

# The Cigar Box Ukulele

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As is supposed to be the case, I found in my first semester at the University a new hobby; instrument-making. Newly introduced to the ukulele (casually referred to as the uke) and cigar box guitars (represented by three letters, CBG), I was freshly inspired to create, experiment and explore a new mode of expression. As an introduction to the art of luthiery (the fancy name for guitar-making), I decided to try my hand at building a ukulele from a cigar box, using only commercial tuners and strings and salvaging the remaining components from a hardware store. Perhaps I should also preface my journey by stating that I have access to a mechanic's toolbox (relatively unrelated to carpentry) and the skill set of a model rocketeer. Suffice it to say that my tools and experience with wood-working and luthiery were, and are still, pretty limited.

So, the first question is, why use a cigar box? Well, that's just what they used to do in the Deep South. Poor folk and slaves didn't have access to quality musical instruments, so many a fine musician was forced to begin playing on an instrument made from ordinary objects. A cigar box, made from a cheap, fibrous wood with a slight veneer, provides a low-cost, readily-available soundbox with included surface art and vibe. In today's economy, cigar boxes are generally available anyplace that cigars are sold and can be had for a few dollars, if not free.

Transforming one of these objects into a musical instrument is quite straight-forward, made exceedingly so when the instrument is a ukulele. I chose a ukulele as first CBG primarily due to its nylon strings, which create a much lower tension on the neck. This fact means that the neck needs no complex carpentry; specifically, a truss rod does not need to be routed and installed in the back side of the neck. Thus, the neck can simply be a 1"x 2" board of appropriate length of virtually any wood. My selection for neck wood was limited to poplar, as this is what was handy at the hardware store, but some searching may have yielded the more desirable maple.

For simplicity and strength in my design, a slot is to be cut into one end of the box to allow the neck to run through, and posts are put underneath the neck at each end of the box for support.

While discussing neck tension, I should mention my first error. I initially assumed that the string tension would still bow the neck, something that I wished to reduce for the sake of the longevity of the instrument. So to lower the tension in the strings I designed the instrument to have a scale length of 13 inches, like some Hawaiian ukuleles. It turned out that the tension exerted by four nylon strings on a uke's neck is so low that neck bowing is not an issue. With the size of the pads of my fingers I have realized that a more traditional 14 inch scale would be easier to play, as well as louder (due to its higher tension). To combat the issue of loudness, I tuned the uke a whole step up from standard tuning (to A D F# B) to increase string tension.

The second benefit of beginning my trek into luthiery with a ukulele is that with nylon strings I could find a way around fretting the neck of my instrument. In my research of the uke I had come upon an instrument that employed even cheaper materials than a cigar box (<http://www.geocities.com/tpe123/folkurban/uke/uke.html>). An ingenious artist had employed flat toothpicks for frets on his economical instrument, a trick that is only possible due to the use of nylon strings. With steel strings the wooden frets would have been eaten away and destroyed very quickly, but nylon will cause significantly less wear. This means that fabricating the neck would be much simpler.

But I ran into another problem in the design of the neck. The commercial tuners I had held the strings at a pretty substantial height off the wood (approximately  $\frac{1}{4}$ " ). So I needed to find a way to lower them and thereby put sufficient tension on the strings at the nut. This would allow the strings to remain in their designated slots. I solved this with a trick that Leo Fender employed in the '50s; I removed a layer of wood from the top of the headstock between  $\frac{1}{2}$ " and

¾". More skilled luthiers tilt the headstock back so as to achieve the same tension, but without the tools to do so I chose to chisel away at the wood.

As for acoustics, I desired to have the top of the cigar box vibrate as well as possible and transmit all of its vibrations to the rest of the box efficiently. Therefore, I remove all the paper from the underside of the lid and filed down the neck-through-body so it wouldn't touch or dampen the box top. I then went on to glue the top of the box onto the sides so as to best transmit the vibrations to the whole soundbox. Unlike more serious instruments, the cigar box ukulele does not have any internal bracing to support its top. The design has the neck running through the box, supporting the strings at the nut and the bridge. This means that all of the tension is being put on the neck and none of it is being put on the top of the cigar box. It seems that this design is less desirable as the lower tension in the top translates into a softer sound with fewer overtones. However, construction was much easier and the instrument is much stronger with this design.

My cigar box ukulele is fitted with a floating bridge, meaning that its bridge is not secured down and is able to be adjusted to compensate for intonation. Right now this is made up of a bolt seated in a piece of scrap poplar from the headstock. The bridge, being the piece that initially and directly transmits vibrations to the rest of the box, is of utmost importance with regards to forming a good tone. With all the loose parts now employed, so much of the vibration of the strings is being lost to movement, friction, and general absorption in the bridge. This is easily fixed, and may be the topic for future investigation.

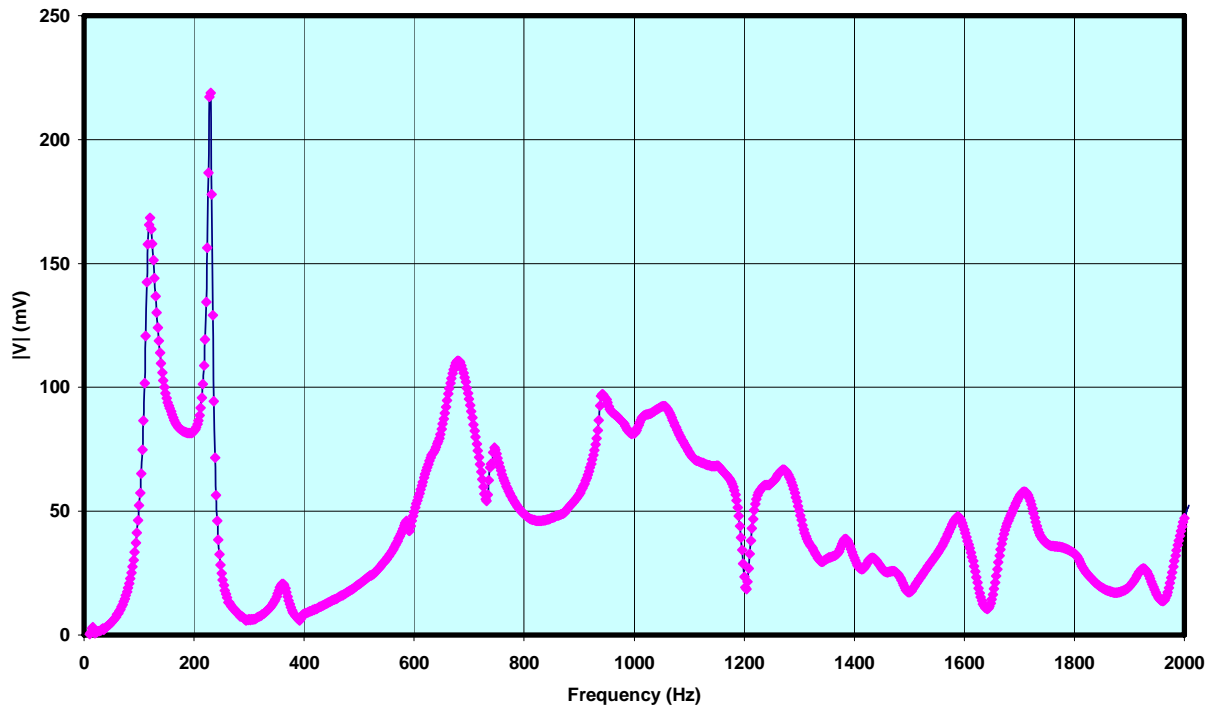
Upon completion, I was pleased to find that my cigar box ukulele has relatively pleasing tone. I am by no means a seasoned 'ukulelist', but to my ears it has a fairly dull tone and not much sustain when compared to the guitar. Its tone can be describe as being very heavy in

middle overtones, not especially rich in bass tones, and lacking in much treble zing. A brass player commented, “It sounds like something from an old-fashioned radio”. I agree with him; like an old radio, the tone is very rich in mids without much in the way of high harmonics. Furthermore, the tone is quite dry, meaning it does not sustain pitches (they die out fairly quickly). This leads to a sound that is similar to a jazz guitar or a pizzicato violin, but again without the singing overtones. It should be noted that this uke is indeed not very loud. This can be easily attributed to low tension strings and a fairly inefficient bridge and soundboard. It could be argued that the use of nylon strings and exclusive finger picking are the real reasons why the tone is warmer, drier, and softer. However, my own experience with classical guitar and ukulele would suggest that this homemade instrument is especially soft and dry, and its mid-heavy tone is unique and very much the result of an inefficient soundboard.

Our limited analysis of the cigar box guitar seems to confirm what has already been observed about the tone of the instrument. When driven by a piezo transducer near the bridge, the center of the soundboard has some peak resonance at very low frequencies and again in the region from 600 to 1200 Hz., with a dip around 800 Hz. This 600 to 1200 Hz range corresponds to the first and second overtones of the open strings and the middle frequencies. Appropriately, this is what one hears in the tone. Overall, the cigar box uke does not respond as well as a commercial uke when driven, seen by the lower peaks in the graph (see attached graphs). This graph was compared with that of a commercial uke and the peaks are significantly lower, demonstrating less response and overall softer sound. Unfortunately, my analysis was limited due to time constraints, but ideally I would like to test the impedance of the bridge, the overtone spectrum, and the decay rate. Maybe these will be the subject of further analysis along with altering bridge design and material.

In the eyes of the craftsman, this project seems to have been a success. I was able to make a working musical instrument for under \$20, using approximately three days of my spring break. Its construction was made more difficult by my limited access to power tools, but with more tools and increased practice some more advance techniques and designs could be employed. The tone and playability are satisfactory, with the only improvement that I really feel needs to be made being an improved bridge. With such an interesting hobby, it was quite easy for me to become engaged in studying why and how the instrument behaves the way it does. I believe this project was a success in that my understanding of the acoustics related to a cigar box instrument has been increased, my skills in making such an instrument have been refined and my interest has been abetted. I would suggest cigar box guitar making to anyone who finds an interest in playing stringed instruments and understanding how the work.

Cigar Box Ukulele  
|V| vs. Frequency



Kanile'a Concert Ukelele  
|V| vs. Frequency

