Acoustic Factors in Musical Phonation : A Study in Off-pitch Phenomenon *

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Introduction

The present study was undertaken to study vocal behaviour of singers. It is generally assumed that singers while singing a note are in perfect match with the theoretically calculated note. These relations between reference note and other notes are standard like between reference note and octave note ratio is 1 : 2. Studies on vocal abuse in singers shownabove may not be true. Thus study of off-pitch behaviour was undertaken. This was studied in octave notes and extreme notes beyond octave. Related behaviour, *viz.*, intensity frequency relation, maximum phonation duration, maximum pause duration, effect of sex on off-pitch was undertaken.

Procedure

Nine trained singers in Karnatak music, 5 females and 4 males, with minimum training of 10 years were taken as subjects. They were asked to sing *alapana* (a style of singing which involves vowels predominantly) in *raga* Kalyani. The instructions were that they should sing for 3–5 minutes, and in this cover their octave, the highest and the lowest note in their vocal range. The sample was fed to PM–100 and FFT analyzer as required. For each singer song spectrum was drawn. With the help of trained singer perceptual analysis was undertaken and those point in the sample were marked where the reference, fifth octave highest and the lowest note occurred. These points were analyzed in terms of FF and intensity. The off-pitch was calculated by subtracting CPU from OPU. For comparison they were converted into percentage.

Conclusions

The following conclusions were drawn from the present study :

(1) Most of the singers do not go off-pitch in the octave fifth and octave notes.

(2) Most of the singers do go off-pitch at the highest note above the octave range.

(3) Most of the singers do go off-pitch at the lowest note below the octave range.

(4) Magnitude of off-pitch is more at lowest note than at the highest note.

(5) No definite relationship between intensity and frequency was found. (Elaborated in 12 and 13 ahead.)

(6) Maximum phonation duration increases in those subjects showing off-pitch at highest note and the lowest note.

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(7) Maximum pause duration increases in subjects showing off-pitch at highest and the lowest note.

(8) No difference was found between male and female with regard to off-pitch.

(9) With age and/or years of training phonation duration does not seem to increase or decrease.

(10) With age and/or years of training preponderance to go off-pitch does not decrease nor increase.

(11) With age and/or years of training maximum pause duration does not seem to increase or decrease.

(12) With increase in pitch increase in intensity could be observed.

(13) With increase in pitch decrease in intensity could be observed.

(14) No two singers sing *alapana* of same *raga* in same manner, *i.e.*, every spectrum of *alapana* has unique and different pattern.

(15) All singers started their *alapana* with the third octave note, which is not defined in musicological text.

(16) All singers sing lower notes below the octave in the latter segment of *alapana.*

(17) All singers reach their highest note above octave in later half segment of *alapana.*

Implications

(1) The study brings out the fact that singers go off-pitch beyond the octave range and they are the one probably more prone to vocal abuse.

(2) The study calls for improved teaching and/or training technique for singers, ear training, use of optimum frequency, singing in right range.

(3) Those who show off-pitch behaviour can be warned and preventive measures should be suggested.

(4) Early identification of vocal abuse and prevention is possible by using such simple methods as used in this study.

(5) New vista for research is opened for future research.

Limitations

(1) Sample was small.

(2) Only *alapana* style of singing was studied—that also specifically of Karnatak style.

(3) Instrument could not give intensity reaching below 40 dB.

(4) Study was not done in sound proof room.

(5) Only limited notes were analyzed due to shortage of time.

Recommendations

(1) The study should be carried on large scale.

(2) Record should be maintained of all singers, and periodic check-up and detail history of vocal abuse should be kept.

(3) Similar studies should be carried in Hindustani music.

(4) Similar studies should be carried in different styles of singing.

(5) Study should be carried in sound proof room and sensitive recording instrument.

(6) Simple portable electronic devise should be developed by which a singer will come to know objectively the pitch he is singing, especially during training period.

(7) It would be interesting to study the off-pitch behaviour at all notes occurring in the sample.