

The Quest for Tone

Michael Tobias

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From Alembic to Zon

Introduction

For the past 20 years, many players and luthiers (including me) have been engaged in the musical equivalent of the search for the Holy Grail. The goal, in our case, is not a physical object but a sound that might be called "Ultimate Tone." There are many ways to approach this quest. There are many paths that lead to tone.

For each of us, the path is different. There are many subtleties and nuances that characterize the sound of one player but are very different (or absent) in the tone of another, even though both are using similar equipment. Like snowflakes, no two of us are alike—we don't have the same ears, the same fingers, the same muscles in our hands and arms. And we may not share the same idea of what constitutes good tone.

The path I have chosen, as a luthier, is based on my early interest in acoustic instruments. When I started building guitars, I was struck by the tone qualities of different woods. One way luthiers check for this is with "tap tones," which are used to judge the resonant qualities of different pieces of wood. (For an accurate comparison, it's best to use samples that are the same size.) Tap tones are generated by holding a piece of wood firmly, but with as little contact as possible, and then striking the wood sharply. You can use a fingertip, knuckle, or something else; the most neutral tapper is a piano hammer—the doubled felt does not add any coloration to the tap tones, allowing you to hear a more natural sound.

I used to buy acoustic guitar backs, tops, and sides that were rough-milled to approximately the same size. While tapping the pieces, I noticed there were differences from piece to piece within the same species. Pieces that were cut from the same log or flitch (a longitudinal section of a tree trunk) had similar, but not identical, characteristics.

I found that stiffer woods yielded bright-sounding guitars. Instruments with thick tops and heavy braces were darker and less resonant. Mahogany and maple backs and sides yielded guitars that were brighter and sometimes sweeter than ones made with rosewood, walnut, or koa—they did not, however, have the warm, rich bass response of the darker woods. To investigate further, at one point I built a batch of guitars that were essentially the same except for one component, so I could observe the difference made by each modification.

If this doesn't seem to relate to electric basses, consider that the electric bass is first and foremost an acoustic instrument. If you amplify a 2x4, it will sound like an amplified 2x4. That in itself may not be bad, but it may not be what you need to get the job done. What you need is an instrument that sounds good acoustically; if a bass sounds good without amplification, then it usually sounds good with amplification. (Sometimes not, since many other factors are involved, including the strings, the pickup, the electronics, the rig, the venue, and the player.)

The Elements

The tone of wood comprises many components, and it can be analyzed and described in a variety of ways. I'll try to do it here in non-scientific terms that will be meaningful to players. One way to explain the different tone qualities of different types of wood is to rate them in terms of hardness. Simply put, hard woods have a sound that is brighter, clearer, more articulate, and more conducive to a sharp attack than soft woods. If a bass is made entirely of hard woods, what you hear predominantly is the attack and the fundamental. Soft woods are more sensitive, allowing you to hear the swelling of the overtones as a note sustains. By combining hard and soft woods, a builder can take advantage of both qualities—if the recipe is right.

A second, even more simplistic, way to rank woods is by color: light woods are generally brighter than dark woods. Sound silly? Think about it—light-colored woods such as maple, alder, ash, and poplar are all brighter sounding than dark woods such as walnut, koa, zebrawood, and rosewood. A third factor in tone is weight/density. Lightweight wood is brighter than heavy wood. The perfect example is swamp ash (also called light ash or southern ash). Lighter pieces of swamp ash have sweet treble response and punchy midrange—but if the wood is too light, the bass response is weak. Heavier pieces lack the sweetness in the treble and that nice midrange, but they have a fuller, rounder low end.

The tone of a piece of wood is a combination of these elements. For instance: Bubinga is an extremely hard wood, even harder than Eastern rock maple. It does not have a brighter sound than maple, though, because it is much heavier. Bubinga and such other hardwood as rosewood and gonzalo alves contain large amount of oil,

wax, or resin; this tends to darken their tone, even though they are hard.

Lamination

Should we make "hippie sandwich" basses out of exotic plywood? If so, what is the purpose, other than aesthetics? Laminating different woods certainly can make instruments more beautiful, but it's possible to overdo it. Too many pieces means too many glue joints--and glue does not have desirable resonant characteristics!

By carefully combining woods, it's possible to focus on particular tone qualities. Different configurations yield different results: a maple neck with a maple fingerboard is generally brighter than a maple neck with a rosewood fingerboard. When making a body, if you put a hard top on a soft back, you can make the low end clearer and more articulate but still retain the desired qualities of the softer wood for the high end and midrange.

A laminated neck has more structural stability, if it's made properly--that is, by correctly matching the grain and the moisture content and correctly clamping it in assembly. Lamination also changes the Q (quality factor) of the neck. Here's what that means: Each piece of wood has a resonant peak. When you laminate several pieces, you create a system with multiple resonant peaks at different frequencies. The laminated piece should have the average of these resonances as its peak, and (in theory, anyway) this average Q should make the neck less prone to accentuate one peak, and thus respond more evenly.

Laminating creates an interaction between the pieces, and it generally makes the neck stiffer. Greater stiffness raises the resonant frequency--hopefully, to a point where the peaks do not match the notes on the neck, thus diminishing dead spots.

Neck-Through Vs. Bolt-On

Neck-through basses respond differently than bolt-ons. Neck-throughs have more sustain and a higher fundamental content in their notes, especially in the low end. This can be adjusted by using different body woods--lighter woods, for instance, reduce the accentuation of the low end. Bolt-ons seem to lack this fundamental response in the low end, especially with the low B on a 5-string. (I believe the mechanical neck joint contributes to this.) This characteristic of bolt-ons is often perceived as a "tighter" sound, thanks to a trick of the human ear.

The ear (or, more precisely, the brain) has the ability to "fill in" the missing components of the sound spectrum. Without the actual fundamental in place to muddy the sound, the ear is able to "extrapolate" the fundamental from the upper partials. The telephone is an example of this principle in action: When you talk on the telephone, the mechanism (which is really a miniature bass-reflex cabinet) is not capable of transmitting the fundamental, especially if you're a man with a fairly deep voice. Yet the person the the other end hears it just fine.

Composites

High-quality, properly seasoned wood is becoming increasingly scarce. Some sources have disappeared altogether, and the rape of the rainforests has raised not only prices but also the consciousness of many people around the world. Consequently, many builders are buying wood from suppliers who harvest from sustained-yield forests or who recycle wood previously used for some other purpose.

Other builders have taken a high-tech approach to materials. Graphite and composite materials have made a great contribution to the music industry in recent years. Whether used for light, super-stiff reinforcements, for parts, or for complete instruments, these new materials are making quite an impact. They offer increased sustain (thanks to greater rigidity) and more stability (due to being less susceptible to atmospheric conditions).

If they're so superior, you ask, why doesn't everyone use them? (I'm sure the people who sell fiber and resin would like to know, too!) Well, you know what they say about opinions being like belly buttons: everyone has one, and they're all different. Not everybody wants to use the same materials, and the different choices made by luthiers offer many different tones to players. Diversity is good, no?

Other Factors

Aside from wood and its composite cousins, there are many other things that influence the tone of an instrument, including the hardware and the finish. Pickups and electronics are also very important--so much so, it would take another article as long as this one just to touch on the important points.

There are many approaches to building hardware for a bass, and many different materials are used. The bridge might be made of brass, aluminum, or steel--or a combination--and each of these metals has a different effect on

the tone. The mass of the bridge also affects sustain and attack. In general, brass is considered to be favorable to sustain while steel and aluminum are brighter-sounding. The most important aspects of bridge construction area: (1) good contact between the parts, (2) a well-defined "witness point" for the string, and (3) sufficient saddle movement to allow for proper intonation.

Finish--the bane of the guitar maker's existence--also plays an important part in determining the tone of an instrument. I believe there must be a compromise when choosing a finish: you have to balance the need for protecting the instrument with the sound-dampening effect of the finish. A finish that's too thick kills the resonance of an instrument; one that's too thin does not offer enough protection.

Modern materials technology now offers finishes that provide good protection from rock & roll sweat, even when the finish is applied in very thin coats. As long as the buildup is not too thick, the resulting tone can be outstanding. There are also new blends of tung oil and urethane that offer the traditional look and feel of a hand-rubbed finish with much greater resistance to moisture and skin oils. They don't, however, offer much protection from scratching and denting. These new oil finishes require greater care than lacquer or urethane sprays--but I'm really fond of the way they sound.

There are cases when a piece of wood sounds significantly better with a certain type of finish. I remember building a bass that had a body made of very light swamp ash that received an oil finish. The instrument's tone was okay but a bit mushy and lacking crispness. For some reason, which I can't recall, we had to refinish the bass; the oil was cleaned off and the bass was shot with polyester. When we plugged it in, lo and behold--it had gained brightness and clarity.

Luthiers' Forum

As I said at the beginning, there are many paths in the quest for tone. Because there are quite a few great bass builders, I thought it would be interesting to hear what some of them had to say on the subject. So, over the past few months, I have interviewed many of my peers. (If your favorite is not here, I apologize; there simply wasn't time to get to everybody.) Because many of the luthiers offered similar responses to my questions, I have tried to weed out the redundancies and focus on what gives each of them--and their instruments--a unique personality.

Coda

I hope you've found this collection of information and opinions helpful. Hopefully, it will generate enough interest to help you form your own idea of "Ultimate Tone" (or at least get you thinking about it). Nothing in this article is meant to imply that one builder's opinions are "right" or "wrong"--we're all different, and vive la difference. As I see it, the only hard-and-fast rules are that the instrument must play in tune and it must be able to satisfy the creative and emotional needs of its owner. Play on!

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