Woodturning

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Detail of woodturning in work

Woodturning is the craft of using the wood lathe with hand-held tools to cut a shape that is symmetrical around the axis of rotation. Like the potter's wheel, the wood lathe is a simple mechanism which can generate a variety of forms. The operator is known as a turner, and the skills needed to use the tools were traditionally known as turnery. In pre-industrial England, these skills were sufficiently difficult to be known as 'the misterie' of the turners guild. The skills to use the tools by hand, without a fixed point of contact with the wood, distinguish woodturning and the wood lathe from the machinists lathe, or metal-working lathe.

Items made on the lathe include tool handles, candlesticks, egg cups, knobs, lamps, rolling pins, cylindrical boxes, Christmas ornaments, bodkins, knitting needles, needle cases, thimbles, pens, chessmen, spinning tops; legs, spindles and pegs for furniture; balusters and newel posts for architecture; baseball bats, hollow forms such as urns or sculptures; bowls, platters, and chair seats. Industrial production has replaced many of these products from the traditional turning shop. However, the wood lathe is still used for decentralized production of limited or custom turnings. A skilled turner can produce a wide variety of objects with five or six simple tools. The tools can be reshaped easily for the task at hand. In many parts of the world, the lathe has been a portable tool that goes to the source of the wood, or adapts to temporary workspaces. 21st-century turners restore furniture, continue folk-art traditions,

produce custom architectural work, and create fine craft for galleries. Woodturning appeals to people who like to work with their hands, find pleasure in problem-solving, or enjoy the tactile and visual qualities of wood.

Wood lathes work with either reciprocating or continuous revolution. The reciprocating lathe is powered by a bow or a spring, rotating the wood first in one direction, and then in the other. The turner cuts on just one side of the rotation, as with the pole lathe. The reciprocating lathe may be human-powered with a bow, as well as with spring mechanisms. The reciprocating lathe is mistaken for a primitive technology, when it requires considerable dexterity to operate. Moreover, reciprocating bow lathes are still used to turn beads for the Arabian lattice windows called Meshrebeeyeh that so charmed Holtzapffel in the 1880's .[1]

Continuous revolution of the workpiece can be human-powered with a treadle wheel, or achieved with water, steam, or electric power. The style of cutting does not have the pause required by the reciprocating lathe's rotation. Even with continuous revolution, however, the turner controls the contact of tool and wood entirely by hand. The cutters are not fixed, nor advanced automatically, as with the metal-working lathe.

The nature of wood defines woodturning techniques. The orientation of the wood grain, relative to the axis of the lathe, affects the tools and techniques used by the woodturner. In spindle turning, the grain runs lengthwise along the lathe bed, as if a log were mounted in the lathe. Grain is thus always perpendicular to the direction of rotation under the tool. In bowl turning, the grain runs at right angles to the axis, as if a plank were mounted across the chuck. When a bowl blank rotates, the angle that the grain makes with the cutting tool continually changes between the easy cuts to two places per rotation where the tool is cutting across the grain and even upwards across it. This varying grain angle limits some of the tools that may be used and requires additional skill from the turner.

Moisture content affects both the ease of cutting wood and the final shape of the work when it dries. Wetter wood cuts easily with a continuous ribbon of shavings that are relatively dust-free. However, the wet wood moves as it

dries. shrinking less along the grain. These variable changes may add the illusion of an oval bowl, or draw attention to features of the wood. Dry wood is necessary for turnings that require precision, as in the fit of a lid to a box, or in forms where pieces are glued together.

The character of the wood creates other challenges for the woodturner. Turners of hardwoods and ivory select different tools than those used for cutting softwoods. Voids in the wood require higher lathe speeds, fillers, or extra safety precautions. Although other woodworkers value tight, straight grain, woodturners often search out the unusual wood from roots, defects, or diseased portions of trees.

The craft of woodturning is preserved and advanced by a community of practitioners. Until the 1970's, an apprentice system in the U.K., and Industrial Arts education in the U.S. preserved many of the traditional skills of the craft. Between 1975 and 1985, industrial arts teachers, hobbyists, artists, collectors, and tool suppliers developed the symposium format for exchange of information about the craft.[2] This community was a kind of prototype for the artisan-based maker culture active in the 21st century. The community organizes regional, national, and international symposiums, publishes journals, and hosts travelling experts at club events. Most publications and DVD's are of the DIY variety, including numerous YouTube videos.

Contents

History

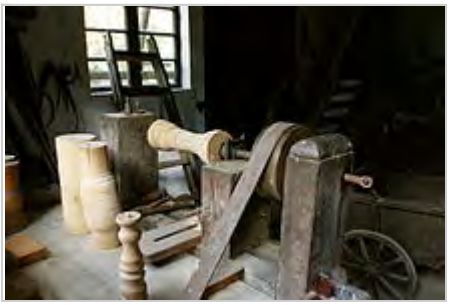
Pole lathe

The archaeological record of woodturning is limited to illustrations because wood is a fiber prone to rot. Egyptian monuments illustrate a strap used by a helper to rotate the lathe while another worker cut the wood. Early bow lathes and strap lathes were developed and used in Egypt and Rome.[3] The Chinese, Persians, and Arabs had their own variations of the bow lathe.[4] Early lathe workers would sometimes use their bare feet to hold cutting tools in place while using their hand to power the lathe. Bow lathes continue in use right up to the present day, and much of our information about them comes from watching turners use them.[5] Between 500 and 1500 A.D., turned wooden vessels served as the everyday bowls and cups of most of the population of Europe. Our knowledge of these humble vessels comes from bowls excavated from shipwrecks, such as the Mary Rose and the Oseberg burial ship, or dug out of deep wells, where they were preserved in a nonaerobic environment. Much of this ware was turned from green wood on a spring pole lathe.[6] Finely crafted drinking bowls, known as Mazers, were produced in very limited quantities from dry wood, then decorated with gilded rims.[7]

As early as 1568, a separate fly wheel powered a lathe via a drive belt.[8] A master would cut the wood while an apprentice turned the crank on a huge wheel, often several feet in diameter. This was a continuous revolution lathe, which led to adaptation to external power sources such as water, steam, and electricity. This lathe evolved into the 'queen of machine tools' which made it possible to turn parts for other machinery.[9] The Holtzapffels developed ornamental turning lathes from the continuous revolution lathe combined with

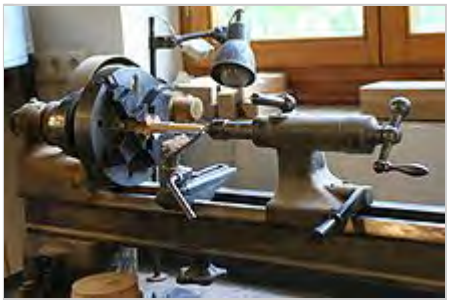
metal-working innovations like the automatic slide rest. These lathes worked from geared patterns to cut designs in hardwoods such as ebony. They were favored as a hobby by European princes, meriting a mention by Tolstoy in War and Peace (1869).[10]

Woodturners in London organized into a guild as early as 1310 on Wood Street. By 1347, the Turners Company was assigned responsibility for regulating weights and measures by the Mayor.[11] By 1591, they built their own Hall. The Company governed the apprentice system, and established pricing for goods. In 1604, they were incorporated as the Worshipful Company of Turners of London.[12] Outside of London, the craft was decentralized and unregulated. Itinerant turners known as Bodgers set up temporary pole lathes near the source of wood for turning furniture parts.



Belt driven lathe

In the 19th and early 20th century, woodturners in England worked in Turning Shops,[13] usually within the master-apprentice system. In Germany and Russia, woodturning was concentrated in villages which had a specialty, such as turning toys. Bow lathes and pole lathes continued in use for decentralized, one-man production of architectural elements and bowls in many parts of the world. In the US, woodturning was part of the curriculum of industrial arts taught in public schools—often a prerequisite for classes in building furniture. The 'problems' from textbooks included both tool management skills, and assignments to turn objects such as gavels, darning eggs, boxes, trays, candlesticks, lamps, and legs for furniture.[14][15]



Electric lathe

Woodturning skills were used by patternmakers in the making of prototypes and shapes for casting molds used in foundries during the 19th and 20th century. They worked very slowly to achieve precision, using enormous patternmaker lathes and slow-cutting scraping tools.[16]

Woodturning has always had a strong hobbyist presence. In the 1970's, an explosion of interest in hobby woodturning in the English-speaking world sparked a revival in the craft. Dr. Dale Nish travelled to England to recruit teachers, tools, and techniques from the last of the apprentice-trained woodturners.[17] A few years later, Canadian Stephen Hogbin spent a year in Australia, pushing the limits of the craft through changes in scale and design.[18] Industrial arts teachers used their institutional affiliation to create seminars, publish books, and foster research. The tool industry identified a new market for lathes and turning tools. A small group of serious collectors invested in the increasingly sculptural explorations of woodturners. It is unusual that woodturning never established a strong foothold in university departments of art and design. Instead, practitioners of the craft have become adept at learning from demonstrations, private classes, regional meetings, their own published journals, and internet technologies. Some artists began as woodturners, and moved into more sculptural work, experimenting with super object forms and other fine craft concepts.[19] The Center for Art in Wood, founded in 1986 as The Wood Turning Center, houses a collection in Philadelphia with over 1,000 objects from international artists [20] as well as a research library and gallery.[21] Other turners have chosen an artisan-based focus on traditional work, custom work, and the pleasure of studio practice.

Techniques

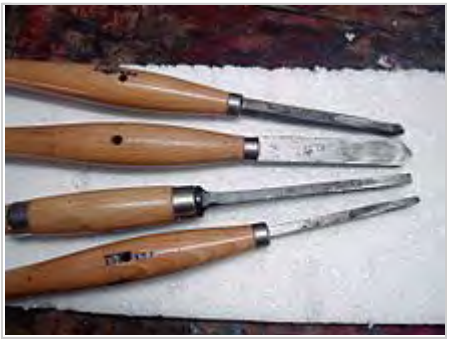
Complex forms made on a wood lathe develop from surprisingly few types of cuts: parting, planing, bead, cove, and hollowing. Parting separates the wood from the holding device, or establishes depth cuts. Planing is done with a tool in which the bevel below the cutting edge supports wood fibers, just as in a typical wood planer. Beads are a convex shape relative to the cylinder, and

coves are a concave shape. Hollowing techniques are a combination of drilling and scooping out materials. The woodturner is at liberty to choose from a variety of tools for all of these techniques, and the quality of the cuts improves with practice wielding the tool selected. Turners rely upon three points of contact making any type of cut: the tool presses down on the tool rest, and against the woodturner's body before contacting the surface of the wood, most often with a bevel edge riding the surface of the wood. The objective is to position the tool correctly so that the wood comes around to the cutting edge, generating a thin shaving without chipping or tearing out sections of the wood. Woodturners prefer to use very clean cuts to minimize the time spent with abrasives. When it is necessary to sand the piece, they do so on the lathe, using abrasives held by hand, in an inertial sander which revolves with the wood's own rotation, or with power tools--drills or right-angle drills. The lathe also becomes a useful holding device for carving, burning, texturing, coloring, and finishing the form.

Holding devices

The wood rotates between the headstock of the lathe which includes the drive mechanism and the tailstock support, which only rotates if its center is 'live' or supported by a rotating holding device. The headstock end may use points or spurs which are driven into the wood. This type of turning is described as 'between centers.' The headstock spindle may also use a cup, collet, or a scroll chuck to hold a tenon on the workpiece which will be removed in the finished product. The wood can also be screwed or glued to a faceplate--a strong disk that is threaded to mount on the headstock's spindle. The use of a chuck or faceplate allows the woodturner to forego tailstock support for the rotating wood. This type of secure holding system is essential for hollowing bowls or hollow forms.

Tools



Gouges for woodturning

Turning tools are generally made from three different types of steel; carbon steel, high speed steel (HSS), and more recently powdered metal. Comparing the three types, high speed steel tools maintain their edge longer, requiring less frequent sharpening than carbon steel, but not as long as powdered metal tools. The harder the type of high speed steel used, the longer the edge will maintain sharpness. Powdered steel is even harder than HSS, but takes more effort to obtain an edge as sharp as HSS, just as HSS is harder to get as sharp as carbon Steel.

A gouge in use

Woodturning tools must be sharpened more frequently than other edged woodworking tools to maintain a clean cut because the wood passes at great speed. Sharpening is usually accomplished with the aid of mechanical devices such as powered sharpening wheels and abrasives. This sharpening process requires either skill of the craftsman, or one of the many available sharpening jigs, which facilitate maintaining a specific bevel on the tool. As with any mechanical sharpening method, overheating or blueing is a danger to be avoided as it will ruin the steel's temper, rendering the steel too soft to maintain a sharp edge. When this happens, the blued area must then be ground away to expose fresh steel and the tool must then have the bevel reestablished and the edge re-honed. High speed steel is not prone to blueing (overheating) whereas carbon steel blues easily, requiring frequent quenching in water or oil to avoid losing temper.

Types

- roughing gouge - a wide fluted gouge used to initially round a wooden spindle, and to roughly shape it. Generally not intended for cutting end grain due to the large cut it takes and the relatively weak tang connecting the blade to the handle. Unsafe for making bowls or any faceplate work.

- spindle gouge or detail gouge - a shallow fluted gouge used to create details on spindles, including beads (raised portions of the turning typically semi-circular in cross section) and coves (relieved portions of the turning).
- bowl gouge - a deep fluted gouge used to turn the outside and inside of bowls and vessels. Often has a thicker shaft and longer handle than a spindle gouge because it has to cut farther away from the tool rest and deal with the forces of turning a large bowl. Sometimes called 'long and strong' gouge[22].
- skew chisel - a wide, steeply pointed chisel with the edge running at an angle to the length of the tool. Used to smooth flat spindles, cut beads, and add details. Skew chisels are only used on spindle work (never on faceplate work) and are honed after sharpening to create a razor edge.
- parting tool - a pointed tool used to separate (part off) work from the lathe, and to create a straight edge separating large and small diameter sections - wide parting tools also called bedans are used to create evenly sized spindle sections.
- hollowing tool - many different types of tools used to cut out the deep sections of steep bowls, vases and hollow vessels. Often with very long handles, to maintain enough leverage when working in a deep vessel, far away from the hand rest.
- scraper - a tool that scrapes the wood fibres instead of cutting - these are used to smooth off wooden items cut with other tools, and to shape items that are not possible or difficult to shape with gouges. A sharp scraper has a burr at the edge which cuts the wood, only a dull scraper actually scrapes.
- bowl saver - a tool used to core out the inside part of a bowl, allowing the waste piece to be used to create a smaller bowl, and to limit the amount of wood chips created when hollowing out a bowl.
- auger - a drill bit used to drill a hole partway or all the way through a wooden item. For cutting the hole for a lamp cord, or as the first step when hollowing out a bowl or vessel
- chatter tool - a flexible scraper used to add decorative chatter marks to turned items
- wire - a simple wire, sometimes with handles attached at either side, for the purpose of burning lines into the piece with friction.

- there are also several tool types for special purposes, as well as tools that are a combination design of the above tools, i.e. skew/chisel combinations, thread cutting tools, ring cutting tools, medium fluted gouges, etc.

Other techniques

- Eccentric turning - turning a single piece multiple times, upon different axes each time.
- Oval or elliptical turning - turning a piece using an accessory mounted to the headstock that changes the center of rotation of the piece in time with the rotation, so that a cutting tool held in a fixed position on the tool-rest cuts an oval rather than a round path on the workpiece
- Therming - mounting a carrier between centers, and then mounting the small workpiece(s) to the carrier, so that the axis of the headstock/tail-stock does not pass through any of the workpieces, and each workpiece gets cut only on one face. As noted in *Wood-turning Methods* by Mike Darlow, the etymology of the term "therming" comes via a corruption of the name of the Greek god Hermes, who was often represented as a statue set atop a plinth with a construction characteristic of thermed work.
- Segmented turning - a method of woodturning where the wood blank is constructed from many individual pieces of wood (segments) which are glued together before being turned. Many interesting patterns can be generated through the process of gluing and shaping on the lathe.
- Green or wet turning - turning wood while its moisture content is above equilibrium. Often done when the wood is newly felled. May be turned to finished thickness, in which case the differential shrinkage of the wood will result in a finished piece that is not perfectly round. Alternatively, it may be "rough turned". Rough turning involves turning the piece only to its general shape, leaving enough thickness so that after turning it can be allowed to dry to equilibrium moisture content and distort. The advantage over first drying the wood then turning is that a rough turned piece dries faster, will probably distort instead of split as solid wood tends to, and that wet wood turns better, since it creates less dust. Rough turning is inexact science: turning wood too thick will lead to splits, turning wood too thin will lead to distortion that cannot be removed, because not

enough thickness is left. Once dry, it is mounted on the lathe a second time and turned to its final form. Rough turning is typically used on most functional work and some artistic pieces.

- Natural edge work - pieces which include the outside of the tree trunk or limb as the edge of the piece. Typically artistic turnings, usually bowls or hollow vessels, and usually green turned to final dimension. May include the bark or not, but pieces with bark should not have any bark damaged or missing.
- Ornamental turning - also known as OT, a method in which the piece is mounted upon a rocking headstock, and a spinning tool is used to cut out exotic and decorative patterns. The device is called a rose engine lathe

Safety

When woodturning, it is important to wear certain personal protective equipment (PPE). Loose clothing should not be worn, all jewellery should be removed, and long hair should be tied back. Wood shavings generated during turning will also need to be periodically removed.

- **Eye protection** is a necessity when woodturning. There are several PPE available for eye protection such as safety goggles, glasses and visors, some of which feature built-in respirators. Although all of these are adequate, for the highest level of protection, a visor that protects the entire head from dust and debris should be worn.
- **Respiratory equipment** and Dust collection systems are also important when woodturning or doing any type of woodworking that creates dust. This can range from a simple disposable dust mask, to a full face helmet with built in respirator. Most stand alone respiratory equipment will interfere with dust shields and visors, so devices that incorporate both are available. Many woods create dust that is actually a health hazard. For example, cocobolo (granadillo) dust is known to be toxic (toxic shock). Many people are sensitive to oils carried in walnut, locust, and oak sawdust. Long term exposure to fine wood dust has also been linked with an increased risk of developing cancer.

- **Ear protection** Compared to other power tools, a lathe is a quiet machine. Ear protection should be used if noise is excessive, this may be due to motor (fan) noise from a shop dust collector, or the combination of wood and tool being used.
- **Hand/Skin protection** Gloves should not be used with rotating equipment, since there's always a risk of getting tangled in the machine. Nevertheless, some woods provide splinters that not only puncture skin, but also cause festering sores and/or skin irritation. Polishes and finishes used in woodturning can also be harmful or irritant to skin, often containing organic solvents such as methanol, turpentine and toluene. This subject continues to be debated in the community.
- **Foot protection**. Protective footwear, often leather steel-toe boots, is required for any type of shop activity.

A good way to check the safety before starting the lathe is 'SAFER':

- S - Speed - check the rpm speed, slower for big, heavy things, faster for smaller lighter things. Most authors recommend always starting at slow speeds and re-setting speed to low at end of session.
- A - Aside - make sure you are standing to the side of the blank's 'firing line' (not in front of the wood).
- F - Fixings - check that the wood, tool-rest, tail-stock etc. are correctly attached.
- E - Eye protection - make sure you're wearing sufficient eye protection.
- R - Revolve - Check that the wood can turn around without encountering any obstructions, such as the tool rest, by rotating it by hand.

Safe usage of a lathe also depends on the operator's choice of proper techniques for the lathe, tools, and wood. For example, using a high spindle speed with an unbalanced wooden blank may cause the lathe to vibrate dangerously. Spinning a large turning blank too fast may cause it to explode. Inappropriate use of tools such as gouges and skew chisels can cause a *catch*, where the tool bites suddenly and aggressively into the wood in an uncontrolled manner. This exerts very large forces on the wood, the tool, the lathe and the operator, often causing the wood to break apart or tear free from the lathe. Lathe accidents often pull the tool out of the operator's hand and

throw them in unexpected directions. Particular care is also required for wooden shapes that are not circular, such as off-center work, or bowls with wings or square rims. Portions of the turning extend farther from the axis of rotation, and are sometimes more difficult to see than the bulk of the wooden blank.

See also

- Turning
- Wood as a medium
- Lathe
- American Studio Woodturning Movement
- Holtzapffel
- Pole lathe
- Worshipful Company of Turners
- American Association of Woodturners
- Ornamental Turning

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4. Holtzapffel (1975), p. 5.
5. Wood (2005), p. 13.
6. Wood (2005), p. 59-98.
7. Wood (2005), p. 99-110.
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9. Woodbury 1963, p. 132-140.
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External links

- Ornamental Turners International (http://www.ornamentalturners.org/)
- Ornamental Turning (http://ornamentalturning.net/)
- The Irish Woodturners' Guild (http://www.irishwoodturnersguild.com/)
- The Dublin 15 IWG Chapter (http://www.craobhcuigdeag.org/) - Craobh Cuig Deag
- The American Association of Woodturners (http://www.woodturner.org/)
- Association of Woodturners of Great Britain (http://www.woodturners.co.uk/)
- The National Association of Woodworkers inc. New Zealand (http://www.naw.org.nz/)
- The British Woodturners Association (http://www.britishwoodturners.co.uk/)
- The Register of Professional Turners (http://www.registerofprofessionalturners.co.uk/)

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