Points of Resistance on Bassoon Reeds

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The most important aspect of producing a good tone on the bassoon is the player's concept of tone. This I learned from **Edward Knob**, my first college bassoon teacher, who studied at the University of Michigan with **Dr. Hugh Cooper**. I'm convinced that I will make the necessary adjustments on any reed to try to make it have the sound I desire. For several years I have been studying the varieties of styles of reed making and what effect different shapes, dimensions, and adjustments have on the way a reed performs. A group of reeds made from one batch of cane will vary a little in timbre. That may be acceptable as long as the reed has the correct pitch and ease of response required.

For our purpose, resonance is the agreement of vibrations between the reed and the bassoon. Hugh Cooper has spoken to this issue through discussion of the pitch of a reed in comparison to the fundamental of the bassoon.[1] While the reed should vibrate freely in order to establish this resonance, it must have some resistance against the air blown against it or the result will be a weak, bright tone, flat in pitch and slow to respond in the high register. **Mark Eubanks**, in his booklet, *Advanced Reed Design and Testing Procedure for Bassoon*, refers to a "point of resistance" at a particular place on the blade of the reed.[2] The areas that provide resistance in bassoon reeds include:

1. Thickness and shape of the gouge, hardness of cane
2. Shape of the reed
3. The profile
4. The bevel
5. Stabilization and aging
6. Wire adjustments
7. Length of blades
8. Slipping of blades
9. Tip dimensions
10. The spine
11. The back
12. The channels
13. Soaking reeds
14. Arch of the blades
15. Leaks

The presentation of topics in this article will closely follow the normal procedure in reed making in order to provide a basis of evaluation and practical implementation for the reed maker.

Embouchure formation and one's approach to playing the bassoon compose an integral part of reed making. My reeds would not work for someone who wanted a reed that they could control by biting the reed. I follow the approach that the less pressure of the lips on the reed the better, essentially allowing, or requiring, the reed itself to hold up the pitch. This relaxed type of embouchure allows more air to pass through the reed, resulting in a larger more resonant sound. Playing with a relaxed embouchure results in a lack of fatigue and soreness in the facial muscles after a long rehearsal.

Though an acceptable reed may be produced by exactly duplicating the dimensions of another reed maker, the art of finishing a reed will not be accomplished until one has fine tuned that reed to sound and respond in the exact manner they demand. Reed making might be compared in that sense to bassoon construction. Many bassoon manufacturers have copied Heckel's dimensions in bassoon construction and used similar raw materials, but few have achieved the same results in the finished products. Mastering the finishing of bassoon reeds is what separates the imitator from the artist.

GOUGED CANE

The thickness and tapers of the gouge are out of the hands of most bassoonists since the most common starting point of reed making is with pre-gouged cane. However, some manufacturers/suppliers do specify the gouge they provide so that, at least, one can choose between brands, if not specify a desired thickness. The hardness of the cane is directly proportional to the thickness of the gouge. The harder cane is closest to the bark, so the thinner the gouge, the closer the profile will be to the bark, resulting in harder cane to work with. Hardness of cane as it relates to growing conditions or aging is beyond our control unless we have experimented and found a supplier whose cane, though gouged to the same thickness as a

competitor, is better quality and more "workable."

I use Glotin cane that is gouged to about 1.35 mm. When I use cane that is thinner, say 1.20 mm gouge, the reeds have been too hard for the profile I normally use and I have to scrape the blades thinner to make the reed work.

Letting the cane age an extra year before usage will allow it to dry and become more workable. Greenness of cane is most evident when cutting the cane off the very back of the blades and rather than come off in clean shavings, leaving a smooth surface, the blade ends up looking rather fuzzy. The color of green, or unaged cane, is really rather yellow and often shiny towards the back.

Lou Skinner's methods of gouging may reduce the resistance in the cane without hampering sound, intonation or response and often result in more response. At least, these methods attempt to accomplish this, because every time we take more cane off a reed we risk weakening that particular piece of cane past its point of optimum performance. One of the more effective gouges that I have used was passed on to me by **Gary Echols,** professor of bassoon at the University of Nebraska. By cutting a small channel parallel with the edge of the shaped cane from the first wire marking to the center of the profiled cane, or at least past the tip, there is created a little larger resonance chamber that really increases the dynamic range of the reed without sacrificing tone quality. This technique actually helps the corners of the reed stay open, enhancing response. The small channel can be accomplished with #320 sand paper wrapped around a mandrel tip and run four times along the inside of the cane after it is shaped, but before profiling. Be careful to stay close to the edge of the shape without damaging it so the blades will fit together without leaks. While I used the sandpaper method for a couple of years, I now use a small Skinner-type cutting disk that has a diameter of 3/4 inch.

SHAPING CANE

Different shapes of cane directly impact the resistance points in a bassoon reed. A reed with a narrow throat dimension will not allow as large a column of air to pass through the tube, resulting in more resistance and decreased resonance. **Mark Kelley,** associate principal bassoon of the Minnesota Orchestra, proved this in a class I once attended when he demonstrated the use of a throat opening mandrel. The use of that tool to open the throat of a stuffy reed resulted in a dramatic improvement in resonance. Narrow throat openings can be attributed to A) the mandrel not pushed far enough into the reed when forming the tube, B) tightening the wires at a later time without the forming mandrel far enough into the tube, thereby closing the throat and making the tube smaller, C) reed shapes that have a narrow throat dimension, and D) beveling techniques that could narrow a tube too much. **Matthew Ruggiero,** retired associate principal bassoonist with the Boston Symphony Orchestra, taught me that I could throw away my reamer if I made the tubes of my reeds the proper dimension to begin with. If I use the proper shape, for me a Fox #2, and push the mandrel in far enough, the result is a reed that fit the bocal without reaming and has an open throat with increased resonance. The only reason I use a reamer today is to adjust reeds brought in by students, or to fit my reeds to bocals of a larger dimension than mine.

The width of a shape at the tip is partially determined by the length of the reed. The longer the reed, the wider the tip of the reed will be. Wider tips result in less resistance and greater response but may be more difficult to control and have a less focused sound. The length of the tube, from the butt of the reed to the first wire, and the length of the bahn, from first wire to the tip, are variable and combined are the overall length of the reed. The length of the tube and bahn are factors in the pitch of the reed, with shorter lengths resulting in sharper pitch, but only in relation to other dimensions such as blade thickness.

THE PROFILE

Dimensions of the profiled cane depend on many factors and must be customized by the individual player. Even so, it seems that most students who have reed problems tend to play on reeds that are too thick rather than too thin. When I was a student, just before I began my studies at Boston University, **Richard Svoboda,** principal bassoonist of the Boston Symphony Orchestra, commented about my reeds being too hard. I now realize that by saying too hard he meant too thick. Hardness in reeds can mainly be attributed to thickness, because that is the way in which we can decrease that hardness. Svoboda said that when he blew into a reed at a Boston Symphony rehearsal or concert he wanted to be sure that the reed would respond immediately. I think **Matthew Ruggiero** put it best when he said response with

bassoon reeds is much like the law of physics which states "the greater the mass, the greater the force required to move it." I profile my cane on a Popkin profiler that reduces the thickness from 1 mm. in the back to 0.5 mm. at the tip. The corner of the tip is 0.1 mm thinner than the center. From those starting points I can, with about fifteen minutes work, produce a reed that is 95% finished. The last 5% of work will be accomplished over several days of playing and testing. My reed blanks will play over the range of the instrument, though, sometimes, high e can be difficult when I first cut the tip. Most reeds seem to harden up a little, that is, to play with greater resistance, over the course of a day or two.

See examples 1 and 2.

Ex. 1 Blades tapered back to front and side to side. This computer drawing shows lines that would be blended in as in example 2.

Ex. 2 In the case of a new reed the half-moon shadow we see at the tip of a reed is not yet present, but will be seen as a reed "seasons" in.

THE BEVEL

There are many variations in the way the bevel is made on bassoon reeds. Some makers bevel all edges with sandpaper, laying the reed flat on it. Others use a knife and bevel from the first wire to the butt on either two or four edges. Sometimes, a half-round file is used to create a tapered bevel that is deepest midway between the first wire and the butt. It seems most clear that the bevel has two primary functions. The first is to provide a fulcrum so that squeezing the first and second wires from the sides has the opposite effect of opening and closing the tip. This effect is already present because of the fulcrum made by the shaping of the cane but is more pronounced when a bevel is added. The second reason is to help provide a seal along the seam of the reed.

STABILIZATION AND AGING

Recent discussions on the IDRS-lists suggest that many of our bassoon reedmakers leave their reed blanks on drying racks for considerable periods of time to allow for stabilization after the forming of the tube. **Matthew Ruggiero** suggested a time period of eight weeks for stabilization before finishing the blades. This procedure lessens some of the dramatic changes that can occur during the several days of finishing a reed.

Many of my students ask how to make a reed with a dark sound. I think that much of a reed's darker tone color results from the aging process that a reed goes through after you finish scraping it. If a student does not get the reed to a finished dimension and has to continually scrape it to improve response the reed will probably always have too much buzz or brightness of timbre. A better method is to try to achieve the response and intonation from a reed first and then let it age a bit. Often a thicker reed is also too buzzy and needs to be scraped, especially in the center of the blade for a more refined tone.

WIRE ADJUSTMENTS

As reed makers, bassoonists have a major advantage over our oboe playing friends: the wires and the ability to adjust them. Some reed makers are adamant against tightening the first wire on a bassoon reed. I respect their opinion, but I imagine they have to throw away a few more reeds than those of us who take advantage of wire adjustments. The wires, first of all, provide a means of assembling the reed and help the wraps and glue we use to provide a stable tube. There are many other possible adjustments to the reed wires that can improve a reed's performance. If small e (first finger) is flat on the bassoon you can often bring up the pitch by tightening the wires. Tightening the second wire is a less drastic adjustment than tightening the first wire, but also will not be effective in raising the pitch of the reed. Tightening the second wire also can create a rounder look to the inside of the tube, giving the reed a higher crow. Squeezing the second wire from the sides can also help raise the pitch of the reed, resulting in easier response in the high register, but can create more resistance than desired in the lower register. Many times if a student is playing a reed that seems to have a

finished blade but is still fairly resistant, I have them squeeze the second wire from the top and bottom. That, if done carefully, increases response. While some sources in reed making suggest squeezing the wires only with a mandrel inserted in the tube, this may defeat the purpose of squeezing the wires. The tube must have the room to move. Squeezing the wires a little at a time will usually obtain the desired result without damaging the tube.

When the first wire is tightened the reed often opens up too much at the tip. Close the tip by squeezing the first wire from top and bottom. The optimum tip opening for me is about 1mm at the center. If the tip is open properly in the center but the corners are closed, the problem is that the corners are too thin in relation to the center of the blade. Squeezing the wires will not help in this instance. Taking a little cane off the center of the blades from the heart to the tip may lessen the pressure on the corners and cure the problem. If the reed is then too open you can close it with the first wire.

Squeezing the tube of the reed instead of the wire, especially on the thread between the second and third wire is another possible adjustment. One can further round or flatten the shape of the tube without affecting the tension of the second wire.

LENGTH OF BLADES

The length of the blades has a direct effect on the intonation and response of a given reed. Most of my reeds play best at 28 mm. from the tip to the forward edge of the first wire. I leave a 2 mm. collar above the first wire. Most bassoon reeds range from 26 mm. to 30 mm. from the first wire to the tip. From the 28 mm. length I have cut reeds back to about 27 mm. and had them play very well for my taste. With a combination of blade length, wire tautness, and the proper profile I can make a reed that "holds the pitch." That means the small e is not flat, small c# is stable, and the high c2 speaks with ease. I have heard that some reed makers rather than cut the tip will move the first wire a little towards the tip to help the pitch of the e, but in essence they still are reducing that very important dimension of the bahn. When changing to a shorter blade length the taper of the profiler may need to be adjusted so the taper of the blade falls off more quickly towards the tip, while if the blade is lenghtened the taper should be less dramatic.

SLIPPING OF BLADES

While I try to avoid the slipping of reeds, there are those players who take advantage of this circumstance. It can create some resistance by the reduction in the air chamber in the reed, but possibly results in some leaky reeds. One may try to fix the overlap by filing the sides even with a permanent nail file, often with good results, but then remember to scrape the rails of the reed that are thicker as a result of the filing. The best ways to avoid slipping blades during construction are to:

1. Make sure the blades are aligned before tightening the first wire in the forming process.

2. Push the forming mandrel straight in rather than twisting it.

3. Make the tube large enough to fit the bocal, thereby eliminating the need to ream it.

TIP DIMENSIONS

Finishing half of a reed towards the tip is the first step I take after completion of a reed blank. The taper toward the tip must be greater in the front half of the blade than in the back. That is one reason for the development of the tip profilers and their growing popularity. The question for the reed maker is: How much taper? One of the major faults in reeds at this stage is that students will often make the taper too great just before the tip, resulting in a ledge. This ledge can and often does result in a point of resistance that will help hold the pitch of a reed and may help tone quality, but hamper response at the same time. If the vibration starts very easy at the tip and suddenly hits a hump at the heart, the result may be poor response, especially at pp levels. After my students thin the tip of the blank, I have them blend in the small hump that may be evident just behind the tip. The bassoon reed does not need the same type of hump as the oboe reed in order to hold the pitch or maintain a beautiful tone.

The optimum tip opening on my reeds is 1mm. Smaller openings restrict resonance and result in a sharper pitch, while larger tip openings are harder to control and will be flatter in pitch. The opening of 1mm. allows me to play pianissimo without biting the reed shut. Some players use an opening that is 10% of the tip width.

THE SPINE

Any reed that is thicker in the center of the blades than the sides has a spine of sorts. Some profiles have a defined spine that appears as a dark line down the center of the reed. I tend to blend this line in so that my reeds appear to have a darker shadow in the center than in the sides without a clearly defined line. I find that too much spine in my reeds results in greater resistance than usually needed and can result in a hard, unrefined tone.

THE BACK

The back of the reed is where I control the response in the lower range and may effect the ease of response in other registers as well. A common defect in student reeds is, when holding the reed under a work light, to see the back of the reed looking lighter than the center. This will usually render a reed too weak to respond properly. The taper of a reed should be back to front. I use a file when reducing the thickness of the back, pulling the cane back against the shoulder, then running the file against the shoulder to cut off the waste. Be sure to make the sides of the reed at the back thinner than the center.

THE CHANNELS

The channels run 2 mm. from the back of the blade to 2 mm. from the tip and are between the spine and rails. The channels are about 1 mm. wide at the back and 2 mm. wide at the front. This area of the reed may be trimmed to increase resonance when it seems the tip of the reed is substantially finished. The best part of this adjustment is that it seems to have little effect on the reed holding the pitch, if done in moderation. Mark Popkin has suggested, in reed making instructions that come with his profiler, kneading the channels prior to trimming them in order to achieve the desired effect without removing cane. Eubanks suggests that there is a place to scrape in the channels to lower the pitch of each note above overblown f#.[3]

SOAKING REEDS

Soaking reeds in water for long periods of time does not increase response or make them more vibrant. Reeds should be made wet enough to seal properly before playing, otherwise they will be very difficult to play and have no dynamic range until they are wetted properly. After the manner in which **Matthew Ruggiero** taught, I dunk the reed entirely in water for about three seconds and then lay it on a flat surface while I put my instrument together. By that time the reed is usually ready to play. Following that method I can then play a demanding two and a half-hour rehearsal, or long opera performance, and my reed won't be water logged. I also keep my reeds dry between playing times, often opening the reed case for them to dry out. My reeds tend to last for months that way. I retire a reed mainly because of the desire for a new reed with a more brilliant quality. Too many times we hear students say "this reed is too hard, I think I'll soak it some more." The opposite is actually true. If a reed is too soft, or not resistant enough, soaking it may actually help, as does playing it. Soaking does make cane more pliable or bendable in the forming of reed tubes.

THE ARCH OF THE BLADES

The arch of the blades may cause a great amount of resistance to the freedom of a reed's vibration. One way to decide how to control the arch is to look in the back of the tube to determine the arch from the inside. The resulting shape should be oval with the point of the oval toward the seams of the reed.

LEAKS

Leaks and other defects in reed making can provide resistance that may be difficult to impossible to correct. The best solution is to avoid leaks with proper construction techniques. Properly rounding the back of the tube and even scoring will help insure a reed that conforms to the shape of the bocal. If a reed is not round on the butt apply a fourth wire that will keep it round and may be removed after the first coat of glue has dried. Some makers use goldbeater's skin to seal leaks that occur at the seam on the blades near the collar.

BALANCING POINTS OF RESISTANCE

Balancing points of resistance is the key to successful reed making. When experimenting with reeds a balance must exist between the changes made with other points of resistance that are affected. Generally, reeds with longer dimensions and or wider shapes would play flatter than a shorter or narrower reed with blades of the same thickness at the back and tip.

The problem that many young reed makers face is how to make this balance work. Standardization is necessary for consistency of reed quality, yet some flexibility will result in a higher percentage of usable reeds. Keeping in mind the relationships between these points of

resistance and the adjustments necessary when changing the varying dimensions and formations of reeds can help lead to successful reed making. ❖

Footnotes

[1]Cooper, Lewis and Mark D. Avery, ed., *Bassoon Clinic Series: Reed Contribution,* (Royal Oaks, MI: Custom Music Co., 1990), pp. 6-7.

[2]Eubanks, Mark, *Advanced Reed Design and Testing Procedure for Bassoon,* Portland; Mark E. Eubanks, 1991), p. 1.

[3]Eubanks, p. 14.

About the Author ...

Dale R. Clark, *assistant professor of bassoon at the University of Memphis, has played throughout the U.S. and in Europe with such groups as the Boston Lyric Opera, Berlin Camerata Vocale, New Bedford Symphony, Granite State Symphony, Nashville Symphony, Knoxville Symphony, Chattanooga Ballet, and Memphis Symphony. He has performed as a solo and chamber musician in many venues including Boston, Würzburg, Germany, and the Massenet villa in France. In December 1998, Dr. Clark was artist-in-residence at Northeastern University in Boston. He earned his bachelor of science degree from the University of Tennessee-Knoxville, master of music degree from the University of Nebraska-Lincoln, and doctor of musical arts degree from Boston University. Dr. Clark has taught at Atlantic Union College, Boston Conservatory, and the University of Massachusetts-Boston. His principal teachers include* ***Ed Knob, Keith McClelland, Gary Echols,*** *and* ***Matthew Ruggiero.*** *Dr. Clark is a member of the Memphis Woodwind Quintet.*