and thus become lighter, so it is pushed up the chimney by the weight of the colder air around it. Since the air provides the oxygen required for the burning, the movement of air caused by the warming is essential to keep the process going. The design and use of drafts and dampers in stoves, of suitable flues or stovepipes, and of fireplaces and chimneys that "draw well" are based on this behavior of heated air.

Rob Tarule has heard somewhere that it takes fifty times as much air to burn a given quantity of wood in a fireplace as it does in a closed "chunk stove"! As a consequence, the fireplace may literally suck more heat out of the room than it returns to the room.

To the amusement of my family and friends, I feel compelled to acknowledge (and, almost secretly, to thank and apologize to) each piece of wood by name as it goes into the fire:

"This morning we're having dry sugar maple kindling with beech and yellow birch to follow."

"I give you a potpourri of elm chips, gray birch and cherry, assisted at first by sugar maple."

"Where else would you be warmed by beech and leverwood topped off with a bit of lilac?"

* * *

Back now in eastern Oregon, my hardwood-burning period is but a fond memory. Only softwoods are readily available, and those considered the best firewood are tamarack (larch) and Douglas fir (red fir), with the pines farther down the scale. Last winter we burned five cords and were scrabbling for another cord before the spring chill was gone. This summer Eugene Crump brought five cords of lovely dry straight-grained, almost knot-free tamarack, and one cord of red fir — good to burn but some of it twisted and full of big knots, a nightmare to split and not conducive to neat stacking. But it's all been conquered now, and we're keeping warm without trouble.

Opening the wood stove to add a chunk of red fir, looking in at the bed of coals glowing yellow and red and feeling the radiation of heat on my face — that moment is so excruciatingly complete, so generous to the visual, tactile, auditory, and olfactory senses, so full of the chemistry of oxidation undoing the magic of photosynthesis, so redolent of the physics of energy transformation and heat exchange and movement, and so rich with the romance and poetry of the history of fire and human culture — how could one ever live with just the tight-closed metal box of an oil or electric furnace shut out of sight in some dark, far corner of his abode?

Tools and the trade

Anthropologists have described man as an animal that makes tools. They rarely mention that the tools also make the man.

The first real tool I owned was a pocketknife. Its capabilities (which increased after I learned to sharpen it) largely defined and limited my expectations with wood. “To make something” was a very small verb.

In due time my whittling expanded considerably. With a handsaw, chisel, hammer, and axe I could do more and bigger things. Later in life I owned a few more hand tools, then an electric drill, and eventually even a radial arm saw.

At age forty-five, at last I watched and then held a chain saw. Having once touched it to wood, I felt a powerful impulse to get one for sculpture, and my life has never been the same since.

What man, having used a chain saw for the first time, is not changed by the experience? Never again will he make judgments, decisions, and choices on the same basis as before. Until then I was always looking for pieces of wood to carve — small pieces, like my thumb, or big ones that I could hold in my lap and work on with chisel and mallet. But from the day I bought the chain saw my wood-cutting potency expanded gloriously.

My neighbor was taking down a dead elm tree in front of his house, two feet thick at the butt, and I talked him out of a six foot length of it; three of us could barely slide it into a pickup to bring it to my yard. From then on I was obsessed, always looking for any piece of wood too big to lift, looking lecherously at any dying tree, windfall, even the log deck at a sawmill. My whole relationship to wood had been changed. I still carve small things, but to rough out even a small carving, or to get the right size and shape for a block or board, or even to excise a bit of wood from a chunk for carving a pair of earrings is often a job for the chain saw.

The increased sense of domination over materials flowed out into other aspects of my actions: I undertook more extensive gardening; tore down a two-story house to salvage the lumber; and for the first time built a building — a small barn, in which I used the chain saw for almost all of the carpentry.

Our tools establish the framework, set the context within which our imagination ranges. Today's engineer will plan roads and bridges that are possible with today's tools. Having seen and used a bulldozer, he will not likely use a horse-drawn fresno to smooth the roadbed, nor men wielding a star drill and single-jack to drill holes for explosives. Conversely, the engineer of a century ago did not yearn for an internal combustion engine pushing several tons of steel to move the soil and stone, because that possibility had not occurred to him; he used muscle power of animals and men, because that's the way things were done, that's what was in his mind as he conceived the design, and that was therefore sufficient for the job.

A man with an axe, a crosscut saw, and a horse can cut and haul away quite a lot of trees in a year. But the same man with a chainsaw, a caterpillar tractor, and a truck can have many times as much effect on the world.

It is said that "we can't turn the wheels of time backward," that "people don't want to go back" to earlier ways of doing things. What this means is that we have become changed, conditioned by our new tools to be dissatisfied with the old. There is an old cliché: "Necessity is the mother of invention." In some cases this may be so, but far more often the exact reverse is true: invention is the mother of necessity. An invention invites our use of it, and we find more and more occasions to use it until we can't do without it. Automobiles, television, and computers are only the most obvious examples.

I am arguing that the tools we use, far from being passive and psycho-politically neutral, have an active and forceful effect on our thought, imagination, choices, and actions, and the unforeseen consequences of this extend infinitely and sometimes dangerously beyond the invention. Our culture has been continually transformed by our tools, by our technology. If we were as wise as we are clever, we might learn to be more cautious about what tools we invent.

A Christmas tree

Christmas in Vermont is invariably white. In our first year there the total snowfall for the year exceeded eleven feet — close to a record. Though it was not nearly that deep at any one time, it was impressive to us and we bought some cheap snowshoes for each family member. The perfect opportunity to try them was an excursion to cut a Christmas tree.

Despite a good bit of fumbling and falling and laughing at each other we persuaded the snowshoes to carry us far enough into the woods for our purpose. Of course there was the usual debating and changes of mind before the final selection was made. I steadied the tree while one of the girls had at it with the frame saw. With the eight snowshoes stowed and the tree fairly securely inserted into the back of our red Greenbrier bus (a jolly Christmas color scheme!), we adjourned home for dry clothes and hot cocoa.

The elementary school's annual Christmas pageant was scheduled for December 21, to be held in Plainfield's gymnasium which had also become the fire station. The parents on the decorating committee wanted a tree for the event, but felt it would be wasteful to cut down a living tree just for this one performance; they wondered whether anyone in the village would like to lend a tree, just for the day of preparation and the day of the festivities.

We agreed to provide the tree, but insisted that the committee chairperson promise it would be untinselled and de-lighted that night after the performance so I could retrieve it the next day.

The event was well attended; the children segued nicely from "Silent Night" and the Birthday Story to "Jingle Bells" and the Santa Claus idiom; they paraded to music that was tolerable considering its source; and there were enough cookies and cider for everyone.

After daylight the next morning I went over to get the tree. I found it leaning against the side of the building, under the eaves.

When several inches of snow accumulate on a roof it insulates the roof from the cold, and the heat from below melts the bottom of the snow layer. As this water trickles to the edge of the eaves it either freezes in a solid ridge or drips down to form icicles, and some may drip free before freezing. The tree was covered with the latter; festoons of ice fingers adorned all of its branches.

With my pocket knife I carefully disengaged two or three twigs that were frozen fast to the side of the building, wrenched the trunk free from a small pool of ice, pulled down my stocking cap and turned up my collar, somehow got the tree hoisted up and balanced on my shoulder, and started walking the three blocks down Creamery Street to home.

There seemed to be a soft haze in the air. Looking upward, I saw the sky appeared white. Visibility ten feet, or ten miles? I couldn't tell. There was no fog near ground level; details of buildings and trees standing along the street in the midst of the snow were sharp and clear, but the sun's light was coming from everywhere and nowhere, strong but completely diffuse. The cloud of my breath and the bite of the cold on my face were intrinsic parts of this suddenly strange atmosphere.

In the near distance, from beyond our house, the familiar murmur of Great Brook was just audible; but overriding the water sounds were the ice sounds — the ringing of tiny ice bells on the twigs of the tree, bouncing and dancing with my steps and throwing out splinters of both light and music. My head was crowded sideways into the tree so that my cap and glasses were pushed askew and I peered out through a screen of crystalline needles.

In that moment the world changed. I was transported to some wonderful place, my movements automatic, my senses overwhelmed, my soul lifted up. I floated along the road, the only living thing in existence, bathed in that halo, that shower of tinkling, shimmering ice — three blocks, five ecstatic minutes that have lasted now these twenty-five years.

Rock-loving pine

Out in the dry and windy prairie between Cheyenne and Laramie, Wyoming, amid some unusual eroded granite formations, some kind of a pine tree with trunk about five inches thick is growing out of the top of a rounded piece of apparently solid stone the size of a truck. The old Union Pacific rail line used to pass just by that rock, and legend has it that whenever a train passed, the fireman sensed a friend in need and sloshed a bucket of water on the tree.

Camping a few miles from the spot I found another pine, this one only about two feet tall with a three-foot spread, again growing out of — or into — seemingly solid granite. I poured some water on the rock at the base of the tree. Perhaps if enough generations of people with their buckets of water pass this way, it too will become legend and merit a fenced enclosure and a “Historic Point of Interest” sign.

End game

Ascending the hierarchy of wood-cutting tools, we come at last and finally to the Sawmill; or, more properly, to The Timber Company. This great voracious creature — a system of far-flung crews of men with chainsaws, hooks and cables, skidders, hoists and trucks, all connected by miles of asphalt tentacles to the Central Digestive Organ — is a marvel of human ambition and ingenuity, muscle and guts.

Early in the century just past, the Oregon Lumber Company bought a ranch and the accompanying timber, built a sawmill and a town, cut Ponderosa pine logs from the surrounding hillsides, skidded them with horses to their narrow-gauge railroad, dumped the carloads of logs into the millpond, and floated them into the mill. On the side of the boiler at the mill was painted "1917." Eventually the horses were replaced by tractors, and the railroad by trucks.

Forty years ago I visited that sawmill in Bates, Oregon. As I walked up the drive the pond man stood on the floating logs, his pike pole extended as far as he could reach to coax a log toward the gaping mouth of the mill.

Inside in the cacophony of bewildering machinery I saw a log some three feet in diameter clamped onto a steel carriage that rode back and forth on a track. Attached to one side of the carriage was a chair in which a man was seated, facing the side of the log, clinging to a pair of levers. Like Ahab riding the white whale, he was bound to every movement of the beast. As the huge log surged forward into the ten-inch-wide band saw, the scream of wood meeting steel and the sawdust pouring from the bottom of the kerf personified the core, the central purpose of this whole massive operation.

At the finish of the cut a board fell away from the raw face of the log, and the carriage with log and human rider whipped back to the starting point. The man's head seemed to jerk sideways as the movement abruptly halted and reversed for the next cut. With each pass the carriage let out an enormous gasping, whooshing sound of steam released from pressure.

Then I saw that a man seated on a platform above the saw was gesticulating, and the man in the flying chair frantically pushed and pulled his levers as if this might in some way rescue him from his obvious peril.

This image has lingered in my mind for decades. I have wondered how it would feel, that constant whipping back and forth; how long a strong man could withstand that treatment, how many minutes or hours would be expected of him at a stretch, how long such a career might last, and what would be the eventual effects on a man's mind and body.

Rapidly the great log, 300 years in the making, was reduced to rough boards gliding down the rolls, past the tailsawyer, to the resaw (slicing slices into thinner slices), through the edger and trim saws, and finally down the greenchain to be piled for the dry kiln, their faces naked and startled in the unfamiliar light.

Green lumber fresh from the saw is heavy and stubborn, containing nearly as much water as wood. Stacking green lumber, or "pulling green-chain," is a job that holds a specific place in the culture of a sawmill. It is hard, back-straining work, and one of the less sought-after jobs. Like some other parts of the logging and lumber business, this job sometimes used to be done on a "gyppo" or piecework basis rather than for an hourly wage. Two compatible people, well muscled and highly motivated, at so many dollars per thousand board feet, could make a pile of money as gyppos on the green-chain, and I have known people who took real pride in this. An Oregon mill worker of Scandinavian descent once told me, when asked his occupation: “I stack green lumber. My brother stacks green lumber, and our father stacked green lumber before us.”

* * *

Last month Steve Courtney met me at the front desk in the Malheur Lumber Company office in John Day, Oregon, wearing a white hardhat and carrying a red one for me. As we walked across the broad yard toward the mill he pointed out the decked logs, mostly pine but some Douglas fir, enough to run the mill for about two weeks. These logs come from private land in five counties — as far as a hundred miles. In past years most of the logs milled around here came from public lands, Forest Service lands nearby; but a combination of politics, environmentalist litigation, and the relentless arithmetic of decades of past logging has greatly reduced the amount of publicly owned timber available. (In 1959 the bookkeeper for Sig Elligson’s company told me, “We’re already looking ahead to retooling our mills to cut smaller logs, because the big ones will all be gone.”)

I asked Steve, “What all does your job involve?”

“Buying logs,” he said. “Finding enough logs to keep us going.”

There is no mill pond here; the logs are brought from the deck to the debarker by a huge rubber-tired machine with lobster-like pincers.

We stand on a catwalk from which we can see most of the action. Everywhere I look, chain conveyors are moving logs or boards, seemingly in all directions. It’s a little slow today, Steve tells me, because a new man is being trained on the debarker. (The company recently invested a lot of money in a new debarker that will handle smaller logs, but today they’re using the larger one.)

The steel grating under my feet shudders as the logs go through the big steel doughnut with revolving teeth that chew off the bark. From there the log shifts sideways, reverses direction, and moves onto the carriage. The double-edged saw cuts from either direction as the carriage moves back and forth, and the log flips over on its rack apparently of its own volition.

There is no Ahab here, no rapid-fire hand signals and frantic levers. Laser sensors scan each log as it moves along. The sawyer/setter is a bank of computers operated by a man in a booth overlooking the carriage, holding a "joy stick" in either hand as in any other video game. We move into a small room and with the click of the mouse Steve brings up on a computer screen a picture of the log that is now on the carriage, with lines on it showing the computer's instantly calculated suggestions of cuts to extract the most value. (The sawyer can override the computer's decision if he sees fit.)

Another screen shows a picture of the board or the cant that has just come off the saw, and again the computer's lines of advice for the edgers or resaw are inscribed on the "virtual" board.

The boards appear to move with uncanny independence — one moves on down the chain, while the next is jolted to a stop by a barrier that leaps into its path and it is flipped sideways by a set of upswinging steel fingers to another conveyor or set of rollers. Then I notice just below me a man — his hat and clothing and gloves appearing the same color as his surroundings — adjusting the boards on the chain by hand as they come off the saw, and operating a set of foot pedals which relay to the moving machinery his split-second judgments as to where each board should go next.

The sawdust goes to the "hog" which feeds fuel to the boiler which feeds steam to the dry kiln. The edgings, scraps and trim ends are sold to Fort James Company (formerly James River) to become pulp for paper. Some scrap is put through a chipper and sold to Boise Cascade to make chipboard or other products. The bark is screened and sold for decorative landscaping. At Bates there had been open-pit burning of a lot of scrap, and at many mills the scrap moved up a conveyor into the top of a big “wigwam” burner (only a few of these old relics mark the sites of long-defunct mills); but here there is virtually nothing wasted.

I follow the boards past the green chain to where they are stacked eight feet high on wheeled platforms to roll into the automatic stickering machine (putting thin spacers between the layers of boards) and then into the scalding steam of the dry kiln.

We stop finally at the planer. It runs only three days a week, and it is down today. The operator is making some cutters for the company’s planer in Lithuania. Yes, Lithuania! It is an identical machine to this one, so the new cutters can be tested here before shipping. Globalization is at work even here! I am told that the planer and the dry kiln in Lithuania are the best and fastest in Europe.

* * *

Luis Bidasolo is a small, square man with a square face. At eighty-three he still speaks with vigor, but he sometimes reached to touch a wall or chair as he led me through his living room to a table. He had just finished mowing his lawn (a small one).

“So you worked at the Bates mill,” I said. “I visited that mill in about 1960, and I need to talk to somebody about it.”

“Sure. Sit down,” he said.

“Here’s a picture of Bates.” He showed me a small snapshot. “This was taken from up on the stack at the mill.” The rows of houses, the two-story hotel, the pond, the store, a few other scattered buildings fit with what I vaguely remembered.

"Up on the stack? Who the heck would climb up the stack just to take pictures?"

Shy smile, pointing to himself. "I was just a young kid then."

"How long did you work there?"

"All my life! Except four years in the Army in World War II. Out of high school I started in cleanup. Then I picked edgings for a couple of years, until I enlisted." After the war he "came back and worked right on up." He was setter for a long time — probably was the very man on the carriage who haunted me for forty years. Eventually he moved up to the file room, where the saws were sharpened — "the elite job in the mill."

"And when did you quit?"

"I can tell you if I look at my wrist watch." He left the room for a few moments. "There it is."

On the back of his retirement watch was engraved: "E.H.L.C. Luis Bidasolo. 5/27/36 — 2/28/81." Almost forty-five years.

"I've always wondered how that was, riding that chair. How long could you do that at a stretch?"

"Well, once you knew what you were doin', it was all right. We'd get a fifteen minute break in the morning and afternoon, besides lunch."

The sawyer sat above, facing the carriage. He had levers that worked the device that turned the log and held it in place, and a lever that controlled the movements of the carriage. At the same time he gave hand signals to the setter, down in the moving chair, directing thickness of each cut and trying to get the most usable pieces out of the log. Luis showed me all the hand signals which he followed with his levers and foot pedals — one inch, two, three, twelve-and-three-quarter inch cant, etc.

He occasionally hesitated in answering. “We’re goin’ back a lotta years here,” he said, rubbing the top of his head.

“It wasn’t bad,” he went on. “With the big logs it was pretty slow. But when they got into them little logs it was ‘Bam! Bam! Bam!’ That was kinda tough.” With a good sawyer, he said, the setter never stopped.

He paused, looked out the window, the freshly-plowed memories showing in his eyes.

“We had a runaway once.”

“A runaway?”

“Yeah. The sawyer pulled his lever and we made a cut; but when he moved the carriage back a pin fell out of the lever and he had a dead stick.” The carriage started its backward travel under a full head of steam, and there was no counteracting steam to arrest its movement.

“There was just a different feeling; I knew something was goin’ to happen. I just braced myself.” (He demonstrated, closing his eyes and gripping the arms of his chair.) “Then there was this big bang, and the carriage shot off the end of the track and out through the end of the building.”

My imagination thrashed around, trying to paint the picture. The photograph he showed me of someone up on the roof afterward assessing the damage did little to fill the void.

“What did it do to you?” I asked, aghast.

“Nothing much. I was lucky.” He grinned. “Just shook up a little.”

While this story was sinking in, we went on to other things.

“Tell me about the pond man,” I said. “Riding all those floating logs, did he ever fall in?”

"No, I never knew them to fall in. Well, maybe once, I think one of them did. One pond man fed logs into the mill, and when loads were bein' dropped into the other end of the pond there was a man to move 'em up. Yeah, they were good, runnin' around on logs with them corks."

"Where did the logs come from?"

"From around Bates, maybe out to twenty miles. Wasn't much competition then from the other mills. The deal was 'You stay on your side of the mountain and we'll stay on our side,' and there was no problem."

One of the pictures of Bates showed the hillside beyond town covered with forest. A later picture showed the same area completely denuded. Driving by that hill now one sees a fairly dense cover of small trees, mostly lodgepole pines up to four or five inches in diameter, replacing the original big ponderosas.

There can be a lot of trees in a twenty mile radius. But the Bates mill cut a lot of trees in more than half a century — around thirty million board feet a year, Luis said.

Gradually the trees were used up. "My wife had foresight," Luis said, and they bought a house down in Prairie City, fifteen miles away. Three years later, in 1980, Edward Hines Lumber Company bought Bates, the mill and the town, closed it down and moved the operation to John Day, 30 miles down the valley — "on the other side of the mountain."

Luis said, "I worked the last shift at Bates, and the next day started work in John Day."

But he didn't like it there. The people, the machinery, the surroundings weren't as congenial to his head and hands as they had been through all those years in Bates. So a few months later he quit early, at 63, as his retirement wrist watch attests.

Meanwhile the Bates mill was dismantled; the hotel was torn down; the school was cut in half and moved to Prairie City for an extra classroom; the houses were sold for $1 each and moved to other towns. The thriving mill town of Bates was no more.

I thanked Luis yet again, and picked up my notes. As I reached the door he said, “Hey!” I turned back. “I’ll bet I’m the only Basco you ever interviewed!”

“You’re right about that,” I said, “and the only one I ever knew who survived being shot out of a cannon.”

Maybe my fretting about him all those years was justified after all.

* * *

Valeria Andrew is a waitress in Prairie City, and about the youngest looking grandmother I’ve known. She grew up in Bates through the seventh grade, until the mill and the town closed down. Last week she brought two large framed photographs of the town, with the mill and the upper and lower ponds, and we drove up there on a cool, bright spring day. “Turn left up there,” she said. Then, “See this road here?” (pointing at one of the photos). “That’s where we are, just coming up to that point of the hill.”

We park and walk slowly into the picture, two nostalgic afternoon archaeologists from opposite ends of history. The road has been changed some, but most of the topography can be clearly matched to the photographs; we keep turning them this way and that to stay oriented.

The upper pond is still full of water. From there the creek comes down a metal chute, then follows around close to the hill, past the dry kiln and the mill at the right end of the picture.

Combining the two photos I count about seventy houses; she thinks the town’s population was around 300.

The dry kiln anchors the present scene. Its concrete walls — most of them — still stand in defiance of the surrounding emptiness. It is the only structure left. You can walk, if you dare, through gaping holes into the cavernous chambers, scrambling over rubble and under big hunks of concrete that dangle from twisted and rusted steel rebar, like the exposed sinews of a half-eaten carcass in the Serengeti. The sky, an azure voyeur, peers down through rusted gratings and catwalks fifteen feet above; bent stubs of ancient steam pipes lead to nowhere, and shreds of railings and brackets and metal sheets cling to the blackened walls like creeping brown parasites.

Outside the dry kiln I cross an expanse of flat ground, then realize that it is part concrete and part asphalt — the area where, in the picture, trucks and forklifts are parked. Where the mill itself once stood are now raw heaps of earth and concrete bits not yet melted smooth by weather — nothing resembling a trace of a building. Barely exposed on the flat surface of earth is a fifteen-foot length of narrow-gauge rail, buried at both ends.

"Right there were four or five houses," Valeria says. We walk up a slight rise to a dimple in the hillside above the road. There is no sign of foundations (Shannon Voigt has told me that the houses were built on skids) but three lengths of double-walled stovepipe lie between an elm and two willow trees.

"One house had a stairway built into the bank, right down to the road," she says; but we can't agree where it had been.

"Our house was way over on the other side," she says, "between those yellow trees." The yellow trees are along the far edge of the meadow, on the ground and in the picture.

I've seen ghost towns, towns gradually abandoned, purpose and function dwindling, inhabitants drifting away, weeds grown up, windows gaping and roofs sagging and falling in, everything turned entropic gray and brown by the creeping fingers of rust, fungus, and weather; perhaps a rectangle of casual stones to mark where the barber shop once stood, or a couple of saloons, the business of the town now conducted by packrats and a pair of bluejays.

But I've never before seen a town swept clean, removed, clear-cut like a forest, all obvious signs of a town gone. We walk across where the mill pond should be — now an expanse of dry hardpan, a desiccated lakebed. Here under a stack of old power poles, we decide, was the log drop, where the trucks emptied their loads into the water.

"Then they parked here," says Valeria, "and walked over there — somewhere — to have a beer in the back of the store before going for another load." A pause, then, "I've driven past, but I haven't really seen the town since we left. It's a weird feeling. I'm getting sentimental." Her eyes look a little watery.

I'm getting sentimental, too. Almost desperate, I sense that the invisible answer to the conundrum hovers here over Bates: the elusive balance between photosynthesis and combustion, between production and consumption, between conservation and exploitation. The whole picture is spread out in front of us: Productive capitalist enterprise, a business based on extraction of a natural resource to the benefit of owners, workers, and distant customers. A forest ecosystem altered, centuries-old ponderosa pines of high commercial value now replaced over three quarters of a century by lodgepole pines with much lower and different utility. Seventy families disposed of, a few able to move to some other mill; proud and prosperous loggers unemployed, their tools and log trucks sold and their families fed with food stamps, moving away in search of work. Sawmills shut down all over the northwestern part of the country, town after town financially devastated. Environmentally political backlash against the abuse of decades ago now shutting down logging even in places and by people who want to cut trees "responsibly." Management policies in government agencies conflicting and stalled in confusion, forest policies set in Congress by people who have never held a chain saw. The Summit Fire, the Monument Complex, other wildfires throughout the West — thousands upon thousands of acres of cellulose and lignin and chlorophyll and all the other life that goes with them converted to smoke and heat and ash and mud and silt, by an indecipherable mix of ignorance and stubbornness and timidity and hot dry weather and bad luck. Extremists on both sides of the equation seeing each other as extremists.

The concept of "sustainability" as a fundamental value eludes us still.

Here is how the world is working. Now how do we assign the meanings that will put us straight? And how much chlorophyll and sunshine and time and wisdom will it take to make this all right again?

As the sun approaches the tree tops in the west, we finally have seen all we can cope with at one time. The birds, the breeze, and the fading light reclaim possession of this quiet valley. We drive back down the mountain, quiet, separate in our own retrospective spaces.

Carving in the yard

In the October afternoon the air is crisp but the last wisps of summer sun are warm enough to lure me out of my shirt. The maple leaves, red and orange and gold, fall with loud whispers around my head, slowly hiding the pile of chips and sawdust. The rank smell of damp elm heartwood combined with the fragrance of linseed oil and turpentine overshadow the subtle autumn smell in the breeze.

Under the chainsaw's harsh attack the log has already assumed some potentially sensuous forms and lines. Its interior stands naked and exposed. (Carve reverently; these cells haven't seen the light for seventy-five years). The more gentle touch of the razor-sharp gouge now peels off spoonful after spoonful of the flesh of the elm, the musical ring of the mallet singing the rhythm of the lines as they pass around and through and back together.

Carving outdoors is an act of respect; the wood is more at home here. Penetration of the wood is an act of seduction rather than rape. The smells, the sounds, the textures of wood and sweat and oil and steel and leaves, the soul of the log and the beat of my pulse, the earth and wind and sky, all converge into one ecstatic visceral awareness. With intense physical pleasure I feel the world move on its endless trajectory, and joyfully go for the ride.

Ted Merrill's 80-year journey with wood began when, as a young boy, he first applied a pocket knife to a piece of pine. Through many of those years, he recorded his observations about the varieties of wood he encountered.

Part technical manual, part design guide, and part storyteller's homage to the art and craft of woodcarving, ***Heartwood: A personal woodcarver's reference*** is an intimate look at our connections to the materials we discover in the world around us.

Ted passed away in 2013 at the age of 90. ***Heartwood*** is his last book.

In his book ***Heartwood: A personal woodcarver's reference,*** *Dr. Merrill tells us the stories of his lifelong experiences with every aspect of wood and wood carving, and shares much of himself along the way. We briefly meet some of his friends and neighbors, but his close acquaintance with the many species of wood he has encountered are his unwavering focus. Dr. Merrill offers a wealth of knowledge contained in entertaining, personal stories which will be appreciated by anyone who has worked with wood or who appreciates the care and craftsmanship of a fine wooden object.*

— Debbie Gordon, BFS, College of Forestry, University of Washington; Senior IT Specialist, The Weyerhaeuser Company