

Harmonic and Melodic Values

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Introduction

Musical intervals are not all equal; they differ in their harmonic and melodic values. Generally, an interval that is harmonically strong will be melodically weak, and vice-versa; in other words, the harmonic and melodic values of intervals are complimentary. Herein we present a method of calculating the harmonic and melodic values of musical intervals that can be used as a basis for an ontology of musical expression.

The harmonic and melodic values of musical intervals are derived from the harmonics comprising the interval. For example, the interval of a perfect unison is a 1:1 ratio of frequencies; therefore it may be derived from the 1st harmonic or fundamental of any tonality. Because it is derived from the 1st harmonic, it is harmonically the strongest interval, but it is the melodically weakest interval. On the other hand, the augmented (sharp) 4th or tritone, with a frequency ratio of 7:5, is derived from the 7th and 5th harmonics. It is therefore much weaker harmonically, but stronger melodically, than the unison.

The composer can use the science of harmonic and melodic values to evaluate the raw materials of scales, chords, melodies and tonalities to express his intended meaning in the language of music. In fact, music has meaning and expression precisely because of these values. If all tones had the same values, they would be meaningless because they would be all the same. Therefore some system of values is necessary to understand the meaning of the building blocks of music, putting them into perspective and giving the composer a coordinate system, a palette of tonal colors and values for designing his compositions.

Music is fundamentally about emotion, just as cooking is about taste and visual art is about light. Especially spiritual music is, or should be, directly an expression of transcendental *rasa*, or ecstatic loving personal relationship with God. These transcendental emotions are ranked in the Esoteric Teaching of the *Vedas* according to their spiritual purity and pleasure-giving capacity. The language of music can certainly express them all, but where is the dictionary that defines the meaning of the language of music?

This work is an attempt to create such a dictionary for transcendental music, and to facilitate composition in this medium. Its axiomatic foundation is that musical intervals have particular subjective emotional meanings based on their harmonic structure. It is built upon the concepts expressed in my 1985 thesis *Svara Saptah: Intonation in Vaisnava Music*. Many fundamental concepts that are not explained in detail herein may be found in that work.

Harmonic Value

The harmonic value of an interval is calculated by this formula:

Where V_h = Harmonic Value

f_1, f_2, \dots = Numerators and Denominators of the intervals' harmonic ratio

n = the total number of factors in the calculation.

$$V_h = \left[\frac{1}{\left(\frac{f_1 + f_2 + \dots + f_n}{n} \right)} \right]$$

For example, the harmonic value of a perfect fifth (harmonic ratio 3:2) would be $1 / ((3 + 2) / 2) = 0.667$. Similarly, the 12 intervals of the octave are calculated as follows:

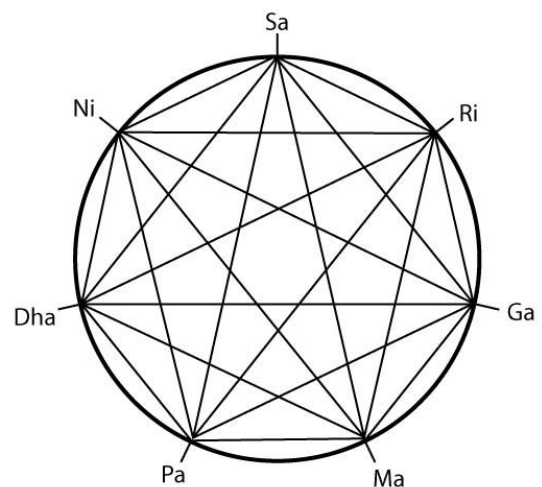
Svaras, Ratios and Harmonic Value			
Interval	Numerator	Denominator	Harmonic Value
Octave	2	1	0.667
N	9	5	0.143
n	7	4	0.182
D	5	3	0.250
d	8	5	0.154
P	3	2	0.400
M	7	5	0.167
m	4	3	0.286
G	5	4	0.222
g	6	5	0.182
R	9	8	0.118
r	10	9	0.105
Unison	1	1	1.000

The highest possible harmonic value is 1, and it approaches zero as an interval is derived from higher harmonics. For a complete discussion of the derivation of the intervals, see *Sapta Svarah*.

Now the harmonic value of a scale is simply the aggregate or matrix sum of all the intervals in the scale. For example, the matrix of all 21 possible intervals in the ordinary major scale is as follows:

S	R	G	m	P	D
R					
G	R				
m	g	r			
P	m	g	R		
D	P	m	G	R	
N	D	P	M	G	R

In general, among any n entities there are $(n-1) + (n-2) \dots + 1$ unique possible relationships; so there are 21 intervals among the seven scale tones. The simple geometric proof at right shows that there are indeed 21 possible intervals among the *svaras* of any heptatonic scale:



If we substitute the harmonic values (V_h) for the *svaras* in the table above and perform the matrix sums, we obtain the following matrix:

S	R	G	m	P	D
0.118					
0.222	0.118				
0.286	0.182	0.105			
0.400	0.286	0.182	0.118		
0.250	0.400	0.286	0.222	0.118	
0.143	0.250	0.400	0.167	0.222	0.118

Totals: 1.419 1.236 0.973 0.507 0.340 0.118 **4.593**

Now if we perform the same analysis on the Lydian Mode scale (Kalyan Thata), we obtain the following result:

S	R	G	M	P	D
R					
G	R				
M	G	R			
P	m	g	r		
D	P	m	g	R	
N	D	P	m	G	R

S	R	G	m	P	D
0.118					
0.222	0.118				
0.167	0.222	0.118			
0.400	0.286	0.182	0.105		
0.250	0.400	0.286	0.182	0.118	
0.143	0.250	0.400	0.286	0.222	0.118

Totals: 1.300 1.276 0.986 0.573 0.340 0.118 **4.593**

In other words, although the internal intervals of the two scales differ, their harmonic values are equivalent. The first scale is used as the principal reference scale in both Western and North Indian music, while the second is the principal scale in the South Indian musical system. The difference between them is largely emotional, with the strong relationship of **m** to the tonic in the first scale suggesting a strong motherly feminine presence, while the leading tone of **M** in the second scale suggests that the feminine is subordinated to a masculine personality with an emphasis on the conjugal mood of **P**. Sure enough, the traditional *ragas* based on both scales express sacred moods, but the mood of SRGmPDN is more general devotion in the mode of *vaidhi-bhakti*, while SRGMPDN almost always expresses conjugal love in *raganuga-bhakti*.

When we perform this matrix analysis for all 32 common Vedic scales, we obtain the following results:

Scale	Name	Harmonic Value
SRGmPDN	Ionian	4.593
SrGmPDN	b2	4.251
SRGmPDn	b7	4.369
SrGmPDn	b27	4.191
SRGmPdN	b6	4.211
SrGmPdN	b26	4.348
SRGmPdn	b67	3.936
SrGmPdn	b267	4.237
SRgmPDN	b3	4.228
SrgmPDN	b23	3.835
SRgmPDn	b37	4.483
SrgmPDn	b237	4.254
SRgmPdN	b36	4.082
SrgmPdN	b236	4.128
SRgmPdn	b367	4.220
SrgmPdn	b2367	4.470
SRGMPDN	#4	4.593
SrGMPDN	b2#4	4.275
SRGMPDn	b 7#4	4.146
SrGMPDn	b 27#4	4.032
SRGMPdN	b 6#4	4.187
SrGMPdN	b26#4	4.348
SRGMPdn	b 67#4	3.729
SrGMPdn	b 267#4	4.054
SRgMPDN	b 3#4	4.151
SrgMPDN	b 23#4	3.910
SRgMPDn	b 37#4	4.351
SrgMPDn	b 237#4	4.146
SRgMPdN	b 36#4	4.005
SrgMPdN	b236#4	4.179
SRgMPdn	b 367#4	4.064
SrgMPdn	b 236 7#4	4.338

When this list is sorted in descending order of harmonic values, this is the result:

Scale	Name	Harmonic Value
SRGMPDN	#4	4.593
SRGmPDN	Ionian	4.593
SRgmPDn	b37	4.483
SrgmPdn	b2367	4.470
SRGmPDn	b7	4.369
SRgMPDn	b 37#4	4.351
SrGMPdN	b26#4	4.348
SrGmPdN	b26	4.348
SrgMPdn	b 2367#4	4.338
SrGMPDN	b2#4	4.275
SrgmPDn	b237	4.254
SrGmPDN	b2	4.251
SrGmPdn	b267	4.237
SRgmPDN	b3	4.228
SRgmPdn	b367	4.220
SRGmPdN	b6	4.211
SrGmPDn	b27	4.191
SRGMPdN	b 6#4	4.187
SrgMPdN	b236#4	4.179
SRgMPDN	b 3#4	4.151
SrgMPDn	b 237#4	4.146
SRGMPDn	b 7#4	4.146
SrgmPdN	b236	4.128
SRgmPdN	b36	4.082
SRgMPdn	b 367#4	4.064
SrGMPdn	b 267#4	4.054
SrGMPDn	b 27#4	4.032
SRgMPdN	b 36#4	4.005
SRGmPdn	b67	3.936
SrgMPDN	b 23#4	3.910
SrgmPDN	b23	3.835
SRGMPdn	b 67#4	3.729

This helpful list allows us to make some interesting observations. For example, we see that most of the familiar Western scales and modes are near the top; but there are some others of equivalent value that are little known and used in Western music, or even common *ragas*. If we play these scales, we find them pleasing to the ear and heart, if unfamiliar, like a beautiful stranger; to me this just increases their allure.

When we investigate the scale-tone chords and tonalities of these scales in the next section, we will see that the tonalities they offer are actually part of our contemporary musical language, especially jazz; but we simply have not had the language to define and talk about them in terms of their scale-tone origins. Hence the value of our effort to create a comprehensive musical ontology is that it will enrich the tonal and melodic resources appropriate to extended seventh- and ninth-chord chromatic harmony.