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A comparison between subjective and objective methods for evaluating the vocal accuracy of a popular song

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ABSTRACT

Background

The accuracy of vocal performances has often been evaluated by music experts. In addition, the vocal accuracy can be objectively rated by measuring the fundamental frequency variations during the performance (Berkowska & Dalla Bella, 2009; Dalla Bella & Berkowska, 2009; Dalla Bella, Giguère, & Peretz, 2007; Pfordresher & Brown, 2009; Pfordresher, Brown, Meier, Belyk, & Liotti, 2010). Technical advances reversed the trend from perceptive methods to acoustic methods in research on singing (Dalla Bella, Berkowska, & Sowinski, 2011). Indeed, for one decade, acoustic analyses have been presented as a more reliable solution to evaluate vocal accuracy, avoiding the limitation of experts' perceptive system and their variability. However, studies providing a direct comparison between objective and subjective methods are scarce.

Aims

This paper presents a direct comparison of subjective and objective methods for evaluating the vocal accuracy of a popular song. Our aim was to test the correlation between these two methods and to find out which acoustic measures can predict the judges' rating.

Method

Hundred sixty-six occasional singers were asked to sing the popular song « Happy Birthday ». The pitch height of the 21 notes of the tune was estimated, using a Short Time Fourier Transform analysis (Larrouy-Maestri, & Morsomme, accepted for publication).

Objective analyses were performed to quantify the pitch interval deviation, the number of contour errors and the number of tonality modulations for each recording. Additionally, eighteen experts in singing voice or music rated the global pitch accuracy of the performances.

Results

The judges provided strongly and significantly correlated ratings, $r = .77$, $p < .01$. In addition, a high correlation occurred between pitch interval deviation (acoustic measurements) and subjective rating, $r = .87$, $p < .01$.

The results of the multiple regression analysis indicated that two variables predicted the score of vocal accuracy given by the judges: their rating was influenced by both tonality modulations, $\beta = -0.45$, $t = -6.33$, $p < .001$, and interval deviations, $\beta = 0.51$, $t = -6.61$, $p < .001$. On the contrary, the number of contour errors did not contribute to explain the judges' scores, $\beta = 0.08$, $t = 1.89$, $p = .06$). The total model of acoustic analyses explained 81% of the variance of the judges' scores.

Conclusions

This study highlights the congruency between objective and subjective measurements of vocal accuracy when the assessment is done by music or singing voice experts. Our results confirm that vocal accuracy can be measured by an analytical objective method through acoustic measurements. The relevance of the "pitch interval deviation" criterion in vocal accuracy assessment is clearly confirmed. Furthermore, the "number of tonality modulations" is a salient criterion in perceptive rating and should be taken into account for the objective vocal accuracy assessment.

Keywords

Vocal accuracy, singing, pitch, occasional singers, acoustical analysis, perceptive rating

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