Spectral and Waveform Properties of 3D-Printed Violins and How to Improve Upon Them

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The advent of affordable fused-filament-fabrication (FFF) 3D printers in the consumer space in recent years has given a remarkable extent of manufacturing ability to hobbyists. While one of the earliest uses of these machines is the inexpensive rapid prototyping of digitally designed objects, the printers do have some use in the creation of more permanent models. This experiment was conducted in the hopes of evaluating and improving the viability of one use case —easily fabricated musical instruments; more specifically printed violins as violins are both very popular while traditionally involving a labor-intensive and expensive manufacturing process. To determine the viability of current 3D-printed counterparts, brief audio samples of notes were recorded on a typical control instrument and a printed instrument. A fast Fourier transform (FFT) was then conducted on the recordings in computer software to analyze the prominence of various sound frequencies in the acoustic output of the instrument, expressible as both a data table or more practical graph of frequency response for specific notes. These graphs showed that there was no localized deficiency in the frequency response of the existing plastic instruments, but rather a discrepancy in volume between it and a traditional instrument, mostly at lower frequencies. The most likely reason for this is limited conduction of sound from the strings, resulting in stifled resonance of the instrument body and thus a weaker sound projected outwards. In future instrument designs, this could potentially be improved upon with a unibody construction or circumvented with equalization.

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