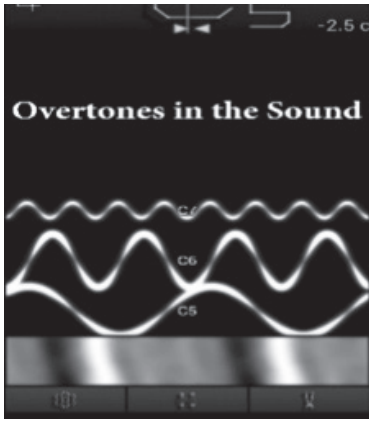
Tone Centering for Trumpet

Randy Adams

Overtones and Tone Color

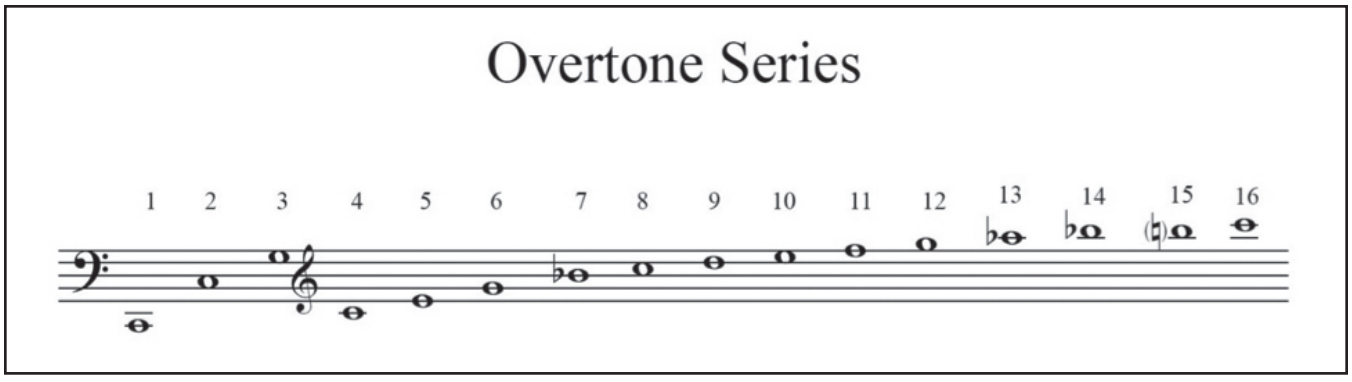
"High, fast and loud" are all great fun, but the fundamental aspect of any musical endeavor is a beautiful tone,—pure, resonant, warm, clear and in-tune. The quest for a beautiful tone should always be first and foremost in the musician's thinking no matter what the tempo, volume or technical challenge. This is our job as musicians—part of our overall "musical hygiene" [Howard Snell, *The Art of Practice* (New Generation Publishing, Ltd., 2015)—and our listeners expect it of us. As daunting as the task may seem when standing in front of a student ensemble or grading the weekly chair test, this quest may not be as elusive as many believe. Understanding the resonance/intonation connection and some basic concepts of embouchure formation, airflow, posture and balance between player and instrument can help remove the mystery of tone production and give teachers and players a clear advantage in achieving musical goals.



Fundamentals of Tone Production

How does one define a beautiful tone? Whether it be a brass instrument, woodwind or even voice, the sounds we find most appealing have warmth, body, focus, depth, highs and lows. When describing a desirable trumpet sound, for instance, we may say that we want to hear a "dark" sound or a "bright" sound. But a dark sound without highs is dull, "woofy" and lacking in projection. A bright sound without lows is thin, edgy and difficult to play with. And both extremes are difficult to tune. Most of us want to hear a "Bright/Dark" sound—something with highs for clarity and projection and lows for warmth and power. These perceived highs and lows embody the whole overtone series sounding in each note we hear.

Each note produced on a brass instrument consists of a combination of overtones perceived by the human ear as **fundamental pitch** (the lowest of the overtones produced for that note) and **tone color** (individual overtones sounding above that lowest frequency in varying degrees of amplitude). For instance, a C on the trumpet contains the C we hear along with the other pitches in the harmonic series for C – C (in several octaves), G, E, Bb, D, etc. *(See "Overtone Series" below.)* Most of us can't hear these pitches in the note, but we can see them on the wheels of a chromatic strobe tuner. When you are tuning concert C with the strobe, you can also faintly see the G wheel standing still and sometimes even parts of the E wheel. A good example of an instrument that produces strong enough overtones to be distinguished from the primary pitch is the orchestral chimes. If you listen closely to the ring in the sound you will notice at least one additional pitch a 6th higher and/or lower, and sometimes these pitches clash with the harmony the fundamental pitch is meant to fit into. This is all part of the color of the chime's sound.



When you hear a C4 on the trumpet and compare it to the same note on the French horn there is an obvious difference in tone color even though the actual pitch is the same. This is because the shape and length of the trumpet tends to amplify the higher frequency overtones in the sound while the larger bell, conical bore and length of the French horn favors the lower. The higher overtones dominant in the trumpet sound are perceived as "brighter" and the lower overtones in the horn make it sound "darker". The higher overtones in both instruments, however, tend to be amplified as the volume level increases. (The fire gets hotter when we add more fuel). The job of the brass player is to produce a free and energetic air column and a pure vibration frequency that aligns with the air already vibrating in the tubing of the instrument. It's the same principle at work when a microphone and speaker produce feedback or certain notes are louder than others while singing in the shower. If vibrations being produced align with vibrations already present in the air they combine and amplify each other. When we buzz into the trumpet the instrument picks up these vibrations and amplifies them providing its own characteristic tone color. If the information being supplied (airflow and vibration frequency) fits the length and shape of the tubing receiving it, we have achieved what the instrument was designed to produce—a beautiful, resonant, clear sound. Voila! If only it were that simple! Having a better understanding of overtones, resonance and acoustics will give us a clearer picture of what we are looking for in tone quality and a better idea of how to accomplish this physically. Catching a glimpse of the wonder and mystery of sound is just a tiny part of appreciating the amazing gift of music.

Airflow and Embouchure

Next, we move on to the nuts and bolts of producing a centered tone. Solid fundamentals are the essential building blocks of resonant sound beginning with air and embouchure.

Airflow - The Fuel Supply

First, the airflow fueling the embouchure must be free and energetic. Poor posture and tense muscles cause shallow breathing and restricted air movement. Just like clogged plumbing creates poor water pressure at the faucet, a tense airflow compromised by a constricted throat, closed teeth or improper tongue placement will adversely affect the vibrating embouchure and impair good tone quality.

Begin with a full, deep breath and a posture that resembles standing. Good posture keeps the body properly aligned and balanced resulting in relaxed muscles. (Many musicians have benefited from the study of the *Alexander Technique* to help with excess tension. Here is a great resource for getting started: *https://www.alexandertechnique.com/musicians.htm*).

Make sure the passageway from lungs to lips is unobstructed. (The glottal area and back of the tongue are major culprits here!) Keep the throat open as if to yawn. Use an "OH" vowel shape.

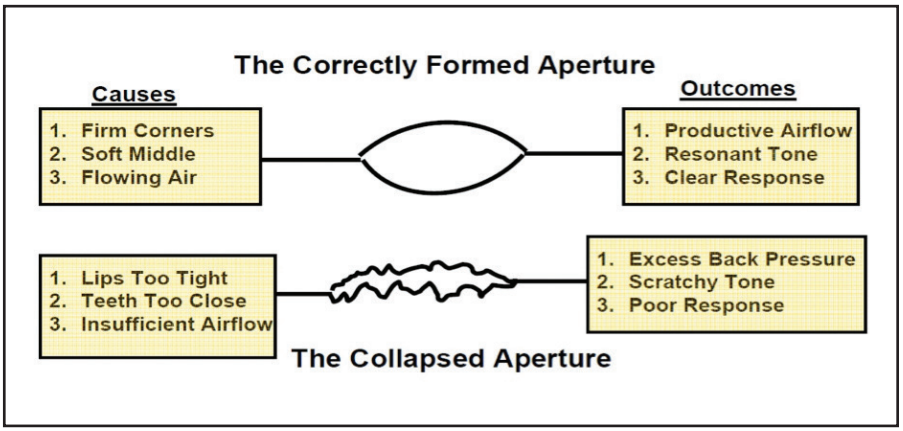
The benefits of a large air column can be realized in many areas of playing, both physical and aural. Sound is vibration in the air around us. Moving air energizes the embouchure causing the air molecules inside the trumpet to vibrate. The trumpet amplifies these vibrations and projects them outward causing the air around us to vibrate. A large, active airflow translates into a large, active sound with a full complement of overtones. *(See Tone Centering, page 27.)* A constricted airflow translates to a constricted sound, lacking overtones essential for resonance. Physically, this large, active air column also helps the embouchure work more efficiently allowing for reduced mouthpiece pressure and a more relaxed setting. This in turn enhances the vibration of the lips and increases endurance.

Embouchure - The Vibration Motor

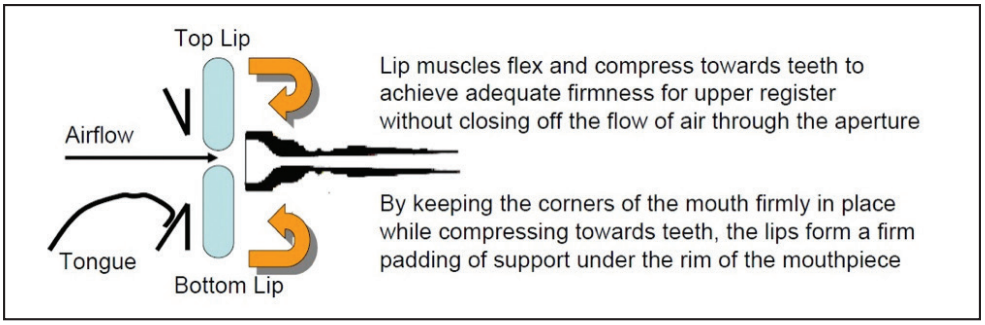
The brass player's embouchure is a paradoxical phenomenon requiring careful training and regular maintenance. An intricate combination of tension and suppleness, compression and flow are required to create a resonant sound.

The most crucial area of the embouchure is the aperture – where wind and flesh meet to produce

sound. A properly functioning aperture requires a balance between firmness and softness, wind and muscle, flow and flesh. The aperture is really a nozzle controlling the air column's focus and speed and must remain soft enough to vibrate freely, firm enough to produce desired pitches and open enough to allow air to flow. Excess tension dampens vibration adversely affecting tone and intonation. Inadequate tension leads to an unstable sound and limited range. A well-developed embouchure, when properly trained and adequately fueled can remain more relaxed and therefore exert less effort in tone production thus enhancing vibration, resonance and endurance.



A common problem with aperture formation is the tendency to press the lips too tightly together, especially in the upper register, thus closing off the "nozzle" and limiting the flow of air. If the lips are pressed so tightly together that air cannot flow through them sufficiently, they will not vibrate. No amount of pressing or straining will work if there is no room for the air to travel through the lips and make them buzz. This presents us with a dilemma: How are we to tighten our lips for the upper register if tightening tends to close the aperture and stop the flow of air? The answer may be found in studying Trumpeter's Enemy Number One: Excessive Mouthpiece Pressure. Why does mouthpiece pressure work? It "works" because we are using our arms to do what our lips ought to be doing—compressing against the firm foundation of the dental structure and producing a resilient vibrating surface which can react with increased air speed to produce higher frequency vibrations. But pressing creates a whole host of other problems—swollen lips, bruising, cuts and abrasions along with tone and intonation issues. What we need to do instead is compress the lips against the teeth by using the lip muscles themselves, not our arms. This allows the lips to become firm enough to produce higher pitches without closing off the opening that lets the air pass through and energize them.



The contracted muscle becomes thicker providing a foundation as well as a protective cushion between the teeth and the mouthpiece. This "pucker tempered with a smile" is a fundamental characteristic of all effective brass embouchures. The lips come in towards the teeth as if to smile, but the corners stay firmly planted without stretching back as the area of lip outside the mouthpiece moves toward the center of the mouth as if to grip the outside of the mouthpiece.

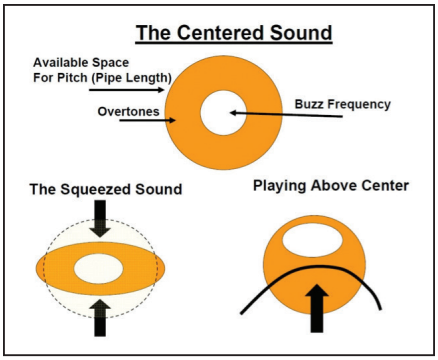
Great caution must be used when reading about or working on the embouchure! It is extremely easy to do too much of something and throw the whole mechanism out of balance. Use good judgment and common sense, and above all, use your ears. Good sound and good technique go hand-in-hand.

Now that we have discussed overtones in the sound and some of the basics of a properly functioning embouchure, let's put all of this to work.

Centering and Tuning

What does "Tone Centering" mean, and how do you do it? Recapping from above, a "centered" sound is a balanced tone containing the full complement of overtones available in an instrument—a "bright/dark" sound with both highs and lows. Producing this sound requires the correct frequency, a properly trained embouchure and an active air column.

Every note we play has a specific "space"—a range of frequencies—available for the buzz to resonate in the instrument. This is the space between the harmonic "walls," the "slots" where a note is produced. The pitch may be sharp or flat, but it is still considered to be a specific note. Above and below this space there exists a wall that divides the note from the next harmonic slot. Our practice of "lip slurs" is an exercise in effectively reacting with these walls and slots. Centering involves adjusting the buzz frequency to match the length of tubing so that optimum sound quality is produced—the resonant "bright/dark" sound described earlier. When the buzz frequency is properly aligned there is room in the available space for the full complement of overtones. If the buzz frequency is misaligned or if the space itself is compromised, the tone will be affected.



The drawings above are representations of proper and improper sound centering. The large circle in the top diagram shows the space available for a given pitch. The small white circle in the center represents a properly centered buzz. The outer orange area represents overtones emanating from the fundamental pitch. A centered buzz allows room for the full overtone series to resonate in the circle or note-slot.

In the photos below, we see representations of two common errors. The bottom left shows what happens when the space is compromised by a constricted aperture or "pinching". The area that was previously available above and below the buzz frequency has been squeezed and the overtone vibrations are dampened. The constricted aperture is also largely responsible for the "ewe" sound frequently heard in beginning trumpet classrooms.

The bottom-right shows a common trumpet malady among developing players—playing above center. Here the buzz is pushed against the upper wall thus dampening vibrations in that area of the note space. While playing in this manner may provide a sense of security in "feeling" where the note is (the wall), significant problems arise with intonation, endurance, accuracy and response.

> If a player gets into the habit of playing constantly above center by pulling out the tuning slide too far, he will not have enough leeway to adjust the fifth harmonic higher above center in order to play in tune; also the sixth harmonic, which is already too sharp, will be pinched still higher and therefore too sharp. Such a player will be constantly in trouble with his intonation.
>
> – Vincent Bach, *The Problem of Tuning Correctly, 1959*

Does this sound familiar? High school and college trumpet players commonly show up to rehearsal with tuning slides pulled out abnormally far to compensate for playing above center. Their high Gs are still unbearably sharp, and they often resort to using alternate fingerings on top-space Es. The tone quality is thin, edgy and lacking in resonance. Pulling the slide may help some with intonation, but ultimately this only enables incorrect playing. Correcting the problem at the source is a much better solution.

Tune the Tone

Finding the center of the sound requires careful attention to the fundamentals of tone production discussed above. Once the air and embouchure are working together efficiently, the next step is to find the frequency that causes the sound to resonate properly. This is the "sweet spot" where the tone seems to come alive sounding richer and louder on its own. Begin with an easy note in the middle register: 2nd line G. Slowly bend the pitch up and down through the various parts of the note-slot listening more for variance in tone and volume than the changing pitch level. Notice how the sound gets duller and loses resonance as the pitch rises to press against the slot's upper wall. Moving back the other direction, the sound gets louder and fuller as it gets lower before finally becoming unstable and "blatty" in the lowest parts of the slot. Explore the full range of sounds listening for the pitch level where the sound has the most resonance. This will be a clear sound with both highs and lows, and it should sound noticeably louder than other parts of the note. Most players find this spot is somewhat lower than expected—almost flirting with instability. Once resonant tone is achieved, check it with the tuner and adjust the slide accordingly. Tune this tone (not the out-of-center tone), and learn to play in this area of the sound in all registers. This is the tone the trumpet was designed to make. Playing in this way allows the air and buzz to work in harmony with the laws of acoustics in the trumpet. Along with sounding better, the improved efficiency helps with range and endurance, and since the buzz is now focused in a larger area of the note-slot, accuracy will also improve.

Randy Adams is Professor of Trumpet at Sam Houston State University where he has taught since 1993. He served as Houston Symphony Orchestra Interim Trumpet for the 2001-2002 season and has been a member of the Houston Grand Opera Orchestra since 1983. SHSU trumpet students have placed in the top five in the National Trumpet Competition's Trumpet Ensemble division, two SHSU students have played Lead Trumpet in the Disney College All-Star Band and graduates have gone on to play Lead Trumpet in the UNT 1:00 Lab Band and sub with the Houston, Dallas and Pittsburgh Symphonies.