Critical Branch Bending

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For the past 30 years I have studied, photographed and collected junipers in the wild. The three most familiar species that I collect are the One Seed, the Alligator and the Utah junipers. (I have repeatedly gone to nurseries looking for good stock as well.) For many of those early years I passed up buying and collecting many trees which had long straight branches or trunks. Most such long straight branches are considered flaws in the general design. Often times, branches might also be on the wrong side or perhaps there might not be a rear branch that completed the 3D design. In this demonstration we will utilize the channeling method as described below.

Like all pre-bonsai material, a close study of the tree was needed to determine the best front. This demo will also show how to approach junipers in general by first selecting the primary live vein to then establish the best front.

One Seed junipers, particularly the female, produce very strong foliage and compact growth, while the mature shoots remain in position. In the demo tree the trunk is straight and too tall and uninteresting. The base diameter is 4.25 inches and the height 37.5 inches. The *jin* that can be seen at the base is also too big and deteriorating, but the most interesting facet of this tree and the main focus is the bulging live red vain framed by the white deadwood. My goal is to create a bunjin by reducing the height by a third to 22 inches, covert the upright style trunk to a slant and reduce the final foliage pads to only the apex of the final design.

At the start I asked: what was it about a tree that gave it the old appearance. With junipers it is the deadwood, and it's often difficult to find the live vein under a layer of bark, since it is not always clear where the veins run and how they are divided.

Exposed live veins are very important in juniper design – the live vein that runs snakelike over the trunk is very important to the overall design. I first studied the tree closely to identify the primary vein and find all the connections between live vein and branches before choosing the front. This was because a front without a visible live vein starting from the base would look like a dead tree and is considered to be a fault. Care was taken when removing two braches because part of the live vein may die back or might have damaged one that needs to be visible from the front of the tree. One of the branches was sacrificed of the preferred option of front for a side that shows the movement of the live vein at its best.

The movement of the live vein was most important and I could not chance the way it ran through the trunk. Tapering a live vein was not important. I followed the cracks in the bark with a sharp knife. Where this are cracks there is a live vein. Once the entire path of the live vein and deadwood was determined then the best front was evident.

Once the front and the path of the live vein was determined, the heartwood of the trunk could be channeled thru the entire predicted bend area. The final width of the remaining live cambium and heartwood is critical to a successful bend. Removing too much heartwood will result in a very un-natural looking trunk and potentially weaken the structural integrity of the remaining trunk. Not removing enough wood will result in an inevitable break. In this case I left approximately 1/4th to 3/8th of an inch.

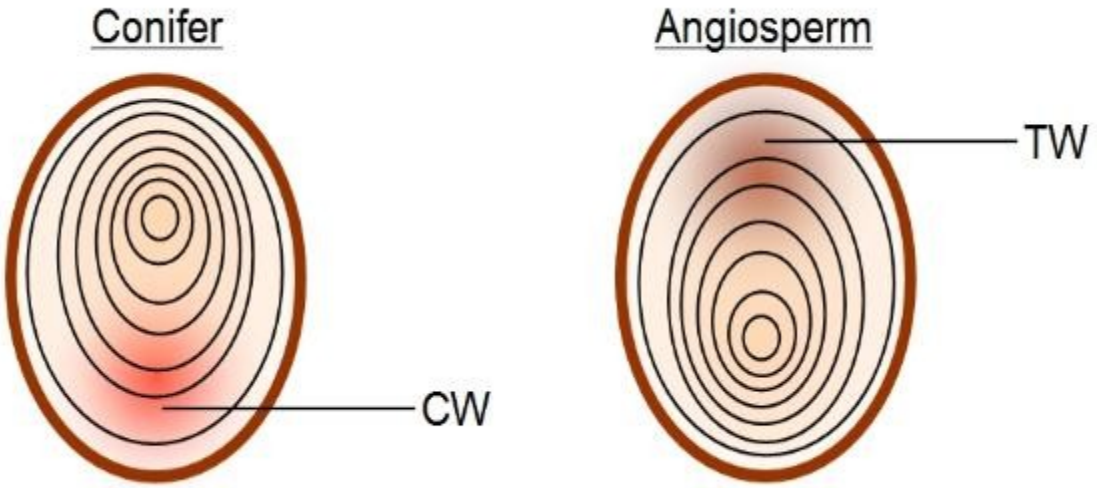
Once the appropriate amount of wood was removed, I placed two six gauge copper wires side by side on the inside of the removed trunk. The wires were held in place by drilling holes in the lower portion of the trunk. Two additional 8 gauge wires were laid above vertical strands of raffia around the outside of the trunk. Raffia which had been soaking in water for 4 hours was then applied horizontally and in the same direction of the anticipated bend, which was applied in 4-5 strand groups very tightly. Once the trunk was completely covered with raffia, a six gauge copper wire was wrapped over the top. A final layer of black electrical tape was applied over the entire surface of the raffia and wire. Now with a bit of gentle and deliberate strength, and listening and feeling the trunk with care, the trunk was bent and given the "S" curving bend to complete the design. The final bend was held in position with a guy wire.

None of the remaining branches were removed at this point and will not be so and wired in position until the bend is determined to be a success. The tree will not be re-potted for 1-2 years until the tips are spiking and the juvenile needles begin to be replaced by mature scale. The raffia and copper wire will be watched carefully to determine that it does not cut into the live wood too severely. The raffia and wire will be removed in approximately 1 year or less.

The following material is a summary of various branch, root, and trunk bending methods as described on the *Bonsai4me.com* website:

Many bonsai artists are looking to develop their trees and in order to do this, they need to manipulate where branches are located and this can be difficult on larger thicker branches and advanced bonsai material. There are certain biological elements of the tree though that will make the bending of branches harder and one of these elements is the formation of reaction wood.

Broadleaved trees and conifers both produce reaction wood and this is wood that is formed when the wood is subjected to mechanical stress and it helps to strengthen the tree to hold the roots, trunk or branches into position. The stress may be as a result of natural forces like gravity, wind, exposure or soil movement and reaction wood is not always visible to the eye but asymmetric growth is a good indicator of this.



Nearly all branches have reaction wood as this enables the tree to hold the branches in place and conifers produce compression wood on the undersides of branches while broadleaved trees produce tension wood on the upper sides of their branches.

Therefore when it comes to moving and bending branches you need to use the various techniques in different locations on conifers to that of broadleaved trees to account for the differences in their wood properties.

Techniques used for bending branches include:

Hollowing out the branches heartwood to make the branch more flexible. This can be hard on small diameter branches and leave scars though and large wounds.

Channeling out the top side (broadleaves) or under side (Conifer) of the branch and this can cause large wounds to be created which the tree is unlikely to be able to seal over.

Splitting either along the sides depending on the movement or bend direction and again on the underside for conifers and topside for broadleaves. The split can be as little as a single scalpel blade width just to release the tension on broadleaves and compression on confers.

Notching where a small notch or wedge is removed from the branch and on Conifers this would be on the underside of the branch and on broadleaves this would be on the topside of the branch.

The easiest and most common way to bend any branch into position is to coil it with aluminum or copper wire, manipulate it by hand and with the aid of the coiled wire, it then remains in its new position.

In some situations, prior to applying the wire it is useful to protect the bark and the wood by using raffia (or similar) to stop the branch cracking or to stop the bark separating from the wood.

However, with all tree species, there is a point where a branch is too thick to physically bend with just the strength of your fingers or there is a danger of the branch (the wood) snapping. For some tree species this can mean a branch as thick as 2.5cm/1" or more and for some species with brittle wood, as thin as just .5mm

Guy wire anchored to a thick root using a single strand of 1mm wire to bring down a Hawthorn branch.

The first technique worth covering in this article is the use of guy wires. Once the thick branch has been bent (either by hand or by using one of the techniques described in this article), it needs to be held into position until it sets. A piece of wire is attached from the newly bent branch to an anchoring point to create a guy wire. The guy wire simply stops the branch returning to its original position.

Various anchor points can be used; another branch on the tree, a jin, a hole through the side of the (training) pot, a thick surface root or even a small brass screw or hook, inserted into the trunk.

A guy wire made from copper wire is always preferred over aluminum for its greater strength and lack of elasticity. Aluminum guy wires can begin to stretch over time, allowing the branch to move slightly out of position.

For aesthetic reasons, try to use the thinnest gauge wire possible. For most situations, 1mm copper wire is adequate though 1.5mm can be necessary when the guy wire requires extra strength.

Guy wires are an incredibly useful bonsai technique. However they do have limitations; guy wires have no control over the shape or movement of a branch and less control over its precise position. The guy wire can only pull a branch in one direction whereas coiled wire allows much greater control and freedom of manipulation along the entire length of a branch. For this reason

The Basic Principle of Weakening Branches in Order to Bend Them

As with a tree trunk, tree branches consist of a live layer of living tissue (immediately below the bark) that surrounds a 'dead' wooden core. The core of a branch (or trunk) exists to provide the branch strength and structure.
This structure supports the live tissues, holding the foliage in position and is strong enough to support the branch so that it doesn't collapse under its own weight, even when snow laden or buffeted by winds.
It is this inner core of dead cells or wood that we are trying to work against when bending a branch. It is also this 'deadwood' that we can weaken or remove in order to bend the surrounding living tissues and therefore, the branch.

There are a number of techniques for weakening a branches' structure so it can be bent; all should be considered 'advanced' and only used with great care and experience. All should be considered risky techniques that can lead to the demise of the branch if care is not taken.

'Notching', 'Hollowing', 'Splitting' and 'Channeling' must only be carried out on healthy trees and vigorous branches that are strong enough to heal and recover from major trauma. The one major downside with these techniques is that they often produce large wounds that may not ever heal over; such wounds should be made so that they are out of sight of the front of the tree and 'dressed' if possible to be made to look like natural deadwood features such as a 'uro' (hollows) or 'shari' (lengths of natural deadwood often seen on coniferous species such as Pine and Juniper).

Timing

The techniques described in parts two and three of this article all cause major trauma to the branch that is to be bent.

The concept held by some enthusiasts that carrying out major work on a tree during the Winter when it is dormant or 'asleep', almost in an effort to 'fool' the tree, is wrong and a little misguided.

If carried out in the early-mid winter when the tree is dormant, the damaged area will not heal until the tree has returned to active growth, weeks or months later. This will leave the wound(s) exposed to frost and further trauma for too long a period.
For this reason, these techniques should always be carried out during the growing season while the tree is in active growth and the threat of frost damage can be kept to a minimum.

For the majority of tree species, the best timing is from midsummer to late-summer or very early autumn when the first frosts are not due for at least 6 weeks.

By midsummer, a tree will have extended the new leaves and shoots of the growing season and will be at its strongest and most vigorous. Work carried out from mid to late summer will allow the tree to heal quickest, reducing the risk of dieback or infection in the tree without interrupting growth.

For resinous coniferous species such as Pine or Spruce, work should be carried out in late summer when sap flow is reduced. For deciduous species that have a tendency to bleed, these techniques should be avoided during early spring before leaf break or bud extension.

Above all else, always try bending a branch with coiled wire and/or guy wires before using these techniques.

Notching

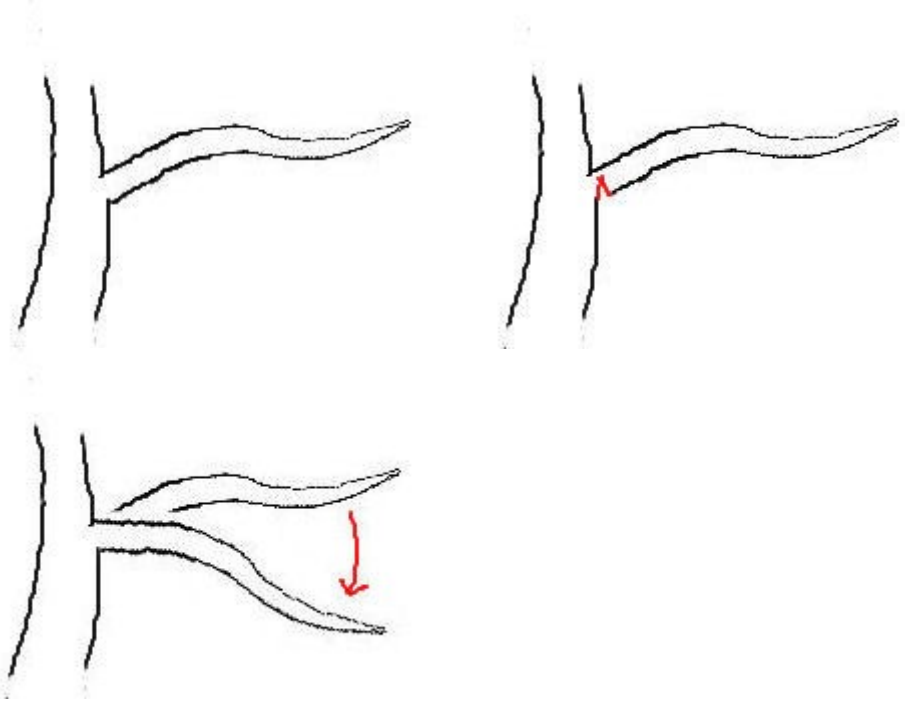
Notching is simply a technique where the branch is cut across its width and the branch is then bent into position.
It is a very quick and straightforward technique to carry out however it has a tendency to produce some callus swelling in the area of the notch.
This technique is also more suited to deciduous and broadleaf species that do not have as strict ‘life-lines’ as conifers (if a life-line supporting a secondary branch and/or foliage is entirely severed on a coniferous species, the live growth can and will dieback).

Branches must be wired or at least guy wired to hold the limb in place while the notch wounds heal and callus. Smear a coat of Vaseline around the exposed cambium of coniferous species or use cut paste on deciduous species.

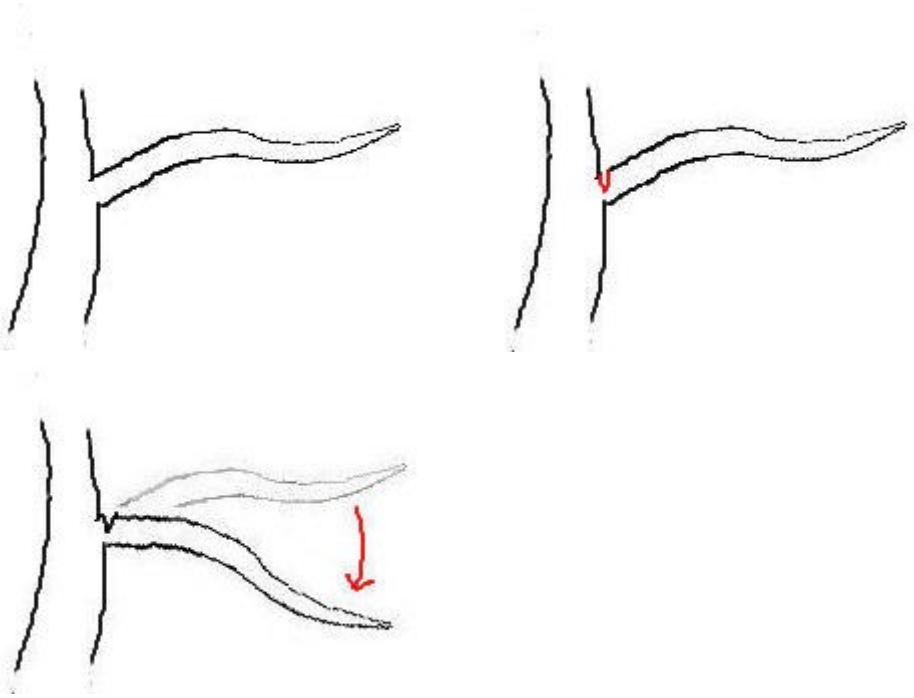
Two angled cuts are made approx. 2/3 of the way through the limb to be bent. If the cuts are not made deep enough, the branch will not bend neatly and cleanly, if at all. The notch is made using a thin saw and should form a triangular shape so that when bent, the two sides of the notch meet; as the resulting wounds callus over, they ‘graft’/grow together.

This image shows the cascading branch of a Hawthorn that has been notched and has since healed over. It also shows one of the disadvantages of notching midway along the length of a branch; the resulting callus formation can create a bulge in the branch. For this reason, a notch made in the middle of a branch should be placed, where possible, so that the notch itself and the resulting wound are invisible from the front of the tree.

Notching is useful for altering the angle at which a branch leaves the trunk of a tree. This can often be difficult to change with just wire alone.



The base of the branch can be notched at the bottom and can then be pulled downwards with coiled wire or guy wires. The sides of the notch are pulled together and they will eventually heal together.



Some enthusiasts prefer to notch above the base of the branch, rather than below. This leaves the notch open and visible until the notch calluses over and fills out the gap.

Ultimately. Either method works reasonably well and should probably be used according the attributes of the plant species it is applied to; some species are slow to form sufficient callus to fill in the notch and a bottom notch is preferable.

Notching can also be useful for bending thick roots. There are occasions where a bonsai will not fit into its intended bonsai pot because of a thick lateral root. If removal of the thick root may threaten the health of the tree, it can be partially severed with a notch instead and bent so that it then fits inside the pot.

The notched area will often callus and produce new roots during the course of a growing season. The thick root can then be pruned back to these new feeder roots at the next repotting. This allows a tree to be fitted inside an otherwise appropriate-size pot and also allows the tree to slowly adjust to the removal of a major root.

Hollowing, Splitting, and Channeling:

Channeling

Hollowing and Channeling involve removal of some of the wood in the center of the branch that needs to be bent. This can involve removing a channel of wood from along the length of the branch, or the creation a hollow so a sharp bend can be made in a small area of the branch.

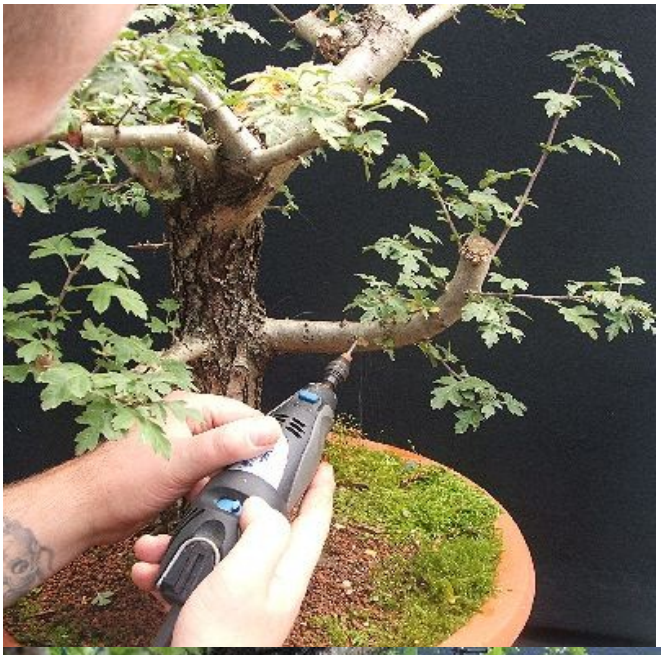
The above image shows the branch of a Perovskia atriplicifolia (a rarely used species for bonsai, similar to Lavender or Rosemary). The wood of Perovskia is very brittle; this 1"/2.5cm diameter branch was too straight and was what is termed as an 'eye poker', that is, it grow straight out into the eyes of the viewer!

Before channeling, bending the branch would have been impossible without snapping it. So a deep channel or groove was carved out of the branch to make it much thinner and more pliable. As can be seen, it was then possible to wire and move the channeled branch.

Consideration must be given to the resulting scar. With this particular example, the channel in the branch will not heal over and will always be visible. However, the tree features many shari and jin already and so the channel can be said to complement the overall design. An alternative would of course have been to make the channel underneath the branch so it could not be seen from at least the front view.

Hollowing

The first branch of this Hawthorn required some movement to be added to break up the long, straight section and to bring down the tip of the branch. As a short abrupt bend was required and a long wound (caused by Channeling) needed to be avoided, the branch was hollowed.



(Seen from the reverse side) To hide the resulting wound, the hollow was made at the back of the branch using a Dremel with a small router bit. As much as possible of the interior wood was removed without damaging the cambium layer.

Having finished the hollowing, the branch was easily bent downwards using two guy wires to position the branch precisely.

(Seen from the front view) After the branch had been positioned, the hollow was filled with sphagnum moss and bound tightly with black plastic tape. This will help insulate the wound through the winter.