



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

Name(s) Hannah Shu	Project Number J1724
Project Title Using Physics to Determine the Audio Frequencies to Evaluate the Acoustics of the Violin	
<p style="text-align: center;">Abstract</p> <p>Objectives The purpose of this project is to research the acoustic of violin and guide violin buyers using fundamental of Physics and smartphone to help find a perfect violin. This project is to investigate 24 violins with different price ranges.</p> <p>Methods 24 violins with price ranges from \$28 to \$16K, LG V20 (Android Smartphone). Software includes VisualAudio smartphone App, Octave, Audacity and Double Elimination Tournament using bracketcloud.com.</p> <p>Results Higher Price Range (HPR) violins have a higher amplitude of power than Lower Price Range (LPR) violins in higher frequencies (2000Hz+) which makes violin sound bright and clear. LPR violins have higher power in frequencies between 1000Hz to 1800Hz than HPR which give nasal tones. HPR violin's fundamental notes and overtones lines are clear and brighter than LPR violins in Spectrogram graphs. HPR violins have a more powerful sound projection than the LPR violins.</p> <p>Conclusions I was able to see the patterns and characteristics in Spectrogram, Power Spectrum graph and sound pressure level between the higher price range violins and the lower price range violins. Using techniques and analysis in this study, I was able to find a few good violins from lower price range violins that have similar spectral characteristics and projected loudness as some of the higher price violins.</p>	
Summary Statement I showed spectrum characteristics and sound projection of violins in different price ranges using smartphone and various free audio spectrum analysis software.	
Help Received Dr. Daphne Kapolka from the Naval Postgraduate School explained me Fourier analysis and Octave code. Dr. Julius Smith from Stanford University and Dr. Jim Woodhouse from Cambridge University explained me on Spectrogram. Mr. Joseph Curtin gave suggestions on ranking violins.	