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Introduction

Late one fall about 15 years ago, on a secluded island in northwest Ontario, I installed my first workshop. With the help of a few friends, I dismantled half of a tumbledown icehouse that once served a commercial fishing camp, long since abandoned. The salvaged lumber and painstakingly unbent nails found their way into the walls of my new shop, which I carved out of the other half. Like the rest of the original icehouse, the 2x4 studframe walls were insulated with sawdust and the outer walls were sheathed in tar paper. Brown kraft building paper beneath the interior planking kept the bulk of the sawdust from drifting into the shop as it settled.

Double-glazed windows were out of the question, so I simply removed a horizontal swath of boards along most of the length of the south and west walls and stapled heavy plastic inside and out. I used driftwood and old 2x6s to build my workbench along the wall beneath the windows and to construct a small sleeping loft above the door at the east end of the building. In the winter, the building's footings and shallow shed roof were banked with snow, and toward spring I hung boxes inside the windows to start seedlings.

The shop was nothing fancy, but for the better part of two years I was happily ensconced, making snowshoes, knives and other artifacts of northern life, sometimes writing about the process. The nearest utility pole was about five miles away by water, so I relied entirely on hand tools. I worked mainly during the daytime, now and then (and especially in the winter) supplementing the natural light from the windows with kerosene and gas lanterns. Heat was more than amply provided, even at temperatures well below 0°F, by a cast-iron woodburning furnace that had been set ashore on the island under rather mysterious circumstances some 30 years earlier. The ganglion heat-exchanger on top of the burner was so effective that I was roused more than once in the middle of the night to quench its ardor. Groggy with sleep, I stumbled down the ladder from the loft to fling open the dull-red door and dump a bucket of snow inside.

I eventually moved on,

abandoning the shop and the island that had been deserted when I arrived. Since then, I have visited hundreds of workshops, almost all of them more sophisticated and better equipped than my own. I worked for a while in six or eight of these shops and shared bench space in a few. But apart from the wilderness workshop that I occupied so long ago, I have never had my own place.

Perhaps I can credit the brief life span of my shop with the fact that I still remember the delicious agonies of decision making that attended every detail of its construction. How wide to make the door and on which side to mount the hinges? How high to make the bench and should I bolt the vise through the top or lag-screw it from below? Where to hang the tools and the other inventory I hoped to acquire in the near future? Decades later, such mundanities may seem trivial, but they were hardly so at the time.

Unsophisticated does not mean crude. Although my workshop was greatly simplified by a lack of electricity and machinery, it was no less thoughtfully organized than many more heavily equipped shops. Likewise, a simple workshop is in no way an impediment to good work. Simon Watts reminded me of how a down-to-earth Nova Scotia boat shop inspired his own "back-to-basics" conversion (see p. 28). The shop's owner, Jim Smith, turned out a fine working skiff every six days — with the aid of no more than an old bandsaw, an electric grinder and a hand-held drill. Coming from a fully outfitted Vermont furniture shop, Watts found it to be "an absolute eye-opener."

Most of us recognize the value of a clean, well-lit work place, even if we cannot always claim one for ourselves. We wear our shops — as well as our homes — like an old jacket or a favorite sweater, and since most of us spend the majority of our waking hours at work, they ought to fit well. We breath the air and rely upon the light and heat it provides for our comfort, efficiency and survival. If it doesn't reflect our needs and priorities, we are bound to be miserable.

Five years ago, when I embarked upon an exploration of workbenches (which culminated in *The Workbench Book*, published by The Taunton Press in 1987), there was no such consensus of opinion about their importance. Wherever I traveled for that project, I felt compelled to explain — often to politely quizzical silence — what was so engaging and important about so pedestrian an object as a workbench.

The process, as it turned out, revealed a lot about the way the workbench intersects the background and personality of the woodworker who builds and uses it. It also pointed the way to the broader subject of the workshop. Indeed, as a tool, a working environment and a reflection of its maker, the workshop is an obvious extension of the bench. Many of the same functional considerations and traditions that find expression in the workbench have an important role to play in the shop.

To gather the material in this book,

I retraced my steps to a few of the most intriguing and well-considered shops I discovered on my original workbench hunt. And I visited dozens more, professional and amateur alike. In the process, I took a close look at the basic systems that constitute most modern workshops: electricity, lighting, heating, wood storage, dust collection and sharpening, among others. And I asked the shop owners to explain how they selected and located equipment in order to foster efficient work flow and safety. Our discussions went beyond the normal range of power tools - table saw, jointer, drill press, etc. - to include the workbench and tool chest, as well as the requirements for assembly and finishing. The workshop, I soon discovered, is not a static creature. Like the workbench and the craftsman who uses it, the shop constantly evolves to accommodate the changing needs of its occupant.

I also found that if you ask any six woodworkers about their shop or tools, you are likely to get at least six different answers. At a recent forum on the guitarmaker's workspace, moderator Jeff Elliott noted that the six panelists had a total of more than 130 years of workshop experience and still, he said, "We don't know where to put the bandsaw."

It will be no surprise, then, that the workspaces I've included here vary widely, from snugly efficient basement shops to cavernous cabinet shops. There are lavish, well-appointed shops alongside workspaces choked with salvaged machinery and shoehorned into garages, chicken coops and pantries. I even found some wonderful oddball "shops," among them a condensed tool kit designed to be carried on the back and a turning shop that travels on the bumper of an RV. Some of the shops in this book may approach the ideal, while others border on the improbable. The most creative solutions won't satisfy every palate, but they all share a common ingredient-they work.

This is not a recipe book. Unlike a workbench, a workshop is never built and outfitted from a set of plans. Although lots of information may be gleaned from the floor plans and drawings in the book, they are perhaps more valuable as inspiration than as blueprints. Likewise, the mention of specific machinery is not intended to recommend one product over another. There is plenty of excellent equipment on the market—new or used, expensive or dirt cheap—and I have made no attempt to evaluate individual brands. For more specific information, either about brand performance or the intricacies of installing, maintaining or overhauling machinery, refer to the sources listed in the Bibliography (see p. 208).

As you think about your shop, don't be intimidated by all the choices confronting vou. Many of us feel compelled to research our equipment to death in our quest for quality. Anything less is, well, less than perfect. We tend to disparage those who work in a hovel with a handful of worn-out tools, but let Art Carpenter's biodegradable workshop (see pp. 32-33) be a lesson. Like the bodybuilder's physique, when the workshop becomes a monument to our obsession, it ceases to be a means to an end and becomes the end in itself. For some people I visited, the workshop is obviously their ultimate creative expression. Never mind what goes on inside.

The measure of a workshop,

I found, is far greater than the sum of its parts. Some of my favorite shops are infused with a sense of personality, a character that derives as much from the placement of tools, the music on the radio and the pictures on the wall as from any ingenious jig or fixture. Stripped of that personality, what's left?

I sensed this most strongly when I visited Carlyle Lynch in Broadway, Virginia, not long before he died at the age of 80. I sat in a chair at the foot of Carlyle's bed, listening to his reflections on a rich lifetime as a woodworker and teacher of woodworking. Behind the house, his sprawling two-story workshop lay idle, and he would never work there again.

Between our sporadic chats (Carlyle wasn't up to much more), I wandered through the shop, wondering about the work and life that had once thrived there. Without Carlyle's presence, the benches, chests, and countless fixtures — even the tools and machinery — seemed like so many bolts and board feet. The future of the shop's contents is uncertain. But whether the tools are kept together or dispersed to other craftsmen who might give them new life, it was clear that the shop could never really be called Carlyle's again.

One final confession:

As I write this book, I am "between shops." My last official workshop was a cavernous space on the second floor of a Toronto industrial building. I was flanked on either side by colorful tenants — a Korean sweatshop to the east, whence emanated the singsong whir of a battery of sewing machines and pungent cooking smells, and a fly-by-night wood-finishing outfit to the west, which generated fumes of much greater concern. Since then, I have shared a group workshop and borrowed space in friends' shops and barns, as the need arose.

Most of my tools are now in boxes, or on loan to friends. My workbench has been rudely decommissioned, its Record face vise removed so as not to interfere with the flow of perforated paper to the computer printer it now supports. A rack of files sits on the opposite end of the bench, and directly beneath them, under the tail vise, is the metal filing cabinet that contains the grist for this book. The whole business is within arm's reach of my chair and computer keyboard.

It's a sordid affair, I'll admit, hardly befitting someone who has spent as much time as I have peering through the windows of other people's shops. But in a way, the odyssey that became this book was a personal quest to discover those elements of the workspace that I will eventually include in my own. As I might have predicted at the start, I stumbled upon no ultimate design, no single solution to the myriad problems of tool selection and organization. But the material I've set between these covers, gleaned from all the shops I visited, will help me greatly when it comes time to recommission my workbench and get back to making shavings. I hope it does as much for you.

A note about safety

Safety must be at the heart of any serious discussion of the woodworking shop, and it was on the minds of many people I visited. High-speed machinery and even hand tools can be dangerous if they are improperly installed, maintained or operated. And basic systems, such as electricity, heat and dust collection can either contribute to a safe and productive environment or they can destroy it. When it comes to building or renovating your workshop, pay particular heed to these systems and make sure to observe safe and accepted installation procedures. Hire professional help if you need it.

Throughout the book, you'll find numerous practical devices and precautions that can enhance the safety of your shop and machinery. But despite all efforts to describe and regulate safety in the workplace, it remains a highly subjective issue. Almost every workshop operation has an element of danger, but the degree of actual risk also depends upon your experience, your state of mind (fatigue and/or haste) and an assortment of other environmental factors (noise, dust and other shop distractions). Just as I would never attempt to paddle my canoe through white water that might be routine to an Olympic kayaker, there are tools others use every day that I get nervous just thinking about. And we all know the dangers of complacency and the overconfidence that comes from mindnumbing repetition.

I recall with a shudder a friend's story about a woodworking shop he operated for the physically impaired. Hearing one of the machines running and noticing that the lights were off, he entered the shop to investigate. He was startled to find one of the clients operating the radial-arm saw in the dark. The operator was blind — but was following every safety procedure he'd been taught. With one hand placed firmly on the work and the other on the saw handle, the risk of injury was actually slight – arguably less than for some cocky cowboys I've seen at work. Mac Campbell said it best when he told me: "The way to protect your hands is to use your head."

"The Carpenter's Shop at Forty Hill, Enfield, 1813," by John Hill. This 19th-century English joiner's shop is probably typical of the period —plenty of natural light, ventilation and elbow room, but no machinery.



The Workshop Tradition

The winter, the timber, the wheelwright's continuous tussle, the traditional adaptation, by skill and knowledge — all these factors, not thought of but felt, to the accompaniment of wood-scents and sawpit sounds, kept me from thinking of the cold... —George Sturt, The Wheelwright's Shop

Chapter 1

F or y crie roo be, with

or years, the makers of period furniture have decried the lack of reliable information about the roots of their craft. Obscure as these origins may be, they are positively transparent compared with those of the shops in which the pieces

were produced. A considerable body of woodwork remains from the 17th, 18th and early 19th centuries, but the workshops of those periods have vanished almost without a trace.

To make matters worse, little was written about workshops at the time. Even if interested in the furniture, most writers would have thought it irrelevant to record much about how and where it was produced. And craftsmen didn't make it easy for the few who tried. In an essay describing the compilation of his monumental, 17-volume *Encyclopédie*, Denis Diderot complained that "people who continually busy themselves with something are equally disposed to believe either that everyone knows those things which they are at no pains to hide, or that no one else knows anything about the things they are trying to keep secret. The result is that they are always ready to mistake any person who questions them either for a transcendent genius or for an idiot...." (Diderot's essay accompanied volume five of his *Encyclopédie* and appears in *Rameau's Nephew and Other Works*).

I encountered some of the same obstacles several years ago while investigating the history of the workbench—at once the most fundamental and neglected piece of equipment in the woodworker's tool kit. But as a subject of historic inquiry, the workbench has several characteristics that make it much more accessible than the workshop. Because they are relatively small in comparison to an entire building, enough old benches have been preserved by eccentric antiquarians to provide a discernible record of their evolution. Also, much can be inferred about benches from the nature of the tools used and from the work performed upon them. This naturally reflects specific cultural traditions as well as differences between trades. There are, for example, important distinctions between the design of English and Continental benches, and Japanese workbenches are completely different from those of Europe.

Architecture is likewise steeped in tradition, but the overall structure of the workshop is more often determined by factors that have nothing to do with woodworking. A craftsman might be inspired to build a bench just like the one he learned on, but he would rarely have the inclination or the resources to build his shop to the same specifications. What little evidence we have suggests that shops were at least as frequently adapted from or appended to existing structures. For as long as craftsmen have wielded tools, they have worked at home or in barns, sheds or buildings constructed for other purposes. Unfortunately, after such a space has been abandoned for a few years (much less a few generations) it is typically converted to other purposes and its complement of tools is dispersed.

So how to pick up the scent of a trail gone cold? In my research, I have found three valuable sources of information about the workshop tradition. First is the documentary record, which includes books, paintings, carvings and other ephemera (inventories, probate records, correspondence and so on). Second are historic workshop recreations in museum collections. Last come the precious few surviving 19thcentury workshops, suspended precariously between the age of craft and the age of machinery. Each of these sources is fragmentary and limited in its authority, but together they provide a reasonable facsimile of early workshop life.

As leavening to these sources, I encourage readers to reflect upon and respect their own instincts. Some of the most interesting research in the woodworking trades is now being conducted not by historians, but by skilled craftsmen working with similar tools and, in places like Colonial Williamsburg, under similar conditions. After all, the use of hand tools and the properties of wood have not changed much in the last few centuries. Many of the same workshop issues that confront the modern woodworker, such as layout, lighting, heat and storage, must have been of equal concern to colonial craftsmen. We have greater options and resources at our disposal, but I suspect that our instincts and priorities are not unique.

The documentary record

One of the first things made clear by the documentary record is the rigid differentiation that prevailed in Europe during the 17th and 18th centuries among the woodworking trades. As Benno Forman explains in his book, *American Seating Furniture 1630-1730*, separate and unequal guilds were estab-

Trade Secrets

Contemporary documents provide much of what we know of woodworking history. The rigid caste system that segregated the woodworking trades in 17th- and 18th-century England is evident in the first of these extracts. taken from a 1632 decision by the London Court of Aldermen settling a dispute between carpenters and joiners. The second reflects the gradual erosion of that system as joiners encroached on the work of carpenters, taken from A **General Description of All** Trades (1748). The third notes the emergence of cabinetmakers, who carved a niche for themselves in furniture making. These and other similar references may be found in greater detail in Benno Forman's book American Seating Furniture 1630-1730.

By law, 17th-century London joiners were granted the exclusive manufacture of:

All sorts of Bedsteads whatsoever (onlie except Boarded Bedsteads and nayled together).

All sorts of Chayres and stooles which are made with mortesses or tennants.

All tables of wainscotte wallnutt or other stuffe glewed with fframes mortesses or tennants.

All sorts of formes framed made of boards with the sides pinned or glewed.

All sorts of chests being framed duftalled pynned or glued.

All sorts of Cabinets or Boxes duftalled pynned or glued.

By the 1740s, the distinction between carpenters and joiners was blurring in England, as is shown by the following anonymous comments:

Carpentry and Joinery, that Part especially belonging to House-work (and even Undertaking, or furnishing of funerals) are often performed by the same Persons, though the work of [the Joiner] is much lighter and reckoned more curious than that of Carpenters; for a good *Joiner* can often do both well, but every *Carpenter* cannot work at joinery.

While joiners were becoming architectural woodworkers, cabinetmakers were taking over the furniture trade. Robert Campbell's The London Tradesman (1747) provides one of the earliest descriptions of the English cabinetmaker:

The Cabinet-Maker is by much the most curious Workman in the Wood Way, except the Carver; and requires a nice mechanic Genius, and a tolerable Degree of Strength, though not so much as the Carpenter; he must have a much lighter Hand and a quicker Eye than the Joiner, as he is employed in Work much more minute and elegant A Master Cabinet-Maker is a very profitable Trade; especially, if he works for and Serves the Quality himself



One of the earliest workshop views is the socalled Stent panel, a bas-relief woodcarving of a 17th-century joiner's shop from England or

northern Europe. Rural economies could not support the rigid structure and specialization of the urban guilds. Woodworkers in such

locations typically performed several functions and were perhaps more like the modern generalist craftsman than we might imagine.

lished that clearly delineated the functions and rights of carpenters, joiners and, eventually, cabinetmakers. (These trade organizations were further subdivided into turners, carvers, chairmakers, wheelwrights, instrument makers and so on.)

Joinery is an ancient craft, practiced by the Romans, Celts and Egyptians. It relied heavily on the use of riven or hewn green wood and very little (if any) glue. The staple joint in both the carpenter's and joiner's repertoire was the draw-bored mortise and tenon, which, in furniture, formed the essential component of frame-and-panel construction. Embellishment was usually limited and accomplished with a plane, a scratch stock or chisels.

Cabinetmaking, by comparison, is a relatively recent and refined occupation, which appeared in England and northern Europe during the 16th century. In place of narrow, riven stock, cabinetmakers employed wide, dry boards, usually dovetailed together at the corners. They were more likely to use sawn softwoods, veneers and other decorative elements than were joiners of the same period. With the declining popularity of the draw-bored mortise-and-tenon joint and its great mechanical strength came an increased reliance upon glue.

As you might expect in a frontier environment, the earliest North American furniture was built in the joiner's tradition. London advertisements and colonial inventories listed axes, saws, chisels and other tools that might be equally useful in building houses, as well as furnishings, in the earlier settlements. (According to Forman, smoothing planes were conspicuously absent.) The joiner exercised a kind of vertical monopoly in which he cleared the land, collected the trees, split the wood and built his own shelter and furniture. Cabinetry, on the other hand, could only thrive in an established and secure community in which sufficient capital was available to invest in dry wood or in green wood that could be set aside for seasoning. Evidence of the first American cabinetmakers does not appear until the late 17th century, with the listing of glue pots and veneering materials in Boston inventories.

The early joiner's workshop might have been closer to the wood yard rather than the parlor, with chunks of log, cleaving and shaving brakes and wood chips in evidence. With dark shadows, marginal heating and dirt floors, they are more likely to have resembled the 17th-century bas-relief shown above than the highly structured workshop dioramas of Diderot and Jacques-André Roubo, which have high ceilings and appear to be uniformly tidy and well lit. (Accompanying the Roubo engraving, shown on p. 8, is a thorough description of an 18th-century French workshop.)

While it may be assumed that colonial woodworkers frequently worked at home or in nearby buildings, the strength of the European guilds was such that, in France, statutes forbade woodworkers from keeping heavy tools at home. Roubo observed that these laws had the benefit of discouraging unqualified individuals from plying their trade. But they trapped enterprising craftsmen in a kind of 18thcentury catch-22. Those who kept a bench at home solely to prepare the tools required for their occupation were equally liable to be prosecuted and then denied employment as a result of their lack of tools.

Two of London's most famous high-style, 18th-century cabinet shops have been well documented in recent litera-

An 18th-century workshop



The following text (and bracketed comments) is excerpted from a translation of Jacques-André Roubo's L'Art du Menuisier, published in Paris between 1769 and 1775. In the original volume, it is accompanied by the engraved illustration shown above, which depicts the interior of an 18th-century joiner's workshop.

Of all the mechanical arts, joinery *[menuiserie]* is the one in which there are the greatest number of tools, the perfect knowledge of which is indispensable both for the manner of making them and for that of using them; but before entering into the details I believe that I should speak of the shop or *atelier* where joiners work. This is not to say that every joiner must have premises of a standard type but it is merely intended to indicate the dimensions and equipment which are required.

There are two types of joiners' shops, those which are located in rented houses and those which are especially built with frame construction in the form of lean-to sheds.

The first are suitable for cabinetmakers *[ébénistes;* Roubo uses this term to apply particularly to those cabinetmakers who produce veneered furniture], all types of furniture makers, and for carriage builders; it is not that the ones of which I have just spoken do not sometimes have very large shops, but what I have said applies in general. For *menuisiers de bâtiments* [those who execute

the fine carpentry-such as the paneling - in building construction] ordinary shops are hardly suitable in view of the space which they require; thus the majority of them (at least the most prosperous), and those who undertake large projects, have a shop [boutique] in their own dwellings where they do their small work and a timber-yard in town where they place their stores of timber and in which they have a shed constructed capable of containing a number of benches equivalent to their requirements. There are others who have no shops but who choose premises large enough to lodge them commodiously and to contain their stores of wood and a workshop of reasonable size. This last method is the best because it permits one to keep an eye

on everything, which is impossible if one is lodging elsewhere.

When space is limited and one requires a large number of workmen, one makes the shed double, that is, one places benches on both the ground floor and on a second floor. The shop of M. Menageot in Porte Saint Martin is constructed in this manner and is possibly the best built in Paris as much for solidity as for all the facilities which are provided for the workmen.

The shop of a *menuisier de bâtiments* ought to be twelve and one-half feet in height at least, because the timber is ordinarily twelve feet in length and it is essential to be able to dress it and to turn it end over end without being cramped. Its depth should be from fifteen to eighteen feet in order that there be three feet between the end of the bench and the sill of the shop, nine feet being the length of the bench, and about six feet at the end so that each workman can have a place for his wood and his work.

As for the width, it must be limited by the available space and by the number of benches one wishes to install, which are ordinarily eighteen to twenty inches in width, and that much again is required between each bench; which works out that each worker needs three feet four inches, which dimension determines that of the workshop by simple multiplication.

The window sills of the shop should be of a height equal to that of the benches so that in the case of jobs of extraordinary length one can let the wood pass over the top while working on it, and thus be supported.

There should be several entrances, the number depending upon the width, which will be closed by doors which should open clear to the top in order to facilitate the entry of wood, and which will be glazed with linen so that when they are closed one can enjoy daylight in the interior of the shop.

The space above the sills must also be closed by frames covered with linen which are raised during the day and held to the ceiling by catches which retain them there.

At the top of the front of the shop there should be a pentroof projecting about 18 inches or 2 feet which will serve to keep water out and to prevent damage to the work and tools.

Near the shop there ought to be an enclosure twelve to fifteen feet square in which there is a fireplace with a mantel six or seven feet off the floor and as wide as possible, that is to say, as wide as is convenient, and facing the hearth there is built a little wall or banquette of masonry, 15 or 16 inches in height by seven or eight inches thick and four or five feet distant from the bare wall or back side of the fireplace. The top of the banquette should be faced by a piece of wood three or four inches thick, which thickness is included in the height of the banquette.

This place is called the *étuve* or sorbonne, in workmen's language, and serves to melt and to heat glue, to warm and to glue wood, and to dry glue joints during the winter and in damp weather. It is useful also to have a bench in the sorbonne in order to be able to pound and to glue joints on it; lacking a bench one uses the top of the banquette which is intended for that purpose as well as for retaining the fire and preventing it from spreading.

The sorbonne should be quite tight, and yet well lit, so that one can work there as I have described above; it serves also as a place for the workmen to take their meals; that is why one must take the greatest possible care to make it comfortable, especially during the bad season. It must be built very close to the shop and even be contiguous if that is possible so that wood taken there to be heated and glued is not subject to being wetted

ture. Christopher Gilbert's book, *The Life and Work of Thomas Chippendale*, and Helena Hayward's and Pat Kirkham's *William and John Linnell: Eighteenth Century London Furniture Makers* each include a considerable discussion of the working environment in which the furniture was produced. Their inventories and descriptions of workshop practices help construct a realistic portrait of workshop life. Gilbert's book also contains the floor plan of "Mr. Chippendale's Premises" (shown below).

These are no humble country quarters. Chippendale's compound, which comprised three separate houses, and



Like many humbler workshop compounds, Thomas Chippendale's home and shop shared adjacent quarters, as shown in this drawing, based on one made in 1803 by the Sun Fire Insurance company. Linnell's three-story workshop each employed between 40 and 50 workers. (A fire in 1755 gutted the cabinet shop in the rear courtyard of Chippendale's shop, destroying the tool chests of 22 workers.) According to Gilbert, these shops are of "middling size," compared with George Seddon's London shop, which employed 400 men in 1786, although Chippendale and Linnell turned out finer work. Although there is no floor plan of Linnell's shop, the inventory indicates that there were seven "inner benches" in the carving shop and perhaps as many arranged around them, 13 benches in the cabinet shop and three in the joinery shop. There was a separate joiner's tool chest in a large garret and four more benches in the gilding shop. In addition, there were turning tools in both the chair room and the cabinet shop.

Both shops were organized around a central courtyard, in which some timber handling and stock reduction must have taken place. (Chippendale lived in the front of the shop, and Linnell's setup included a sawpit and an office, which do not appear on the Chippendale plan.) They also include several "German stoves," a square furnace used to dry wood and to warm it before gluing or veneering. (Authors Hayward and Kirkham mention that such stoves were used to harden japanning, but they were also widely used for cabinet-shop heating because of their safety.) Not surprisingly, Hayward and Kirkham note that "every available inch of space was utilised in [Linnell's] Berkeley Square workshops," including lofts and staircase landings.

These books help to animate what woodworking historian Frank Hubbard refers to as the "spiritless image" conjured up by most shop inventories. Besides, as Rob Tarule pointed out to me, "you could put together all the 17th-century inventories and maybe get one complete inventory of tools." Tarule, a former Curator of Mechanick Arts at Plimoth Plantation in Plymouth, Massachusetts, now rives and planes green wood in his basement shop. He has spent a lot of time poring over old inventories and has discovered quite a few holes. Many of the most valuable tools were either given away after the woodworker died or were so rough-hewn or worn that they they were overlooked by the appraiser who drew up the list. Large items like built-in workbenches might not be mentioned at all. As intriguing as an inventory may be, it is no more revealing of the actual workspace than is a bill of materials of a piece of furniture.

For "color," we have only a handful of painter's views of early shop interiors, like the one on p. 4, until the late 19th century, when photography got around to recording craftsmen at work (see the photo of an Arts and Crafts machine room on p. 68). Of course, some of the most familiar images come from the great 18th- and 19th-century encyclopedias compiled by Diderot, Roubo and André Felibién and their English counterparts, Joseph Moxon and Peter Nicholson. But workshop illustrations in these books primarily illustrate benches and tools.

One of the limitations of all of these sources is our inability to verify their accuracy. Diderot and Roubo went to great lengths to interview their informants, but we have no way of knowing how closely their illustrations reflect contemporary reality. Accurate renditions of specific tools do not guarantee the authenticity of overall room views, which may have been sketched for context more than precise detail. Views may be composites, conveying all the elements the author or illustrator considered important, even though those elements might not have appeared together in an actual workshop. It does seem clear, however, that each author drew heavily upon the work of his predecessors; the English encyclopedists, in particular, borrowed liberally from earlier French publications.

As a document of period craftsmanship, George Sturt's The Wheelwright's Shop is hard to beat. Although the book was first published in 1923, Sturt's shop itself was built in 1795 and then purchased in 1810 by his grandfather. Sturt himself assumed control of the business upon the death of his father in 1884, after only a month of training, and steered the shop into the Machine Age. Fortunately for us, Sturt has described its transformation with the eye of an informed but sensitive participant.

Descriptions of early woodcraft are often tinged with romanticism, and *The Wheelwright's Shop* is no exception. But Sturt's attachment to the waning craft era is mitigated by his frank portrait of its harsh realities. Working days were long -12 to 14 hours was not uncommon — and conditions were often difficult. There was no machinery in the shop when Sturt took over apart from the great-wheel lathe, which buried the floor of the "lathe house" under a foot of chips. The grindstone stood outside beneath a walnut tree, and in the absence of a bandsaw or circular saw, the felloes were shaped with an ax and adz or were clamped to a bench and sawed with a frame saw. As in the Linnell shop, there was a sawpit on site for preparing lumber.

Within five years, Sturt introduced power to the shop in an effort to save his business. Years later, he noted wistfully that "...there in my old-fashioned shop the new machinery had almost forced its way in —the thin end of the wedge of scientific engineering. And from the first day the machines began running, the use of axes and adzes disappeared from the well-known place, the saws and saw-pit became obsolete. We forgot what chips were like. There, in that one little spot, the ancient provincial life of England was put into a back seat.... 'The Men,' though still my friends, as I fancied, became machine 'hands.'"

The windows of Sturt's shop were merely shuttered openings, bolted at night and wide open to the elements during the day. "With so much chopping to do one could keep fairly warm," he writes, "but I have stood all aglow yet resenting the open windows, feeling my feet cold as ice though covered with chips. To supply some glass shutters for day-time was one of the first changes I made in the shop." Once the machinery had assumed the heavy work, he notes, "men would not and probably could not work at all in such a place; yet it must have sufficed for several generations. My grandfather and my father had put up with it, and so did I until the winter came round again...."



We shape our buildings; thereafter, they shape us. -Winston Churchill

Chapter 3



ou may or may not have much choice in the location of your workshop. But what you do within its walls is entirely up to you. (Unless, of course, you have to share that space with the family car or three other business partners.)

Nothing less than your safety, efficiency and enjoyment hang in the balance.

I wish I could offer one or two ideal layouts that would satisfy most needs. But the factors that affect shop layout from the height of the ceiling to the size of your wallet and the type of work you do—vary so greatly that any such attempt would be folly. Aspects of layout are sprinkled liberally throughout this book. The selection of machinery, for example, relates strongly to layout, as do wood storage and dust collection. In fact, just about everything that goes on in the shop has something to do with the subject. What follows is a discussion of the principal considerations involved in laying out any workspace, along with examples drawn from a wide variety of workshops.

Flexibility

Good layout is more than just deciding where to put your equipment. In many shops, it includes planning flexibility into the shop. Limited space or a variety of woodworking projects will make this planning critical in most small shops, while in larger shops or production and specialty shops where the type of work is more predictable, only certain areas need be flexible. As one woodworker wrote to me, "As much as I'd like to bolt things to the floor, I don't because I never know when I'll have to push something over a few inches to allow for some other operation."

Flexibility is most often expressed in the selection and orientation of machinery. In the majority of shops I visited, the table saw occupies a preeminent position in the middle of the floor. A table saw demands space on all four sides fore and aft, for long boards, and to the left or right for wide panels. By contrast, all the other major pieces of commonly used woodworking machinery — radial-arm saw, jointer, planer, bandsaw, drill press and shaper — require space in only two or three directions and can be placed against a wall.

Arranging the machines around the perimeter of the shop, or even isolating them in a separate machine room, liberates the bulk of the floor space for a constantly changing flow of shop projects. Flexibility is enhanced by folding outfeed tables or portable outfeed horses and rolling tool carts, clamp caddies and assembly tables, an assortment of which are shown in chapters 8 and 9.

As important as flexibility is to most shops, good organization also requires a careful analysis of what kinds of things you do repeatedly and in what order. If you make solid-wood furniture, for example, you are likely to follow a similar sequence of operations regardless of whether you're making a highboy or a chair: You saw and plane rough lumber to dimension, cut joints and shape parts, assemble them, then apply finish. Unless you're really pressed for space, it probably makes more sense to put your table saw or bandsaw, rather than your finishing area, next to your jointer and planer. If you work mainly with plywood, or do a lot of turning, you can also identify an overall order to your work, one you'll usually, if not always, follow. Determining what that order, or workflow, is for you is the first step to finding the best relationships between the components that make up your shop.

Workflow

I've yet to meet a woodworker who felt he or she had too much space. But more space doesn't necessarily mean more efficient space. In fact, the luxury of a large shop may simply provide room to spread out your mess. If a small space forces you to be organized, a large space may have the opposite effect.

This was decidedly not true for Kelly Mehler of Berea, Kentucky, who transformed the 3,200-sq. ft. interior of an old car dealership with a logical attention to workflow rarely found in much smaller shops. (In fact, this *is* a smaller shop for Mehler, who began his business in a 6,000-sq. ft. chicken barn that he rented for \$40 a month.) A professional furniture maker, Mehler works mainly on mammoth, second-hand industrial machinery, but the organizational principles evident in his workshop may be applied to any space — however large or small.

Sure, Mehler's shop is luxurious. In its tightest corridor, the machines are still 4 ft. apart. There is a virtual prairie of



unclaimed footage in the main work area. (Not to mention the nearly 800 ft. of sparsely populated showroom at the front of the building.) But Mehler regards all that space as a challenge rather than an excuse, and he distributed his tools and materials according to their function in the process of turning rough lumber into finished furniture.

Material enters the shop by way of an 8-ft. wide overhead garage door that opens directly onto the sidewalk of Berea's main thoroughfare. Lumber is delivered by truck right into the shop, where Mehler unloads it onto rolling carts (for immediate use) or onto the wood racks that line both sides of the entryway. The racks are made of utilitygrade 2x4s and are positioned on both sides of a radial-arm cut-off saw.

This is the "break-down" lane, where stock is converted to rough dimensions for particular projects, and Mehler keeps a clipboard handy with his work order and materials list. At the start of a job, wood is pulled off a cart or rack, crosscut on the radial-arm saw roughly to length and bandsawn roughly to width. Scraps and usable "shorts" remain in this area, filed in bins across from the lumber racks until they are used in other projects or burned in the shop stove. This end of Mehler's break-down lane illustrates a solid principle of workflow planning: Don't move heavy pieces of wood farther than you have to. Mehler lugs bulky lumber the shortest possible distance from delivery truck to storage rack and from the rack to where it is broken down into manageable pieces.

Wood racks flank the cut-off saw in the 'break-down' lane of Kelly Mehler's shop. Mehler crosscuts and rips lumber to size here, before moving it into the primary production area of the shop, where the more exacting machine work -dimensioning, joinery, shaping or turning -is done. Beyond the heavy machinery, Mehler does whatever handwork, gluing and assembly is required at one of several workbenches. A fully-equipped spray booth is at the end of the production line. All switches and lights are explosion proof, and the fan exhausts to the outside.



Kelly Mehler's shop: Layout for smooth workflow



The next operation usually involves jointing a face and edge in preparation for thickness planing or resawing to thinner dimensions. A 12-in. jointer is located conveniently across from the radial-arm saw, between the bandsaw and planer. The classic 36-in. Oliver bandsaw (with a 5-hp motor and a ½-in. skip-tooth resaw blade) and the 24-in. Crescent planer (with a 7½-hp motor) are essential components in these initial conversions. Dust is carried off in a network of stove pipes (sealed at their joints with duct tape) by a 5-hp blower; it is deposited in a large waste bin behind the shop and trucked away.

After the stock is reduced to its rough dimensions, it is placed on a cart and rolled into the primary production area of the shop, where it is ripped and crosscut to final dimension and all the joinery is performed. A Rockwell Unisaw is the heart of this part of the shop, augmented by a fourspeed Oliver lathe and an overarm router. Jigs and fixtures live on the wall behind the planer, within easy reach of the table saw.

To save space — one man's warehouse is another's closet — Mehler prefers not to use an outfeed table on the saw, but he is careful to use a portable outfeed roller when he has to rip long stock. When a lot of additional support is required, he uses his workbench, which sits behind the saw and is the same height as the saw table. The table of the overarm router can also be raised or lowered to the same height.

Projects proceed to the workbench for hand joinery, carving and other hand-tool tasks. A drill press is located to one side of the bench, and a portable router table and pneumatic drum sander—one of Mehler's favorite machines—are kept close at hand. The router table, which is just a piece of fiberboard fitted with a clamp-on hardwood fence, has an unusual base—it sits atop a 45-gallon oil drum and is held in place by the weight of the router. (The drum doesn't amplify the router's whine as much as you'd imagine.) In an alcove next to the bench is a sharpening station and hardware depot.

Beyond the primary production area, a second workbench serves as a gluing and clamping station adjacent to the spray booth and finishing area. Mehler keeps the window next to the booth open when he's spraying, so the booth's exhaust fan draws air from outside rather than dust-laden air from inside the shop. (The lacquer dries quickly, so there's little problem with dirt from the unfiltered outside air.) Flammable materials are stored in a metal cabinet in the alley between the spray booth and the sink.

Despite his attention to workflow, Mehler admits that things eventually descend into chaos at some point during a job. The shop, he says, "goes through cycles," and from time to time he stops to straighten it out. To keep things from getting out of hand, he routinely dedicates Saturday to shopimprovement projects.

Mehler heats the shop with wood (there's a gas stove in the gallery), a cheap and available resource in southern Kentucky. The shop can be "coldish" in the winter, he says, but the main wood stove is well-situated near the bench, where it provides heat during the less aerobic exertions required for careful joinery. It and a secondary stove are also a safe distance from the large sawdust producers in the break-down lane and the volatile chemicals that surround the spray booth.

The primary work areas are well lit by overhead fluorescents and light from large, south-facing windows (which also warm those areas in the winter). Here, the ceiling rises to about 16 ft. at the roof peak, tracing a pleasing catenary curve that contributes to the spacious, airy feeling in the shop. It is one of the architectural reminders of the building's earlier life. A dropped ceiling beneath a large storage loft covers the remaining three-quarters of the shop, including the office and showroom, but there's still 10 ft. to 12 ft. of clearance in the break-down lane.

During the ten years in his current location, Mehler has filled the showroom with furniture and a line of lap desks, quilt racks, desk organizers and other accessories that helped draw cash and customers through the shop. For a while, he dabbled in gallery sales, soliciting crafts from local artisans and hiring help to tend the showroom and keep the books. But as the furniture eclipsed the accessories — Mehler does a wide variety of work, from desks and beds to Shakerstyle chairs — he reduced the shop staff from five employees to one and let the showroom go unattended. On the several days I was in town it remained dark, with only a few dusty pieces of furniture on display and the front door locked. It's a luxury to let that much space lie fallow, but Mehler hasn't been spoiled. "I jump in the air sometimes," he says. "I don't know how I got this. I didn't plan it at all...."

Workshop Triangles

Another useful way to consider organizing workshop space is in terms of work triangles, which describe the relationships between several different tools within a single work area. This familiar, motion-study approach is often used by kitchen designers to analyze traffic patterns between the stove, sink and refrigerator — hence the name. (Not all work "triangles" have three sides — some may be squares, trapezoids or circles.) It is equally valuable in developing a workshop layout and amounts to a study of workflow in microcosm.

The workbench triangle Perhaps the most fundamental workshop triangle is formed by the workbench, tool chest and assembly area. The relationship between these elements is apparent in John Nyquist's shop (shown in the top left photo on the facing page). Nyquist, who builds about 30 pieces of furniture each year in his Long Beach, California, workshop, can easily get any hand tool he needs while working at the bench. The tools are arranged in the built-in wall cabinets according to their size, function and frequency of use (similar tools – marking and measuring tools or saws, for example – are grouped together). A low assembly table (in the foreground of the top right photo on the facing page) is likewise accessible to the bench, which may be needed for making final adjustments as the piece is put together.

A well-organized basement shop Organization and storage are more than a luxury in most basement workshops. Jim Whetstone's shop in New Cumberland, Pennsylvania, is as highly organized and economical in its use of space as any I've seen. As the floor plan below shows, Whetstone located his major power tools near the centerline of the shop. Three workbenches surround the machinery, and wood storage is at the far end of the shop. This arrangement allows him to rip 4-ft. by 8-ft. sheets of plywood on the table saw and cut 14-ft. lumber on the radial-arm saw. It also provides space to lay out, construct and finish a variety of projects.

The ceiling and partition between the shop and the rest of the basement are of drywall construction, which makes for easy maintenance and sound insulation and aids fire prevention. Electrical boxes hang from the ceiling to keep cords off the floor. For safety and convenience, Whetstone color coded the circuits—red for lights and orange for equipment. To promote order and style, he painted his cabinet cases and door frames green and the doors blue. I was impressed by the number of clever storage ideas he had come up with, one of the reasons he's able to cram so much in such a small space and to keep it neat. Several of these are shown in the photos on the facing page.

The shop appears to be complete, but according to Whetstone, it has evolved a little bit each year since it was built in 1974. "It is not finished," he explains. "No true woodworker with a reverence for wood, order and quality is ever satisfied with his workplace. It will grow as I grow."

ЦЦ Electric panel. Bar clamps Shop Wood library Scrollsaw Clamb Bulletin Sander Side workbench Tool storage storage (6 drawers and boards tree Bandsau 3 shelves below.) Miscellaneous storage Paint Table saw Main workbench Vacuum (hung from Steel ceiling) column Hand tools, Jointer electric tools. hardware Supplies Wood storage Miter Rear workbench Overhead rack (rolling) (on wheels) box for sheet material Heater Hardware Fasteners 0 Bit Rags Wood Drill Waste Partition Radial-arm Router wall table storage storage press saw

60 Chapter Three

Jim Whetstone's basement shop: A place for everything...











Jim Whetstone gets a lot of mileage out of his small basement workshop by making sure there's a place for everything and that everything is in its place. He has come up with some creative ideas for storage, shown in the photos at left. The 34-in.-sq. rack (shown at far left) pivots down from the ceiling to provide access to sheet goods; drill bits are stored in a handy, ceiling-hung rack above the drill press; handscrew clamps are stored on a 4x4 'tree' and three cork bulletin boards, which display plans and patterns are hinged to a single post. (Photos by James Whetstone.)