A KARNATIC

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The Carnatic

of North

ABOUT THE AUTHOR

Dr. Parthasarathy Sriram, is an aerospace engineer, with a bachelor's degree from IIT, Madras (1982) and a Ph.D. from Georgia Institute of Technology where is currently a research engineer in the Dept. of Aerospace Engineering. The preface written by Dr. Sriram speaks of why he wrote this monograph. At present Dr. Sriram is looking after the affairs of the provisionally recognized South Eastern chapter of the Carnatic Music Association of North America in Atlanta, Georgia. CMANA is very privileged to publish this scientific approach to Carnatic Music written by a young student of music.

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1990

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Table

P

Om Sri Gurubhyo Namaha.

This booklet is aimed at mus
little bit about the basic theory of Ca
books on many aspects of Carnatic m
an advanced nature - they have lots
difficult for a novice to start learning
are mastered, these books provide en
This opinion is shared by many of my
expressing a need for a simple bookle
in producing this booklet was to put
beginner can get started off easily. I
Symmetries, there is very little new
books have been consulted to obtain
are encouraged to further their knowl

The New Groves Dictionary
Sri Krithi Mani Malai by R.
Ganamrutha Varna Malika b
Abhyaasa Gaanam by A. Su
Karnataka Sangeetham by A
Karnataka Sangeetham by Pr

This book is intended to be rea
inadvisable to delve into the later se
sections. Most of the terminology is
attempt to use a standard translitera
both used. In fact, I have mixed Tam
ragams can all be found in the tex
assumed little more than an interest i
and thus, the initial sections deal with
a scientist and an engineer, I was ten
ever possible. Further, it is very d
analytical approach in a book like thi

and physical concepts used are elementary and are no more advanced than what one would encounter in high school.

A few words of advice to readers: Listen to as much music as you can and find friends who share your interest. Discuss what you know and you will almost always end up adding to your knowledge. There is no question that is so silly that it does not deserve to be asked. The art of identifying ragas cannot be learned from a book and it usually takes years of listening before one begins to identify ragas reliably. Patience and perseverance are the key words here.

Inspiration for this work was provided by my uncle Valavanur N. Jambunathan (who was born of parents who were neither musicians nor musicologists and who did not have the benefit of any musical education, whatsoever), who is our family musical resource. Further encouragement was provided by my cousins, especially Basu (S. Baskaran, Dubai, U.A.E.), and many others who expressed interest in a document such as this. Special thanks are due to my 'brothers' of the Atlanta Panchapandavas, Drs. Mahadevan (Nashville, Tennessee), Gajanan (Knoxville, Tennessee), Chander (Washington, D.C.) and Kannan (Philadelphia, Pennsylvania) for aiding me in my discovery of love for classical music and (especially to Mahadevan) for reviewing and contributing to the material in this book.

This work is dedicated to my Gurus Sri. Prathapam Natesa Iyer (disciple of Ariyakkudi Ramanujam Iyengar) and Smt. Jayalakshmi Ramaswamy (disciple of G.N. Balasubramanian). Anything good you see in this book is a consequence of the musical knowledge they instilled in me while the errors you may come across are entirely due to my inability to comprehend what I was taught.

I sincerely hope that reading this book accelerates your understanding and appreciation of music. This document is by no means perfect and I welcome all suggestions and comments.

P. Sriram
Atlanta, U.S.A.
February 1989.

Intı

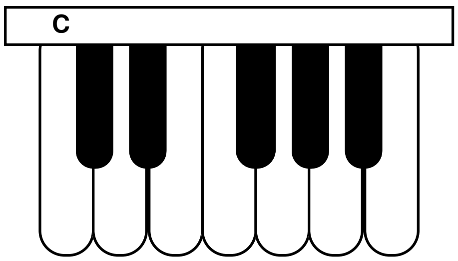
"Nature has endowed this univ
many different shapes, sizes and abili
produce sounds and some of them
using varied sounds. Man is unique
sound." This is how Swami Ja
Kanchipuram) introduces the Kamala
Dikshithar. The ability to express th
art which we call music. Music can
sounds in a fashion that follows certa
cial inner feeling of happiness and co
basic principles are natural and thus
man to rationally explain what is al
rationalization helps in understandin
increasingly higher levels of apprecia

The most basic unit of mus
indicates the position in the audible s
the pitch of the sound. Actually, th
swara sthana. Inherently, certain sou
This property was realized by man t
the term harmony; lack of harmony is
ther, let me introduce, as a practi
immensely as we go along deeper
Purists may frown at this, but as l
keyboard and why the purists frown,

At first glance, a keyboard is
keys of two different lengths, usually
closer examination shows a pattern o
full keyboard. The repeating pattern
keyboards indicate the location of th
case, a C key can be identified as the
of a group of two black keys or the
there is more than one C key (perhap

key is so called due to the notation used in western music for the notes. The successive white keys to the right of C are labeled D, E, F, G, A and B. As a first example of harmony, play a C key and the next C key simultaneously and listen carefully+. The combined sound has an oneness. Playing a C key and the white key next to it (the D key) does not produce a similar effect and the two tones stand out separately. They do not merge as in the case of the two C keys. Total disharmony is difficult to demonstrate using a keyboard due to the discrete nature of the notes that can be played. One would have to produce a sound that is located 'between' two keys in order to hear a set of highly disharmonious (abaswara) notes but the preceding demonstration is a simple example of two levels of harmony.

Keyboard Layout



Two successive C keys are separated by what is called an octave which corresponds to a ratio of two in frequency. That is, the frequency of a C note is exactly double the frequency of the C immediately below (to the left of) it and exactly half the frequency of the C immediately above it. Two sounds are perceived to be very similar if they are separated by an octave and the only explanation for this is that that is how mother nature has made it!

The concept of harmony is closely related to the notion of harmonics. Consider a string fixed at both ends and vibrating at a fundamental frequency f. From basic physics, the upper harmonics of the string are at integral multiples of f, namely, $2f$, $3f$, $4f$ etc. Harmonious tones have common harmonics and this implies that the tones have fundamental frequencies that are related as a ratio of two integers. A high degree of harmony is associated with ratios involving

+It is assumed here that the keyboard is polyphonic i.e., has the ability to produce more than one tone at a time. Many inexpensive keyboards lack this ability and are not suitable for this demonstration.

powers of 2 (2:1, 4:1, 8:1 etc.) and
signifies that the second harmonic c
third harmonic of the lower frequency
detected by the human ear. Two to
perceived as being very harmonious b
and 85th. Such high harmonics typic
be beyond the frequency range of the
is inherent in our perception of sou
frequencies that appear in successio
develops the ability to perceive the ab

Next we observe that there a
pattern (or twelve swara sthanas in a
twelve swara sthanas has evolved ov
from the fact that while some ancien
the current forms of many styles of cl
(including Western, Hindustani and
an octave. In ancient Vedic chant
denoted as normal, low and high. Int
these three swara sthanas can be rep
chants of later periods use as many a
the precursors of the raga system.
considered to be the maximum numb
perceive to be different without too m

Western music believes in spe
thus, the frequencies of all keys are fi
all instruments, if one can locate th
based on relative positioning and thus
is the analog of the note C. The whit
the successive white keys are assigne
on. The black keys are assigned frac
and so on). Note that there is no
accompaniment (tampoora or sruthi
indicate the reference pitch by saying
pitch, or a veena is tuned to four and

has been set to that pitch and all other swaras occupy corresponding sthanas. The importance of the Sa is that it provides the fixed foundation note upon which the rest of the music is built. Such a foundation note exists in classical Western music also and is indicated by the scale name eg. F-Major indicates that the tune is built using F as the base note. The base note can be discriminated with a little practice since the music generally returns to dwell on the base note every now and then.

Swaras an

There are seven swaras in
Rishabam (Ri), Gandharam (Ga),
Dhaivatham (Da) and Nishadam (Ni
there is an odd number (seven)
subsequently. For simplicity, let u
remaining swaras at the successive w
a raga (in this case, containing all the
ancient Vedic chants have but three s
(Indian as well as other forms, eg. Ch
Pa and Da of the scale we just creat
swaras, and perhaps, a few thousan
advance to a point of discriminatin
seven swaras are mythologically asso
animals and the names of the swaras
The name Madhyamam appears to be
in the seven notes and Panchamam i
five, denoting the position of the note

We observed earlier that doub
results in going up in pitch by one o
Sa^1) results in another Sa (Sa^2) whic
A further doubling produces Sa^3 wh
octaves above Sa^1. Three times the c
Sa^2 and Sa^3. In other words, the pitc
pitch of the Sa below it (and three fou
come to an important limitation of th
into the twelve swara sthanas. Since
the division is done on a logarithmic l
saying that the pitch values of the s
progression). An octave is a factor of
we make all the intervals equal to
corresponding to any key will be x t
immediately to the left of it. Exten

value of x should be. The thirteenth swara sthana results in an octave, or, stated mathematically, $x^{12}=2$. Then, we have x to be the twelfth root of two or a factor of approximately 1.06. Using this logarthmic division procedure, Pa (the 8th swara sthana) corresponds not to a ratio of 1.5 but 1.498. Though the discrepancy is very small, a well trained ear (eg. professional musician) can pick out this difference.

Carnatic music is based not on logarithmic division but on rational division. An octave is based on the ratio 1:2; Pa is located through the ratio 2:3; similar definitions exist for all the twelve swara sthanas. A few centuries ago, Western classical music too was based on rational division (the resulting scale was called as the natural scale), but this has given way to the equally tempered (also called chromatic) scale produced by logarithmic division. The difference is subtle, but quite important. The rational division claim is supported by the fact that tuning of instruments (for example, in setting the frets of veena) is performed mostly by the ear and not by reference to standards. Further, the swara sthanas of Carnatic music define only nominal locations for the swaras. Depending on the raga in which the swara is used, it manifests a deviation from the nominal sthana. Actually, the deviation from the nominal sthana depends on the swara phrase in which the swara occurs; thus, a single swara in a given raga can appear at different deviations from its nominal sthana when occuring along with various other swaras of the same raga. In a general sense, this deviation is called gamaka. Gamaka can refer to a constant deviation from the nominal swara sthana or a time dependent deviation or the path taken in reaching the nominal swara etc. Truly, gamaka is the life blood of Carnatic music and the raga system. Ragas are defined more by the gamakas and the way in which certain swara phrases (chain of swaras) are used than by the mere presence or absence of certain swaras. Thus, playing the keys corresponding to the swara sthanas of a certain raga will not reproduce the true character of the raga but only provide a general idea of what it sounds like. This is the reason why purists object to the use of keyboard instruments in Carnatic music - the lack of gamaka, which leads to a mutilation of the raga swaroopa. The use of gamaka also implies that the method used for defining nominal swara sthanas (rational or logarithmic division) is not too critical as long the correct raga swaroopam can be accommodated.

In the past, Hindustani music a
acceptance of the Harmonium has ca
few of the gamakas remain in use
Hindustani music has lost some of
Carnatic music is one of the very fev
lost their traditional character due to
contrary, Carnatic music has enhan
good things from other systems of
very good example of a positive in
techniques have been successfully ac
This adaptation is so complete that th
concert without a violin accompanyin

The seven basic swaras occupy
of sixteen swaras that form the b
emphasized that the swara sthanas a
on the raga, the swara is not fixed
locations around a nominal swara sth
and Panchama swaras are like the fou
is constructed. So, these occupy fixe
swaras as Prakruthi swaras (all the
swaras). Further, these two swaras a
In order to identify the sthanas of the
sthanas. The names of the swaras ar
in the following table.

Numbered sthana	Name
1	Shadjam
2	Suddha R
3	Chatusrut
	Suddha G
4	Shatsruth
	Sadharan
5	Anthara G
6	Suddha M

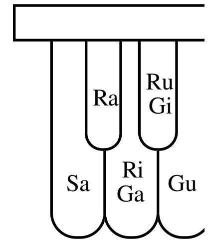
7	Prati Madhyamam	Mi, Big Ma
8	Panchamam	Pa
9	Suddha Dhaivatham	Da,Small Da
10	Chatusruthi Dhaivatham	Di, Big Da
	Suddha Nishadam	Na
11	Shatsruthi Dhaivatham	Du
	Kaisika Nishadham	Ni, Small Ni
12	Kakali Nishadham	Nu, Big Ni

The numbering used above allows one to easily locate the swaras on fretted string instruments (veena, mandolin etc.). One simply counts up the frets till the desired swara is reached. For example, if a Sa is played on a particular fret, to get a Prati Madhyamam, one simply moves up 6 frets on the same string (moving six steps from 1 results in 7, the number denoting the Prati Madhyamam). The Ra-Ri-Ru notation exists chiefly for convenience and is not used very widely. In conformance with that practice, this document will point out when the notation is being used. In the absence of such an indication, Ra should be taken to imply not Suddha Rishabam but a generic Rishabam. The following keyboard diagrams show the locations of the swaras for one kattai and four and a half kattai reference pitch using the ra-ri-ru notation. A similar indication can be easily made up for fretted string instruments simply by using the swara sthana table and counting up the frets starting from Sa.

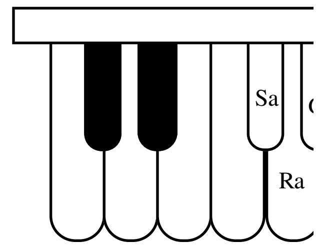
The use of sixteen swara names has led to some people describing an octave as being divided into more than twelve swara sthanas (as many as twenty two). But, as the table and keyboard diagrams show, there are only twelve sthanas and certain pairs of swaras occupy the same nominal swara sthana (eg. Chatusruthi Rishabam and Suddha Gandharam). In an earlier era (or for that matter, in contemporary Hindustani music), the duplicate name swaras were not used i.e. each swara sthanam was associated with one and only one swaram. The swaras of the octave then read (in Ra-Ri-Ru notation) Sa - Ra - Ri - Gi - Gu - Ma - Mi - Pa - Da - Di - Ni - Nu - Sa. The remaining swaras, Ru, Ga, Du and Na, were considered to be tainted ('Dhosham') and their use was to be avoided. These four swaras are called as Vivadi swaras and their use is now generally accepted. The occurrence of combinations of swaras gives rise to melodies

which can then be classified on the b
to the scheme of ragas which is our n

Swaras for one



Swaras for four and



Ragas

Ragas are sometimes defined as melody types. The raga system is a method of organizing tunes based on certain natural principles. Tunes in the same raga use the same (nominal) swaras in various combinations and with practice, the listener can pick up the similarity. Each raga has a swaroopam (a musical form or image) that is defined by the swaras used, the gamakas given to these swaras, the sequence in which the swaras occur etc. This definition is termed as the raga lakshanam*. Raga lakshanam usually contains the arohanam, avarohanam, details of raga chaya swaras (the swaras which are chiefly responsible for the characteristic melody of the raga), gamakas, characteristic swara phrases and general usage notes. It is intended more for the performer than for the listener. We shall first define arohanam and avarohanam. Arohanam is the sequence of swaras used in a raga in the ascending passages i.e. as the pitch goes up. Avarohanam is the sequence of swaras to be used in descent. The arohanam and avarohanam (or the scale) of a raga provide only a skeletal outline upon which the rest of the raga is formed.

Ragas are not simply abstract collections of swaras that occur together to produce a tune. Each raga has a distinct image or swaroopam and it is this which defines a raga. Arbitrary selection of a set of swaras is unlikely to produce a distinct raga swaroopam and this is the reason for attributing the foundations of the raga system to nature. The ragas that we know of are the products of centuries of experimentation. Each ragam has associated with it a feeling that it induces in the listener and the performer. Hours of dedicated practice with a single raga (Saathakam) results in the realization of the raga swaroopa on the part of the performer and this is often referred to as obtaining a Dharshan of that particular raga. The unfortunate consequence of this is that various performers have slightly different mental concepts of a single raga and this is manifest in their music. But the good part is that it adds a tremendous variety to the music. This is also the reason why Carnatic music (performance) can never really be learnt from a book but needs a Guru who can portray the

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*The magazine Sruthi usually contains a discussion of ragalakshanam of one or two ragas in each issue.

raga swaroopam in such a manner
viewpoint of the listener, a realizatio
of the qualities of the music can be
listening pleasure.

Ragas fall into two types, the
janya ragas. Melakarta ragas have a
scheme of scientific organization wl
and are liable to evolve with the mu:
character over time. Janya ragas are
various means as described subseque
fact that they use all seven swaras anc
Sa-Ri-Ga-Ma-Pa-Da-Ni-Sa and Sa
arohanam and avarohanam is deno
completeness. The existence of mult
Ni implies that by collecting combir
melakartas. This concept will be dev
that does not belong to the melakart
characterized by missing notes in the
Ga-Pa-Da-Sa), the use of twisted pro
etc. Janya ragas and their classificati

The definition of melakarta gi
the past, melakartas have been defin
with the sampoornam characteristic
much more elegant and that appears
acceptance and use in the past few ce

The Melakarta Scheme

Contemporary Carnatic music is based on a system of 72 melakarta ragas. These 'creator' ragas are also called janaka ragas and thai (mother) ragas. The current system can be traced to the works of Venkatamakhi who appears to be the first to use 72 melakartas. Earlier works generally contain fewer melakartas and most have flaws in organization. At that time, (16th century) many of Venkatamakhi's melakartas were unknown and were not assigned names. Later, all 72 were given names and this system is sometimes referred to as the Kanakaambari - Phenadhyuthi system after the names of the first two melakartas in it. Muthuswamy Dikshithar's compositions are generally based on the raga names and lakshanams (definitions) in this system while Thyagaraja used a later scheme devised by Govindacharya in the late 18th century. Venkatamakhi did not believe that melakartas must be of simple sampoorna arohanam - avarohanam but favored the idea of calling a raga as a melakarta if all the seven swaras occurred in either the arohanam or the avarohanam. Thus a raga which went Sa-Ri-Ma-Pa-Ni-Sa, Sa-Da-Pa-Ga-Ri-Sa could be a melakarta under this scheme. Govindacharya's insistence on sampoorna arohanam - avarohanam leads to a system which is more elegant from a mathematical viewpoint. In this scheme, the melakartas arise out of systematic permutation of the seven swaras into the twelve swara sthanas. Seen this way, the melakarta scheme is a product of mathematical abstraction and the naming of swaras (and the introduction of vivadi swaras) is of no consequence as far as the organization of the melakartas is concerned. No wonder, Venkatamakhi is reputed to have said that even Lord Maheswara could not create more melakartas!

As we noted before, all melakartas employ a complete (sampoornam) arohanam-avarohanam structure. The purvangam of a melakarta refers to the lower half of the Arohanam-Avarohanam, namely Sa-Ri-Ga-Ma and uttarangam refers to the upper half or Pa-Da-Ni-Sa. First let us examine the possible variations in the uttarangam. Pa is fixed. Da can occupy three sthanas and so can the Ni. But, the Ni has to be always above the Da and that leaves us with the following six possible uttarangams.

(1) Pa-Suddha Dhaivatham-

(2) Pa-Suddha Dhaivatham-

(3) Pa-Suddha Dhaivatham-

(4) Pa-Chatusruthi Dhaivatl

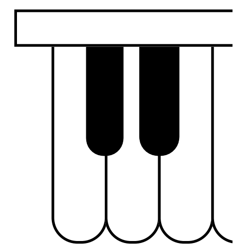
(Suddha Nishadam occu
Dhaivatham and hence t

(5) Pa-Chatusruthi Dhaivatl

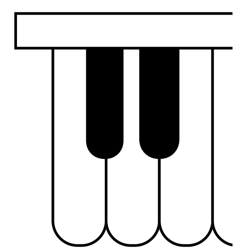
(6) Pa-Shatsruthi Dhaivatha

These six uttarangam combina
Bhu, Ma and Sha respectively. The
keyboard locations of the swaras in
the corresponding numbered swara s
the next octave) for one kattai sruthi.

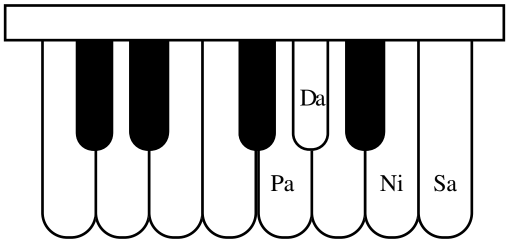
Swara Locations for the



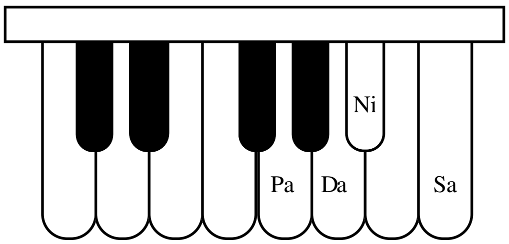
Swara Locations for the



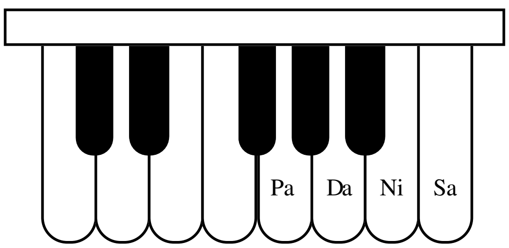
Swara Locations for the 'Go' uttarangam (8-9-12-13)



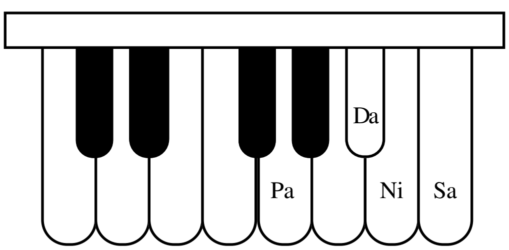
Swara Locations for the 'Bhu' uttarangam (8-10-11-13)



Swara Locations for the 'Ma' uttarangam (8-10-12-13)



Swara Locations for the 'Sha' uttarangam (8-11-12-13)

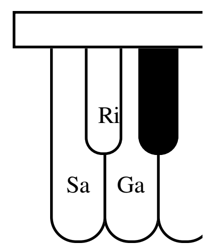


As in the case of the Da and N
provide six possible combinations.
two Madhyamams to yield a total of
purvangam combinations are each cal
corresponding purvangams are as foll

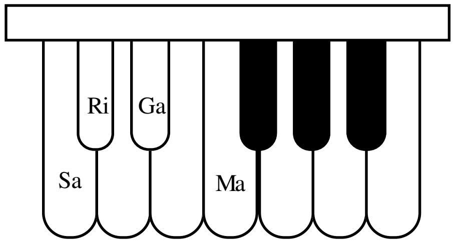
(1)	Indu	Sa, Suddha Rishab yamam
(2)	Netra	Sa, Suddha Rishaba
(3)	Agni	Sa, Suddha Rishaba
(4)	Veda	Sa, Chatusruthi Ris
(5)	Bana	Sa, Chatusruthi Ris
(6)	Ruthu	Sa, Shatsruthi Risha
(7)	Rishi	Sa, Suddha Rishaba
(8)	Vasu	Sa, Suddha Rishaba
(9)	Brahma	Sa, Suddha Rishaba
(10)	Disi	Sa, Chatusruthi Ris
(11)	Rudra	Sa, Chatusruthi Ris
(12)	Aditya	Sa, Shatsruthi Risha

The chakra names are associat
For example, there are four Vedas, a
following illustrations depict the swa
chakras, along with the numbered sw

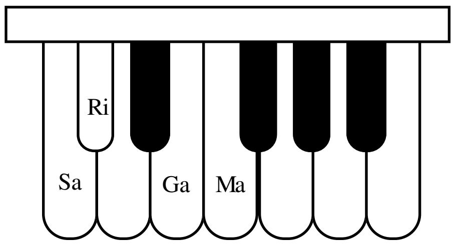
Swaras of Ind



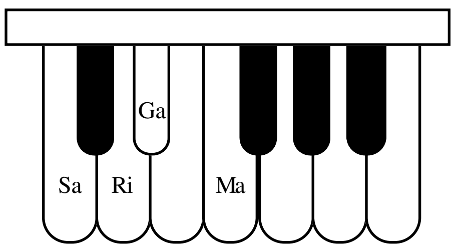
Swaras of Netra Chakra (1-2-4-6)



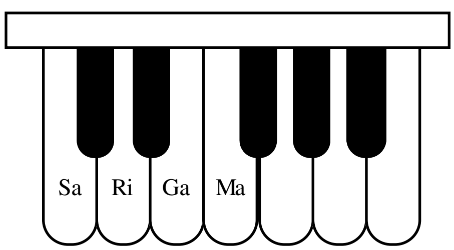
Swaras of Agni Chakra (1-2-5-6)



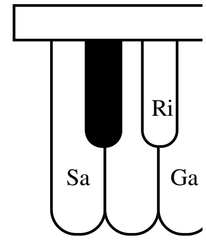
Swaras of Veda Chakra (1-3-4-6)



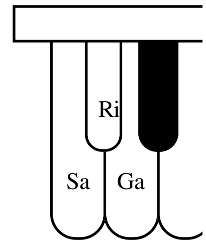
Swaras of Bana Chakra (1-3-5-6)



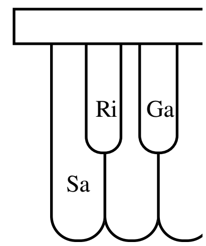
Swaras of Rut



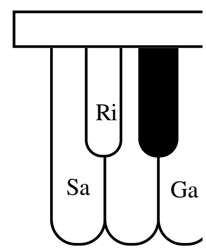
Swaras of Ris



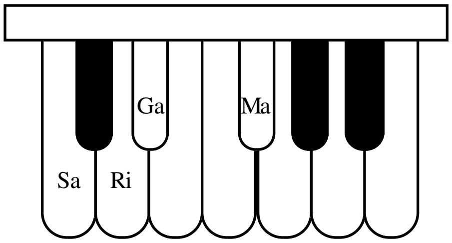
Swaras of Vas



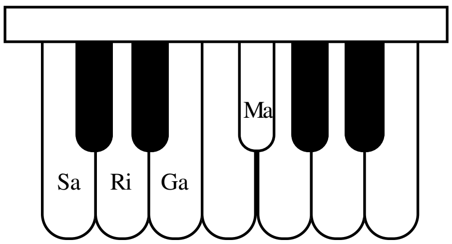
Swaras of Brah



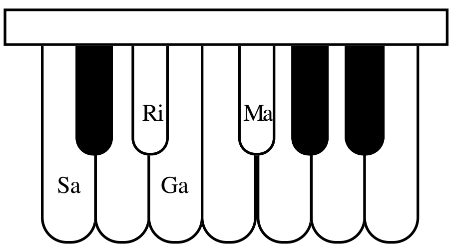
Swaras of Disi Chakra (1-3-4-7)



Swaras of Rudra Chakra (1-3-5-7)



Swaras of Aditya Chakra (1-4-5-7)



Each of the twelve purvangams can be combined with the six uttarangams to obtain a total of 72 melakartas. The melakartas are then identified by combining the chakra name with the Pa - Sri designation. Thus, a melakarta described as Rudra-Ma (or no. 65, Mechakalyaani) corresponds to an arohanam and avarohanam containing Shadjam - Chatusruthi Rishabam - Anthara Gandharam - Prati Madhyamam - Panchamam - Chatusruthi Dhaivatham - Kakali Nishadam - Shadjam. The following table lists all the 72 melakartas and the swaras used in each of them using the chakra and Pa - Sri notation as described. The first 36 melakartas use Suddha Madhyamam and melakartas 37 through 72 use Prati Madhyamam. These two groups are sometimes identified

as Suddha Madhyama melakartas o
melakartas or Uttara melakartas resp
fashion that a Suddha Madhyama m
melakarta which shares all swaras e
line. Thus to find out what is the Pra
Maayaamaalavagowla, one just read
(which is also known as Pantuvaraa
pairs would sound very similar and
curs.

Melal

No.	Name	
1	Kanakaangi	
2	Rathnaangi	I
3	Gaanamurthy	N
4	Vanaspathy	D
5	Maanavathy	U
6	Taanaroopi	
7	Senaavathy	N
8	Hanumathodi	E
9	Dhenuka	T
10	Naatakapriya	R
11	Kokilapriya	A
12	Roopavathy	
13	Gaayagapriya	
14	Vakulaabharanam	A
15	Maayaamaalavagowla	G
16	Chakravaaham	N
17	Sooryakaantham	I
18	Haatakaambari	
19	Jhankaaradhwani	
20	Natabhairavi	V
21	Kiravaani	E
22	Kharaharapriyaa	D
23	Gowrimanohari	A
24	Varunapriya	

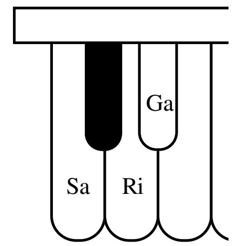
25	Maararanjani		Pa	R	Kaantaamani	61
26	Chaarukesi	B	Sri	U	Rishabhapriya	62
27	Sarasaangi	A	Go	D	Lataangi	63
28	Harikaambhoji	N	Bhu	R	Vaachaspathy	64
29	Dheerasankaraabharanam	A	Ma	A	Mechakalyaani	65
30	Naagaanandini		Sha		Chitraambari	66
31	Yaagapriya	R	Pa	A	Sucharithram	67
32	Raagavardhani	U	Sri	D	Jyotiswaroopini	68
33	Gaangeyabhooshani	T	Go	I	Dhaatuvarthini	69
34	Vaagatheeswari	H	Bhu	T	Naasikaabhooshani	70
35	Shoolini	U	Ma	Y	Kosalam	71
36	Chalanaata		Sha	A	Rasigapriya	72

Many of the melakartas have alternate names like in the example just cited and some of these are listed in the Appendix. In addition, some of the common ones (like Thodi) are listed with prefixes (Hanumathodi). This is in accordance with the so called 'Katapayaathi' formula. Using this formula, numerical values are assigned to consonants as listed in the following table (the devanagari script is the basis upon which this assignment is done). To find out what is the location of a melakarta in the table, the first two consonants are deciphered using the numerical assignment table and the resulting number is inverted left to right. For example, consider Hanumathodi - the first two consonants being Ha and Na. Ha is assigned 8 and Na is zero. The resulting number if 80 and after inversion, this yields the number 8, which is the melakarta number corresponding to Hanumathodi. One must be careful in decoding prefixes - for example, Thodi, Sankaraabharanam and Kalyaani are melakartas which take on prefixes to identify their melakarta numbers but Naata, Bhairavi and Kaambhoji are not melakartas but actually janya ragas of Chalanaata, Natabhairavi and Harikaambhoji respectively. The naming of melakartas in accordance with the Katapayaathi formula is generally attributed to Govindacharya. Govindacharya was well versed in astrology and the Katapayaathi convention has been widely used in astrology for centuries.

Once the melakarta number is known, one can use the chakra scheme to identify the swaras in it. As an example, consider Shanmugapriya. The consonants are Sha and Ma. Sha=6 and Ma=5 to yield the melakarta number 56. Dividing 56 by 6 yields a quotient of 9 and a remainder of 2. This means that

Shanmugapriya belongs to the 10th
raga in that chakra. Thus Shanmug
swaras in Shanmugapriya are (collec
the tables) Sa - Chatusruthi Rish
Madhyamam - Pa - Suddha Dhaivath
figuring out the chakra, we need to a
number. We can use the melakarta t
Disi-Sri and end up with the same sw
lustrates the location of the swaras in

Swaras in Ra



Letter Values in

Values		l
	Ka series	Ta
1	Ka	Ta (as
2	Kha	Tha
3	Ga	Da (as
4	Gha	Dha
5	Nga (as in Bengal)	Na (as
6	Cha (as in chip)	Ta (as
7	Chha	Tha
8	Ja	Da
9	Jha	Dha
0	Ngya	Na (as

It is worthwhile to observe l
designation is also based on the Kat
The formal organization of the me
similarities between certain ragas.

purvangam and thus, sound similar in that portion. This explains, for example, the similarity between Kharaharapriya and Kiravaani. Ragas whose melakarta numbers differ by a multiple of six (meaning they have the same Pa-..-Sha designation) have the same uttarangam and this too causes similarity, as in the case of Lataangi and Kaamavardhani. One can find many pairs of melakarta ragas that differ by a single swaram, as in the case of Lataangi and Kaamavardhani (which differ only in Ri). Locating such pairs is often very instructive. A good musician makes it a point not to dwell on chains of swaras that are shared by various ragas, but often introduces contrasting swaras that are designed to let the listener identify the similarities and the differences simultaneously. This aspect can be used as a test of how good a musician really is. In a recent concert, a popular musician was performing a composition in the raga Chaarukesi. Chaarukesi can be seen to have the same purvangam as Sankaraabharanam and the same uttarangam as Shanmugapriya or Thodi. However, singing the purvangam portion of Sankaraabharanam and then the uttarangam of Shanmugapriya or Thodi has very little to do with the true swaroopam of Chaarukesi. This is like arguing that glueing a lion's head to a human torso results in the creation of a new being, when all it really does is create neither a lion nor a human being. The resulting creature is a poor excuse for a human or a lion and can be seen only as such. The use of gamakkas is also intricately connected to the concept of raga swaroopam and even though swaras may be the same, the gamakkas are often different, leading to ragas that are quite distinct in character.

The melakarta ragas in which vivadi swaras appear are called as vivadi melakartas. Thus all melakartas of Indu, Ruthu, Rishi and Aditya chakras as well as all melakartas with Pa or Sha designation are vivadi melakartas. The Pa and Sha designated ragas have a vivadi swara in their uttarangam while the Indu, Ruthu, Rishi and Aditya chakra ragas have a vivadi swara in their purvangams. Thus, there are 40 vivadi melakartas, out of which 8 have two vivadi swaras and the rest one vivadi swara each. If a melakarta system is constructed without the vivadi melakartas, a number of fairly common ragas will have to be treated as being outside the system (eg. Gaanamurthy, Jhaalavaraali). Further, janya ragas like Naata will have no associated melakarta, exposing the limitations of the classification system.

Jan

Janya ragas, as we have seei
ragas. The simplest way to generate
the swaras in the arohanam and/or ava
Ma and Ni in the arohanam of Dheera
- Ga - Pa - Da - Sa for the arohar
resulting raga is called Bilahari. Thu
the 29th melakarta Dheerasankaraabh
Sa - Ri - Ga - Pa - Da - Sa, Sa - Ni -
that when going up the scale, one i
namely, Sa, Ri, Ga, Pa, Da and Sa
descent. Thus, when a Ma or Ni is u
notes from the avarohanam).

Dropping out more than two s
and experience suggests that it is vi
swaroopam with the remaining swar
use only four swaras in the arohanam
Kannada, derived from the 28th mel
Sa-Ga-Ma-Pa-Sa, Sa-Ni-Da-Ma-Ga-
avarohanam is called sampoornam, oi
shadava and one with two swaras
arohanam and avarohanam to
independently, the following possib
constructed.

(1) sampoorna - sampoor
(2) sampoorna - shadava
(3) sampoorna - oudava
(4) shadava - sampoorna
(5) oudava - sampoorna
(6) shadava - shadava
(7) shadava - oudava
(8) oudava - shadava
(9) oudava - oudava

The first case evidently refers
generate any janya ragas. The examp

- sampoorna case. Using the sampoorna - shadava case as an example, there are 72 sampoorna arohanams and six shadava avarohanams for each, leading to total of 432 janya ragas of this type. By the same argument, there are 432 janya ragas of shadava - sampoorna type. Following this procedure, one can arrive at a total of about thirty thousand independent janya ragas. However, a large number of these are not in use since they do not have distinct raga swaroopas. This brings us to the important observation that it is not just mathematical jugglery that produces ragas. As the saying goes, 'Ranjayathi ithi Raga' - that which is beautiful is a raga. Ragas are produced through experimenting with the possible combinations, looking for distinct swaroopas. This process has been conducted for centuries by composers and musicians to arrive at the few hundred or so janya ragas currently in use.

The type of janya raga we have considered so far, namely, what is derived by simply dropping notes from a melakarta raga, is called as an Upaanga raga. There are alternate means of generating janya ragas. The arohanam and/or avarohanam can use a twisted progression. For example, we can construct a janya raga from Dheerasankaraabharanam using the arohanam Sa - Ri - Ma - Da - Ni - Ga - Pa - Sa and a simple sampoorna avarohanam. The resulting raga is called Katanakuthoohalam. A janya ragam employing a twisted arohanam and/or avarohanam is termed as a Vakra ragam. We can also mix notes from two melakartas in the arohanam and avarohanam to produce janya ragas. For example, the ragam Bhairavi uses Chatusruthi Dhaivatham in its arohanam and Suddha Dhaivatham in its avarohanam. This type of structure is indicated by the term Baashaanga ragam. A ragam can be Baashaangam or Upaangam but not both. The Vakra characteristic can be combined freely with both types. The result is that a very large number of combinations are possible and only the ability to create a distinct swaroopam dictates what combinations are actually used in creating janya ragas. The description of a janya raga usually indicates the melakarta from which it is derived, whether it Vakram or not, whether is Upaangam or Baashaangam, and if it Baashaangam, the swaras which make it so. The arohanam and avarohanam provide further details (like sampoorna, shadava or oudava).

The term varja is sometimes used to indicate missing swaras. For example, the raga Sriranjani has an arohanam - avarohanam of Sa - Ri - Ga - Ma

- Da - Ni - Sa, Sa - Ni - Da - Ma - (
melakarta Kharaharapriya. It is th
derived from Kharaharapriya. Consid
is a Madhyama varja raga derived fro
designation of the parent ragam a
Madhyama varja raga derived from t
to Malayamaarutham. The problem
differ only in Ma and since Malaya
derived from either. In such cases, t
be studied to decide which of the m
parent raga. This problem is comp
which are anyway derived from
assignment of a parent melakarta is
often ascribe different parents for a g
the ragam Mohanam, which has an ar
Da - Sa, Sa - Da - Pa - Ga - Ri - S
Gandharam and Chatusruthi Dhaivath
janya ragam of Harikaambhoji (mela
more are possible. It is a matter of in
ragam. As long the distinct swaroop
what is assigned as the parent ragam.

Taalam

We have seen that the term raga refers to the tune or melody characteristics. The analogous term referring to the rhythm or beats of Carnatic music is taalam. It indicates the pacing of the music and the placement of syllables in the composition. It is vital to realize that the taalam system is essentially based on a cyclic pattern; in other words, the rhythm is always cyclic. In Carnatic music, the singer indicates the taalam using gestures. There are three basic hand movements used in keeping the rhythm - the downward beat with the palm facing down, called thattu, the wave (sometimes the downward beat with the palm facing up) called veechu and counts using one finger for each count staring with the little finger (sometimes using the thumb to indicate a finger or portions of a finger). These basic movements are combined into three groups, called Laghu, Dhrutham and Anudhrutham. A Laghu is one thattu followed by a specified number of counts to make up the requisite number of beats. A Dhrutham is one thattu followed by one veechu while an Anudhrutham is just one thattu. Each beat or unit of taalam is termed as an aksharam and thus, an Anudhrutham is one aksharam long, a Dhrutham is two aksharams long and the Laghu is of variable length. There are several other movements but these are rarely seen in practice.

The absolute duration of an aksharam is not fixed and it varies, depending on the composition and the mood of the performer. This is similar to the way in which the absolute pitch of the swaras is not fixed but defined only relative to the reference pitch or sruthi. The aksharam is further divided into a number of swaras and this division is referred to as gathi or nadai. Four swaras per aksharam is standard and is termed Chaturasra nadai. The other standard divisions and the associated number of swaras per aksharam are Tisra (three), Khanda (five), Misra (seven) and Sankirna (nine). These divisions apply to medium tempo or Madhyama Kaalam. The divisions can be doubled to yield a fast tempo termed Dhuritha Kaalam or halved to yield the slow Chowka Kaalam. Further doubling and halving are also possible but rarely heard. Most of Dikshithar's compositions have the last line of Anupallavi and Charanam (see Elements of Recital section for definitions) set to Dhuritha Kaalam.

There are seven common taala
just described. In standard notation, t
by a 0 and the anudhrutham by a U.
subscript placed after the |. For exam
comprises of a thattu followed by a t
aksharams. The seven common taala

Eka

Roopaka

Triputa

Mattya

Jhampa

Dhruva

Ata

The length of the Laghu has
There are five possible Laghu len
Chaturasra (4 aksharams), Khanda (
these five Laghus can occur in the
thirty five taalams. For example, Mis
aksharams, an Anudhrutham and a
thattu (counted one) followed by a si
seven), two thattus and a veechu, fo
thirty five taalams can be divided int
Sometimes, the taalam names are u
Laghu and are to be interpreted as
(Chaturasra Roopaka), Triputa (Tis
(Khanda Ata). Chaturasra Roopakar
veechu (each of two akshara length) i

In addition to the taalams jus
taalams - Aadi, Khanda Chaapu and M
given to the most common taalam
Chaapu is a five beat taalam also ca
usually indicated 0 U 0, though there

can also see a thattu of two aksharams followed by two veechus of one and two aksharam durations. Khanda Chaapu is often used as a version of Misra Jhampa. Misra Chaapu is similar to Tisra Triputa and is sometimes used as an alternative. The usual indication consists of a thattu of three aksharams followed by two veechus or two thattus of two aksharams each, for a total of seven aksharams (and hence the name).

There is another aspect of taalam which merits attention - the starting point of the song in relation to the taalam or the eduppu as it is called. Many songs start simultaneously with the beat and this is termed as sama eduppu indicating that the start is level with the taalam. Often, the song starts after the taalam is started, leaving an empty rhythm pattern at the beginning. This gap allows the singer greater freedom in improvisation (see also under the section titled Elements of a Recital). This is indicated by the term anaagatha eduppu. Sometimes, the song starts before the beat and this is termed atheetha eduppu. This construction is often used to add a one or two syllable prefix (eg. Hari, Sri, Amba) to the text of the melodic line. A peculiar eduppu is associated with a taalam called Desadi taalam. Though this taalam actually consists of four movements, each of two aksharam duration, it is customary to keep pace for this taalam using simple Aadi taalam. Then, the eduppu is at one and half aksharams from the start of the taalam or three eighths way into the laghu. An example for Desadi eduppu is the song 'Bantu reethi kolu viya vayya Raama' in the ragam Hamsanaadham.

Elemen

The exact form of a concert o
perceived needs of the listener an
described here is generally attrib
Ariyakkudi Ramanuja Iyengar. Ther
Music Recital - a composed portion
portion is fixed (more or less) while t
heavily dependent on the skills a
extempore portion is thus governed b
odharma sangeetham. Recitals oft
composed piece of fairly short durati
usually performed at the start of a r
simple and consist mostly of long syl
which bring out the essential features
an Anupallavi, followed by a Mukth
with various Chittaswarams. The P
the raga, typically in the lower por
Anupallavi provides a parallel or
(uttarangam). The Mukthaayiswaran
of swaras rendered using the swara
Charanam is often composed on a
Anupallavi.

The recital then proceeds wit
Kirthanais (songs) in various ragas
main items of performance, are co
compositions are of a devotional nat
between music and religion. Genera
included. The Trinity refers to the
Thyagaraja, Muthuswami Dikshithar
temporaries who lived in the late 18
Tiruvarur (near the South Indian City
his five compositions in the ragas Na
generally referred to as the Panc

compositions include the Kamalaamba Navaavarna Krithis and the Navagraha Krithis. Thyagaraja and Shyama Shastry composed mainly in Telugu whereas Dikshithar mostly used Sanskrit. Dikshitar and Shyama Shastry have often included the name of the raga also in their lyrics. The word Thyagaraja appears in Thyagaraja's compositions to identify the composer. Dikshithar used Guruguha as his identifier while Shyama Shastry used Shyama Krishna. The identifiers for several other composers are listed in the appendix.

Krithis formally have a Pallavi, an Anupallavi and one or more Charanams. A Kirthanai is similar to a Krithi but has no Anupallavi. Often, a number of Sangadhis are used for each line of the song. Sangadhi is the repetition of a single line or similar short portion of the song using various melodic tunes. Initially, the tune is simple and slowly, the structure of the raga is revealed using more complicated structures. This portion is generally composed but many performers include their own variations also. A Swarajathi is sometimes included along with the Krithis and Kirtanais in the main portion of the concert. A Swarajathi is like a Krithi but its Charanam section is rendered first using the swaras and then the lyrics. One of the most dedicated Carnatic musicians of our times, Sri Semmangudi Srinivasa Iyer, often used to sing Shyama Shastry's Swarajathi composition in the raga Bhairavi beginning with the words (Kanji) Kamakshi. The Charanam sections of the Pancha Ratna Keertanais of Thyagaraja are customarily sung in the Swarajathi fashion i.e., first using the swarams and then with the lyrics.

Some of the songs are preceded by an Aalaapanai, and may include Niraval and/or Kalpanaaswaram. An Aalapanai is an improvisation in the same raga as the song. It has no lyrics and only abstract (meaningless) syllables are used (eg. Ta, Da, Ri, Na, Nau). There is no rhythm for this portion of the performance which is essentially an extempore attempt by the performer to convey the raga swaroopam as experienced by him/her. The Aalaapanai has a formal structure, similar to the Pallavi - Anupallavi scheme. It includes movements in all the three sthaayis as the raga allows. Sthaayi is the octave or register of the swaras. The normal or middle sthaayi is termed Madhya sthaayi, the upper octave is Thaara sthaayi, the lower octave is Mandhara sthaayi. Similar names exist for further octaves. An Aalaapanai generally starts in the Madhya sthaayi, proceeds upward into the Thaara sthaayi and then downward to

the Mandhara sthaayi before return
structure is modified for ragas which
Aalaapanais in the raga Ataana are c
on the raga and the imagination and
take up from a few minutes to a half
of great performers who have rend
significant repetition of the raga phra

Niraval is similar to sangathi b
performer selects a single line or a si
it in various tunes, all within th
Kalpanaaswaram is to Chittaswaram
renders improvised swara phrases (
while repeating a selected line from t
time staying within the constraints of
for songs which have an Anaagatha
fixed short phrase at the end of ea
momemtum, adding to the graceful
Kalpanaaswaram rendition requires th
Madurai Mani Iyer was well known
with every song.

Many recitals have a major ite
Ragam portion is an elaborate Aalaa
ragam. The Thaanam portion is lik
rhythm is maintained not by an expli
syllables of more or less fixed leng
include Ta, Na and Nom. Thaanam
the nature of the instrument. The Pal
generally consists of rendering a lyr
taalam. For example, the line can be
twice per cycle, once every two cy
keeping the rhythm at a fixed speed
varying the rhythmic pace while the
Pallavi rendition is intimately conne
When mentioning Pallavi singing on

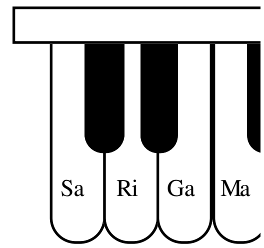
contemporary of The Trinity, whose title of Shatkaala was given due to his exceptional ability to sing at six speeds. It is also common to make the Pallavi portion into a Ragamalika (garland of ragas), meaning, a number of lines, each in a different raga. The Pallavi portion generally includes Kalpanaswarams also.

Devotional items are quite common towards the end of the recital. These include slokas, Bhajans and compositions by or in honor of the performer's Guru(s). A Thillaana is performed at or very near the end of the concert. The Thillaana is a composed piece intended mainly for dance. Usually, there are no lyrics and only certain syllables denoting division of the taalam are used (Ta, Deem, Thom, Takadimi etc.). The concluding piece of the recital is called Mangalam and is generally in the ragas Saurashtram, Madhyamavathy or Surati.

Grahabedan

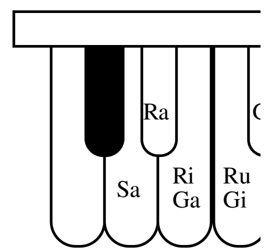
The topics of this section are abstract and mathematical. Readers skip this section. The basic principl rooted in mathematics. Thus, a ce almost unavoidable in any explanati process of modifying ragas by shiftir swara sthanas. Symmetry indicates of the swaras used in a ragam. Graha janya ragas. Consider Dheerasan melakarta ragam. The swara sthanas the following keyboard diagram.

Swaras in Dhee



Suppose we continue to use th two kattais, what was Sankaraabhara swara locations for two kattai sruthi a

Swaras for



Using this figure, we see that becomes Sa and Anthara Gandh

Continuing along, the Suddha Madhyamam becomes Sadharana Gandharam, Pa becomes Suddha Madhyamam, Chatusruthi Dhaivatham becomes Pa, Kakali Nishadam becomes Chatusruthi Dhaivatham, Sa becomes Kaisika Nishadam. Consulting the melakarta tables, we see that the new swaras correspond to the 22nd melakarta Kharaharapriya (Veda - Bhu). Thus, moving the sruthi to the swara Ri of Sankaraabharanam results in Kharaharapriya. It should be remembered that the absolute pitch of the swaras continue to be the same; it is only because of the shifting of the origin of the scale (the Sa) that a different raga is produced. Evidently, one can carry out the process for janya ragas also.

Consider a notation system for the swara and swara sthanas as follows. Let us represent the swara sthanas by a string of 12 digits, each one corresponding to the twelve swara sthanas into which an octave is divided. The presence of a swara sthana is denoted by a one in the corresponding digit and the absence by a zero. Thus, in the above example of Sankaraabharanam, the representation would be [101011010101]. The first 1 corresponds to Sa; the next swara sthana corresponds to Suddha Rishabam which does not occur in Sankaraabharanam and thus the corresponding digit is 0. The third digit is for Chatusruthi Rishabam and Suddha Gandharam. Since Chatusruthi Rishabam occurs in our example, the third digit is set to 1. The same process can be continued to obtain all the twelve digits. Note that the first digit is always 1 to indicate the use of Sa. In the case of melakartas, Pa is always used and thus, the eighth digit is always 1. Further, all melakartas use seven and only seven swaras and thus the notation always contains seven ones and five zeros. In general, the number of ones in the notation denotes the number of swaras used in that raga. The following list gives the number strings corresponding to the twelve chakrams and the Pa-Sri.. designations. Note that the Purvangam is represented by seven digits and the uttarangam by five digits. The purvangam notations carry a 1 in parenthesis to indicate that the next swara is Sa, which is always present.

Indu	1110010	Rishi	1110001	Pa	11100(1)
Netra	1101010	Vasu	110100	Sri	11010(1)
Agni	1100110	Brahma	1100101	Go	11001(1)
Veda	1011010	Disi	1011001	Bhu	10110(1)

Bana	1010110	Rudra
Ruthu	1001110	Adity

Using this notation, Grahabed
digits from one end of the number to
Sankaraabharanam is represented by [
we make the digit corresponding to
The two digits which were removed
[101101010110]. This can be easily
ability of a raga to generate other ra
term Murchanaakara. The abs
Amurchanaakara. In light of the ab
Kharaharapriya are Murchanaak
grahabedam on a ragam leads to non-
Ni of Sankarabharanam as the base
has two Madhyamas and no Pancham
the current melakarta scheme. Evid
the grahabeda derived scales of it sh
(39) is an example of a melakarta wh

It is important to note that Gra
Instead of generating Kharaharapr
with Kharaharapriya and move the
Hence, it is appropriate to group tog
other and state, for example, that K
Grahabeda pairs instead of inapprop
derived from Sankaraabharanam t
considered leads to the most famous
of Mechakalyaani (65), Dheerasan
Kharaharapriya (22), Natabhairavi
possesses another interesting proper
all the swaras (big Ri, big Ga etc.)
written above, the 'big' swaras are
'small' swaras. Thus Dheerasankara
'big'), Harikaambhoji uses 'small'
Hanumathodi, which uses the 'small'

The Grahabedam process as above can be used on janya ragas also. The notation can handle only janya ragas with symmetric arohanam and avarohanam (meaning the arohanam and avarohanam should have the same swaras) and janya ragas with vivadi swaras cannot be distinguished correctly. The most famous Grahabedam group of janya ragas includes Mohanam, Hindolam, Suddha Dhanyaasi, Suddha Saaveri and Madhyamaavathy. Some other groups are listed in the Appendix.

The next logical question that arises is whether it is possible for a raga (assumed to have symmetric arohanam and avarohanam) to be Grahabedam derivable from itself. If the raga has five or seven swaras (including the fixed Sa), then it turns out that it cannot be Grahabedam derived from itself. Thus, melakartas are not self Grahabedam derivable since they all have seven swaras. If a ragam is self Grahabedam derivable, it can be confusing to the listener since the same tune can belong to a single ragam at two different sruthis! Perhaps, it is no coincidence that we see ancient systems of music with five note scales and the current system with seven note scales, but no significant six note scales. The seven swara scale is most probably here to stay since setting more than seven swaras into twelve swara sthanas would allow very little room for the creation of distinct base ragas especially if the Panchama sthana is reserved and always present.

Consider the 1st melakarta, Kanakaangi (Indu - Pa). It is represented by [111001011100(1)]. Note the symmetry between the lower and upper portions of the structure due to the repeating sequence 111001. This is an example of a class of symmetry, where the lower and upper portions (not exactly the purvangam and uttarangam, but close) of a raga have a similar structure. This characteristic is possessed by the following melakartas: Hanumathodi (Netra - Sri), Maayaamaalavagowla (Agni - Go), Kharaharapriya (Veda - Bhu), Dheerasankaraabharanam (Bana - Ma) and Chalanaata (Ruthu - Sha). The sixth melakarta Thaanaroopi (Indu - Sha) is denoted by the string [111001010011(1)]. The lower portion of this 111001 is the same as the upper portion 100111 written backwards. This means that the swara steps in the lower portion of the raga in the arohanam are similar to the swara steps in the upper portion in the avarohanam, or these ragas employ a similar swara step structure in the arohanam and avarohanam. This is another type of symmetry and the

melakartas which possess this pr
Kokilapriya (Netra - Ma), Maayaam
(Veda - Bhu), Chaarukesi (Bana - Sri

Note that Maayaamaalavagow
have looked at. Further, it has no
appearing in pairs). This characteristi
instrument) since pairs of swaras occ
that this ragam is almost invariably
many of the initial lessons are set to
reached and students begin to render l
sing first in Maayaamaalavagowla or
A systematic examination of the c
reveals a good degree of specializat
ragas*. Saint Thyagaraja's comp
Kharaharapriya and its janya ragas.
degree of symmetry possessed by the:

+This practice is generally attributed
father of modern Carnatic music.

*In fact, there is an interesting story
composing songs. From a very you
and used to travel to many temples.
Lord Subramanya in Thirutthani wh
dropped a piece of sugar in his mo
mysteriously. Dikshithar was inspire
composed the (some say his firs
Maayaamaalavagowla.

Appendix

Synonymous Ragas

As we have seen before, different names have been assigned to the same ragam by various sources, leading to some confusion on the part of listeners and performers alike. This problem is very evident when one compares the compositions of Thyagaraja and Muthuswamy Dikshithar, since the former used the Kanakaangi-Rathnaangi scheme of Govindacharya while the latter followed the Knakaambari-Phenadhyuthi scheme (which did not require sampoorna melakartas). In the case of Janya ragas also, there are some discrepancies in the names as well as definitions used in the two systems. The following list contains the names of the melakartas in the Kanakaambari - Phenadhyuthi scheme. Some of the names are marked with an asterisk (*) to indicate that they refer to the same raga as in the Kanakaangi - Rathnaangi scheme. Thus, Chaamaram, which is marked, is the same as the corresponding (56th) melakarta, namely, Shanmugapriya. Detecting such correspondence is tricky since different sources often offer conflicting definitions for the same ragam. The indicated correspondences were obtained after a careful scrutiny of the songs as given in Rangaramanujam Iyengar's Krithi Mani Malai.

1	Kanakaambari	37	Sougandhini
2	Phenadhyuthi	38	Jaganmohanam
3	Gaanasaamavaraali	39	Dhaalivaraali*
4	Bhaanumathi	40	Nabhomani
5	Manoranjani*	41	Kumbhini*
6	Thanukirthi	42	Ravikriya*
7	Senaakrani	43	Girvaani
8	Janathodi*	44	Bhavaani*
9	Dhunibinnashadjam*	45	Sivapantuvaraali*
10	Nataabharanam*	46	Sthavaraajam*
11	Kokilaaravam*	47	Sowveeram*
12	Roopavathy*	48	Jeevanthini*
13	Geyahejjajji *	49	Dhavalaangam*
14	Vaativasanthabhairavi	50	Naamadesi*
15	Maayaamaalavagowla*	51	Kaasiraamakriya*
16	Toyaveghavaahini	52	Ramaamanohari*
17	Chaayaavathi	53	Gamakakriya
18	Jeyasuddhamaalavi	54	Vamsavathi*
19	Jhankaarabhramari	55	Shyaamala
20	Naarireethigowla	56	Chaamaram*

21 Keeranaavali
22 Sriraagam
23 Gowrivelaavali*
24 Veeravasantham
25 Sharaavathy
26 Tarangini
27 Sowrasena*
28 Harikedaaragowla
29 Dheerasankaraabharana
30 Naagaabharanam*
31 Kalaavathy
32 Raagachudaamani*
33 Gangaatarangini
34 Bhogachaayaanaata*
35 Sailadesaakshi*
36 Chalanaata*

The following list indicates janya rag

Suddha Dhanyaasi or Udaya R

Suddha Saaveri or Devakriya

Aabheri or Karnaataka Devaga

Grahabeda Groups

The following list contains g derivable from each other within a melakarta ragas.

Kanakaangi, Kaamavardhani
Rathnaangi, Gamanasrama, Jh
Gaanamurthy, Visvambari, Sh
Vanaspathy, Maararanjani
Maanavathy, Kaantaamani
Senaavathy, Lataangi, Sooryak
Hanumathodi, Mechakalyaani,
Dheerasankaraabharana
Dhenuka, Chitraambari, Shann
Naatakapriya, Vaachaspathy, C
Kokilapriya, Rishabhapriya
Gaayagapriya, Dhaatuvardhani

Vakulaabharanam, Kosalam, Kiravaani, Hemavathy
Maayaamaalavagowla, Rasigapriya, Simhendhramadhyamam
Chakravaaham, Sarasaangi, Dharmavathy
Haatakaambari, Gavaambhodhi
Varunapriya, Raagavardhani
Naagaanandini, Bhavapriya, Vaagadheeswari
Gaangeyabhooshani, Neetimathy
Chalanaata, Subhapantuvaraali
Shadvidhamaargini, Naasikaabhooshani

The following are the Amurchanaakara melakartas, meaning they are not related to any other melakarta through Grahabedam.

Taanaroopi
Roopavathy
Yaagapriya
Saalagam
Jalaarnavam
Jhaalavaraali
Navaneetham
Paavani
Raghupriya
Suvarnaangi
Divyamani
Dhavalaambari
Naamanaaraayani
Raamapriya
Sucharithra
Jyotiswaroopini

The following are Grahabeda related Janya raga groups and hence it is appropriate to call these Janya ragas as Murchanakara Janya ragas.

Suddha Saaveri, Suddha Dhanyaasi, Madhyamaavathy, Hindolam and Mohanam
Ghambeera Naata and Bhoopaalam
Kalkata and Lalitha
Naagaswaraavali and Hamsadwani

Aarabi, Mohana Kalyaani, Aak
Dhanyaasi and Saalaka Bhaira
Aabhogi and Valagi
Kaambhoji and Desiya Thodi
Bilahari and Yadukula Kaambl

In the preceding list, the first four avarohanam (use the same swaras in the rest use asymmetric scales.

<u>Composers and thier ident</u>

The following list contains identifiers used by them. The names

<u>Composer</u>

Sadasiva Brahmendra

Jayadeva

Purandara Dasa

Bhadrachalam Rama Dasa

Narayana Theerthar

Annamacharya

Bhodendra

Thyagaraja

Muthuswamy Dikshithar

Shyama Shastry

Maharaja Swathi Thirunaal

Harikesanallur Muthiah Bhagavathar

Papanasam Sivan	Ramadasan
Patnam Subramanya Iyer	Venkatesa, Venkateswara
Veenai Kuppaiyar	Gopaladasa
Mysore Vasudevacharya	Vasudeva
Tirupathi Narayanaswamy	Tirupathi (pura) Varada Venkatesa
Gopalakrishna Bharathi	Balakrishna
Vedanayagam Pillai	