



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

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<b>Project Title</b> <b>The Effect of the Thickness of Reeds on the Timbre Produced by Woodwind Instruments</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The objective of this experiment is to determine how the physical properties of a reed relate to the timbre (or quality of sound) produced by a musical instrument. Notes from instruments have multiple frequencies: the fundamental, which is the primary note, and several overtones. Overtones are frequencies that are an integer multiple of the fundamental frequency. Timbre, or quality of sound, is characterized by the number and loudness of overtones in the sound. My hypothesis was that thinner reeds would create more overtone because they would vibrate faster. This would produce a bright and punchy tone, such as a square wave, which is full of overtones, would. Thicker reeds would create fewer overtones because they would vibrate slower. This would produce a mellower sound, such as a pure sine wave would.</p> <p><b>Methods/Materials</b> Three reeds of different thicknesses were played on a clarinet and a saxophone. Two notes (B flat 3, 233.08 hz, and F5, 698.46 hz) were played on each reed on each instrument. The resulting sounds were analyzed using a software called Visual Analyser. To find the difference in timbre produced by different reeds, the frequency spectrum of the sound was examined. The frequency spectrum is a graph showing all the overtones present in a sound and their respective loudness.</p> <p><b>Results</b> For the lowest note tested, the thinnest reed produced around 37 overtones on the clarinet and 34 on the saxophone, while the thickest reed created 22 overtones on the clarinet and 27 on the saxophone. For the highest note tested, the thinnest reed made 15 overtones on the clarinet and 14 on the saxophone, while the thickest reed produced 11 overtones on the clarinet and 12 on the saxophone. In addition to this, the thinnest reed had a greater loudness for most of the higher overtones.</p> <p><b>Conclusions/Discussion</b> My hypothesis was proven correct. The results indicate that the thinnest reeds create more overtones in the sound, while the thickest reeds created fewer overtones. The thinner reed, which makes a bright, punchy sound, could be used for jazz playing, while the thicker reed, with its soft and mellow tone, could be for classical playing. Using this data, musicians who play reed instruments can find out which reed to use based on their sound preference.</p>	
<b>Summary Statement</b> This experiment shows that the quality of sound and the number of overtones produced by a reed instrument is dependent on the thickness of the reed used.	
<b>Help Received</b> I received advice and ideas from my science teacher Mrs. Sujatha Raghu, and mentors at the school science club, Tsing Bardin and Edmond Pelta, as well as from my parents. My mother and sister helped me with the board.	