

Creating a Musical Space

The effect of room dimensions on different instrumental families

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Abstract

Instruments with several different sound creation methods, a trombone, a guitar, and a violin were compared by looking at their overtone series and dominant frequencies. This was repeated in rooms of varying sizes, and pitches were compared between the room's resonant frequency, and non-resonant frequencies.

Intro

Musicians often find that the way their instruments sound in the spaces they practice is different from the spaces they perform in. This can lead to confusion at the time of performance, and be detrimental to the musician. This experiment was designed to try to quantify the differences in these sounds. **When one note is played on any instrument, many frequencies are present (overtones). The relative strength of these frequencies determine the characteristic sound of the instrument (timbre).**

Methods

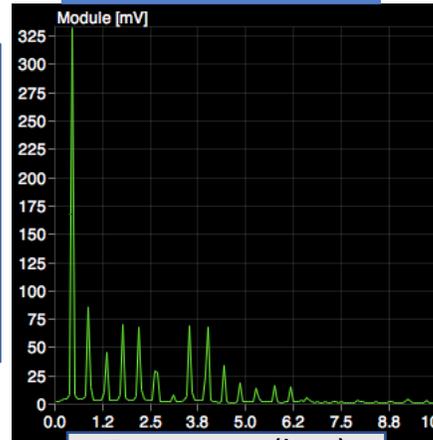
1. Frequencies were measured using AudioXplorer in an attempt to understand the dominant frequencies of the instruments.
2. Room dimensions were measured, and resonant frequencies were calculated using amroc
3. Resonant and non-resonant frequencies were played on a trombone, guitar, and violin, in a practice room, recital hall, and chapel
4. Sound collected was analyzed using AudioXplorer in order to visualize individual frequencies
5. Results were graphed by comparing each primary frequency in relation to the dominant frequency

Results

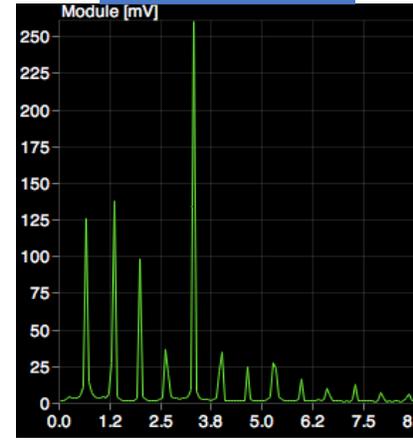
The Trombone saw similar results in the two large rooms when playing non-resonant frequencies, the same is true for the violin. The Guitar, however, had a the largest difference in the chapel, which is the largest room, when compared to very similar results in the two smallest rooms. Playing resonant frequencies changes the results significantly across the board, but the most staggering changes came from the

The room you play in changes the characteristic qualities of your instrument.

Non-Resonant
Recital Hall
Violin

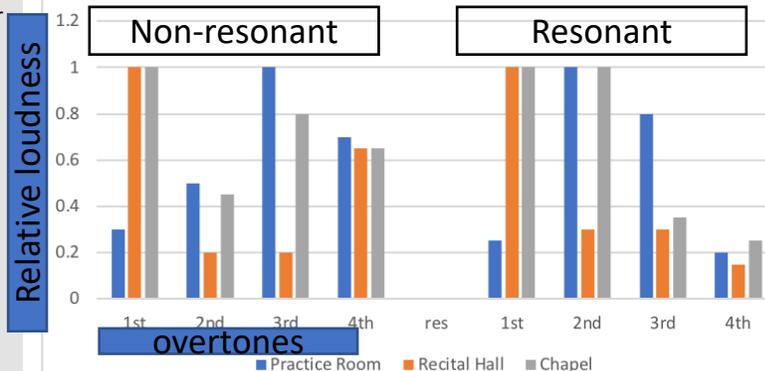


Resonant
Recital Hall
Violin

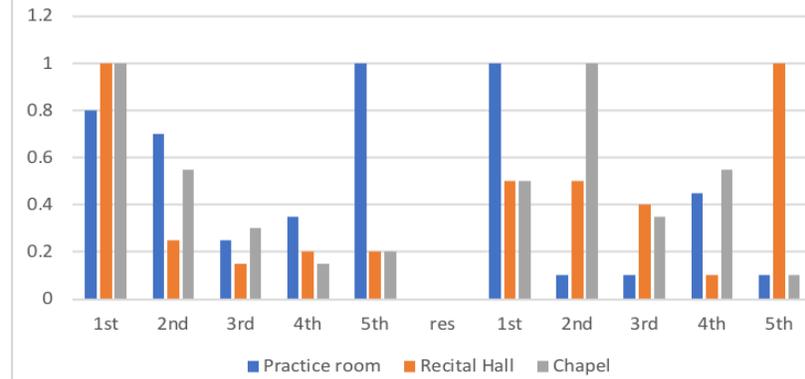


VS

Trombone Frequencies by Room



Violin Frequencies by room



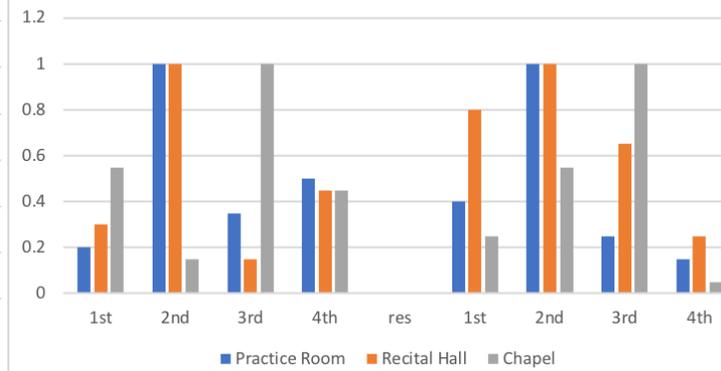
Discussion

Many factors could have affected this data including the microphone used, the placement of the microphone, the pin-drop method by which AudioXplorer collects data, and many more. If this experiment were to be repeated, some ways to get more relevant data include finding a software that would analyze over time, and testing different microphone placements to see if the data changes depending on where in the room the sound is coming from. It would also be interesting to see if different instruments have a different effect

Conclusion

The Changes made to the overtones when playing the resonant frequency, and when playing in different rooms varies wildly between instruments. There are, however, performance spaces that generally preserve the character of different instruments. For more resonant instruments, like trombone and Violin, larger spaces do this, while for quieter instruments, like guitar, smaller spaces bring out characteristic sound more.

Guitar Frequencies by room



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