

SOUND BOARDS [TOPS] AND THE CIGAR BOX GUITAR

(A pseudo scientific paper. Do not bother to read it if you want a quick conclusion, I meander on and on (boring!) before I get to the punch line, which I hope will make the function of our soundboards more efficient) Brian Lemin June 2009.

Introduction.

I come from a mixed discipline of musical instrument making. Mostly Early Music Instruments that I have constructed from scaling up old illustrations. I wanted to hear what they sounded like and on the way I had to make a lot of decisions regarding the sounds that they were reported to make, the musical sounds of that time and what I “thought” they would sound like.

One of the foremost developments in musical instruments was brought about by the need to improve volume. Hence the recorder became too soft, the portative organ could not hold its own, and the lute was far too sweet and quiet. In my brief encounter with swing guitar (1950s) we had to have two guitars in the ensemble to make any impact with the brass and woodwind. (We were not amplified at that stage) My original instrument, the banjo in a traditional jazz band, still rules; good volume, good beat and tuneful.

If you are wondering what this is all about, it is my way of saying that the sound board (top) of the CBG is what produces the tone and the volume and we need to think a bit more deeply about its role and the way we make CBGs. *At this time we, of course, have to discount the issue of amplification/resonators in this discussion.*

Firstly I plan to quickly review traditional stringed instruments, and then apply what we learn from them to our CBGs’.

Sound board materials.

The acoustic guitar and indeed any of the acoustic stringed instruments all (until very modern times) have relied upon wood for their sound production. Wood for the top; for the sides (which are both constructional support and acoustic surfaces) and the bottoms, which are treated very much as part of both tone and volume production.

Traditional makers were fanatical about their wood. I am sure that Stradivarius would have picked his wood with fanatical care. Modern makers chose likewise, but they are more flexible these days. The European spruces (Sitka Spruce) still appear to be the Rolls Royce of woods, but cedar of various genii, maple and cherry plus other tone woods all play their part.

The defining attributes of these tone woods is all about their “strength to weight ratio”. They can be thin and also strong; at least with some help from judicious bracing a tone producing barring. Most modern acoustical instruments of any quality have a sound board of about 3mm thickness, and sometimes marginally less. The other attribute is “how the virgin sound board sounds”. That is before it is even shaped and attached to the instrument. Makers tap their boards and listen for the note, the tone, the reverberation etc before they select it for an instrument.

The Body of the guitar.

Traditional stringed instruments have shapes that are constructed from carefully delineated radii. Basically the bigger the box, (volume of air contained within it) the louder the sound it will produce.

Our youngest son (40 something!) is an audiophile. He makes all his own amplifiers using old fashioned glass valves and all the mystical yore that goes with those audio perfectionists. I mention this as he often has me up for a “holiday” because he needs a speaker box constructed! I find it fascinating as everything in that box, and the box itself, is calculated according to a formulae that will minimize distortion and maximize real life sound production. Yes, actual formulae decide its dimensions and various other components.

We do not have formulae (though some acoustical physicists do have them) but we do have devices for acoustical improvements that we add to the box; we call these bars and braces. Though both of these perform some acoustical benefit, the braces are mainly for strength and the bars for sound.

Now follows a brief description of four of the more popular traditional forms of guitar sound board bracing.

1. Torres bracing (Hauser) it has two full width braces above and below the sound hole, and then on the lower half of the body it has 7 fanned bars. This is probably the most popular pattern of Bars and bracing and produces what we would know as the traditional guitar sound.
2. The Flamenco bracing. This has an angled brace below the sound board and then 7 straight (as opposed to the fan above) bars in the lower half. This straight bracing appears to catch the sounds of individual strings, and if you imagine the sounds of a Flamenco guitarist, you can tell that it is a different kind of instrument.
3. Symphonic bracing. This is more random and has a few star-like bars configurations accompanied by a sound hole that is off to one side. Quite a voluminous combination and also is known for it's sustain abilities.
4. Symmetrical Radial bracing. This has the full width brace below sound hole, then another half way between that and the bottom of the sound board with a star burst of bars radiating from this lower brace. This give a well balanced sound.
5. There are indeed many others that could be mentioned too.

Finally a comment on the configuration of the wood used for the sound board. It has to be “quarter sawn. That is in V cuts from the outside of the tree to the centre of the trunk. This ensures that the grain of the wood is parallel to the edge of the guitar top.

I must not leave the subject of the body (sound box) without mentioning the Dubros/resonator box. Of course this was part of the development for the need for sound. This metal, sound reflecting, sound amplifying box (resonating) did just that. It certainly changed the sound of the guitar dramatically. This

is a topic of its own, but suffices to say that the introduction of a more or less enclosed metal box within an acoustic wooden box produced a great deal more volume.

We can see that whilst there may not (or may) be formulae that can be applied to the guitar sound board and body, mostly it is the combined experience of makers and players over the years that have produced boxes which meet the need of the performer.

Poor comparisons or the soul of the CBG?

I am going to take the view that if we compare the sound board and body traditional guitar to the CBG then we are certain to have poor comparisons.

True we often use cedar, but it is often much thicker than 3mm. We tend to leave the cedar liners in the box too and that makes a small box even smaller. There is a small surface area of the sound board to vibrate and we often glue the through-neck to the sound board thus making it almost impossible to vibrate. The total volume of the body is often small as cigar boxes with deep sides are not easy to come by; and so the comparisons go on.

“Poor ol’ CBG”. I know I am writing this article all about the production of sound but in truth the CBG is not a sweet and melodious instrument and was never used in that way. The Cigar Box and its stringing is the soul of our hobby. Even then I would like to try and get the best out of it and that is why I am writing this article. 😊

The Sound hole.

In our discussion of this feature of the guitar we are edging slowly to matters which may have a more direct bearing on our instruments.

The two main sound hole constructs are the **f** hole and the round hole. The larger the volume of the box and those boxes which have an arched top, the more useful is the “**f**” hole. The sound exits towards the two top corners of the box, each side emphasizing the tones of the strings on that side. (Bass and treble) It provides a good volume and balanced sounds. The round hole on the other hand is the choice for the softer (smaller box) instruments. This hole is, more or less, central in the guitar body. *Just as an aside, the early guitarists who amplified their “f” hole sound boards soon covered them up as they were convinced they caused pick up feedback.*

I want to dwell a little on the round sound hole. What comes out of it? [OK that is a stupid question] but I maintain that more bass come out of it than treble. “Of course” you say, as the bass strings are thicker and vibrate slower and their sound therefore travels longer and further (witness the thump, thump, of the amplified radio of the car as it passes.) Bass seems to travel through anything and treble bounces back of things. However the smaller the box the less bass is produced and possibly (at least comparatively) more treble is produced. [OK you physicists can argue with me about that]

In the photos of the Cigar Box Nation, I see a variety of positions and shapes for the sound hole. Now ignoring the issue of amplification, why not have “no sound hole” for our small guitars? I am not sure

that I am knowledgeable enough to explain the physics of the “no sound hole” approach, but if you would bare with me when I tell you a couple of things.

1. The sound hole allows the string s to vibrate thus causing waves of high and low pressure that comes out of the sound hole. Mostly bass as that is the nature of that vibration. Along with this is the fact that the high and low pressure waves often clash and try and push each other out of the way leading to tonal impurities.
2. The sound board is also part of the construction of the guitar, it helps (with the help of other structures) the stability of the whole structure, and because of this we have to brace it and bar it, or it would warp and or bend because of string tension.

If, instead of having a hole in the middle of the sound board we had a hole in the side (I have seen many have experimented with this) what would change? Subjectively there would be a better balance between bass and treble as the bass would not just jump out of the first big hole it found; it would need to travel in the box, mix a bit before it came out of the side hole. Secondly the chances are that the sound (though coming from the side) would project better. This is based a bit like the water and hose principle, a lot of water pressure and a small hole and the water squirts out farther. [I am sure that this is very acoustically un-scientific] I had thought of a third reason, but for the life of me I can’t remember it now I have come to write it! Yes, I have remembered it; I think it would produce a louder sound. (I do not know why but it seems right to me!:() Oh dear, I am opening myself to a lot of challenging.

Why do I like this Idea of side placed sound holes?

Simply that it lends itself to CBG’s as opposed to acoustic guitars. The way to improve the structural rigidity of the traditional guitar is to use some form of through-neck which still allows for the sound board to vibrate but resists string tensions forces. You would not have to use strengthening braces (particularly above and below the sound hole which in some way defeats the idea of good vibration).

But all this would be too hard for a traditional guitar as it would require strengthening bars/rods whatever, it would mess up the inter-box flows of vibration and reduce the volume of the box. These things only matter when you have a big box for pressure waves to move around in.

On the other hand CBGs have small boxes, whatever we do inside such small volumes will have little effect; but we do have a traditional structure of through-necks. One thing we can do that will produce results for an acoustic CBG is allow the sound board to vibrate more freely than our traditional approach of sticking the through-neck to the sound board. That process for an acoustic CBG does not make sense.

I notice in some pictures of “what is inside the box”, a few makers that have developed a method of fixing the sound board to the lid at the top and bottom of the through-neck and curving the through-neck away from the sound board for most of the length of the box. The curve should not be too deep as the construction strength for maintain string tension must be maintained. (Say about 1/8 or ¼ inch.)

Along with this we should use only a side sound hole on the treble side of the box.

Should we do anything with barring the sound board or the box bottom? To be honest I do not believe that in such small boxes as we use that it will make much difference. That does not mean it is not worth experimenting with. I myself will play around with it for sure.

Conclusion.

As over the ages, makers have made changes to their instruments to meet the needs of the performers. We modern performers are obsessed with bass and volume, and as we cannot achieve that from the design restrictions forced on us by the small size of our guitars, we resort to amplification. Fair enough, but I still think we can try and get better original sound from our boxes before we amplify them.

Summary.

1. Use a through-neck but attach it to the sound board only for the first and last ½ inch (say) and reduce the thickness of the neck so that it does not touch the sound board other than where you have glued it.
2. No sound hole in the lid.
3. Put a small sound hole (say 1" dia... perhaps a bit bigger) on the top *side* of the cigar box.
4. Add bars if you like.
5. "Suck it and see if you like it" 😊
6. Complain to me if you don't like it, if you do like it then just enjoy your CBG.

The Small print.

I am no scientist, just reasonably experienced in the general field of instrument making. What is above is just my thinking about what I have learnt from experience and from the experience and writings of others who are far more knowledgeable than I am. Basically I have translated and simplified what could be complex ideas about complex instruments to apply to our simple, but great, fun instruments. Here is to a good "twangy" CBG!

Thanks for reading it.

PS. I am not sure what I will do if you complain to me?