Why Do Beginners Produce Noise Instead of Music When They Play Musical Instruments? —Taking Erhu for Example

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Erhu is a Chinese bow-string instrument with which music played by beginners is not beautiful but annoying. Its music characteristics and noise production mechanism haven't been thoroughly studied. To discover the fundamental reasons, this research used the audio processing software Cool Edit to transform waveform view into spectral view. The effects of four different performance gestures of the bow or the finger were analyzed in the experiments, respectively. Afterwards, the phase diagram of self-excited vibration caused by dry friction was optimized. The concept of pitch was redefined, and a pitch judgment bug in Cool Edit was discovered. The amplitudes of harmonics in the standing wave diagram were calculated by solving the universal definite equation. The causes of rough or acute distressing music were thus quantitatively explained. Machine learning based on Erhu music with or without the four disturbing characteristics was then introduced to judge in real time whether the music played was unpleasant. White noise was subsequently output for discomforting music to alleviate annoyance with its masking effect. The fluctuation of Chroma Vectors in the music thus experienced an average decline of 51.6%, and the maximum decline of a certain value at a specific moment was 94.1%. Therefore, the four fundamental reasons of noise produced by Erhu beginners were identified as mismatched bow speed and bow pressure, wrong bow location, the finger's virtual pressing, and imprecise pressing position. This study gives a comprehensive and reasonable analysis of annoying music played by Erhu beginners, and provides scientific guidance for their performance.

Awards Won:
Acoustical Society of America: First Award of $1,500, plus students School will be awarded $200, and Mentor awarded $500.