A brief manual for building an Estonian dugout canoe

Priit-Kalev Parts
Illustrations and photography by Juha Sven Korhonen

Raw material

To make an Estonian dugout canoe, a straight and healthy aspen trunk (*Populus tremula*) is needed: 5 m length minimum, with a top end diameter of at least 50 cm, 60 cm recommended. There are records of dugouts made from linden (*Tilia cordata*) or unspecified species of willow, but aspen is the most common, readily available and safest option. According to biologists, Estonia and Latvia are the best habitat for *Populus tremula* in the world – this might, in part, explain why aspen is mostly used and why Estonia is the westernmost country in Eurasia where dugout canoes are found.

The most important characteristics of a healthy aspen tree are a lack of branches (both living and dead) and fungal fruiting structures (*Phellinus tremulae*) 7–8 m up the trunk from the root of the tree. Branches indicate knots, which will prove difficult to carve and have a tendency to crack, and fungi are an indication of internal cord rot. Unfortunately, cord rot can not be detected with absolute certainty either visually or by test drilling. Cord rot may become obvious after felling or at the worst after considerable amount of carving work.

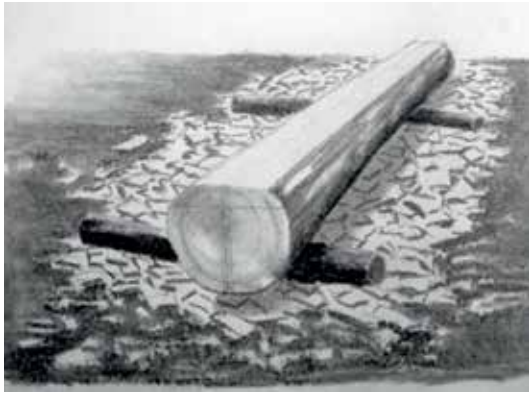
A dugout is made from green wood. Before carving begins, the trunk must be kept green and unpeeled. If unpeeled, the trunk can stay usable for up to three years. In this case, it is advisable to store it away from direct sunlight and to protect the ends with some kind of end-seal if carving is to be delayed.

However, it is most advisable not to delay – to both carve and spread as soon as possible after felling – in order to minimize the checking that occurs as the timber dries.

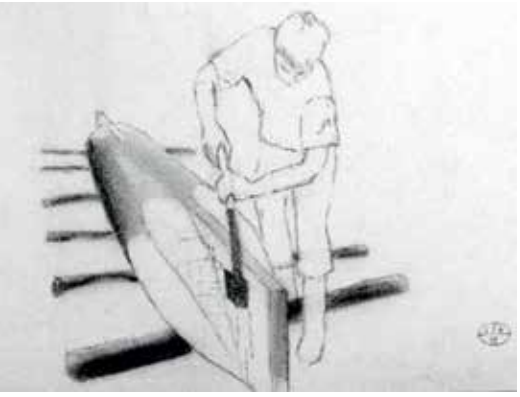
This article was originally compiled as the learning material for the MTÜ Rahvusliku Ehituse Selts (NGO Society of Estonian Native Construction) project "Traditsioonilise ehituse ja puutöönduse õpitoad Viljandimaal" (Traditional construction and woodworking workshops in Viljandi County). The project is supported by the Mulgimaa Development Centre from the LEADER measure. The author is grateful to Alexander Kamelhair for proofreading the English version of the manual, and for his sharp remarks on phrasing and terminology.

Giving a dugout canoe its exterior shape

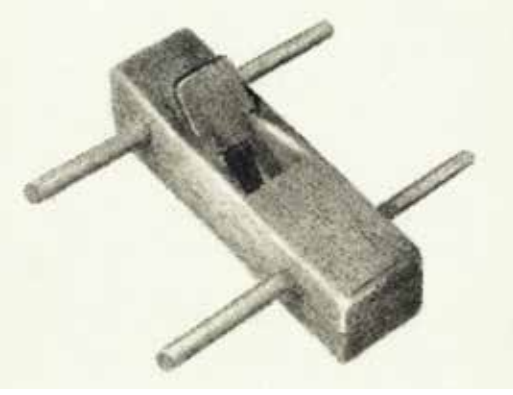
First, the trunk must be peeled using a large drawknife or peeling spud, and all tree-bark removed. From the peeled cylinder of the trunk, one side is removed in order to form the flat bottom of the canoe. Approximately ¼ of the diameter of the trunk should be removed. For this task, a saw and axe are used. To scribe the bottom, a level and soot line (nowadays a chalk line) are used. By orienting the flat bottom first, the canoe-makers are able to carefully select and remove the most irregular or defective side of the trunk, making the whole piece more regular and creating a standard reference for the proceeding steps of the shaping process.



In the next step, the workpiece is given its canoe-like shape. The use of a chain-saw accelerates this process remarkably, but a good axe with a moderately thick blade is still an irreplaceable tool for the job.



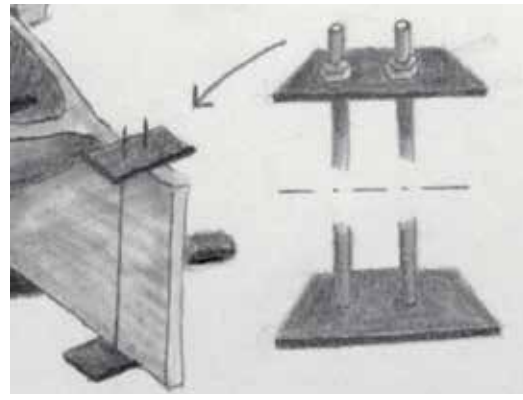
As well, the planks help to impede checking when clamps are installed onto them. Historically, rope and wedges were used for this purpose, and later on, wire or other more advanced iron-made mechanisms.



planer is an option, but such a tool is easily clogged by green wood, and the power cable can get in the way. Instead, a large hand-plane is recommended.

After planing the exterior surface, small holes of 3–6 mm are drilled into the

At both ends of the workpiece, short planks are formed. These planks make it easier to perceive the geometry of the boat to come and finally, when given their finished form, make the canoe easier to steer in water. This shape also provides a convenient grip when turning and lifting during the carving process.

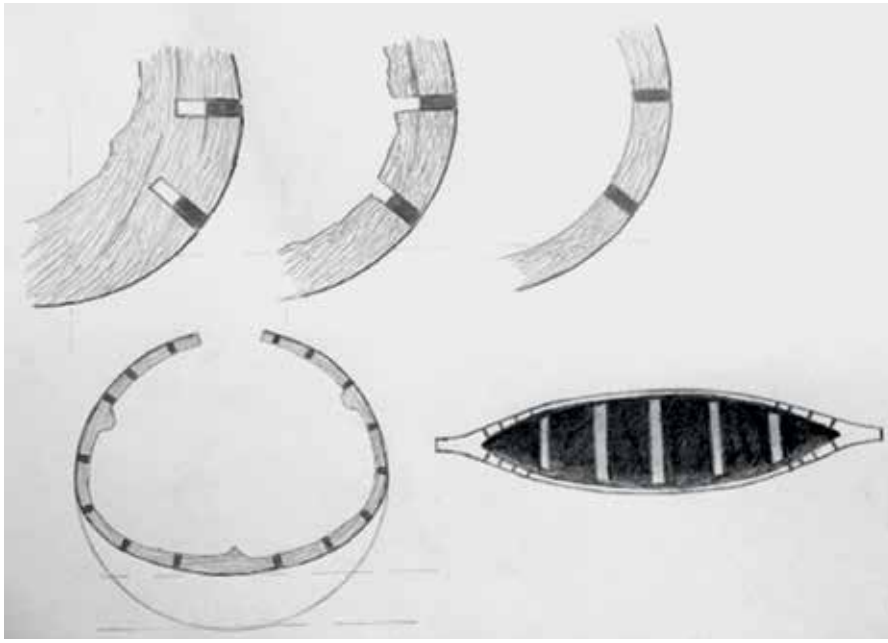


After the ends are shaped, the body of the boat is given an even and symmetrical convex shape. Looking at the workpiece from the ends, the transition from ends to the middle, must be smooth and even – there should not be any concavities, indentations, or low spots. At this stage, any extraneous cuts from the axe are also removed. For this task, an electric

workpiece in a regular layout with distance between the holes about 20 cm in horisontal direction and about 10 cm in vertical direction. Extra holes can be drilled in the ends of the shell because of its more complicated geometry. These holes are necessary for measuring the thickness of the hull while carving the interior shape in the next step.

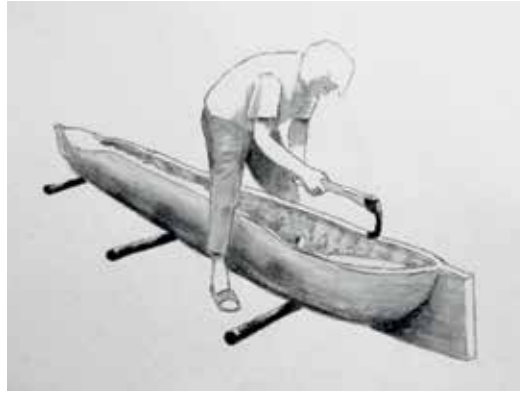
Giving a dugout its interior shape

There are several techniques for measuring the thickness of the hull. Two are presented here for example. In the illustration below, small pegs of coloured or naturally colourful wood are plugged into the drill-holes to signal to the crafter that the correct thickness has been achieved. Another option is to leave these holes unfilled during this step, and instead to measure their depth with an awl or similarly applied measuring tool.



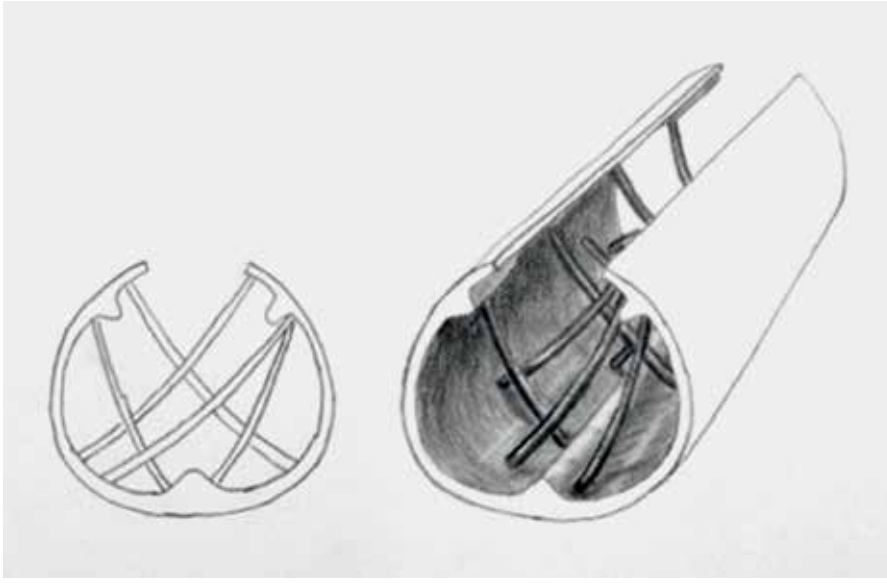
Once the exterior shape has been planed and the measuring holes drilled, the workpiece is turned over so the profile of the rim of the hull can be scribed. Then, the digging out of the inner shape can begin. At first, an ordinary axe is used. Chain-saw cuts can also be very helpful, and the deeper the crafter dares to cut the faster the process is. On the other hand, this can fill the interior of the workpiece with messy sawdust that makes it difficult to perceive where and how to carve most effectively, and there is always a risk of cutting too deeply or even to penetrate the outside of the hull.

At a depth of 20–30 cm the crafters must switch from axe to adze. The kind of adze most suitable for carving a dugout canoe has a horse-shoe-shaped cross-section. This shape enables the crafter to cut "over the corner," and is equally effective both for removing big round chips with powerful chops and for plane-like finishing, or "chiseling." Naturally, plenty of other wood-working tools can be applied to this task, but such an adze remains indispensable. Principally, the dugout canoe can be made using only axe and adze.



At first, digging out the canoe seems a relatively quick process. However, later it becomes tedious and burdensome for the crafter's back to dig out the final few centimeters, especially in areas where it is difficult to reach with the tool. The hull is left 1.5–2 cm thick on the sides, and 3 cm thick on the bottom. In the fore and the stern 10–20 cm of wood is left uncut. The transitions between these varying thicknessness should be shaped smoothly.

On the sides and the bottom of the hull, thicker blocks are left in order to fix the ribs later, which will provide structure and stabilize the canoe's shape. On the bottom, the wedge-like block is left the full length of the canoe in order to prevent the hull from bowing lengthwise or the flat bottom from bending into a concave shape while spreading. This "spine" is also handy for supporting the sticks used for this spreading process.



When the interior shape is ready, the holes are plugged (if the awl-method of measuring thickness is used). For plugging the holes, pegs can be carved from waste material from the same aspen workpiece, or from another soft wood. If convenient, even industrially manufactured pegs can be used. There are many possibilities. The author prefers to use tiny willow branches – the ones that have not yet lignified, but still have a sponge-like pith. Making such willow pegs does require some additional labor, but because of their particularly soft quality, these pegs don't cause cracks in the hull while spreading or later on when the canoe is in use. When finishing the outside of the canoe, tar imbues into them, preventing them from rotting.

Spreading the hull of a dugout canoe

Spreading the dugout canoe takes usually about six hours, but exact duration is unpredictable and dependent on many factors including the character of the particular tree, weather, emergent cracks, and other contingencies. The job itself requires diligence and responsibility, and can be stressful.

A warm and calm day should be chosen. Either one or two long fires are made alongside the canoe, which is placed on two logs to raise it above the fire where the heat is most effective. The author prefers to make just one fire and to turn the work from side to side occasionally. The job is hot and smokey, and working between two fires is much more exhausting. As well, two fires require twice the attention, and the crafters' attentiveness is a crucial resource. On spreading day no naps or lunch pauses can be taken – food and drinking water must be had on site.

Spreading the hull demands plenty of firewood, up to 2 m^3, but it is wise to stock up spare fuel (and time!) for any case. Because re-starting the process on another day would mean thoroughly soaking the canoe and extra waste of fuel (the most effective heat for spreading is generated by the smouldering coal one gets after a few hours of burning the fire), it is ill advised to be under-prepared.

Once the canoe is placed near the fire, several bucketfuls of water are emptied into it and it is left to warm up. Hot stones can also be added to accelerate the heating. After an hour or so, when the water has begun to vaporize, and steam appears, the crafters can begin to wedge sticks into the hull. These sticks are usually white alder or some other "unworthy" brushwood available in the vicinity. Whatever is selected, the sticks must be flexible enough to make constant pressure on the sides of the hull – like springs – without breaking. This pressure must distribute evenly across the length of the canoe, and the sticks should never be pushed in too forcefully.

Little by little, as the hull spreads, the sticks will come loose and drop into the bottom of the canoe as the tension lessens. This means the spreading process has successfully begun. Loose sticks can be used again in the narrower ends or thrown away, but never into the fire – green wood burns poorly and it is unwise to create even more smoke to be inhaled. Extra water is kept on

hand and the hull is wetted regularly in order to minimize scorching and prevent ignition.

Both ends are protected from splitting with "clamps" made of wooden boards (see illustration above). If a crack does occur, these "clamps" will help prevent the crack from spreading to the bottom, where it is more critical and difficult to repair. The "clamps" are kept slightly loose by sliding them towards the ends from time to time, by cutting them wider, or by making new, wider "clamps" altogether.

Smaller cracks will inevitably appear during this process. They should be immediately stopped from propagating with small metal staples, which the author usually makes from old bicycle wheel spokes. If needed, other mechanisms may need be devised to hinder cracking or unwished spreading. The cleverness and ingenuity of the crafter is applied here. Solutions can be improvised from wood, wire, threaded rods, or anything else immediately available.

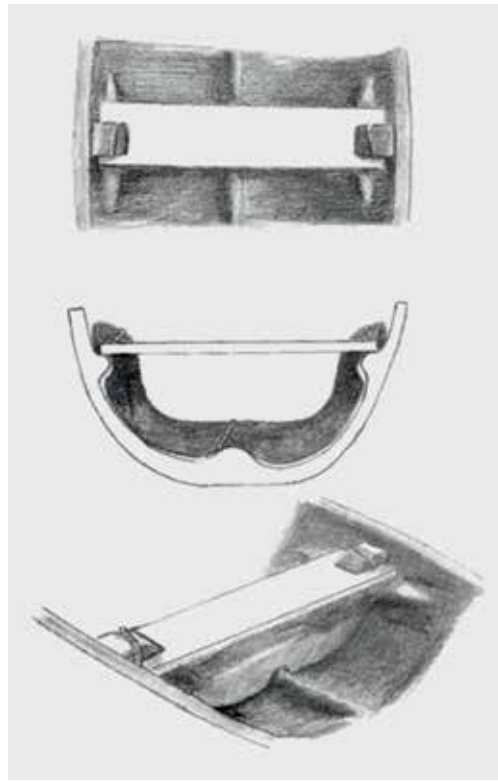
Deciding when to stop spreading can be a difficult choice. Pursuit of perfection can be risky – a dugout canoe is never perfectly symmetrical and at some point the crafters must decide that it is both sufficiently wide and symmetrical enough, and that it is not worth the risk of possible new cracks or splitting the hull altogether.

When the crafters are pleased with the shape of the canoe, the shell is carefully taken away from the fire and placed on two logs to cool and "calm down". The spreading sticks that are still under tension should be left in place, and the tightness of all the clamps and the improvised repairs should be checked. If necessary, extra straps and bindings can be selectively placed, and some sticks nailed or screwed into the rim of the hull and into the "spine" on the bottom. These clamps, sticks, and bindings prevent the hull from either returning to its initial shape or from spreading further. Now the canoe can be left alone for a few days, advisably under shade, protected from direct sunlight.

When the canoe is cooled down and dried in the open air a few days, it should be taken under the roof into a well ventilated, and preferably cool space such as a barn or storage shed. Traditionally, all of the finishing tasks were left for the next spring when the canoe had thoroughly dried and all tensions created during the spreading process had relaxed. This is still recommended.

Finishing the hull into a ready-to-use dugout canoe

After the hull is completely dried and "calmed down," sticks, straps, and clamps can be removed and the inner surface cleaned. The "spine" on the inner bottom surface of the canoe is cut away except where blocks are needed to fix the ribs. Possible cracks can be pulled together or filled. The rim of the hull can be trimmed and planed. Usually, the inner surface also needs some smoothing



and if wished, the hull can be thinned further using an adze, round drawknife, or special round planes. For repairing the cracks, historically linen and tar was used. In contemporary times, polyurethane glue and automastik glue can be used. Still, it is obviously preferable to have as few cracks and fissures as possible, even if some splitting is inevitable.

The planks left on the ends of the canoe should be cut streamline and an iron bar affixed with nails or screws in order to avoid endgrain cracking and to protect the canoe from stones and other unseen obstacles beneath the surface of the water. Alternately, a strip of oak can be glued to the ends instead of iron.

The ribs are usually cut out from fir roots or are bent to shape. The ribs help to maintain the shape of the canoe and protect from loads encountered in usage and transportation. Historically, ribs were fixed with linden-fiber ropes. However, for over one hundred years, metal wires have been used instead. In some regions, wooden pegs or iron nails have been used, but stiff connections are not advisable, since a one tree canoe must have some flex, as it will always be slightly changing shape with temperature, humidity, and load, and stiff joints can cause cracking.

Historically, the Estonian dugout canoe was driven standing or luggage was used for sitting. Modern users generally prefer to sit on seats, since navigating in the standing position requires exceptional balance, practice and skill. The seats are placed onto ribs, in as low a position as possible for better balance. Seats also re-enforce the ribs and offer more possibilities for grip in use or transportation. Usually, one-sided paddles have been used to steer a dugout canoe.

It is recommended to tar the dugout canoe both inside and out. For the outer hull, it is best to use thick, undiluted pine tar and to apply it to the surface hot. For the inner surface, it is preferable to use a mixture of tar and varnish. This will make the surface water resident, but will not stain the passengers. Fortunately, aspen itself is quite resistant to rot, and historically in Estonia the dugouts were not tarred at all, since tar was expensive and it was considered more economically wise to make a new canoe every ten years or so.

Finally, the durability of a dugout canoe depends much on maintenance. It is advisable to put a dugout canoe under the roof for wintertime and other long periods when out of service. A properly and regularly tarred and maintained canoe that is consistently lifted out from the water and turned upside down onto logs after usage can be enjoyed for many generations.

Priit-Kalev Parts (b 1972) defended his PhD at the Estonian University of Life Sciences in 2015, focusing on sustainable community practices in relation to cultural heritage protection. He is the founder and first editor-in-chief of Studia Vernacula, and he has been the groundlayer and long-term head of the Estonian Native Construction programme at UT VCA. Since 2017, he has turned his attention to developing platforms for applied heritage solutions and craft enterpreneurship.

Photo by Tauno Uibo.