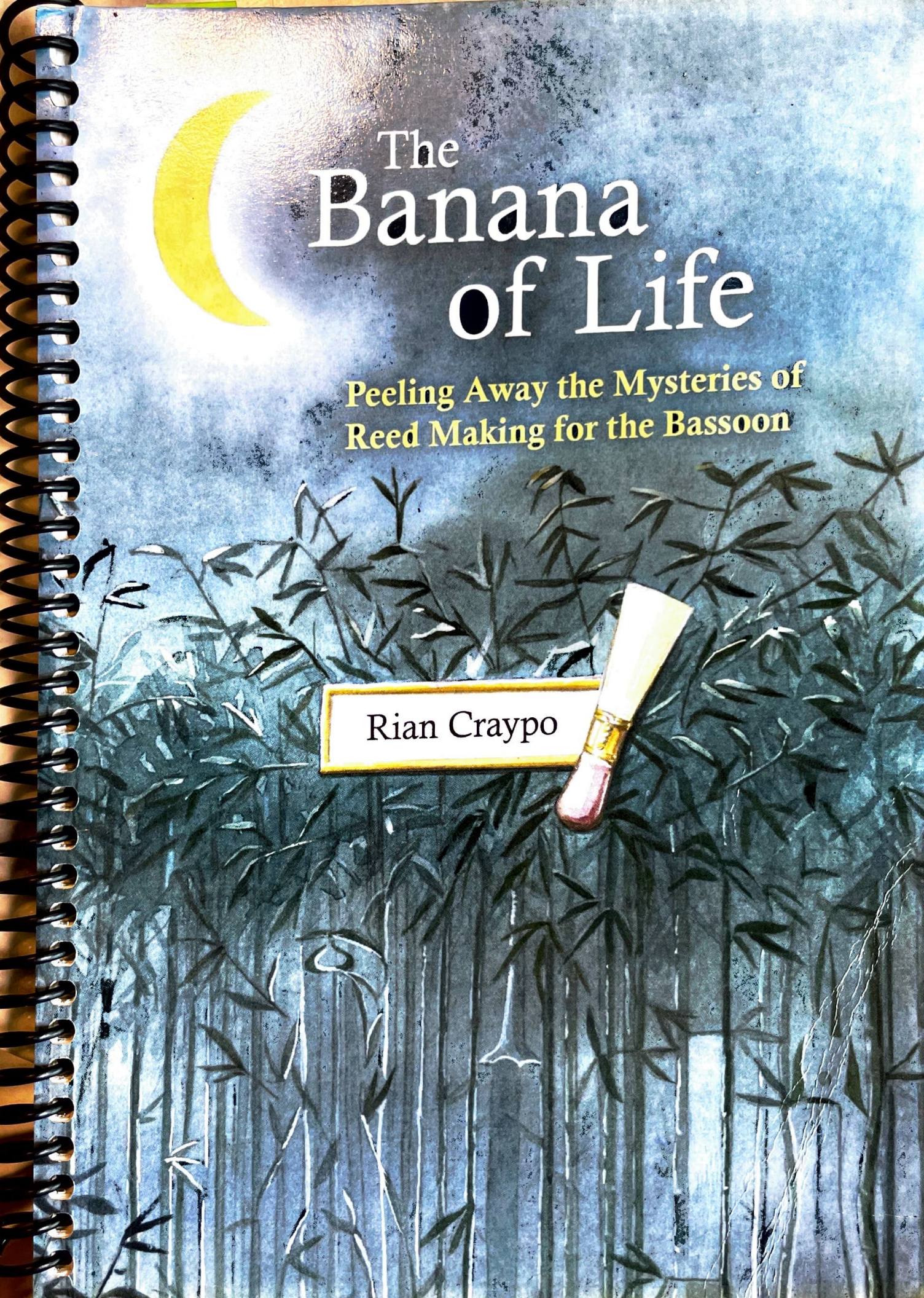
The
Banana
of Life
Peeling Away the Mysteries of
Reed Making for the Bassoon
Rian Craypo

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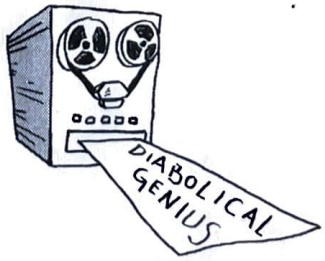

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"The secret of getting ahead is getting started. The secret of getting started is breaking your complex overwhelming tasks into small manageable tasks, and then starting on the first one."

Mark Twain

"Nature is pleased with simplicity. And nature is no dummy."

Isaac Newton

Contents

Part 3

Appendices

Introduction

Reed problems are threefold, the latter two of which we can influence:

- material (bad cane)
- trim (misguided or overenthusiastic scraping)
- structural issues (profile contour, blank construction)

The three sections of this book address those parts of reed making which are observable and under our control.

Part One - Defines and explains the various ways to make changes to a reed (five systems of reed making).

Part Two - Primary and secondary guides for determining where and how to make an adjustment to a reed, plus a Day One Scrape.

Part Three - Troubleshooting intonation, response, strength, resistance and resonance.

*A set of reed making videos by Herzberg/Kamins students (Ben, Rian, etc.) can be found at http://www.musicandthebassoon.org/links.

*Pages with BK in the bottom right hand corner indicate material taken directly from handouts from Ben Kamins.

*Pages with BK/RC refer to material from Ben Kamins with added material from Rian Craypo.

*Any specific pitches referred to in this text are notated based on their relationship to middle C on the piano. Ex: the speaker key C on the bassoon is C4. Some tuners may indicate this.

Part 1

Change is good.

Mechanisms of Change

Priority of considerations when planning a reed adjustment:

FIRST

wires
scrape
shape
internal bevel
blade length

LAST

Wires + Scrape

These adjustments can be made **after** construction of the blank.

Shape + Internal Bevel

These adjustments need to be made **before** construction of the blank, except in extreme circumstances. If you are not in a reed emergency, assess the overall construction of your blanks and revise accordingly with your next batch.

Blade Length

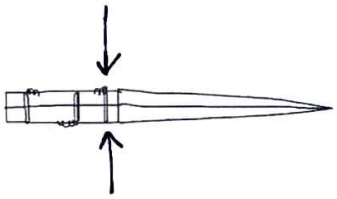
Last ditch effort to save a reed if you have nothing else to play.

Each system has undesirable side effects when taken to the extreme, so be prepared to use a *combination* of small adjustments to multiple systems if you need a big change.

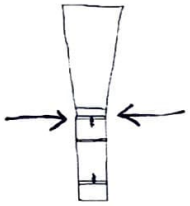
Wires

The first consideration when adjusting a reed for the simple reason that the process is reversible. See the bottom of page 77 for a note on tightening wires.

Flattening



Rounding



First Wire

Round	Flatten
Opens Tip	Closes Tip
Strengthens	Weakens
Adds Resistance	Lessens Resistance
Darkens	Brightens
Sharpens Pitch	Flattens Pitch

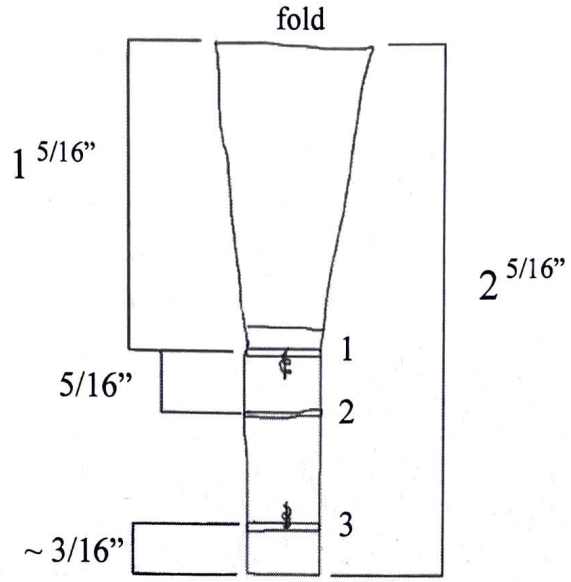
Second Wire

Round	Flatten
Closes Tip	Opens Tip
Strengthens	Weakens
Adds Resistance	Lessens Resistance
Darkens	Brightens
Sharpens Pitch	Flattens Pitch

Choosing to play a reed wire-up or wire-down is simple: one side of the reed is stronger. Using normal embouchure and air play F4 and manipulate this pitch up and down. Do this on both sides of the reed. One side will be stronger, and therefore more stable. Sometimes the difference is stark, sometimes it is subtle, and it is not always visually obvious.

BK/RC

All measurements are initially determined first from the fold line and then to and from the middle of each wire.



These default measurements are based on placing the second wire as close as possible to the narrowest point of the shape.

Changing the placement of the wires makes adjustable both:

- The comparative narrowness/width of the shape
- The amount of roundness/flatness of the wires

The **further** from the fold you place the first wire, the narrower the blades and the rounder the wires.

The **closer** to the fold you place the first wire, the wider the blades and the flatter the wires.

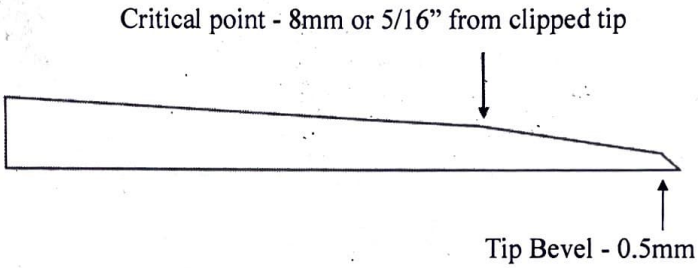
(Why would I want to change my shape? See page 7.)
(Why would I want rounder or flatter wires? See page 8.)

BK/RC

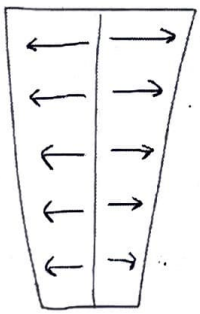
Scrape

Scraping consists of refining the tapers of a reed (straightening them out, adjusting their angle, integrating them) and adjusting material thickness. All tapers must decrease evenly from thick to thin.

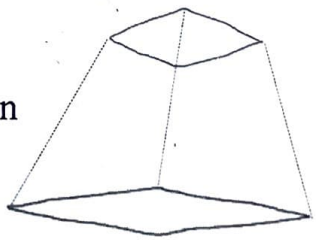
The **collar to tip** taper is made up of three smaller tapers seamlessly blended together. The tip bevel is the steepest, each segment becoming gradually less inclined.

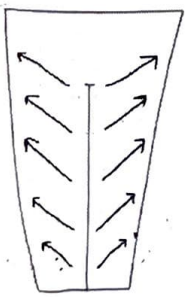


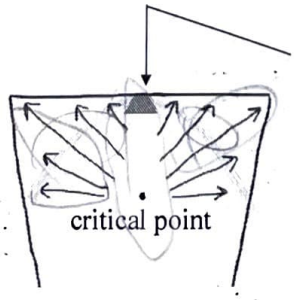
The **spine to rail** taper is thickest at the spine and thinnest at the rails.



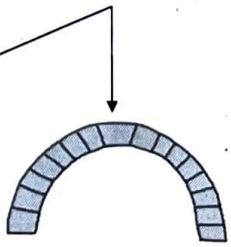
Good file technique creates straight tapers that seamlessly transition from steeper at the collar to flatter toward the tip.







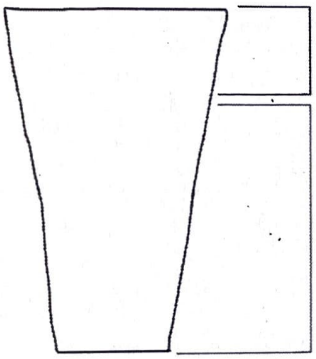
Keystone of the thumbnail. It can be extremely small but it must be there. Keeps the curve of the tip opening from collapsing, like the keystone of a stone arch.



Integrate the collar to tip and spine to rail tapers by working diagonally, **leaving the back as heavy as possible**. The 4 corners of the tip are the thinnest part of the reed.

A good piece of cane is one that responds to the trim and doesn't change back. This is an immutable characteristic of cane, as is the ultimate degree to which a dynamic taper is available (response), and whether the cane is hard or soft, dense or porous. Good reeds can be made out of cane from a variety of hardnesses and densities, but they must be made from a high quality piece of cane and have a high degree of response available. Assuming we have found a good piece of cane, we can affect changes to intonation, response (but only to the degree possible for that piece), strength, resistance and resonance (tone).

Where:



Response, intonation, resonance in front third

Correct blowing quality, flexibility, and comfort in middle and back thirds (strength + resistance)

toward **rails**	sharper	stronger	more resistant
toward **spine**	flatter	weaker	more free blowing

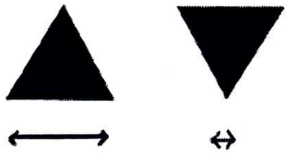
Work according to:

- adjustment guides (Part Two, begins on page 15)
- quality of cane (rate of change, hard or soft)
- natural break-in period of reed (page 86)

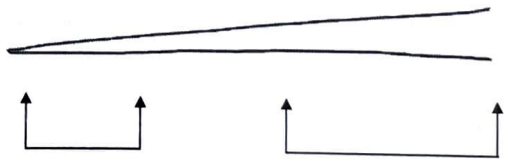
BK/RC

How: A three square diamond file has an adjustable cutting surface and removes cane moving in all directions. Using a file instead of a knife better integrates adjustments into the overall tapers and allows minute changes to be made on a flat plane. Use a medium grit for initial adjustments and a fine grit for finishing and working on the corners of the tip and the thumbnail area. A pillar file is useful for removing larger amounts of cane left by thicker profilers. Use a plaque that isn't too thick and has a slight center to side taper (like the opening of a reed).

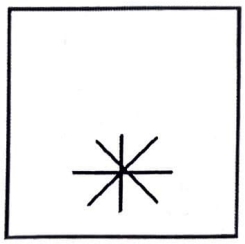
Hold the file on a plane parallel to the table. Move the file across the grain of the reed and on this plane only. Rotate, swivel and angle the reed under the file to achieve desired angle of taper. When approaching the limits of the reed (tip, corners of the tip), roll the file up on its edge and continue into the space beyond the reed. No matter what size your adjustment is, integrate your work across the larger taper. To avoid cracking, support the reed around and below (on the opposite blade) where you are working.



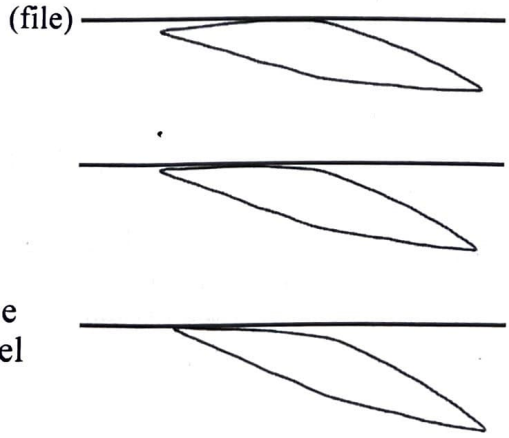
adjusting the cutting surface



fine adjustments larger adjustments



file rotates on plane parallel to table surface (not necessarily parallel to *edge* of table)



Shape

With a **wider** shape the following will occur:

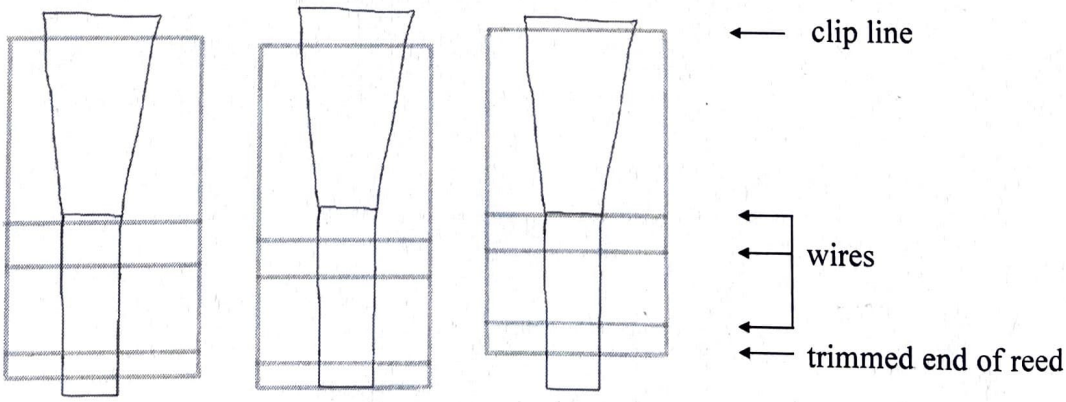
- Pitch is generally lower, accentuating the tendencies of flat notes
- Will favor playing in the low register
- Broader, wider, richer tone

Conversely, with a **narrower** shape the following will occur:

- Pitch is generally higher, accentuating the tendencies of sharp notes
- Will favor playing in the high register
- Narrower, more focused tone

Wires and their relationship to shape:

You can alter the shape of a reed by changing the placement of the wires. The closer to the fold the first wire is placed, the wider the reed. Conversely, the further from the fold the first wire is placed, the narrower the reed. You may need to adjust the placement of the thumbnail shape on your profiler so it remains in the same place on the reed in relation to the clipped tip.



Default Narrower Wider BK/RC

Internal Bevel

The internal bevel uses the principle of the lever to cause the reed tip to spring open when clipped. Changes to the length and depth of the internal bevel (i.e. adjustments to the location and size of the fulcrum) affect both the:

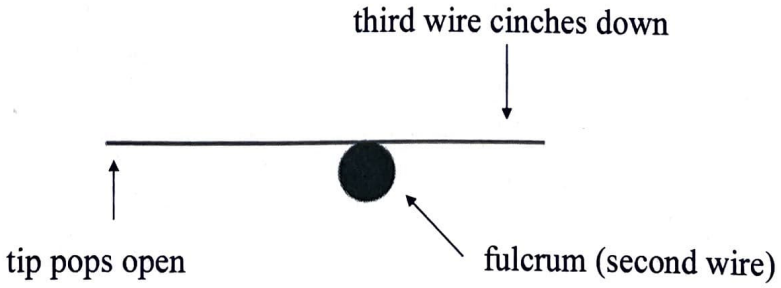
- the relative roundness of the tube
- the stability of the tip opening

Why would we want to adjust the **roundness of the tube**? Specific demands of principal or section bassoon, different orchestra tunings and instrument tendencies can all be taken into account. See the wire chart on page 2 for more information.

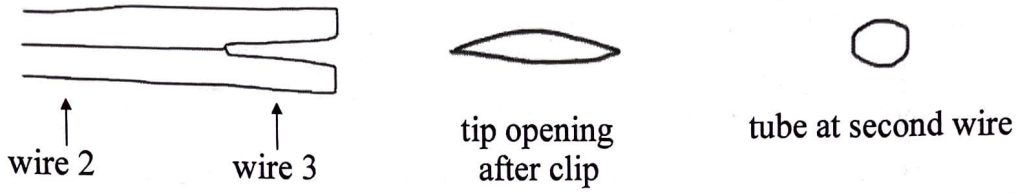
Rounder: favors sharp tendencies and high register, more resistant, more focused tone.

Flatter: favors flat tendencies and low register, more free blowing, less focused tone.

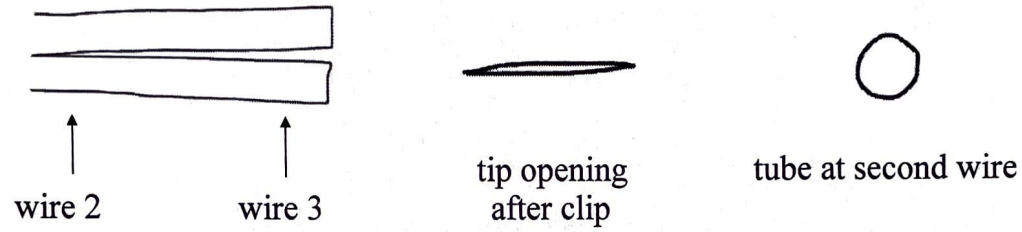
Why would we want to adjust the **stability of the tip opening**? One of the major contributing factors of reed failure is the collapse of the tip opening. A strong, counterbalanced tip opening can provide stability and strength for better response, intonation and resistance.



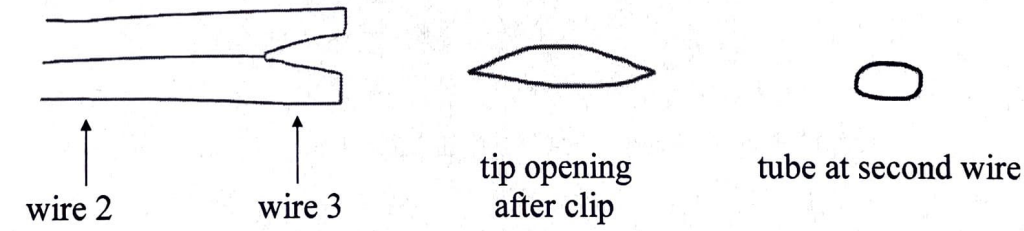
Default bevel (approx. 3/8" long, less than 1mm deep)



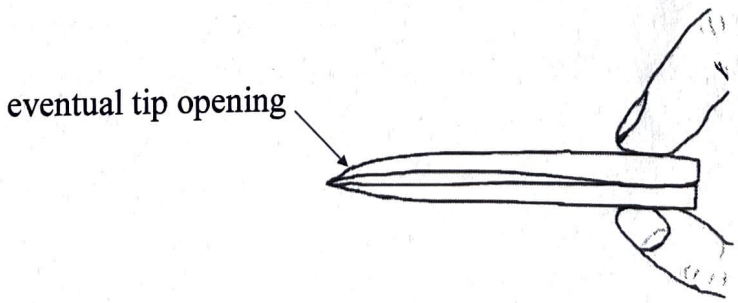
Rounder tube - longer, shallower bevel



Flatter tube - shorter, deeper bevel



Observe how when the bark end of a beveled reed is held closed (with no wires constricting rest of tube), the tip is forced open. The size of the gap between the blades will vary with the bevel you use. Remember: a little bit goes a long way.

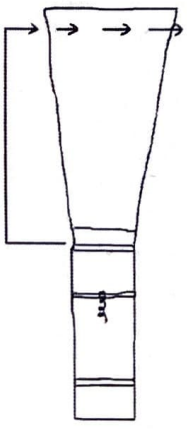


Blade Length

Default clipped blade length is **28mm** from the **top** of the first wire to the tip.

Leaving the blade **longer** than 28mm widens the shape of the reed and weakens the lever action created by the wires and internal bevel, requiring a rounder tube to prevent the tip opening from collapsing. This may cancel out whatever benefits a wider shape provides.

Clipping **shorter** than 28 mm narrows the shape of the reed and increases the amount of cane available to scrape, therefore making the reed stronger and sharper. However, this is problematic and should be used as a last resort. The thumbnail pattern and tip bevel must be recreated as the clip distorts the existing balance.



If you are having chronic problems with reeds that are saggy or flat in the tenor register (especially a problem in orchestras that play higher than 440, on a bad bocal, or with a problematic instrument), assess the construction of your reeds and decide what can be done in lieu of making your reeds shorter (page 55). If you are having chronic problems with reeds that are limited in the lower register or always sharp, see page 55 to see what possibilities exist other than leaving your blades longer and changing the functional shape of the reed.

Notes

Part 2

Houston, we have lots of problems.

Adjustment Guides

Playing on the reed is your primary diagnostic tool for estimating both where to make the trim and how big of a trim to make. Visual cues provide a secondary tool for refining exactly what the trim will entail.

"Do the task until you can make a decision." ~ Ben Kamins

*How to use the indicator notes: these notes are the canaries in the coal mine of the bassoon, i.e. the pitches that are most sensitive to imbalances in construction. They are often referred to as note tests but are, on the whole, to be observed **in the context of practicing fundamentals or repertoire**.

Support Structure (Air and Embouchure)

Comparing how a reed **does** play with how a reed **should** play is the most important guide you have for determining what trim to make on an unfinished reed. There are two simple rules to follow when using fundamentals, etudes or repertoire as diagnostic tools:

1. Expect to play as you would on a good, finished reed.

2. Don't adjust beyond that.

How does this work? How you would play on a good, finished reed = **default support structure (air and embouchure expectations)**. You know how much you are willing to adjust to a reed; use this knowledge to ascertain how a reed-in-progress does not meet your expectations.

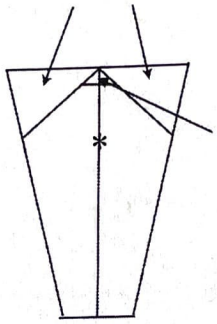
When we sit down at the reed desk, we need to be aware that our support structure is likely to be momentarily specialized, i.e. we are set up to maximize the potential of the last reed we practiced on. It may or may not have been a good or finished reed*, so mindfully beginning again and returning to our default support structure is key. Support structure maintenance requires not only an awareness of how our support structure may have become warped during the daily onslaught of playing on crappy and unfinished reeds but **deliberate attention and practice on good reeds**.

*When is my reed finished? See page 86.

Indicator Notes

A3 speaker key

Is the difference in intonation between A3 normal fingering and A3 with depressed speaker key unmanageably severe? Check evenness of tapers from critical point to corners of the tip, and definition of thumbnail on these diagonal lines…



Result: weaker, flatter, more responsive, more free blowing; degree of change depends on where trim is in relation to spine.

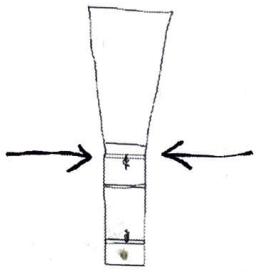
B2 slurred to B1

With the whisper lock down, a mezzoforte slur from B2 down to B1 cracks or keeps the upper harmonic. Back of reed is too weak in comparison to front. Work here…

Result: more stable, seems stronger.

Bb2

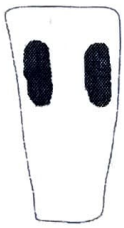
Does Bb2 take too much embouchure to play comfortably in tune? Reed is weak, round the first wire (and second if necessary).



Result: more stable, sharper, less responsive, more resistant.

Bb3 false fingerings

1. Does Bb3 with no speaker key crack? Refine tapers here (they must be straight, not rounded) according to desired intonation and resistance. Be very careful not to weaken the reed too much.



2. Is the difference in intonation between Bb3 full fingering and Bb3 false fingering (LH 1,2,3 RH 1,3) severe? Refine tapers here (they must be straight, not rounded) according to desired intonation and resistance.

Result: weaker, flatter, more responsive, more free blowing.

Short Eb3/F4

Is short Eb3 (LH 1,3 and W) sharp or unstable? Is F4 also flat? Too much cane in back third channels, refine tapers. Be **very careful** not to weaken the reed too much.

Result: weaker, flatter, less responsive, more resistant.

Eb4 (D4)

Is Eb4 (including resonance key) unstable, especially in dynamic taper? Rails in the middle third are too thick in proportion to spine. D4 is affected too, although not as much. Work in VERY small increments to avoid over scraping, integrate with overall rail taper.

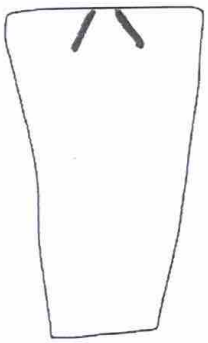
Result: more stable, less responsive, more resistant.

F2

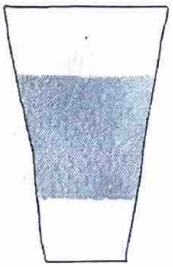
Is mezzoforte attack on F2 very sharp? Front third is too heavy compared to the back. Combine with F#3, Bb3, A3 speaker key and F4 indications to determine where to work.

Result of scrape: weaker, flatter, more responsive, more free blowing.

F#3



The degree of ability to taper F#3 to *a niente* while remaining in tune shows the intrinsic quality of response present in this piece of cane. Rolling out the embouchure ever so slightly in pp/ppp allows you to extend the taper even further. If reed goes sharp easily, cuts out at an unacceptable dynamic, or loses resonance and substance of tone, define thumbnail and taper to tip here:



If the reed requires too much embouchure to make the dynamic taper, very lightly brush the middle half of the reed maintaining current tapers. Be careful not to weaken the reed too much.

Result: weaker, flatter, more stable, more responsive.

F4

1. Does F4 crack? Reed is too strong, flatten first wire. Rarely, the second wire may be too round. Check tip bevel for proper taper - page 26.

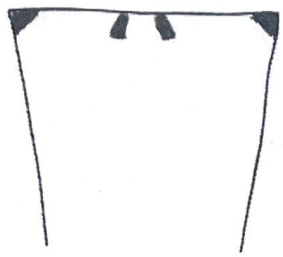
2. Is F4 flat but the rest of the reed is sharp? Rails from the front third to the middle third are too heavy in proportion to spine. Work in VERY small increments to avoid over scraping, integrate with overall rail taper.

Result of wire work: more flexible, flatter, more responsive, more free blowing.

Result of scraping: more stable, seems stronger.

Rachael Young B3 Pinchy Test

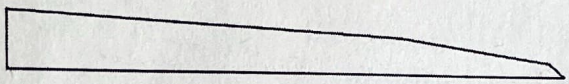
Does B3 respond to applied embouchure or air with unmanageably quick rate of change? The areas behind the tip are too strong in comparison to the very tip. Refine tapers here as necessary.



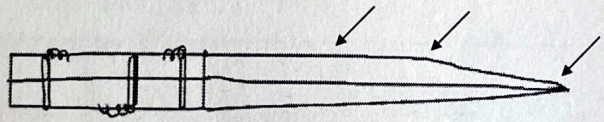
Result: more stable.

Collar to Tip Taper

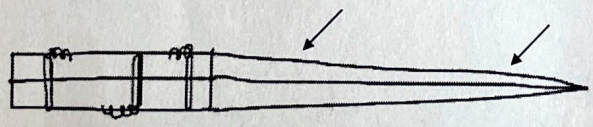
Visual cues are the second most important guide for determining a trim. They are only valuable in the context of already knowing what your problem is and having a general idea of where to scrape and how much. Compare the existing taper with the ideal one and begin the balancing work by scraping on the strongest areas most out of alignment (arrows). If an area is too weak, work around it to make it seem stronger in comparison.



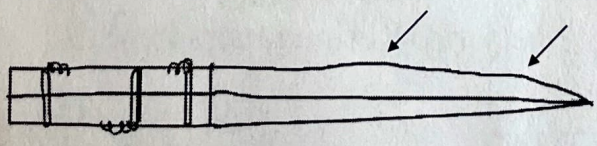
ideal tapers - angles will vary slightly with cane hardness and density



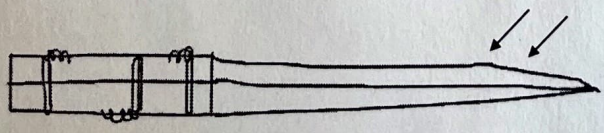
middle third too heavy relative to back third, too flat just behind the tip bevel



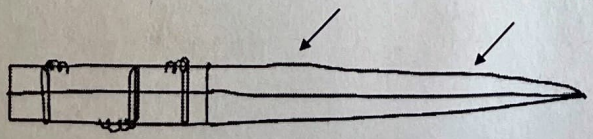
middle third too weak relative to front and back thirds



several obvious bumps, back third is too weak relative to the front two thirds



front third is too heavy relative to the rest of the reed, there is a bump at the critical point



back third is too heavy relative to front two thirds, taper in middle third is too flat

Rails

Integrity of rails is important in maintaining correct embouchure. Rails must taper evenly from thick to thin (collar to tip). If rails are overall too weak in proportion to spine, reed feels small and stuffy and collapses under correct embouchure. If rails are overall too heavy in proportion to spine, reed feels weak, unstable and free blowing. If rails are too thin too far back reed is flat and stuffy. If rails are too thin in front, reed collapses under correct embouchure, and is small, stuffy and inflexible.

- too steep

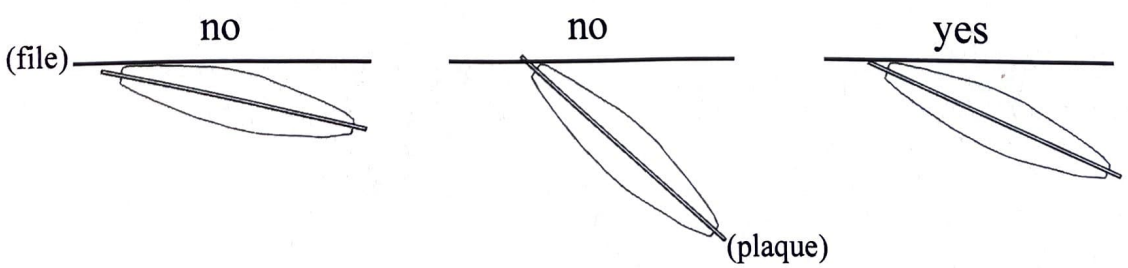
- no taper

- asymmetrical

- uneven taper

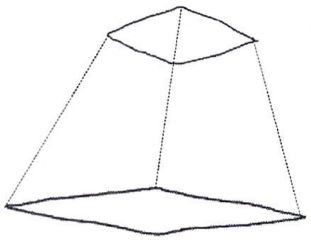
- bumpy

How to rotate the reed when working on the rails:

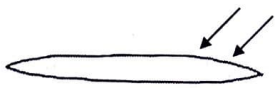


Spine to Rail Taper

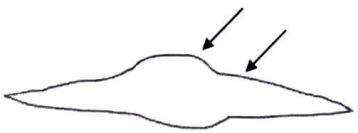
Proper file technique is very important in achieving straight and even tapers from spine to rail (page 6). Avoid channels, bumps, and flat places. Compare the existing taper with the ideal one and begin the balancing work by scraping on the strongest areas most out of alignment (arrows). If an area is too weak, work around it to make it seem stronger in comparison. The spine to rail tapers at the tip opening are addressed in depth on the next page.



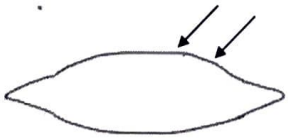
ideal tapers - transition from more steep near the collar to more gradual near the tip - angles will vary slightly with cane hardness and density



taper is much too flat



spine too round, weak spot between spine and channels



spine is flat, channels are too strong in proportion to spine and rails

taper at rails is too flat, this is almost impossible to fix if the reed is flat or weak

Tip Opening

The shape of a reed transitions from a round butt end (matches the bocal) to an elliptical tip opening (matches your mouth). An ideal finished tip opening tapers from thick to thin (middle to corners) and should close evenly from the corners to the center.

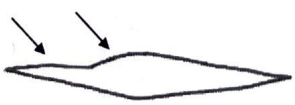
Compare the existing tip shape with the ideal one and begin the balancing work by scraping on the strongest areas most out of alignment (arrows). If an area is too weak, work around it to make it seem stronger in comparison.

- collapsed channels: generally a symptom of bad cane. Probably not salvageable, especially if the reed is weak or flat.

- asymmetrical: a symptom of incorrectly splitting the tubes (see page 75).

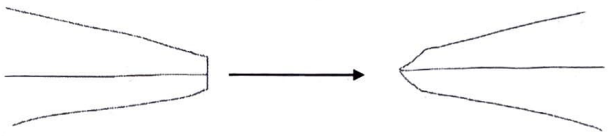
- one blade more curved: differing cane densities. These reeds are difficult to balance if the difference is too extreme.

- scraping error or cane inconsistency



Tip Bevel

Beveling the tip is a technique for getting a really good taper at the tip of the reed. This is the **most important place** on the reed and a proper taper here is critical for response and strength. Create a 45 degree angle in the front 1/2 mm.



Direct the knife or razor straight into the plaque, no scooping.

To preserve this bevel later in the finishing process, roll the file up on its edge as you approach the tip of the reed.

- too shallow: stuffy, sluggish response and a weak, collapsing tip

- scooped: hesitant attacks in p/mp, especially in the tenor register

- cut, bump or other imperfection: response will have a hitch.

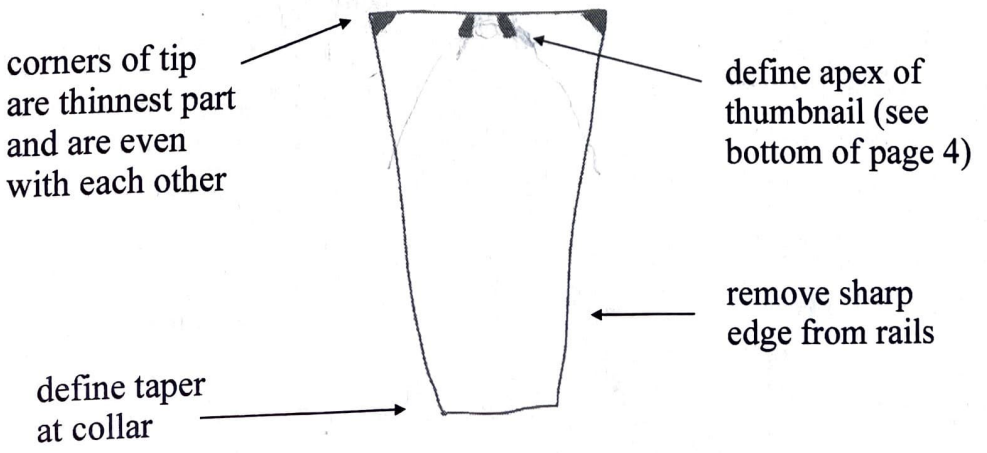
Day 1 - Starting a Blank

Goals:

1. Stabilize intonation
2. Identify degree of response
3. Determine cane quality - is it hard or soft, does it hold the trim, what is the rate of change?
4. Determine wire-up or wire-down if possible
5. Balance middle half for proper embouchure

Plan:

"Day 1 Scrape" is a defined as a *set* of scrapes that you know every reed will require (because you have done all these scrapes on every reed you've ever made). **This will include a tip bevel**, and may also include roughing in a thumbnail shape, defining the collar, taking the edges off the rails, refining the general tapers, or correcting a center to side taper that doesn't exist or isn't steep enough. "Day 1 Scrape" will vary by individual and depends heavily on the contour and thickness of your profile. As an example, below is a sketch of first day work based on a Herzberg profile (includes a tip bevel). Reminder - good reeds require relatively little work, but they do require *this* work.



About the Crow

The name crow is commonly used to refer to many different species in the genus *Corvus*, including rooks, crows, ravens and jackdaws. There are about 40 different species of crow, and they range in size from 19-27 inches. They are found on all temperate continents except South America.

Crows are considered to be among the world's most intelligent animals and have been observed to make and use tools, hide and store food across seasons and engage in sports and play. They may also be capable of displacement (communication about an object that is not immediately present). Some crow species top the avian IQ scale and many have an encephalization quotient that is equal to non-human primates.

Crows have excellent individual memories and can identify specific human by their faces. If they meet someone who causes them harm or distress, they teach the rest of their flock to recognize that person's face. They can also communicate a person's kindness to their community and the entire flock will become more friendly toward that person.

Crows will eat almost anything and are incessant scavengers. They quickly become habituated to most attempts to scare them off and can therefore be a real problem to farmers.

Crows often mate for life, with young from their previous nesting cycles joining them to protect the new nest and feed the

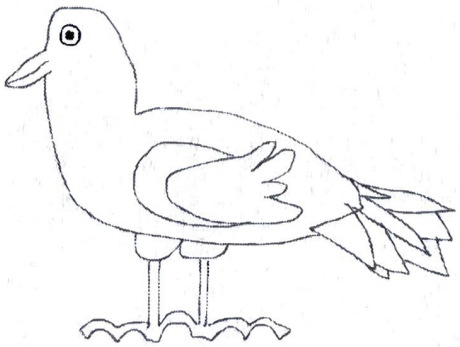
new young. Wild crows can live up to 14 years, however the oldest known captive crow died at 59.

Crows sometimes stand on anthills and allow ants to climb on them, rubbing the ants into their feathers. The ants remove parasites and can cause the crow to become drunk off the formic acid released from the ants' bodies.

Crows hold funerals, gathering around dead members of their group to try and identify what caused the death. They will avoid areas where dead crows have been found, even if there are food sources available.

Crows are important in mythology and fables in many cultures. They are often identified as tricksters or messengers of the gods, and can be harbingers of either good or evil.

Crows are no exception when it comes to poetic descriptions of gatherings of multiple birds. Among such beauties as a murmuration of starlings and a parliament of owls, a group of crows is referred to as a murder.



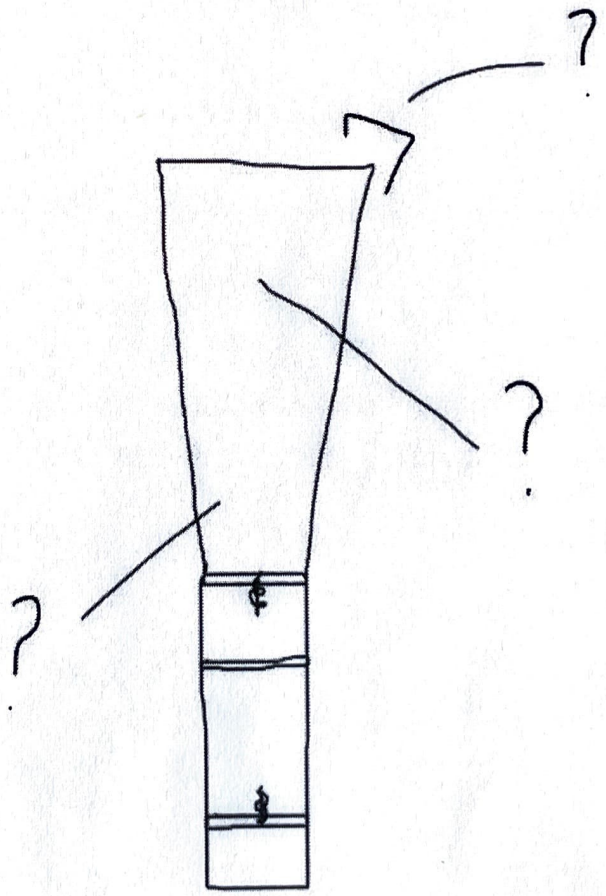
"Crow"
by Amelia Craypo
age 10

Notes

Notes

Part 3

Choose Your Own Reed Making Adventure:
What do I do now?



Choose Your Own Adventure

"We make our reeds for intonation and response in the context of fundamentals and good practice habits." ~ Ben Kamins

"All good reeds are alike; each bad reed is bad in its own way."
~ Leonard Tolstoy Sharrow

How to Use CYORMA

Although the information backwash from playing on a new or difficult reed can be overwhelming, all reed problems can be organized into five categories: problems with intonation, strength, resistance, response and resonance. Clarify your thought process by simplifying your vocabulary and sticking to the facts you know.

Begin CYORMA by picking a starting point from the categories on page 35. After choosing a path through the options and arriving at a "Fix-it" page (45 and later), confirm your **Goal** with your support structure and your **Plan** with your visual cues. This is often sufficient to execute "Day 1" and most "Day 2" work. Then, along with your visual cues, **suggestions for finer work** will help you decide where to make more precise trims later in the reed making process (Day 3 and beyond). All these observations are to be made **in the context of practicing fundamentals, etudes and repertoire**.

Reminders:

- Always work within the overall tapers and integrate your trim into the ideal structure of the reed.
- A good reed is made of good cane and has a high degree of response. Most reeds aren't that reed.

Troubleshooting Intonation

Using normal embouchure and air expectations and observing fundamentals and tendency notes in context, my reed is…

Sharp - go to page 42

Flat - go to page 43

Unstable - go to page 44

Troubleshooting Response

Using normal embouchure and air expectations and observing fundamentals and tendency notes in context, my reed is…..

Unresponsive - go to page 45

Too Responsive - go to page 46

A note on the basic underlying responsiveness of a reed…

Degree of response is an intrinsic element of each individual piece of cane. Identify this characteristic early in your process using the F#3 indicator note on page 20. Rolling out the embouchure ever so slightly in pp/ppp allows you to extend the taper even further, as a successful dynamic taper combines flexibility of embouchure and of the reed. MOST REEDS DO NOT RESPOND WELL. It is too easy to sacrifice intonation, strength and resonance in the (futile) search for perfect response on the majority of reeds. Maintain good practice habits and measure reeds against a constant (normal embouchure and air expectations). Know when you have reached the optimal balance of all factors and therefore when to stop scraping, as the reed has reached its particular potential.

Troubleshooting Resistance

Using normal embouchure and air expectations, the baseline resistance of my reed is…

Stuffy - go to page 47

(Less than ideal air capacity and flow. Like blowing through a coffee straw. Small, tight, resistant.)

Free blowing - go to page 48

(More than ideal air capacity and flow. Like blowing through a milkshake straw. Big, loose, easy.)

Troubleshooting Strength

Using normal embouchure and air expectations and observing strength indicators*, my reed is…

Strong - go to page 49

Weak - go to page 50

*Indicator	Strong	Weak
high register	easy, sharp	unstable
low register	difficult, sharp	easy
slurring down	difficult	easy
slurring up	easy	difficult
embouchure manipulation - low register	too much	very little
embouchure manipulation - high register	very little	too much

Low Register - Bb1through F2

Notes tend sharp to very sharp with a few exceptions. Balance your expectations with your needs, i.e. don't expect to have an amazing low register on reeds built to play Rite of Spring. If you are having a lot of trouble with this register, consider using a longer bocal or having instrument maintenance done.

To distinctly favor the low register, build reeds that are:

- wider
- longer
- shorter and deeper internal bevel (flatter tube/wires)

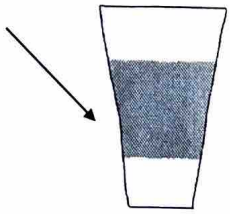
Intonation:

- F2 mf attack sharp - page 20
- overall sharp - page 49
- Outlier notes may require adjustments to the instrument in the way of tube inserts, pad height or fingering choices.

Response:

- too heavy in the back compared to the front - page 22
- rail taper is uneven and too thin too far back - page 23
- B2 slurred to B1 cracks - page 17
- B2 slurred to B1 doesn't speak - page 49
- overblowing or cracking in mf, f - page 50
- need better response on otherwise good reed? Use sparingly.

- need better response in low register and reed is not flat? Light brushing in middle half. Use sparingly.



Middle Register - G2 through Ab3

Includes both sharp tending and flat tending notes. A properly structured front third is crucial, as is the balance between flexibility and strength in the middle third.

Intonation:

- Bb2 unstable - page 18
- E3, C#3 saggy, dropping or very flat - pages 43, 50
- F#3 sharp - page 20
- D3, F3, G3 especially sharp - page 47
- Outlier notes may require adjustments to the instrument in the way of tube inserts, pad height or fingering choices.

Response:

- Bb2 unstable - page 18
- F#3 cuts out at unacceptably loud dynamic - page 20
- Bad response - page 45
- G#/Ab3 cracking, possibly function of cane - or pages 47, 49

Resistance:

- D3, G3, F3 especially tight - page 47, 49

Tenor Register - A3 through Ab4

Notes tend flat to very flat, resistance and color vary widely by note. Many bocals are too flat in the tenor register - choose wisely. A structured front third, spine to rail proportions, proper rail tapers and strength in the back third are crucial. To distinctly favor the tenor register, build reeds that are:

- narrower
- shorter
- longer and shallower internal bevel (rounder tube/wires)

Intonation:

- B3 unstable in dynamic taper - page 21
- Bb3 unstable in articulation and taper - page 18
- A3 sharp or cuts out - page 17
- F4 low but reed overall high - page 21
- Eb4/D4 unstable - page 19
- Sharp tending notes unstable but otherwise in tune - page 8, 24, 49 and see bottom of page 1.
- Revisit playing on the correct side of the reed - page 2
- Outlier notes may require adjustments to the instrument in the way of tube inserts, pad height or fingering choices.

Response:

- Tenor response stuffy or thuddy - check tip bevel - page 26
- Collapsing tip - page 8, 23, 50, also tip bevel - page 26
- F4 cracking - flatten tube at first wire

Strength:

- Weak register - rails too thick compared to spine - page 24, 50, or revisit playing on the correct side of reed - page 2

Tone:

- Substance of tone in tenor register comes from amount of cane in the back of the reed and good rail tapers - page 23

High Register - A4 through E5

Includes both sharp and flat tending notes. Proper tip bevel, structured front third and strong middle/back construction are crucial.

To distinctly favor the high register, build reeds that are:

- narrower
- shorter
- longer and shallower internal bevel (rounder tube/wires)

Intonation, Response, Strength:

- Unstable intonation, cracking notes, weak register - page 50
- Revisit playing on the correct side of the reed - page 2
- Check collar to tip tapers for correct proportions - page 22
- Check rails for smoothness of tapers - page 23
- Check tip bevel - page 26
- Outlier notes may require adjustments to the instrument in the way of tube inserts, pad height or fingering choices.

Tone:

- Quality of tone - page 41

Troubleshooting Scraping

Goal: Make fewer and better calculated changes, working in tandem with the reed's natural break-in period, leaving more cane on a balanced reed for better intonation, response, resistance, resonance, strength and a longer lifespan.

Plan: Do the work (fundamentals, repertoire, etudes, etc.) with normal expectations of embouchure and air (default support structure) until you can make a decision. Resisting excess adjustment and allowing the reed to fail is really difficult and takes practice and experience. Experiment thoughtfully and with intent. Maintain an awareness of your support system, diagnose thoroughly and use the right tool for the job.

Technique:

- sketch in pencil the trim you wish to make and follow the markings exactly
- view the reed from a different angle
- initially limit file strokes per trim
- observe angle of reed under file
- observe pressure of file, do not dig at surface
- observe quality of shaving as it is removed from the cane
- experiment with different file grits
- experiment with different mental vocabulary - not "file" or "scrape" but draw, push, pull, slide, direct

Diagnosing:

- indicator notes, on the whole, are to be observed in context, not performed as isolated tests

- observe results of one change before moving on to the next one, even if you are sure of your next trim (especially if the cane is very responsive)
- work according to break-in period - page 86
- work according to quality of cane - better cane will respond more efficiently to a smaller trim
- work according to density of cane - harder cane can be scraped more thinly
- use degree of change observed to determine the degree of change to make next
- observe a reed you have saved that you like, either from a teacher or one of your own, and compare
- make reeds with someone else - troubleshoot for each other
- if reed responds to the trim, continue with your work. If reed doesn't respond or loses the trim within a relatively short amount of time = THIS REED WILL NEVER WORK = RIP = DON'T WASTE YOUR TIME

Tools:

- use different light, brighter light, a different color lightbulb
- use magnification
- check your machines, especially your profiler - are the measurements too thick? too thin? are the blades sharp?
- make sure your instrument is sealing correctly
- make sure your plaque is not too thick and that it tapers like an ideal reed (front to back and center to side)
- Evaluate type and quality of tools. Use only those of high quality and that are suitable for the task

Notes

Notes

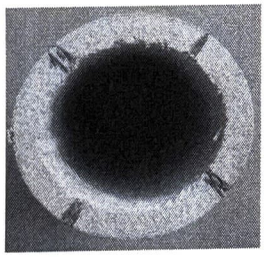
Notes

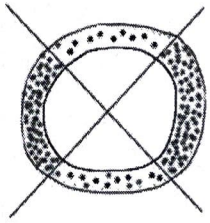
Appendix A

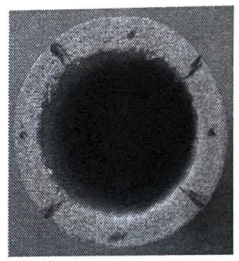
"If you know what you want in a reed, it can be made. However, it is not a substitute for the daily practice of long tones, scales, and intervals." ~ Norman Herzberg

Reed construction recap:

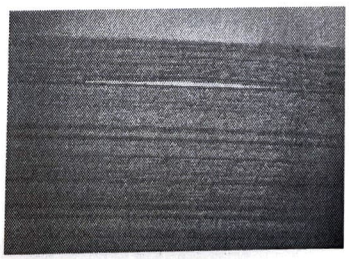
Split - Most tubes are elliptical. Divide the tubes into 4 in an X across the ellipse. A tube curves according to the density of the vascular bundles, therefore mixing more and less curved cane in one piece results in asymmetrical (unevenly curved) tip openings.







Gouge - Concentric. Default measurement is 1.39mm (0.055"). A thicker gouge means that the eventual profiled surface will be farther toward the inside wall of the tube, and therefore of softer cane. A thinner gouge means that the eventual profiled surface will be closer toward the bark of the tube, and therefore of harder cane. I sort and discard according to the quality of the curl.



← GOOD

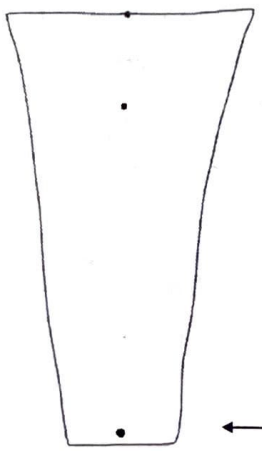
BAD →

Hardness test - Test and record several months worth of reeds to determine a range of densities that work for you. This range will vary according to personal preference, type of micrometer, local humidity, alignment of the planets, etc. This range will most likely change as you become a better reed maker and finish your reeds properly (it did for me).

Sink test - Soak overnight (9-10 hours). The cane that sinks is more likely to be of good quality. Discard what floats.

Shape - Page 7. Once the shaped cane is dry, use sandpaper to smooth the underside (you can't do this after profiling, as it would effectively change the thickness of the profile).

Profile - A profiler attempts to reduce errors in scraping by getting the blank as close as possible to a finished reed without exceeding the minimum proportions required of a wide range of cane densities (because a good reed can be made of both soft and hard cane). Trim ends of cane to 2 5/16" from the fold and score bark so reed doesn't split while forming. Measurements are as follows (critical point is the most important measurement to achieve, hence the name):



Fold = 0.12 - 0.14mm (0.005")

Critical Point = 1/2" from fold = 0.58 - 0.62mm (0.024")

Just outside bark = 0.9 - 0.96mm (0.036" - 0.038")

Mummify - Fold the cane and place the first wire (page 3). Tighten wire, wrap above and below wire with thin cotton thread, soak for a minute or two, then push reed firmly onto mandrel. Use pliers to further round the tube as you push it as far onto the mandrel as it will go, then remove and place on drying pin/rack. Let dry for at least 2 weeks. Remove thread and wire and open reed…

Internal Bevel - page 8

Blank - After beveling internally, place the third wire on the reed and tighten it incrementally, rounding the tube and allowing the blank to move up the mandrel as you close the gap between the two halves. After the third wire is firmly set, loosely place the second wire and then the first on the blank. Use a ruler to set them in their proper places (page 3), then tighten the second, then the first all the way.

Clip - Trim blank to 28mm from top of the first wire to the tip - page 10

Day 1 Scrape - page 27

*Note on tightening wires: pull the wire strongly at a perpendicular angle to the reed, then release the tension and twist the wire to conform snugly to the tube all the way around. Don't allow the wires to bite into the cane. Mind the gap!

*Note on soaking: To be sure your material is completely hydrated, do not submerge the entire piece of cane or reed but leave a portion sticking up out of the water. Observe how the cane darkens as the water wicks up the straw-like vascular bundles.

Appendix B

It is key to remain in good playing condition so that we can judge a reed according to a reasonably reliable constant (i.e. our normal in-shape embouchure and air expectations). Only after we are finished excavating the best possible reed out of a particular piece of cane according to that constant do we then adjust to that reed. High standards of quality control in both reeds and bassoon playing are how we continually maintain and improve our musical and professional integrity. Doing otherwise is asking for a whole heap of trouble, both physical (injury) and psychological (needless worry, frustration and cane-quality-unrelated reed "slumps").

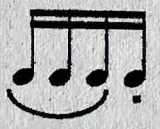
Attend to these basics everyday: intervals, scales and long tones, and as always…..MORE. SLOW. PRACTICE.

Intervals are practiced with a metronome and a tuner. Choose a key and play slow broken thirds from the lowest to the highest note of the instrument (independent of key) - all slurred. Listen to make sure there are no notes in between notes (blips and cracks) and no crescendi or diminuendi between notes. Be mindful of sustaining the proper support and airflow for a legato that exactly matches the resistance of the instrument in both the holding of a note and moving to the next note. Practice in different dynamics, and do not accelerate until you have mastered the exercise at a slow tempo.

Do the same process with fourths and fifths.

Scales are not practiced diatonically. Pick a key, begin with the first pattern on the lowest possible note on the instrument (either A#/Bb, B/Cb or B#/C) and proceed to the highest note that will allow you to turn around and return to that beginning note as the first note of a pattern grouping. Start each succeeding articulation pattern one step higher than the preceding (this will correspondingly alter the turnaround note). From the third articulation onward there is enough room in the range of the instrument to begin adding another pattern grouping/turnaround below the starting note. For each succeeding articulation do a similar add-on to the bottom, always covering as much of the range of the instrument as possible. Scales are practiced with a metronome, beginning slowly at ff or f and gradually increasing the speed while reducing the dynamic (not during the pattern, but rather between repetitions of patterns).

1. 

2. 

3. 

4. 

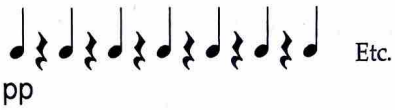
5. 

6. 

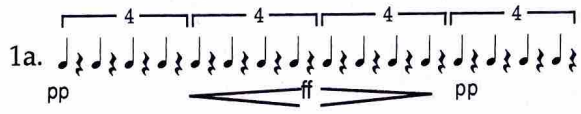
7. 

8. 

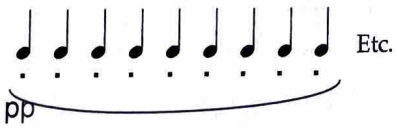
Always practice **Long Tones** with a tuner and a metronome set to quarter note = 60. In this exercise *pp* means as softly as possible (on your current reed) and *ff* means as loudly as possible (on your current reed). The goal is to expand your tonal and dynamic range every time you practice. There are only two rules: you must be with the metronome and you must be in tune. The dynamics are variables to be expanded from day to day depending on you and your reed. The use of drones is recommended.

1. 

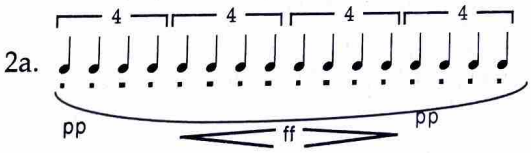
1. Play alternating quarter note, quarter rest with as soft an attack, release and duration as possible. Make sure you are right with the metronome and in tune.

1a. 

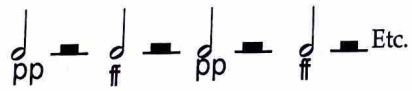
1a. Play four notes of PP, four notes of crescendo to FF, four notes of diminuendo to PP, and four notes of PP.

2. 

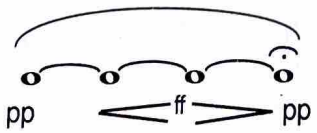
2. Play a series of quarter notes as softly as possible with as light and long an articulation as possible.

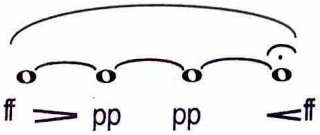
2a. 

2a. Play four notes of PP, four notes of crescendo to FF, four notes of diminuendo to PP, and four notes of PP.

3. 

3. Alternate half-notes/half-rests at the extremes of your dynamic range to set your dynamic levels. Be very careful of the pitch.

4. 

5. 

4. The whole notes in steps 4 and 5 are to be interpreted as segments of equal length. Play the first segment as softly as possible, the second with a perfectly measured crescendo to as loudly as you can play, the third with a perfectly measured decrescendo to as softly as you can play, and the fourth another segment of PP. A fermata is added in case you have air left over. If you do have air remaining in steps 4 and 5, add one beat to each segment. Always try to expand the duration of steps 4 and 5.

5. Start the first segment as loudly as possible and immediately start a perfectly measure diminuendo. The second and third segments are both PP and the fourth a perfectly measured crescendo to FF. A fermata is added in case you have air left over. If you do have air remaining, add one beat to each segment.

Appendix C

How long does it take to make a reed (while also not watching TV or talking on the phone or surfing the internet, etc.)?

minutes per piece retained	action (incl. cleaning machines)
1.8	marking (per tube) with Arlen Fast radius gauge
0.3	splitting and cutting to length with guillotine
0.1	pregouging
0.7	gouging and sorting according to quality of curl
0.3	hardness testing
-	sink test (overnight)
2.2	shaping
3.5	profiling
1.9	making mummies
5.6	making blanks
16.4	total minutes work per blank - before scraping

Appendix D

How much cane do I need to buy?

I kept tabs on 4 different orders of cane, two were 1kg orders, two were 2lb orders. I treated them the same although the weights are not exactly equal. They were from several different companies and of different lengths and types of cane.

type of cane	number of tubes	pieces split and cut	good gouge *	hardness test - in my range	sank overnight
RGO (RDG)	47	118	47	27	27
RGA (RDG)	50	123	62	40	31
Alliaud	35	114	34	22	22
Rieger	56	174	95	45	42
average	47	132	60	34	31

Result: 1 kg/2 lbs of tube cane = 31 pieces of cane that are ready to shape and profile.

This will last you 5 weeks (at 6 blanks a week). Therefore, about 10 kg/22 lbs of cane will last you one year. Adjust according to your workload/level of obsessiveness.

*See Appendix A for example of good gouge.

Appendix E

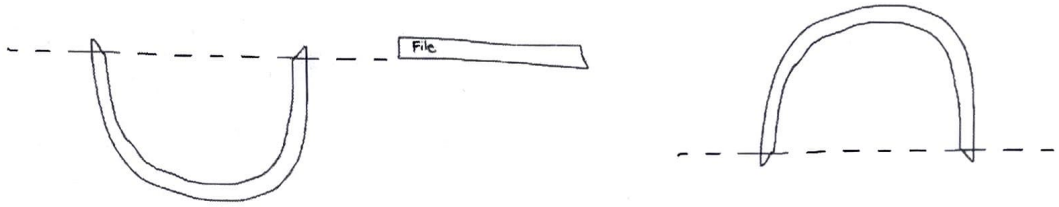
How much time do I need to spend processing cane? This chart shows how much time it takes to process 1 kg/2 lbs of cane. One kg/2 lbs = 31 pieces of ready-to-shape cane = 5 weeks of blanks. Adjust according to your workload.

action	minutes per tube or piece	average tubes/ pieces per kilo	total time in minutes
mark	1.8	47 tubes	84.6
split	0.3	132 pieces	39.6
pregouge and gouge	0.8	60 pieces	48
hardness test	0.3	34 pieces	10.2
sink	-	-	-
shape	2.2	31 pieces	68.2
profile	3.5	31 pieces	108.5
mummies	1.9	31 pieces	58.9
blanks	5.6	31 pieces	173.6
		total minutes	591.6
		divided by 60	9.86

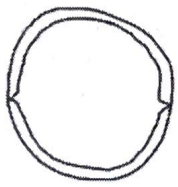
So if I need 1 kg/2 lbs every 5 weeks (see Appendix D) and it takes me about 10 hours to process one kilo of cane, I need to spend 2 hours a week, or about 17 minutes a day processing cane. This does not include working on clipped reeds.

Appendix F - Leaking Around Bocal

1. Internal bevel problems (page 8)? The angle of the file across the formed tube (or tube across sandpaper) is crucial.

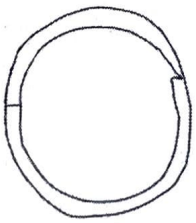


If you turn or angle the reed under the file, or push too hard and the cane spreads apart, when the tube springs back into shape this happens…

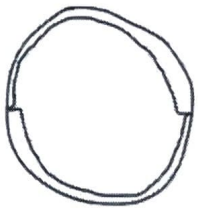


…and it cannot always be corrected.

2. Bad shaping…



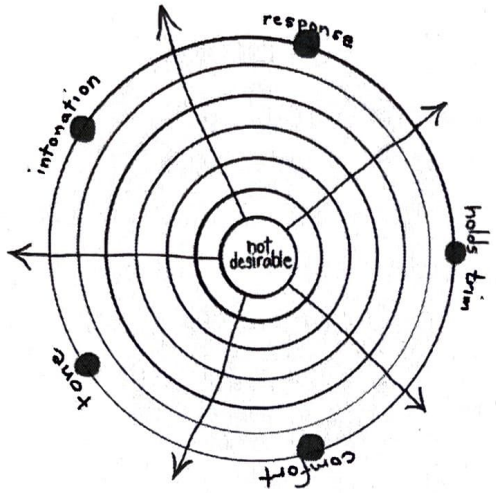
…or gouging job?



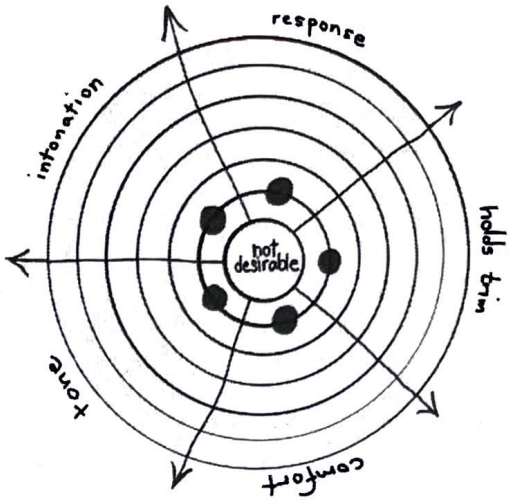
Options:

- Ream thoroughly and carefully (spiral or fluted reamer, then diamond reamer).
- A diamond rat tail file can help smooth out small fissures and gaps remaining after reaming is complete.
- Roll your mandrel on a block of slightly melted pure beeswax, then insert the mandrel into the reed and scrape the beeswax into the holes or gaps.

Appendix G - Reed Diagrams

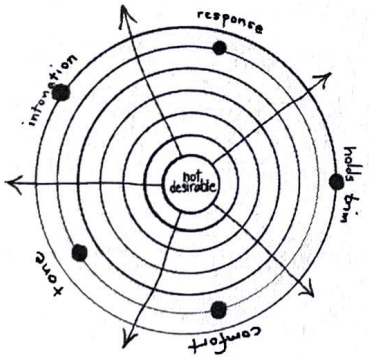


archetypal perfect reed

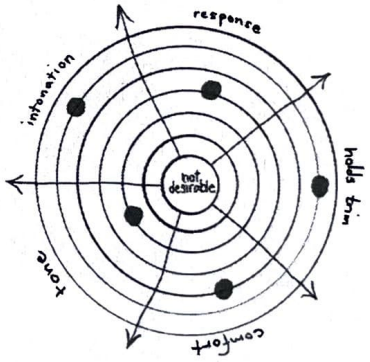


archetypal worst possible reed

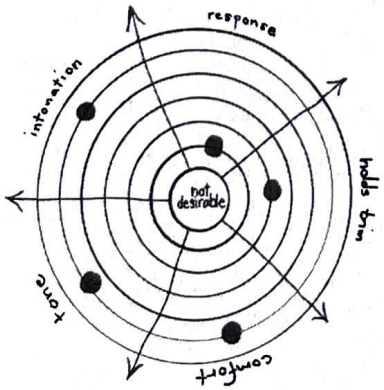
Reality is everywhere in between.



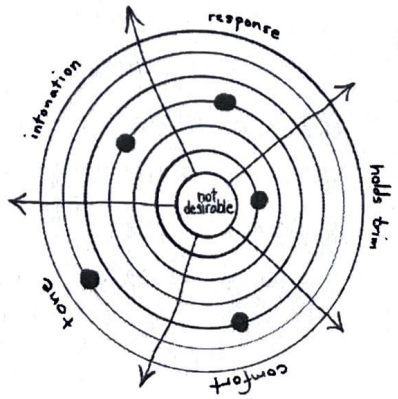
good



practice



bad



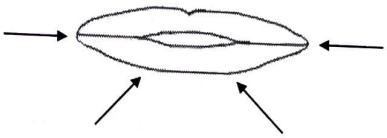
also bad

Appendix H - Glossary

Catch 22 of reed making: you need to stay in shape to make good reeds but you need good reeds to stay in shape.

Default: a middle of the road approach to reed making. A set of touchstone measurements to return to when feeling lost or to reset your reed making after the demands put on you have changed.

Embouchure: a firm and structured gripping of the reed that doesn't pinch. Support the reed here.



Finished reed: a reed that has been taken to the limits of its potential. This does not mean a good or perfect reed. It does mean that there is no more work to be done to that reed without negatively affecting the intonation, stability or response. Finishing a reed should be done over several days in conjunction with the natural break-in period (see below).

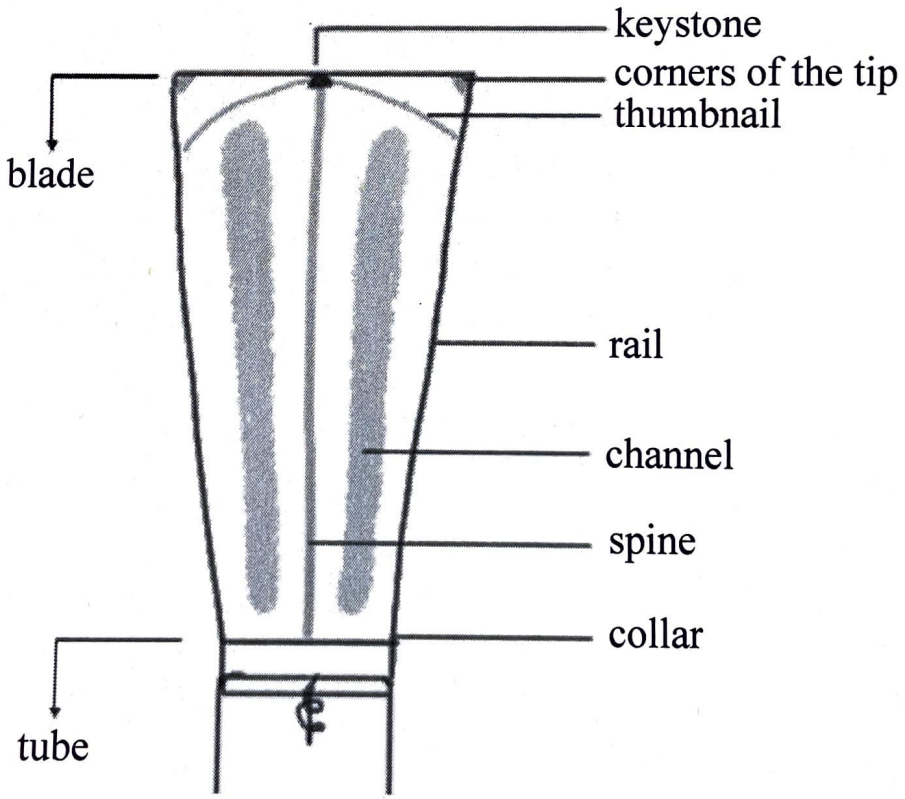
Good Reed: one that plays in tune (intonation) and in time (response).

Natural break-in period: the natural physical changes of the cane fibers over the wetting/vibrating/drying cycle. The cane reacts differently as it ages, becoming sharper, more resistant, more mellow, less responsive and more stable over time. This is important to keep in mind in the early stages of trimming the reed. Good cane is more responsive and changes less between cycles.

Normal embouchure and air expectations: the embouchure structure and air control and volume you would expect to use on a finished reed made of good cane. Air and embouchure together are referred to as support structure (see page 16).

Rate of change: How quickly and how much does a piece of cane respond to a trim? How much and how quickly does it change back?

Taper: from collar to tip and from spine to rail, each point on the reed becomes gradually thinner. No bumps, channels, windows, holes or flat areas should be visible.



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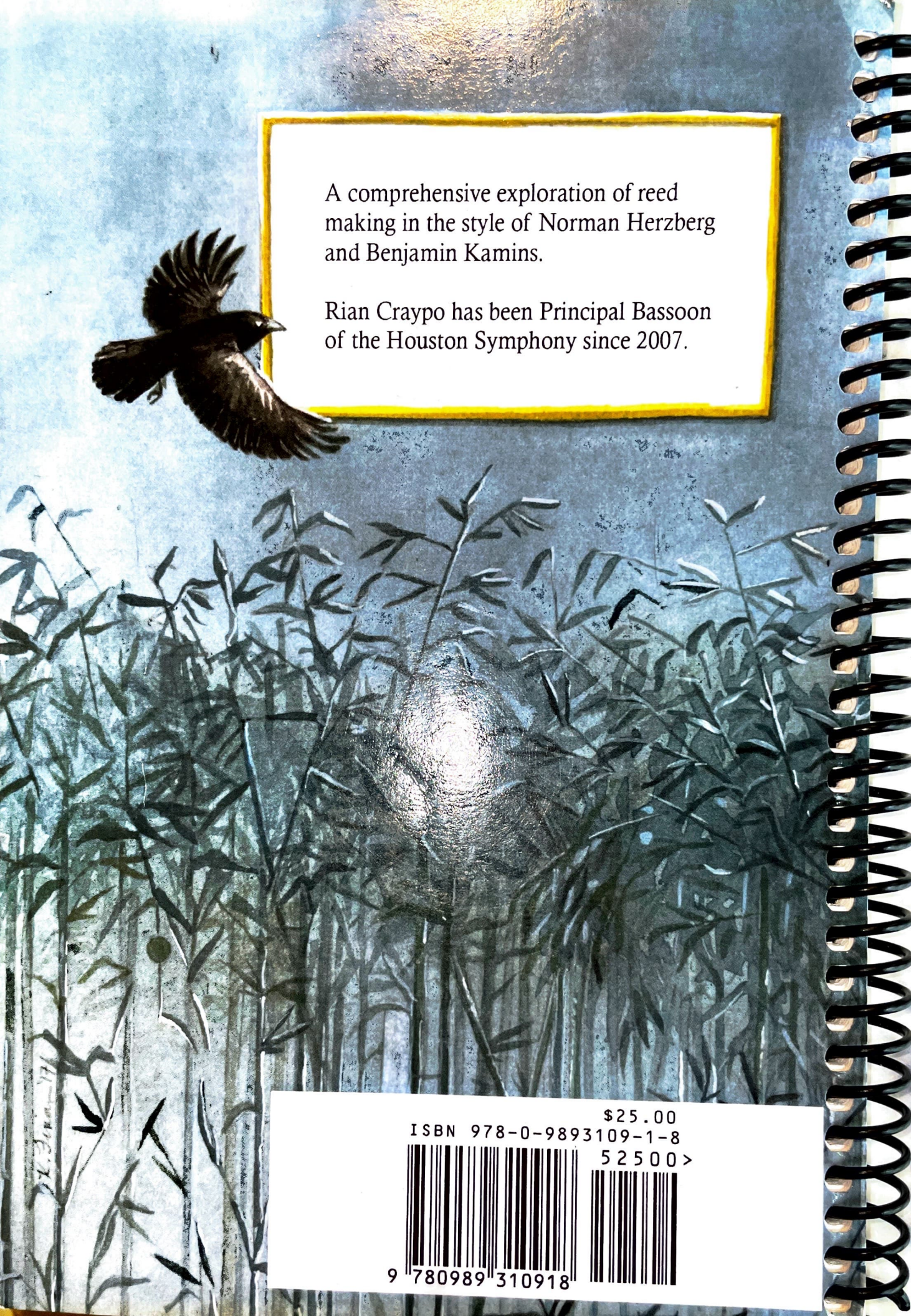
Ben Roidl-Ward
Isaac Schultz
Jessica Goldbaum
Sean Craypo



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Rian Craypo has been Principal Bassoon of the Houston Symphony since 2007.

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