

Spectral Moment Analysis of a Synthesized Singing Voice

Objective: The field of voice pedagogy has used formant tuning analysis to describe the singing voice for over forty years. Given the diversity of styles, voices, and sounds that this sub-field seeks to analyze, traditional formant tuning analysis is not always most objective tool for studying the singing voice. Past literature has used spectral moments to characterize recording technology, pre- and post-treatment measures of patients with dysphonia, the EGG decontacting pattern, and speech sounds. While useful for understanding differences between repeated measures, spectral moment measurements often lack context and, as such, are often difficult for the clinician or the researcher to interpret. This study analyzes the use of spectral moments of the LTAS to describe the singing voice systematically. It aims to work toward a more complete understanding of the parameters that alter spectral moment measurements.

Method: *Madde* was used to synthesize 132 samples with systematically varying f_0 , vibrato rate, vibrato extent, vowel (f_{R1} , f_{R2} , and f_{R3}), spectral tilt, and duration. For each sample, all parameters except for the one being altered were held constant. Spectral mean (M1), spectral standard deviation (M2), spectral skewness (M3), and spectral kurtosis (M4) were calculated for each audio sample using *Praat*. Linear models with Bonferroni corrections were created.

Results: M1 was significantly associated with vibrato extent, spectral tilt, vowel, and duration. M2 was significantly associated with vibrato extent, spectral tilt, and duration. M3 was significantly associated with f_0 , vibrato extent, and duration. M4 was significantly associated with vibrato extent and duration.

Conclusion: Based on these findings, it seems that further investigation of the use of spectral moment analysis on the singing voice is warranted. Using these measurements to describe singing voice audio samples may provide a “broader picture” of spectral features that characterize different singing styles and sounds. As such, future studies might use the results of this inquiry as context to analyze the singing voice objectively and unobtrusively.

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