

THE ACCEPTABLE RANGE OF PITCH FREQUENCIES AND DURATION OF NOTES IN SINGING

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ABSTRACT

Performing musical notes correctly does not mean that all the performers play the notes in the exact same pitch, onset, offset, duration, and loudness, but they normally perform the notes within acceptable psychoacoustic ranges.

Sundberg et al. [1] studied what mean F0s were accepted as being “in tune” and “out of tune”. The results showed that for most of the tones deemed to be in tune they had an average F0 that varied within a narrow band of about ± 7 cents, whereas most tones judged as being out of tune were outside this frequency band. Moreover, Sundberg et al. [1] found that singers exhibited the same patterns of changing intonation when performing the same notes but using slightly different frequencies when they repeated these notes in other bars.

According to the Seashore [2] study, long notes were sung with an average F0 that coincides with the theoretically correct value. Moreover, many of the long tones were observed to change their average frequency in various ways during the tone. Bjørklund [3] found that such deviations were typical for professional singers as opposed to nonprofessional singers. With regard to short tones, the relationship between F0 and the theoretical pitch seems to be considerably more complicated [4].

Sundberg & La [5] analysed the tuning of premier baritone singers and found examples of quite large deviations from equal-tempered tuning, sometimes exceeding 50 cents. In particular, the highest note in phrases with an agitated emotional character was often sharpened. The intonation of such tones was flattened to equal-tempered tuning, and a listening test was run in which musician listeners were asked to rate the expressiveness in a pair-wise comparison between the original version and the version with manipulated tuning. There was a significant preference for the original versions. This result indicates that intonation can be used as an expressive device in singing.

Based on the above explanation, researchers have found that the amount of allowable/imperceptible frequency deviation in each sung note depends on its position in a piece of music. However, since there are some limitations in the previous studies, the exactly acceptable ranges of pitch, onset, offset, duration, and loudness of a note in a piece of music is not fully understood yet. Therefore, this study

examines a dataset of recorded vocals to discover the true relationship regarding the acceptability between the perceived F0 and duration of a note against its theoretical frequency and duration. As the result, this study provides an algorithm to calculate the acceptable range of frequencies and duration of each note based on its position in a piece of music. Therefore, the algorithm uses a data driven approach to derive the rules that are implemented in the new software algorithm.

Keywords: singing, tune, pitch frequency, duration, acceptable range.

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