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Raga classification in Indian Classical music - revisited

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ABSTRACT

Ragas are a fundamental concept to the Indian Classical music which provide immense scope for artists to improvise aesthetically. Raga is a complicated melodic structure that is deep in nature and aesthetic by definition. This is a unique melodic concept of Indian music. To classify such complex entities based on one common feature is a difficult task. Different systems that have been trying to do that have encountered their own problems in giving a logical and unambiguous solution. This solution to resolve ambiguities in the previous classification systems of Indian music, also opened up the prospects of classifying melodies of different musical systems of the world. This solution moves towards the fact that Music is universal in nature.

1 Introduction

Indian classical system comprises of two systems, the *Hindusthani system* (followed in the Northern regions) and the *Carnatic system* (followed in the southern/Carnatic region) and the concept of *raga* is shared by both. A *raga* is a melodic framework of *svara-s* (notes) for the musician to improvise in a certain scope. Each *raga* (as the term suggests) has its own color in terms of its "unique melodic personality" [1]. Inspite of having various properties, every raga is bind by the pitch positions(swarasthan-s) that provide the basic framework or structure to it.
These pitch positions are arranged in ascent and descent manner in a specific order. The order contributes to the uniqueness of the raga. Traditionally a raga comprises of at least 5 *swaras* (notes), although ragas discovered in the recent years may violate this principle [2] [3].
The existence of numerous ragas demands a classification system for analysis and study. Classifications have been done based on different aspects like characteristic phrases, time association, embellishments, number of notes present, presence of foreign notes, region in which they are prominent, influence of other systems.
Venkatamakhin (17th century) proposed the *Melakarta* system as a collection of 72 fundamental scales in the Carnatic system [5] taking the swarasthana(pitch position) as its base. Recent classification systems considered the parent-child association of raga-s as the basic criteria of classification. The *Janya raga* (child raga) is associated with one of the *Janaka raga* (parent raga). Exemplary cases of raga include *Varja ragas* (Janya is devoid of some notes), *Upanga ragas* (notes used in the raga is strictly a subset of the Janaka), *Bhashanga raga* (some notes used in the raga are not contained in the Janaka, they are the foreign notes to that raga).
Pandit Vishnu Narayan Bhatkhande created the *Thaat* system of classification followed in the Hindusthani system which works based on *Gaana Kaala(time of the day)* and *Rasas* [4].

In Venkatamakhin's system, the 72 melakarta-s were arranged into 12 *chakras(groups)* with each chakra containing 6 scales [6]. Each of these are named based on the *katapayadi system* [7]. Each *sampurna* (7 swaras) melakarta contains S & P and one note (*Madhyama*) from M, m and two notes (*Rishabam* & *Gandharam*) from R, r, G, g and two notes (*Dhaivatam* & *Nishadam*) from D, d, N, n. Here the concept of 16 swara sthanas was used where some frequencies are referred by multiple names.
Note: Swaras sthanas in the increasing order of frequency in an octet: *S, r, R, g, G, M, m, P, d, D, n, N*

The Carnatic terminology of these 12 notes is
S-Shadja , r- Suddha Rishabha, R- Chatusruthi Rishabha, g- Sadharana Gandhara, G-Antara Gandhara, M- Suddha Madhyama, m-Prathi Madhyama, P-Panchama, d-Suddha Dhaivata, D-Chatusruthi Dhaivata, n-Kaisiki nishada, N- Kakali Nishada.
In these 12 positions R, g, D,n share two names each. R which is Chatusruthi Rishabha is also perceived as one variety of Gandhara and is given the name Suddha Gandhara. But the pitch position is the same. Similarly g which is Sadharana Gandhara is perceived as one variety of Rishabha and given the name Shatsruthi Rishabha which is no different from sadharana Gandhara's pitch position.
The same idea applies on Dhaivata and Nishada and two more new names Suddha Nishada and Shatsruthi Dhaivatha arise sharing the same pitch positions of D and n respectively. This is how the 12 pitch positions becomes 16 in terms of names but positions retaining to be 12. These four new names are called vivadi swaras and the ragas which contain them are called vivadi ragas. So formally in Vivadi ragas two varieties of the same swara occur, that is either r,R or gG, dD or nN one as Rishabha other perceived as gandhara in case of rR, first one as Rishabha and second one as gandhara in case of gG and accordingly with dD and nN. This idea paved the way for the execution of this new variety of ragas called Vivadi ragas. This 16 swarasthana idea is the basis for the 72 melakartha system.
Melakarta system is strictly based on the swara sthanas and is considered by far the most logical and scalable system for raga classification in Carnatic music. On the contrary to its efficiency in classifying Janya ragas, classification of Upanga and Bhashanga ragas is still ambiguous.

In this paper, section 2 deals with the drawbacks of the Melakarta system. Section 3 outlines the related work and section 4 explains our approach to solving the problem. Section 5 justifies the correctness of our solution mathematically and demonstrates the same with some examples. Section 6 explains the global adoption of this approach followed by the conclusion in section 7.

2 Melakarta system & its drawbacks

Melakarta system is one of the most recent and logical forms of classification that employs the 16 swara sthanas idea to classify ragas. Here there are 72 Melakartas (Janaka ragas) which are sampoorna ragas onto which the Janya ragas are classified. As introduced earlier, the drawback with the Melakarta system lies in its inability to classify the Upanga and the Bhashanga ragas appropriately. *Hamsadhvani* and *Bhairavi* are the respective examples considered throughout the paper. *Aarohanam* (ascent) & the *Avarohanam* (descent) of the ragas [8]-
Hamsadhvani - SRGPNṠ & ṠNPGRS
Bhairavi - SRgMPDnṠ & ṠndPMgRS
Bhairavi is classified into *20th Melakarta Narabhairavi (Natabhairavi)* (SRgMPdnṠ) and Hamsadhvani is classified into *29th Melakarta Dheera Shankarabharanam* (SRGMPDNṠ) [9].
NOTE: Bhairavi considered here is from the Carnatic system and is not to be confused with the Bhairavi raga of Hindusthani system (which references to Sindhu Bhairavi in the Carnatic system).
Hamsadhvani's swaras are also a subset of Mecha Kalyani (SRGPN ⊂ SRGmPDN). Bhairavi also contains D which is not present in Narabhairavi (D ∉ SRgMPdn) and hence considering only *saptaswaras* **Karaharapriya (d ∉ SRgMPDn) could also be used as the Janaka raga.** *Thus the classification of Hamsadhvani and Bhairavi to 29th and 20th Melakarta is ambiguous and not justified.*

3 Related work

On the contrary of being bothered by some ambiguity with the Melakarta system, musicians and musicologists have predominantly accepted the convention of raga classification (like Hamsadhvani is conventionally classified under Dheera Shankarabharanam). S. Kalyanaraman (SKR) on the other hand, ventured deeper into scales and came up with *Dwi-Madhyama Panchama Varja Ragas* by including 36 *vikritha panchama melas* [10]. Here the raga contains both the Madhyams (M & m) but is devoid of Pancham (P) (the ragas are obtained by replacing P with m in the first 36 Melakarta and the nomenclature involves *"Sri"* as a suffix).
Consider the raga Rohini (SrGMmDNṠ & ṠNDmMGrS) which is classified onto *17th Melakarta Sooryakāntam* (SrGMPDNṠ) [9]. This also holds an ambiguous spot in classification since m ∉ SrGMPDNṠ and this ambiguity is resolved by classifying Rohini as/under *Suryasri* (SrGMmDNṠ) proposed by the *Dwi-Madhyama Panchama Varja* extension for the already existing 72 Melakarta to 108 ragas. This system is the only practically accepted extension to the Melakarta system but still fails to clear the ambiguity we initially wanted to address about Hamsadhvani and Bhairavi.

4 Our Approach

The traditional (Dwi-Madhyam Panchama Varja) Melakarta only considers Sampurna (7 notes) scales to be classified as Melakartas (Janakas). This method may fail to scale and support the modern experimentations and discoveries of newer ragas.
Current approach-
1. 2 notes from r, R, g, G occur and are referred to as Rishabha & Gandhara
2. 2 notes from M, m, P occur (extension from Dwi-Madhyam Panchama Varja)
3. 2 notes from d, D, n, N occur and are referred to as Dhaivata & Nishada

Our approach releases these constraints and allows every note's individual existence. We fix only the *Shadja* of the 12 swara sthanas and allow all the other 11 swara sthanas to (not)occur depending on the raga. Refer to table IV for the contrast between the existing models and our approach.

The swara sthanas so chosen will form a scale onto which many Janya ragas would be classified. We shift from the Janaka raga paradigm to Janaka scale paradigm where the Janaka provides the scale and structure for classification of the Janyas.

This would hence be a global system and not be confined for the Indian (Carnatic) musical system alone. This is the major scalable aspect which this method provides and this would be consistent with also the ragas which could be discovered in the future.

For easier analysis, we group the following-
1. RGset - notes occurring from r, R, g, G. (#RG)
2. MPset - notes occurring from M, m, P. (#MP)
3. DNset - notes occurring from d, D, n, N. (#DN)

Table 1 gives the details of the numbering of each set based on the occurrence of swara sthanas.
The final numbering for the raga is obtained as
"*(#MP - 1) * 256 + (#RG - 1) * 16 + #DN".*

TABLE 1. NOMENCLATURE/NUMBERING OF EACH SET.

Numbering	RGset (rRgG)
1	----
2	r---
3	-R--
4	--g-
5	---G
6	rR--
7	r-g-
8	r--G
9	-Rg-
10	-R-G
11	--gG
12	rRg-
13	rR-G
14	r-gG

15	-RgG
16	rRgG

Numbering	MPset (MmP)
1	---
2	M--
3	-m-
4	--P
5	Mm-
6	M-P
7	-mP
8	Mmp

Numbering	DNset (dDnN)
1	----
2	d---
3	-D--
4	--n-
5	---N
6	dD--
7	d-n-
8	d--N
9	-Dn-
10	-D-N
11	--nN
12	dDn-
13	dD-N
14	d-nN
15	-DnN
16	dDnN

Note: Considering the *vivadi* swara sthanas in the Melakarta system (leading to 16 swara sthanas), we propose a method to stay consistent with the convention in Table 2 [11]. This table is relevant to fit in the *Vivadi* ragas [13].

TABLE 2. CONVENTION ON VERBAL SOUND UTTERED WITH SWARA STHANAS.

Swara sthanas	*Bol* (verbally uttered sound)
rR--	Rishabam (R), Gandharam (G)
--gG	Rishabam (R), Gandharam (G)
dD--	Dhaivatam (D), Nishadam (N)
--nN	Dhaivatam (D), Nishadam (N)

TABLE 3. DIFFERENT SYSTEMS AND THE NUMBER OF SWARAS TO OCCUR FROM THE DIFFERENT SWARA STHANAS.

#notes	MK	DMPV	OA
S	1	1	1
r	2	2	0/1
R			0/1
g			0/1
G			0/1
M	1	2	0/1
m			0/1
P	1		0/1
d	2	2	0/1
D			0/1
n			0/1
N			0/1

Key:
MK - Melakarta
DMPV - Dwi-Madhyama Panchama Varja
OA - Our Approach

4.1 Bhashanga ragas and drawbacks

This new system structures the ragas according to their swara sthanas. *Bhashanga* notes in the ragas are not included in the process. i.e. if a swara is not included in the ascent/descent structure of the raga but is used to a good extent in the compositions, it is not considered for the classification & nomenclature.
Like if we consider the Bilahari raga, *n* is used in the composition of the raga as a Bhashanga note but is not considered in its ascent/descent structure. Though *n* is not mentioned in the basic structure, it's an integral component to the raga. Hence we would like to solve this issue by restructuring the basic structure itself.

4.2 Restructuring Ascent and Descent of the ragas

We propose to restructure the Moorchana(ascent and descent together) to include the Bhashanga swara. We do so by adding the *actual phrase containing the Bhashanga note in the ascent/descent*.
As discussed earlier, Bilahari has the Bhashanga note *n*. Similarly *Anandabhairavi* comprises of the Bhashanga notes *d, N,G*.

Restructuring approach:
The portions between two single # like #.....# or between double # and a single # like " ##.....# " indicates the phrases in which Bhashanga (foreign) notes occur along with the specific phrase. This is employed in the ascent/descent.

For Bilahari:
Conventional structure:
SRGPDS
SNDPMGRS.

New structure:
SRGPDS
SNDP#DnDP#MGRS.

Anandabhairavi:
Conventional structure:
SgRgMPDPS
SnDPMgRS

New:
SgRgM#GGM#PDPS
SnDP##dP#MgRS##NNS#

The portions between the symbol # are supposed to be the exact phrases in which the foreign note occurs.
Before and after the # is the conventional structure.
Where ever there is necessity for including two or more foreign notes along with the phrases, ## is the beginning of the phrase with the foreign note and single # indicates the end of that phrase.
In this case Bilahari takes the number *1439* and Anandabhairavi *1520*.
By adding these Bhashanga(foreign) notes into the Moorchana, they are included in the process of calculating the number and thus resolve the existing ambiguity

5 Correctness and Examples

Consider a raga (R) with a moorchana(ascent/descent) M and define SS_R as the set of all swara sthanas in R. Let the Janaka (J_R) of this raga in our system be SS_{JR}.
$SS_R = \{X | X \in M\}$
Janaka contains all the notes present in R and amounts to no ambiguity: $SS_{JR} = SS_R$ (unique J_R is assigned). Also, no two Janaka ragas would be the same (they'd differ in at least one of the RGset, MP set or DNset) and hence offers a unique numbering to each raga.

Proof for the nomenclature:
MPset: for every mp∈MPset, there are 16*16 combinations for #RG & #DN. ***256***
RGset: for every rg∈RGset, there are 16 combinations for #DN. ***16***

DNset: the #DN with the #MP & #RG gives a unique numbering. ***1***

Verifying the solution to the problem with initial ambiguity examples:
Hamsadhvani - SS_R = {SRGPN}
RGset = {RG} → 10
MPset = {P} → 4
DNset = {N} → 5
Hence unique Janaka's numbering: 256*(4-1)+16*(10-1)+5 = *917*.

Bhairavi - SS_R = {SRgMPdDn}
RGset = {Rg} → 9
MPset = {MP} → 6
DNset = {dDn} → 12
Hence unique Janaka's numbering: 256*(6-1)+16*(9-1)+12 = *1420*.

Hence both Upanga and Bhashanga ragas are given a unique Janaka resolving the ambiguity.

6 Global approach

This new approach can be applicable to any musical systems, the 12 pitch positions being universal in nature with different nomenclatures.

Though Western musical system does not follow the fixed tonic (base frequency) like the idea of 'sa'(Shadja) in Indian music, considering the first note of the scale as 'sa' and notating other tones accordingly would enable us to associate even Western tunes with specific numbers with our formula.
Consider the master piece ***Fur Elise*** by the world renowned composer *Ludwig van Beethoven.* There is a chromatic scale in the piece which covers all the 12 pitch positions. So this piece can be given number 2048. Other than the chromatic scale, the remaining portions of this piece also have all the 12 pitch positions. Whenever the piece employs all the 12 pitch positions in any system, it gets the number 2048.

In Indian music, raga *Sindhubhairavi* (Carnatic) equivalent to *Bhairavi* (Hindusthani) is the only raga which takes all the 12 pitch positions. That raga also claims the number 2048 in this system.

Hence, it is very important to note that we are considering only the total number of pitch positions used in each melodic structure and not any other parameter. So the above mentioned different melodies that take number 2048 are nowhere close to each other in their sound as the characteristics and applications are starkly different.

Similarly extracting relevance to the Hindusthani Ragas:
Haamir

Conventional:
SGMDNS
SNDPmPGMRS
n is foreign (Bhashanga) swara

New structure;
SGMDNS
SNDPmP #DnDP# GMRS

Hence its numbering would be 1951 as against 1946 calculated without the Bhashanga (*vivadi* according to Hindusthani) note.

7 Conclusions

Since the existence of Indian classical music, several attempts have been made in clustering and analyzing ragas based on a certain property. Melakarta system definitely surpasses the other systems through its logical methods of classification which can work at scale but fails to provide justification for Upanga and Bhashanga ragas.
Our approach is a proposal to classify ragas into unique Janakas and remove the ambiguity in the classification of Upanga and Bhashanga ragas. This approach is consistent with the existing conventions of the classical Indian music including the 16 swara sthanas. Nomenclature is shifted from the Katapayadi system to formal numbering. This model covers all ragas presently

practiced in the system and is also scalable to accommodate newer ragas which may be discovered with time. We also propose the shift from the Janaka being a parent raga to Janaka being a parent scale (in accordance with Hindusthani Thaat's conventions).

Though different systems of the world employ different concepts with a variety of approaches, the 12 pitch position level stands invariant universally. Thus, our formula holds appropriate only to that extent in the context of Global music but it does definitely resolve the current ambiguities in the Indian raga Classification system.

References

[1] Dorothea E. Hast, James R. Cowdery, Stanley Arnold Scott (1999). *Exploring the World of Music: An Introduction to Music from a World Music Perspective*. Kendall Hunt. ISBN 978-0-7872-7154-1.

[2] Deepa H. Ramakrishnan (2016, November 23). *Balamurali, a legend, who created ragas with three swaras*. The Hindu (http://www.thehindu.com)

[3] Nettl, Bruno, (2010). *Raga, Indian Musical Genre*. Encyclopædia Britannica.

[4] Pandit Bhatkhande, (2009). *Hindustani Sangeet Padhati, Kramik Pustak Malika* (six volumes). Published by Sangeet Karyalaya, Hathras.

[5] Shree Muthuswami Dikshitar Keertanaigal, by A Sundaram Iyer, Madras Book Publications, Mylapore, Chennai

[6] South Indian Music Book III, by Prof. P Sambamoorthy, Published 1973, The Indian Music Publishing House

[7] J.F. Fleet (Jul 1911). *The Katapayadi System of Expressing Numbers*. The Journal of the Royal Asiatic Society of Great Britain and Ireland. Royal Asiatic Society of Great Britain and Ireland: 788–794. JSTOR 25189917.

[8] Ragas in Carnatic music by Dr. S. Bhagyalekshmy, Glossary pages, Pub. 1990, CBH Publications

[9] Wikipedia contributors. (2019, January 8). List of Janya ragas. In Wikipedia, The Free Encyclopedia. Retrieved 18:50, January 28, 2019, from https://en.wikipedia.org/w/index.php?title=List_of_Janya_ragas&oldid=877348452

[10] RAGA PRAVAGAM, by Dr. M. N. DHANDAPANI & Smt. D. PATTAMMAL, The Trinity music book publishers 1984.

[11] Gaanaamrutha Varna Maalikaa by A.S. Panchaabakesa Iyer

[12] Te Nijenhuis, (1974), pp. 13–14, 21–25

[13] Ragas in Carnatic music by Dr. S. Bhagyalekshmy, Pub. 1990, CBH Publications