Reed Making Notes: Selection of Gouged Cane

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[On page 63 of the Winter 1991 issue of *The Double Reed*, Prof. Cooper's article entitled *Reed Contribution* states "The drawings are to full scale." This statement is incorrect, as Prof. Cooper's original copy was necessarily reduced to 7/9 scale to fit the octavo format of the I.D.R.S. publication. However, all numerical values for the drawings are accurate as given.

Secondly, page 59 of the same issue indicates that the *Reed Contribution* article was the "first of two installments," when in fact the article was printed in its entirety within the Winter 1991 issue.

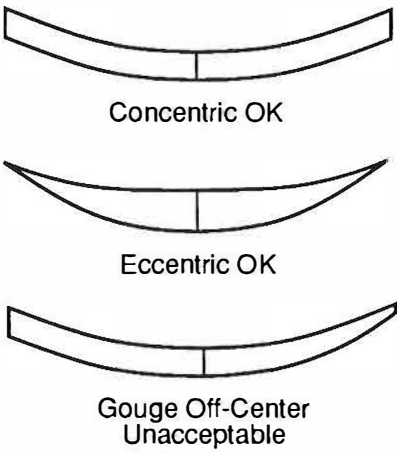
As a result, to fill the copy void, created by this misunderstanding, Prof. Cooper has graciously consented to the publication of an additional chapter of his new book entitled *Bassoon Clinic Series*, now being final-edited by Prof. Avery. As previously indicated, each of the book's chapters will relate to a specific topic and, in essence, are refined examples of the Lecture notes distributed over the years by Prof. Cooper during his varied clinic sessions. Publication of *Bassoon Clinic Series* is anticipated within a year. *Reed Making Notes, one* involving "Selection and preparation of gouged cane" is printed here with the kind permission of its authors who remain sole owners of its contents. ED]

Selection of Gouged Cane

1. The most costly element in reed making is time! Every effort should be made to eliminate those pieces of cane that show little promise of producing acceptable finished reeds. Cane with the following visible faults should be discarded before valuable time is wasted processing flawed pieces that offer little chance of success.

   A. The grain should be straight.
      1. Look at the gouged surface. Does the grain run true from end to end? If not, discard any pieces with major deviation.
      2. Lay the gouged cane on a flat surface. Is the surface of the shell/bark (epidermis) in contact with the test surface from end to end or is it convex like a rocker or concave like an arch? Unless reasonably straight, discard.

   B. The gouge thickness should be symmetric.
      1. End to end thickness, as measured down the center line with a dial indicator or cane gage (gauge), shouldn't vary substantially more than .05mm (002"). Even this variance should be corrected during the initial sanding process. If the discrepancy is much greater, and many commercial gouges are, don't waste your time trying to produce a reed from the flawed cane, unless the problem(s) can be easily corrected.
      2. Even more critical is the side to side symmetry of the gouge. Whatever the intended design contour (e.g., eccentric, concentric, reverse eccentric, etc.), the gouge measurements should be the same at equal distances from the center line of the cane.



Note: The gouge thicknesses are somewhat exaggerated.

Deviations of .05mm (002")* or more are unacceptable unless correctable by sanding or scraping.

**Note:* .05mm (002") represents slightly less than the thickness of a sheet of legal pad paper.

Also — There are types of mutated gouges that are intentionally made asymmetric in either or both lateral and longitudinal dimensions (e.g., Mechler [Moechler]

asymmetric gouge, etc.). [See "Gouge": Other Observations]

C. The contour and thickness should be consistent from piece to piece.
   1. Each reed type requires a specific gouge contour and thickness.
      a. Excellent reeds can be produced from a variety of gouge contours and thicknesses, but each change in gouge requires accommodations in other design areas to achieve the desired resultant.
      b. All else remaining constant, if the gouge contour and thickness varies from piece to piece, each reed produced will be different in nature.
   2. Using a cane gage or preferably a *dial indicator*, check each piece of cane for consistency of both lateral and longitudinal thickness. Deviations of more than .05mm (.002") under "normal" dimensions should be discarded; however, the canes that are too thick can be sanded or scraped down to the desired measurements. Only use those pieces that conform closely to your personal design requirements.
   3. Inconsistent gouges result in inconsistent reeds!

D. Pieces with discolorations in the woody (parenchyme) portion of the cane should be avoided.
   1. Pieces with a slight overall greenish cast may be stored in a ventilated area to cure for several months before using.
   2. Those having darker greenish areas probably won't respond to additional curing and should be discarded.
   3. More concentrated green to black spots usually indicate fungal growth in the woody (parenchyme) portion of the cane and should be discarded.
   4. Thin dark lines visible in the vascular tubes indicate that mold has already invaded the cane and will soon destroy it.

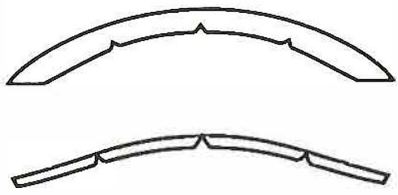
   **Note:* Discoloration of the shell/bark (epidermis) ranging from light brown flecks to extensive purplish areas is normal and does not affect the cane's quality. In fact such discoloration is proof of the cane's maturity, as it is a resultant of a certain fungal growth in the dead wrapper leaves of mature cane. All cane with a mottled discolored shell/bark (epidermis) is mature; however, all mature cane is not necessarily mottled or discolored.

E. More subtle color gradients of the woody (parenchyme) surface offer insight, to the experienced eye, as to the cane's relative hardness.
   1. Pieces with a brownish cast have a high mineral and/or sap content and usually are very hard.
   2. Very white cane can be excessively soft and pithy in nature.
   3. Cane ranging from a rich cream color to a light yellow represents a middle ground and usually produces the best results.
   4. With experience one learns to recognize the characteristic color of the cane that works best for you.

F. The cane's maturity may also be judged by observing the layer of dense "sap wood" (dermis) immediately beneath the shell/bark (epidermis.) In mature cane this layer is a rather intense shade of orangish-gold easily visible when looking at the end grain of gouged and/or shaped cane.

G. Mature, well-cured cane breathes.
   1. Air can be drawn through the end grain of gouged cane.
   2. Air can be blown through to the vamp of profiled and shaped cane producing minute bubbles on the blade's surface when immersed in water.
   3. The degree of porosity offers additional insight when judging the density of the cane.

H. Major imperfections in the surface of the gouge that cannot be remedied by sanding or scraping should disqualify the piece of cane.
   1. A major groove down the inner surface of the gouge will ultimately become a cracked tip as we scrape through to it while seeding finished measurements at the tip.



   All the time and energy previously spent bringing the reed to a finished stage is wasted as the inner groove(s) becomes a crack. Discard or correct the flawed piece *before* you make a blank out of it.
   2. Small imperfections can be sanded out, but excess sanding to remove the deeper flaws thins the gouge to an unacceptable level.
   3. Piles of fibers rising above the gouge surface must be removed by sanding or scraping to assure success with the finished reed.

II. Many other more sophisticated methods of cane selection may be utilized.

A. Flexing the cane, by twisting it laterally with your fingers, to ascertain its relative hardness is rather accurate with experience.

B. Observe the vertical float level of the cane when a dry piece is carefully immersed in a glass of water.
1. Deeper = Denser = Harder
2. Shallow = Less Dense = Softer

C. Water absorption rate of wetted cane.
1. Useable cane should sink after being immersed in water for one to three hours.
a. Faster Rate = Harder
b. Slower Rate = Softer
2. Cane that sinks appreciably sooner than one hour is too hard.
3. Pieces that remain buoyant substantially longer than three hours are too soft.
4. Individual reed making concepts will determine mid-range preference but in general either extreme should be avoided.

D. A pitch is produced when a piece of dry gouged cane is dropped shell/bark (epidermis) side down on a hard flat surface. *Note:* Pieces must be uniform in width, length and thickness for this test to be valid.
1. High Pitch = Harder
2. Low Pitch = Softer

E. Thumb nail pressure indent (in an area that won't become a part of the finished reed).
1. Deep Groove = Softer
2. Shallow Groove = Harder
3. In addition to the indent test on the gouged surface a shell/bark (epidermis) that is easily marked with a thumb nail is an indication that the cane is too soft.

F. Use of a mechanical gage, such as a Rockwell Superficial Hardness Tester, that measures penetration of a probe finger under a given pressure, may also be used to determine the relative hardness of the material.

G. Use of a mechanical gage that measures the relative flexibility of cane by suspending a given weight from a clamped piece of cane while measuring the degree of deflection may also be employed.
**Note:* Articles describing such mechanical gages and their usage in detail have appeared in various issues of The International Double Reed Society's publications. See, *Index of Articles in I.D.R.S. Publications* compiled by Dr. James C. Prodan, Librarian, School of Music, University of North Carolina at Greensboro, Greensboro, NC 27412-5001.

III. Finally, while it is the personal preferences of each individual reed maker that determines the relative merits of hard vs. soft cane, thin vs. thick gouge, eccentric vs. concentric contour, etc., once the parameters of personal choice are established the consistency and accuracy of the cane and gouge are of vital importance.

A. Ideally, gouge your own cane selecting only the observably better pieces for your own use, •r

B. Purchase gouged cane only from reliable sources.
1. Although cost is not a valid criterion of the cane's quality, it is better to pay a little more if it will insure higher quality.
2. Obtaining cane from one source helps to insure that the gouge contour will remain reasonably consistent from shipment to shipment.
3. If the vendor offers various options of gouge contour, cane thickness and length, always specify your known preferences when ordering. Even minor differences in these basic dimensions will have a profound effect on the final results of your reed making efforts.
4. Even when ordering cane from a single reliable source the given quality of cane can vary considerably between widely spaced shipments.
a. Cane, like wine, from the same grower, will vary in texture and quality from year to year, depending on variable growing conditions. So,
b. First order a small quantity to test the "vintage" then,
c. If pleased with the results, ascertain if more of the same batch is available; if so immediately place a large order before the vendor's supply is exhausted.
d. Cane will keep for many years if protected from exposure to direct sunlight and extreme humidity. In fact if stored in a well ventilated area it will usually improve over the first year or two of storage.

C. In conclusion, it is not the intention of the author to imply that all of the above test procedures be utilized to evaluate quality. However, a sufficient number of inspection procedures should be utilized to insure that you eliminate canes not adaptable to your reed making process. If you are serious about reed making and regardless of whether you are gouging your own or buying processed commercial cane, don't hesitate to discard any and all pieces that fail to meet the strictest qualitative inspection. Realistically, the author expects only 20 to 25% of the canes to meet all criteria.

Preparation of Selected Gouged Cane

I. Sanding the inner surface of the gouged cane (parenchyme) serves two important functions.

A. The primary purpose of sanding is to correct the remaining dimensional flaws to insure end to end and side to side symmetry in the gouge contour. Due to the preceding selection process, this corrective procedure should be minimal in nature, unless one wishes to deliberately make major modifications in the type of gouge (e.g., more or less eccentric, concentric, etc.)

1. Use a narrow strip of 220 grit, *flexible back,* wet and dry, emery paper (approximately 12 to 15mm [3/8" to 1/2"] wide). Further break its backing down by drawing the strip, smooth side down, back and forth several times over a table edge.
2. With the strip of now very flexible sandpaper held curved over the pad of your index finger, carefully sand those heavy areas that need thinning. Take care not to disturb the basic curve of the gouge unless incorrect curvature represents the inherent problem.
3. A dial indicator setup (preferably) or cane gage is indispensable for checking the dimensional and symmetrical accuracy of the gouge. Measure the gouge several times before and during this important corrective process.
4. Work first to produce longitudinal accuracy down the center of the gouge. Although actual measurements can vary with different gouge concepts (from a minimum of 1.0mm [0.040"] up to 1.5mm [.055"]), conistency of thickness from piece to piece and end to end should be the goal.
5. After correcting the end to end centerline discrepancies, shift your attention to the lateral flaws. Again, each gouge concept will dictate its own dimensional pattern but consistency of lateral taper (or lack of it) is necessary for optimum results. (A "normal" Sassenberg type contour will taper from a center line 1.27mm [.050"] out to .89mm [.035"] at the width of a shaper tip, approximately 16mm [5/8"] wide.) Different gouges require different values but consistency of the lateral taper is especially important in determining the success of a reed.
6. End to end inaccuracies profoundly affect the reed's mechanical fulcrum, causing a functional imbalance between the two blades.
7. Lateral imbalance directly affects the reed's inner curve and causes off-centered asymmetric tip openings that are not correctable at a later stage.
8. Great care must be taken not to thin the gouge dimensions beneath acceptable limits during this corrective sanding.

**Note:* It is wise to gouge, or order gouged cane, slightly thicker than desired to allow for modification and/or correction of contour.

9. After assuring that the gouge contour and dimensional attributes are as accurate as possible (certainly under .04mm to .05mm [approximately .002"], proceed to the next sanding procedure.

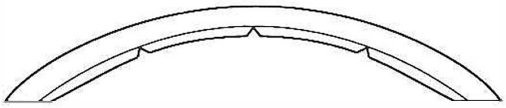
**Note:* The above corrective process can also be accomplished with a cane scraper, such as marketed by Prestini, or the much more sophisticated scraping discs advocated by Louis A. Skinner.

B. The second function of sanding is to smooth the inner surface of the gouge contour.

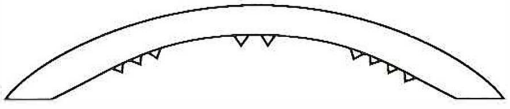
1. Using similar width strips of finer emery paper (400 to 600 grit), sand the entire inner surface of the gouged cane until it is as smooth as a piece of finished furniture.

**Note:* The use of 600 grit paper throughout this process will result in a brighter, less damped sound in the finished reed, while 400 grit will result in a more covered quality.

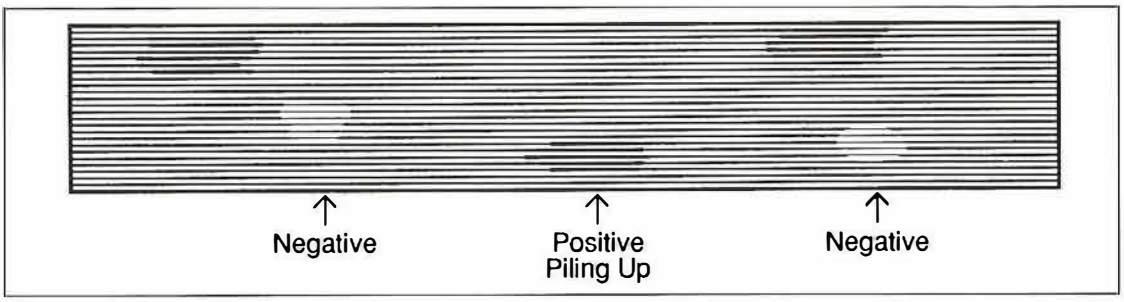
2. This is the inner surface that will ultimately beat together at the tip of the finished reed and any irregularities in this area are equivalent to having chips in the tip of a single reed mouthpice. All surface imperfections, especially in the blade area, must be eliminated at this stage of manufacture.
3. All remaining longitudinal grooves must be sanded out, as they will ultimately turn into cracks in the tips of finished reeds.



4. All raised graining must also be eliminated.



5. Check the inner gouge surface for either positive or negative discontinuity of graining by inspecting the surface, held at an angle, under a strong light source. All grain fibers should run continuously from end to end of the cane without interruption.



Note: The above continuity is valid, unless making a reed type which requires inside tapering and contouring.

a. A positive "piling up" of fibers will inhibit the longitudinal transmission of vibration back past that heavy point in a finished reed.
b. Likewise, a depression that causes a break in fiber continuity will also inhibit longitudinal transmission of vibration back beyond that weak point.
c. Continue to lightly sand until all longitudinal fibers can be seen to run from end to end of the cane without any apparent discontinuities.

C. After each piece of cane has been adequately sanded, both for dimensional accuracy and smoothness of gouge surface, the inner surface should be slightly wetted and the piece laid aside to dry.
1. Using a wetted finger, moisten the inside surface of the sanded cane, wiping off the excess moisture.
2. Lay the wetted cane aside with the wet surface up, preferably under the heat from a light source.
3. Proceed to correctively sand and smooth additional pices of dry gouged cane, wetting each in turn, while earlier canes continue to dry.
4. After sanding 10 or 12 additional pieces, the ones first wetted will be dry and the once smooth inner surface will again have a raised corrugated surface and minor discontinuities in graining.
5. Repeat the finish sanding process, using fine emery paper until the imperfections are again eliminated, then wet each piece and lay aside to dry.
6. This sanding, wetting, drying cycle normally must be repeated three or four times before the gouge surface will remain smooth after wetting and drying. Only after such stability of graining is achieved should one proceed to the next step.
Note: Some individual makers, to maximize the grain distortion and shrinkage, actually soak the cane overnight between each drying and sanding cycle.Although the author has no quarrel with this methodology, the slight difference in results (if any) hardly justify the additional time involved.

D. The necessity of maintaining a precise consistent gouge must be emphasized, for gouge configuration represents the *primary* element that determines the reed tip's final inner contour.Careful informed workmanship is as important (or more so) at this critical early stage of manufacture, as it is during any subsequent procedure. Poorly conceived inaccurate gouges guarantee bad results! Intelligent application of the preceding corrective techniques will *significantly* improve the success rate of any reed making methodology.

II. Soaking of gouged and sanded cane.
A. A broad range of opinion exists amongst reed makers regarding this seemingly impossible procedure.
1. Minimalists believe that the cane should be soaked for the shortest possible period, which ranges from a minimum of a few minutes in hot water to the time needed for the cane to sink (normally one to three hours when started in hot tap water).
2. Mid-ground traditionalists advocate allowing the cane to soak overnight or at most one or two days.
3. A third, much smaller contingent, maximizes the soaking process by immersion of the cane, under controlled circumstances, for weeks or months. (The author is a firm believer in the advantages of this third approach.)
B. Advantages of prolonged soaking:
1. Leaches out most of the soluble saps and minerals trapped in the gouged cane's vascular/cellular structure.
a. Minimizes allergic reaction in individuals sensitive to contact with new cane. (This was the original motivation that induced the author, many years ago, to successfully experiment with prolonged soaking.)

b. Minimizes the "breaking in" process by removing entrapped vegetable and mineral material *before* the reed is formed. As the loss of these elements is intrinsic to the stabilization of a new reed, it is far less traumatic to the player, both physically and mentally, to remove this soluble material while the cane is still in the soaking phase. Having these materials slowly dissolve out while "playing in" the reed greatly extends the "break in" period.
c. Such soaking also results in much greater homogeneity of texture, color, and strength beween individual sticks of cane, resulting in improved consistency in the finished reeds.
d. Improves the quality and workability of the cane, thus contributing to a greater success rate and better final results.

2. Although only a matter of convenience, it is a very real advantage to always have soaked cane available to make reeds with whenever a few spare moments materialize. This constant availability is especially useful to a studio teacher who wishes to spontaneously demonstrate a reed making technique during the course of a regular lesson.

C. The prolonged soaking procedure.

1. Following the sanding process, put the prepared cane to soak in a tall transparent jar with a tightly fitted lid. The jar should be tall enough so that the stick cane can be completely covered by water while standing in a vertical position. Allow sufficient extra height to be able to ascertain when individual pieces of cane sink. (A method, previously described, of determining the relative hardness/softness of individual pieces of cane.)
2. Place the cane in the jar and fill it with distilled water or hot tap water. Make sure the jar is filled to the brim before screwing on the top.
3. After 24 hours of soaking, the water in the jar will be discolored and look like green tea (assuming a sufficient quantity of cane is being soaked [10 to 20 pieces]).
4. Pour out the contaminated water, rinse the cane, and refill the jar with distilled water or hot tap water.
5. After an additional day or two of soaking, the water will again be discolored and look like weak green tea.
6. Pour out the discolored water, rinse cane, and refill.
7. Repeat the above process several times, or until the water remains clear after a day or two of soaking.
8. Empty the soak water again, rinse cane and refill the jar with fresh distilled or hot tap water. Make sure that the jar is completely filled with water, then place the jar lid on tightly to eliminate all air from the jar, thus avoiding contamination of the cane with mold spores, algae, or bacteria.
9. Store the sealed jar in a dark location such as a drawer or cabinet. A light-free environment and use of distilled water will help minimize the possible growth of mold, algae, or bacteria during the prolonged soaking.
10. Each individual must ascertain the optimum soak time for themselves; however, it is the author's experience that the cane doesn't reach its peak quality until after two or three months of soaking.
11. Only experimentation will find what is best for you.
    a. Prepare and put to soak 25-30 pieces.
    b. Soak for a minimum of 3 weeks and then make two or three reeds.

    **Note:* There is often a misleading "hardening" effect that occurs during the first two or three weeks of soaking, so be patient until the cane is ready.
    c. Wait another week and make 2 or 3 more.
    d. Continue this process until all the cane is utilized over a period of several months.
    e. The resultant reeds will continue to improve in direct proportion to their soak time, until they reach a maximum level of improvement.
    f. A maximum level of improvement is normally arrived at only after two or three months of soaking. Following which time, the cane stabilizes and remains consistent thereafter, unless it becomes contaminated with mold spores or algae.
    g. The jar of soaking cane should be periodically examined for evidence of such contamination. If any evidence is found (discoloration of water and/or cane, obvious growth on the surface of the cane, etc.), the water must be changed immediately and the cane rinsed. Should the contamination persist, proceed to finish processing the cane before major deterioration takes place.

    **Note:* Care must be taken not to contaminate the soak water when the cane is removed from the jar. Also the permanent soak water should never be used to clear the file or cane of shavings while working on reeds.

12. The author is convinced that most soluble *minerals* are leached out of the cane during the first few days of soaking, unless tap water of high mineral count is used, which probably adds more by reverse osmosis then is being lost. The soak water used *does* make a difference in results!

    **Note:* Based on recent empirical observation, the author suggests watching out especially for city water supplies that have high concentrations of potassium permanganate added to mask the foul taste and odor of algae. This chemical is usually added during the summer months when reservoirs are low and seems to convert any cane or finished reed into the Arundo equivalent of stainless steel. Perhaps for the slight difference in cost it would be wise to always use distilled water.

13. The author is also convinced that residual sap and other vegetable elements take much longer to remove than the mineral salts contained within the cane.
14. In any respect, whatever the cause, there is an observable major change that consistently takes place in the texture, quality, and workability of cane soaked for extended periods. This change is apparently not directly related to the more obvious leaching process that visibly discolors the water during the first week of soaking, but depends on some other unknown benevolent phenomenon that occurs much later.
15. Which approach is best? Give each approach a reasonable trial and let experience be the judge. At most it will only represent an investment of a little time and a few pieces of cane.

D. In addition to the above, other less known methods of soaking are as follows:
    1. Soaking the cane in sea water (or sea salt solution) for a prolonged period. This method is used by at least one internationally known bassoonist, and according to a current theory is the process inadvertently used in curing the wood of Cremona violins made by Amati, Guarneri, and Stradivari.
    2. Allowing the cane to ferment in its soak water (without change) for a week or two, This method produces a cane wine (more like vinegar) that begins to effervesce after several days in a closed jar. This chemical process causes a transformation of the organic substances in the cane and seems to have the effect of making the cane more malleable.
    3. Two other methods recognize that cane (Arundo donax) is one of Mother Nature's best thermo-plastics. When cane is heated, it can be readily bent into intricate shapes which permanently hold their contour after cooling. Both of the following methods utilize an intense wet heat source after the gouged cane has been profiled and shaped.
        a. Subsequent to soaking the gouged stick cane overnight, it is profiled and shaped, following which the shaped blank is briefly immersed in boiling water for a maximum of one minute or *less,* then immediately formed into a tube while the cane is still hot. In addition to expediting tube formation, this process partially "cooks" the cane and definitely changes its character.
        b. At least one major commercial reed maker uses a similar approach; however, steam is used instead of boiling water. This method is particularly adaptable to assembly line production, as the cane must be dry when machine shaped and profiled using rotating cutters or sanding drums. Subsequent to a minimum soak (15 minutes), the shaped and profiled blanks are exposed to live steam just prior to and during tube formation. When cooled on the mandrel the tubes are fairly stable thereafter.

        **Note:* All seven of the described soaking procedures, and possibly many more that the author hasn't heard about, have advocates who sincerely believe that their way is most effective. Certainly each will produce different results. Experiment and find what is best for you.

III. Conclusion: The previous selection process and the above preparatory steps are of vital importance in the craft of reed making. Because they involve seeming minutia these details are often ignored or circumvented in the headlong rush towards finalizing a reed. However, only through meticulous attention to these and other crucial details can the craft be mastered and the reed making process elevated to the status of an art form.