Sound of the Wood-body Resonator Guitar

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The signature spectrogram features that were previously shown to distinguish metal-body resonator guitars from wood flat-top acoustic guitars also appear for wood-body resonator guitars. That's no surprise. They twang, too. As with metal-body resonators, the cone need not be metal nor a cone.

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I. INTRODUCTION

When John Dopyera left National String instrument Corp. in 1929 and founded Dobro Manufacturing Co. with his brothers, they did not have the capital on hand to buy the necessary tooling to manufacture the metal-body instruments Dopyera had invented. Skilled luthiers, they simply made the new ones out of wood. The new guitars were similarly loud and produced resonator twang, albeit somewhat more mellow than the original metal bodies. Undaunted by having been snookered out of the patent for the single cone he had designed, Dopyera invented a new one, and Dobro was off to capture a significant market share. Four years later, he bought out his original partner and formed the combined National Dobro Co. They went on to manufacture all manner of resonator guitars.

The spectrograms of a small sample of flat-top and metal-body resonator guitars revealed a kind of feature that was common to all of the resonators and absent from the flat-tops.[1] Two of the resonators had typical spun aluminum cones. The cone of one of the others was made of paper cardstock, and another used a thin, flat, plastic platter in place of the cone. The common feature of the resonators which was absent from the flat-tops was the clear presence of particular frequency components that were not directly related to the frequencies of the plucked string. These were weaker and shorter lived than the string harmonics. They were clearly evident in the spectrograms because their decay times were much longer than the initial, broad-band, loud noise. The combined sound of computer-synthesized sounds, designed to match these extra frequencies in amplitudes and decay times, and the sound of a flat-top pluck produced a total that sounded like a resonator guitar.[2] On their own, the complete set of the computer synthesis sounds rather like a gong.

This note simply presents the pluck spectrograms of a wood-top resonator guitar — with standard aluminum cone, with the green cardstock substitute, and with a black plastic bowl in place of the cone. Players and builders know that the wood versions still have the characteristic, identifiable twang of resonator guitars. The new result is the demonstration that the spectrograms display the same signature behavior.

A. a technical note on break angle and tuning

The cardstock cone and the black plastic bowl could not support the same down-pressure at the bridge as the original aluminum cone. In the previous inquiry[1], the tailpiece was raised to reduce the break angle to 4°, which allowed the cardstock to be functional. The issue was even more severe with the black plastic bowl. As an easier alternative, I simply lowered the string tension and used the tailpiece from the previous cardstock experiment. Hence, the pitches of the 1st string plucks and the played tune with the black bowl are lower than on the original guitar.

II. DISTINCTIONS IN THE SPECTROGRAMS

FIG. 1 shows spectrograms from 200 to 3000 Hz for single plucks at the 18th fret on the open 1st strings on five different instruments. They are, in order, a typical brass-body resonator guitar, a wood-body resonator with standard aluminum cone, the wood body with the cardstock cone, the wood body with a plastic bowl cone substitute, and a flat-top acoustic guitar.

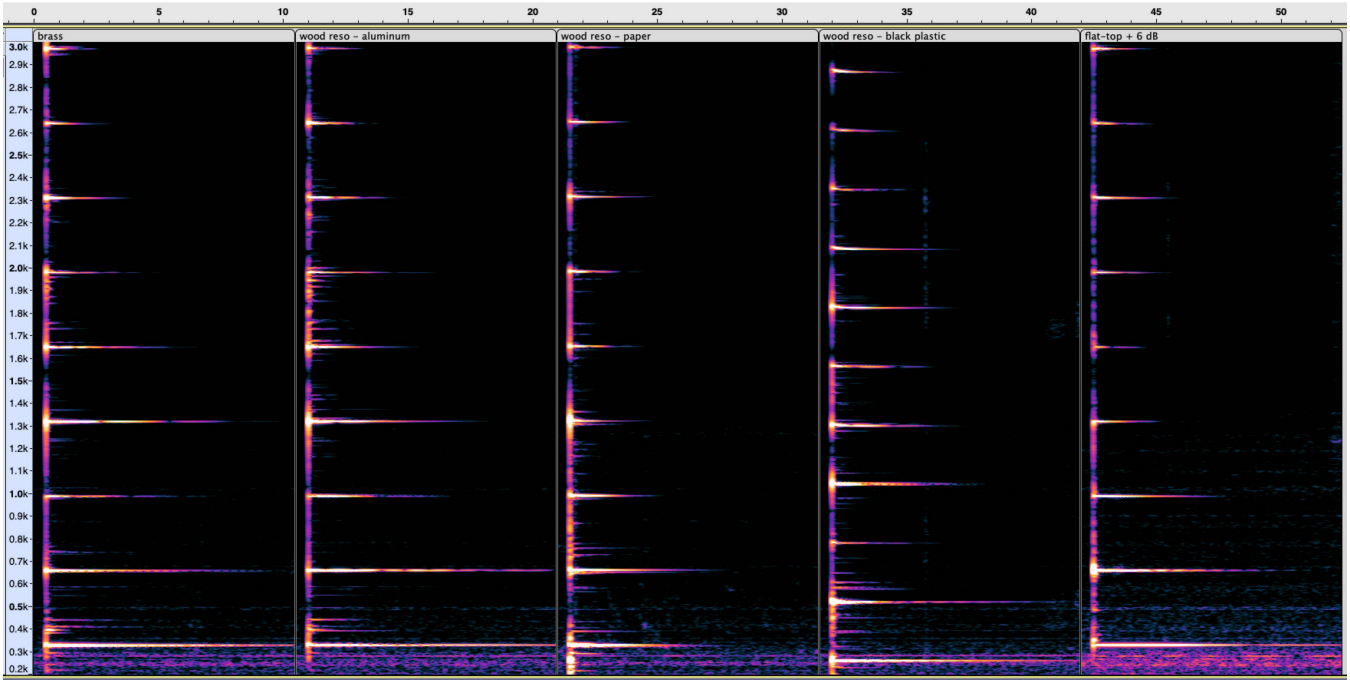

FIG. 1: single plucks on a brass body resonator, three wood body resonators, and a flat-top

This is a sound file of those plucks in the same order: http://www.its.caltech.edu/∼politzer/wood-reso/royall-rattle-aluminum-paper-black-sp+6dB-18th.mp3 Clearly, peaks that appear at frequencies other than harmonics of the string pitch that are characteristic of metal-body resonator guitars and are absent for flat-top acoustic guitars also appear on all of the wood-body resonators.

III. THE BLACK PLASTIC BOWL

A black plastic take-out container had exactly the $9\frac{1}{2}''$ diameter of the standard aluminum cones. To underscore the point made in ref. [1], i.e., that many alternatives to the standard aluminum cone can produce resonator guitar twang — albeit with a somewhat different sound — I installed the bowl. As noted above, rather than crafting a slightly higher tailpiece, I simply lowered the string tension to prevent the bowl from collapsing. This is the same music selection as was played on all instruments in ref. [1]:

http://www.its.caltech.edu/∼politzer/wood-reso/KC-rattle-black.mp3

FIG. 2: take-out container cone substitute

[1] D. Politzer, *Resonator Guitar Physics Clue from a Paper Cone*, HDP: 23 - 03, http://www.its.caltech.edu/∼politzer/paper-cone/paper-cone.pdf.

[2] D. Politzer, *Resonator Guitar Synthesis*, HDP: 23 - 04, http://www.its.caltech.edu/∼politzer/pluck-synthesis/pluck-synthesis.pdf.