

Melody in Carnatic and Hindustani Music

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Abstract

The study investigated the acoustic and perceptual differences in melody between two styles of Indian classical music namely Carnatic and Hindustani. Eleven Carnatic and seven Hindustani classical singers sang a:la:pana in four ra:gas. These were audio-recorded and acoustically analyzed to extract fo related parameters.

Introduction

Indian music is practiced all over India and in southern part Carnatic classical music is practiced predominantly. According to the existing literature Hindustani music appears to be more melodic. However, this has not been testified by acoustic analysis. Therefore the present study aimed at investigating the acoustic and perceptual differences of melody between the two styles of music.

Method

Subjects: For the purpose two groups of subjects were selected. Group I consisted of 11(10 females and 1 male) Carnatic classical singers and group II consisted of 7 (6 females and 1 male) Hindustani classical singers. All the subjects had passed senior examinations in music.

Procedure: Subjects were asked to sing a:la:pana:s in four ra:gas namely, Kalya:ni/Kalya:n, Ma:ya:ma:lavagaula/Bhairav, Ka:mavardhini/Pu:rvi, Pu:rvikalya:ni/Ma:rva for a duration of 60 seconds. The a:lapana:s were audio recorded, digitized at 8 KHz using 12-bit A/D converter and stored onto the computer memory. It was hypothesized that melody would be acoustically correlated with wider f0 range, greater extent and rate of f0 fluctuation, higher Kurtosis and Skew ness. Therefore, the acoustic parameters mean f0, range of f0, rate and extent of f0 fluctuations were extracted from the singing samples using Vaghmi software (Voice and Speech Systems, Bangalore). Skewness and kurtosis were obtained from Long-term-average-spectra on CSL 4500 (Kay Elemetrics). Ten untrained listeners analyzed the samples perceptually. They rated melody of each a:la:pana on a 3-point scale and provided the perceptual correlates of melody. The results indicated that Hindustani singers used significantly higher f0 and higher rate and extents of f0 fluctuations compared to Carnatic singers.

Statistical analysis: ANOVA and t-test were administered to find out significant differences between the two styles of music.

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Results and Discussion

The results of the acoustic analysis indicated that a significant difference exist between the two styles of music in terms of mean f0 ($P < 0.01$), rate and extent of f0 fluctuations ($P < 0.01$). Hindustani singers used higher f0 compared to Carnatic singers and had higher rate and extent of fluctuation of f0. Skewness and Kurtosis were significantly (0.01) higher in Hindustani singers compared to Carnatic singers. Table 1 shows the mean values of all the acoustic parameters. Tables 2 shows the mean values of these parameters in all the ra:gas.

Table 1: Mean f0, SD, extent and range of f0, Skewness and Kurtosis in Carnatic (C) and Hindustani (H) singers.

Parameters	C	H
F0	269	364
SD	71	82
Extent of fluctuations	26	35
Rate of fluctuations	19	32
Range of f0	212	243
Skewness	0.40	2.24
Kurtosis	2.29	6.39

Table 2: Mean f0, SD, rate (R) and extent (E) of f0 fluctuations, and range of f0 in all ra:gas in Carnatic (C) and Hindustani (H) singers.

Ra:gas	Mean f0		SD		R		E		F0 Range	
	C	H	C	H	C	H	C	H	C	H
Kalya:ni/Kalya:n	290	371	69	77	20	38	29	33	215	194
Ma:yama:lavagaulla/Bhairav	277	356	72	86	16	33	21	33	215	284
Ka:mavardhini/Pu:rvi	256	368	72	78	18	26	25	40	195	237
Pu:rviKalya:ni/Ma:rva	284	369	70	87	19	31	27	34	224	257
Average	269	364	71	82	19	32	26	35	212	243

Hindustani male singers had higher f0, extent and rate of fluctuations compared to Carnatic male singers. But the difference was not significant. Tables 3 and 4 show the mean f0, rate and extent of fluctuation and range of f0 in male.

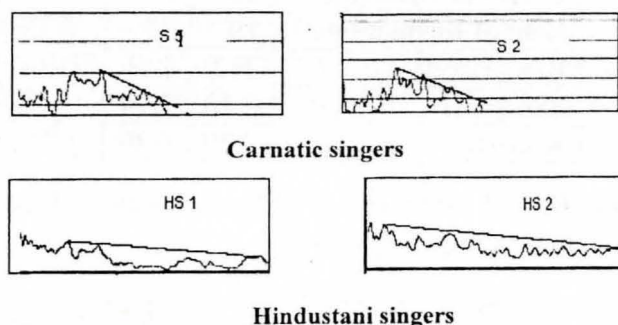
Table 3: Mean f0, SD, extent and rate of fluctuation of f0 range in Carnatic (C) and Hindustani (H) male singers.

Parameters	C	H
F0	210	225
SD	83	77
Extent of fluctuation	50	52
Rate of fluctuations	19	28
Range of F0	229	224

Table 4: Mean f0, SD, rate (R) and extent (E) of f0 fluctuations, and range of f0 in all ra:gas in Carnatic (C) and Hindustani (H) male singers.

Ra:gas	Mean f0		SD		R		E		F0 Range	
	C	H	C	H	C	H	C	H	C	H
Kalya:ni/Kalya:n	201	237	100	80	20	29	253	296	75	61
Ma:yama:lavagaulla/Bhairav	194	225	61	84	15	26	133	225	38	61
Ka:mavardhini/Pu:rvi	223	224	85	84	20	35	270	198	45	56
Pu:rvikalya:ni/Ma:rva	224	213	85	59	22	23	260	178	43	30
Average	210	225	83	77	19	28	229	224	50	52

Figure 1 shows the LTAS in Carnatic and Hindustani Singers. In the figure it can be observed that spectra falls off fast in Carnatic singers and slow in Hindustani singers. Also, energy concentration at high frequencies is more in Hindustani singers compared to Carnatic singers.

**Figure 1:** LTAS in Carnatic and Hindustani singers.

The perceptual correlates of melody included continuity, pleasantness, pitch fluctuations and rhythm. While the first three parameters contributed significantly to melody, rhythm contributed to melody about 4.1% of times. Acoustically pitch fluctuations can be correlated with the time of sustaining a:la:pana which was not investigated in this study. Pleasantness can be correlated with energy at high frequencies. Thus, the perceptual analysis and acoustic analysis correlated well with each other indicating singing as melodic when it has rising and falling f0, wider f0 range and energy at high frequencies.

The results of the present study have brought light into the acoustic parameters of melody. However, a general statement about Carnatic or Hindustani music cannot be made on this basis. It is suggested that the acoustic correlates of continuity be explored in future studies to provide a complete picture of melody.